KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 9

2023 Mathematics 2024

Unit 14 Tasks – Part 1

DO NOT WRITE INSIDE

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Unit 14 Tasks – Part 2

DO NOT WRITE INSIDE

Contents Page

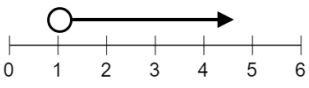
1 Linear Inequalities

Fluency Practice

Representing Inequalities

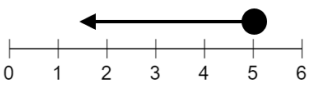
(a)

Write down the inequality shown.



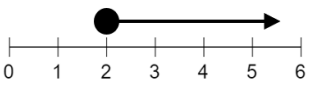
(b)

Write down the inequality shown.



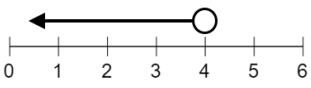
(c)

Write down the inequality shown.



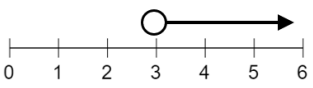
(d)

Write down the inequality shown.



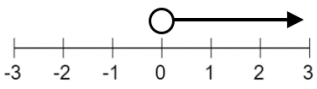
(e)

Write down the inequality shown.



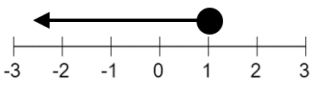
(f)

Write down the inequality shown.



(g)

Write down the inequality shown.

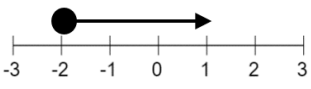


(h)

Write down the inequality shown.

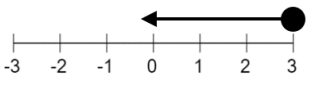
(i)

Write down the inequality shown.



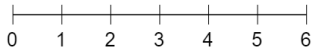
(j)

Write down the inequality shown.



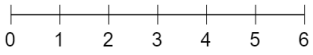
(k)

Show the inequality $x > 3$ on the number line.



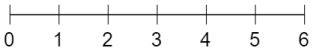
(l)

Show the inequality $x \leq 4$ on the number line.



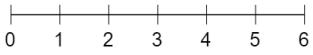
(m)

Show the inequality $x \geq 2$ on the number line.



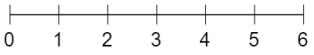
(n)

Show the inequality $x > 0$ on the number line.



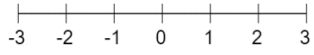
(o)

Show the inequality $x < 5$ on the number line.



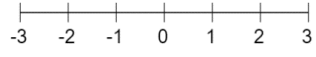
(p)

Show the inequality $x \leq 1$ on the number line.



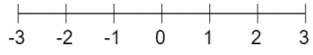
(q)

Show the inequality $x > -2$ on the number line.



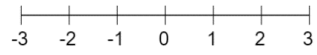
(r)

Show the inequality $x < -1$ on the number line.



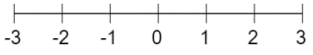
(s)

Show the inequality $x \geq -3$ on the number line.



(t)

Show the inequality $x \leq 0$ on the number line.



Fluency Practice

Representing Double Inequalities

(a)

Write down all the integers that satisfy the inequality

$2 \leq x \leq 5$

(b)

Write down all the integers that satisfy the inequality

$1 < x \leq 4$

(c)

Write down all the integers that satisfy the inequality

$-1 \leq x < 3$

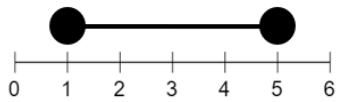
(d)

Write down all the integers that satisfy the inequality

$-4 < x < 1$

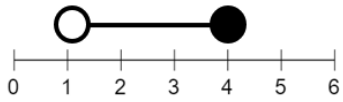
(e)

Write down the inequality shown.



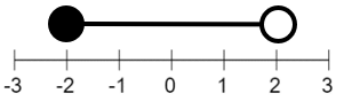
(f)

Write down the inequality shown.



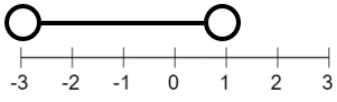
(g)

Write down the inequality shown.



(h)

Write down the inequality shown.

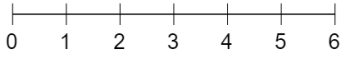


(i)

Show the inequality

$1 < x < 6$

on the number line.

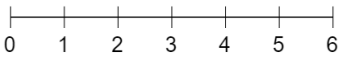


(j)

Show the inequality

$0 \leq x < 3$

on the number line.

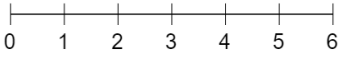


(k)

Show the inequality

$1 \leq x \leq 3$

on the number line.

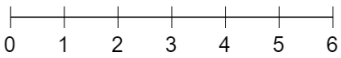


(l)

Show the inequality

$2 < x \leq 5$

on the number line.

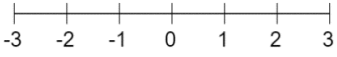


(m)

Show the inequality

$-1 \leq x \leq 3$

on the number line.

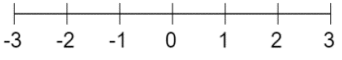


(n)

Show the inequality

$-3 \leq x < 0$

on the number line.

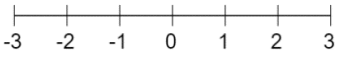


(o)

Show the inequality

$-2 < x < 2$

on the number line.

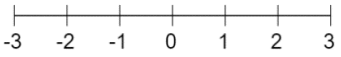


(p)

Show the inequality

$-1 < x \leq 1$

on the number line.



Fluency Practice

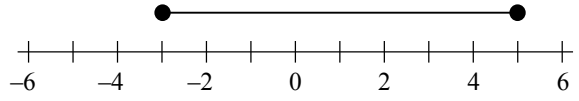
A1

Write down the integers which satisfy the inequality

$$2 \leq x \leq 7$$

A2

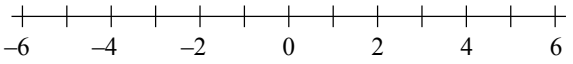
Write down the inequality shown on the number line.



A3

On the number line, show the inequality

$$1 < x < 5$$



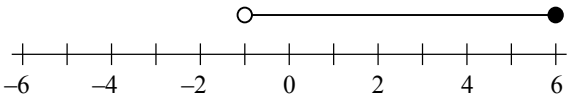
B1

Write down the integers which satisfy the inequality

$$-7 < x < -2$$

B2

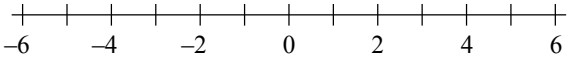
Write down the inequality shown on the number line.



B3

On the number line, show the inequality

$$-4 < x \leq -1$$



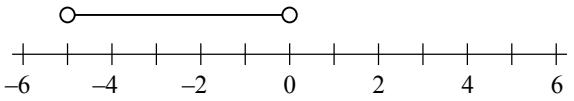
C1

Write down the integers which satisfy the inequality

$$-3 < x \leq 3$$

C2

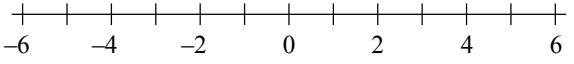
Write down the inequality shown on the number line.



C3

On the number line, show the inequality

$$-5 \leq x < 3$$



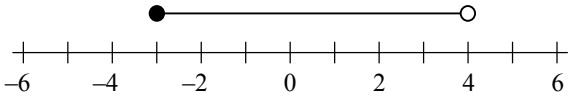
D1

Write down the integers which satisfy the inequality

$$-1 \leq x \leq 5$$

D2

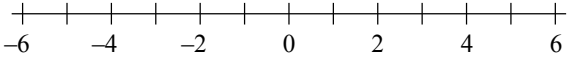
List the integers that satisfy the inequality which is shown on the number line.



D3

On the number line, show the inequality

$$-4 < x \leq 2$$

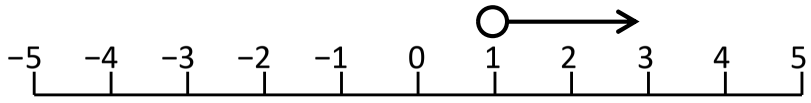


Representing Linear Inequalities

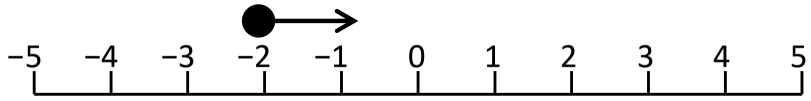
What inequality does each diagram represent?

○ excludes
● includes

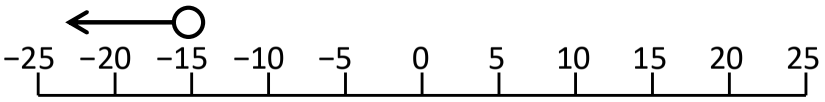
A



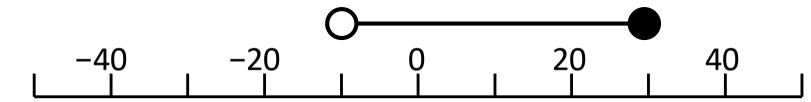
B



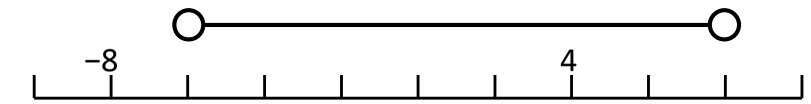
C



D



E



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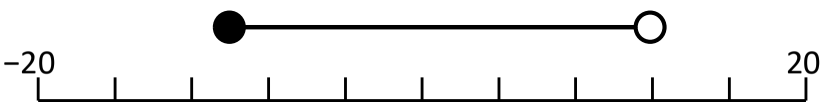

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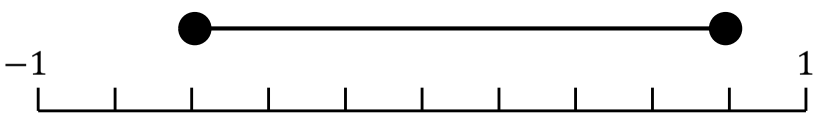

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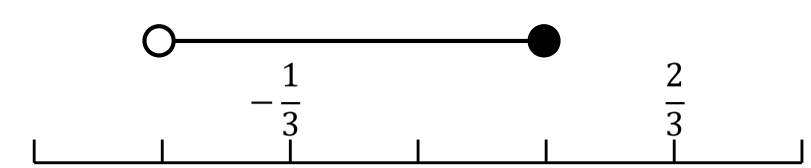
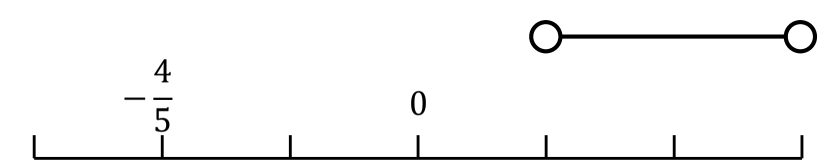
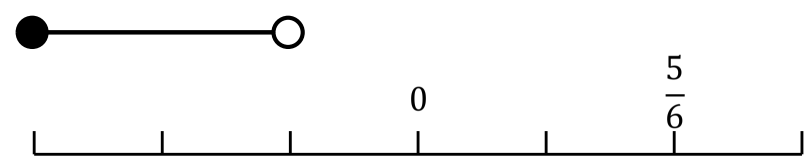


I



J



Fluency Practice

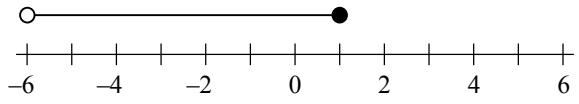
A1

Write down the integers which satisfy the inequality

$$1 < x < 5$$

A2

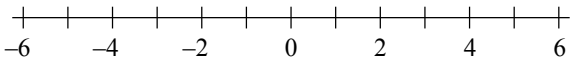
Write down the inequality shown on the number line.



A3

On the number line, show the inequality

$$0 < x < 3$$



B1

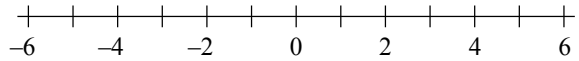
Write down the integers which satisfy the inequality

$$-4 \leq x \leq 2$$

B2

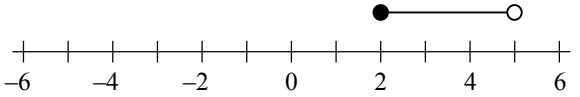
On the number line, show the inequality

$$-5 < x \leq 4$$



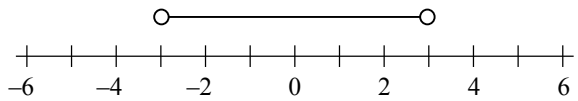
B3

Write down the inequality shown on the number line.



C1

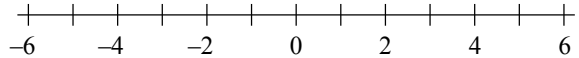
List the integers that satisfy the inequality which is shown on the number line.



C2

On the number line, show the inequality

$$x \geq -2,\ x < 4$$



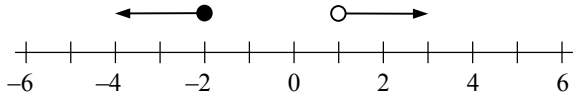
C3

Write down the integers which satisfy the inequality

$$-2 < x \leq 3$$

D1

Write down the inequality shown on the number line.



D2

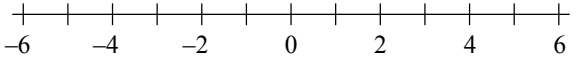
Write down the integers which satisfy the inequality

$$-6 \leq x < 0$$

D3

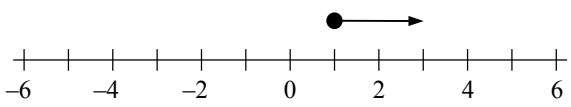
On the number line, show the inequality

$$x \geq 1,\ x < -3$$

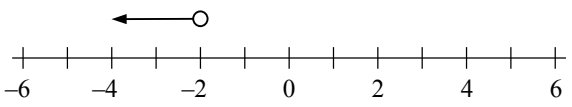


Fluency Practice

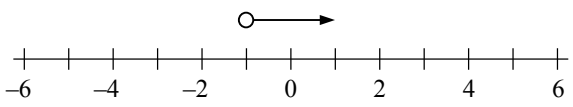
A1
Write down the inequality shown on the number line.



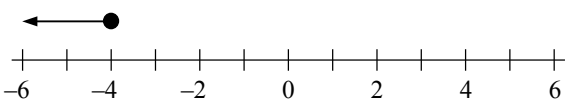
A2
Write down the inequality shown on the number line.



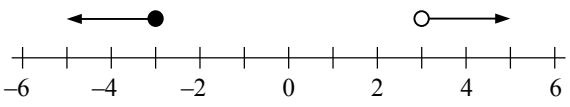
A3
Write down the inequality shown on the number line.



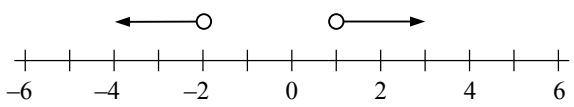
B1
Write down the inequality shown on the number line.



B2
Write down the inequality shown on the number line.

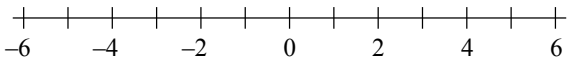


B3
Write down the inequality shown on the number line.



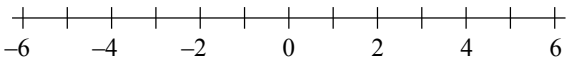
C1
On the number line, show the inequality

$x > 2$



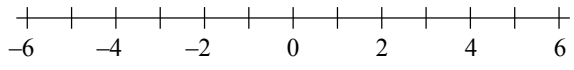
C2
On the number line, show the inequality

$x \leq 3$



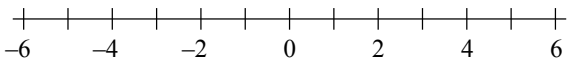
C3
On the number line, show the inequality

$x \geq 4$



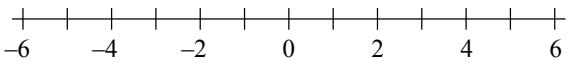
D1
On the number line, show the inequality

$x < 0$



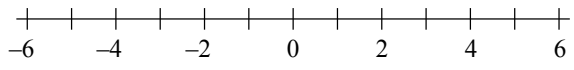
D2
On the number line, show the inequality

$x \leq -2$ or $x \geq 3$



D3
On the number line, show the inequality

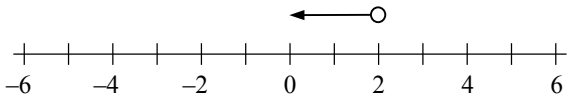
$x > 1$ or $x \leq -3$



Fluency Practice

A1

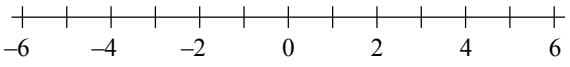
Write down the inequality shown on the number line.



A2

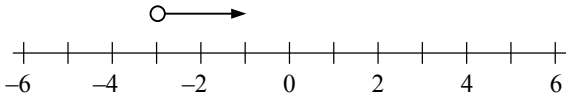
On the number line, show the inequality

$x \geq -2$



A3

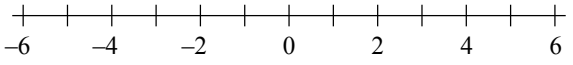
Write down the inequality shown on the number line.



B1

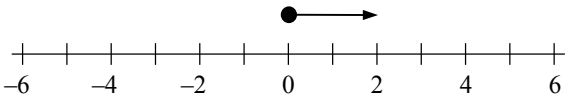
On the number line, show the inequality

$x < 4$



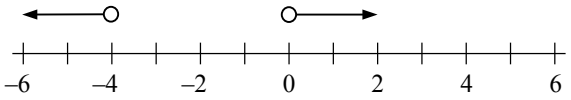
B2

Write down the inequality shown on the number line.



B3

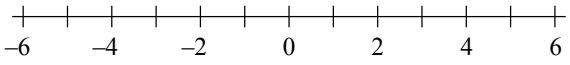
Write down the inequality shown on the number line.



C1

On the number line, show the inequality

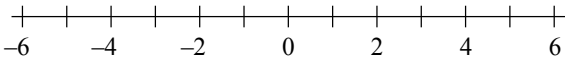
$x \geq 3$



C2

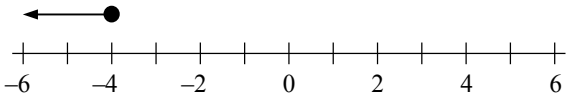
On the number line, show the inequality

$x < -3$ or $x \geq -1$



C3

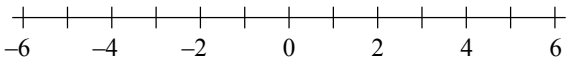
Write down the inequality shown on the number line.



D1

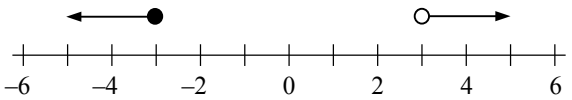
On the number line, show the inequality

$x < -2$



D2

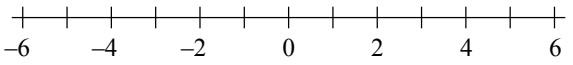
Write down the inequality shown on the number line.



D3

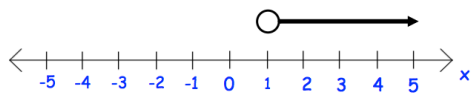
On the number line, show the inequality

$x > 4$ or $x \leq 1$

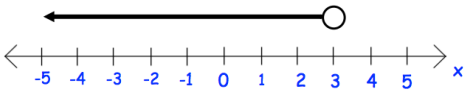


Question 4: Write down the inequalities shown below

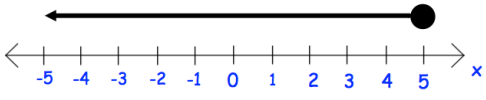
(a)



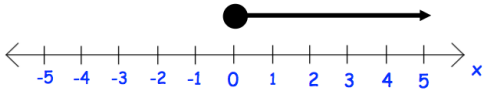
(b)



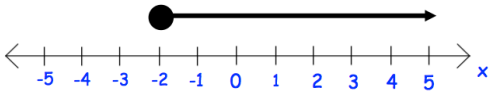
(c)



(d)

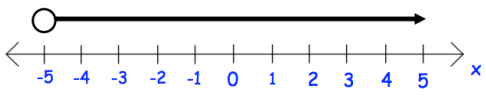


(e)

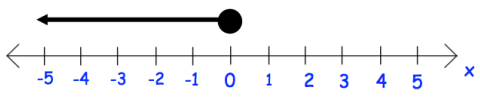


(f)

(g)



(h)



Question 5: Show these inequalities on a number line.

(a) $x > 2$ (b) $x < 4$ (c) $x \geq 3$ (d) $x \leq 5$

(e) $x \geq 0$ (f) $x \leq -1$ (g) $x < -4$ (h) $x > -5$

(i) $x \geq -6$ (j) $x > 0$ (k) $x < -2$ (l) $x > -1$

Question 6: Write down an inequality for each of the following

(a) x is greater than 2, but less than 5
(b) x is greater than 0, but less than 4
(c) x is greater than 1, but less than or equal to 7
(d) x is greater than −5, but less than or equal to 2
(e) x is greater than or equal to −8, but less than 3
(f) x is greater than or equal to 10, but less than 20
(g) x is greater than or equal to 3, but less than or equal to 6
(h) x is greater than or equal to 8, but less than or equal to 11

Question 7: Write down the meaning of these inequalities

(a) $3 < x < 5$ (b) $2 < x < 9$ (c) $19 \leq x < 20$ (d) $5 \leq x \leq 10$

(e) $0 < x \leq 4$ (f) $-4 \leq x < 1$ (g) $-8 \leq x \leq -6$ (h) $100 < x < 200$

Question 8: List all the integers (whole number) that satisfies each inequality

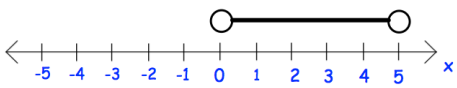
(a) $2 < x < 6$ (b) $5 < x < 10$ (c) $4 \leq x < 8$ (d) $12 \leq x \leq 15$

(e) $-2 < x \leq 3$ (f) $-5 \leq x < 1$ (g) $-10 \leq x \leq -5$ (h) $-4 < x < 4$

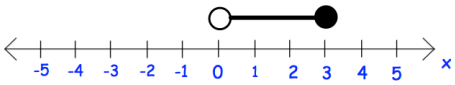
Question 9: Write down the inequalities shown below

(a)

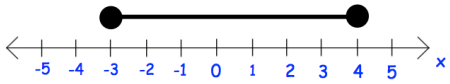
(b)



(c)



(d)



(e)

(f)

Apply

Question 1: The cost, c, of a TV is less than £300. Write this as an inequality.

Question 2: To go on a rollercoaster, a person's height, h, must be over 140cm. Write this as an inequality.

Question 3: The value of a house, v, is £100,000 or more. Write this as an inequality.

Question 4: There are 20 students in a class. The number of students present on a particular day is 20 or less. Write this as an inequality.

Question 5: Write down any integers (whole numbers) that satisfies **both** $x > 4$ and $x \leq 8$

Question 6: Write down any integers (whole numbers) that satisfies **both** $2 < x \leq 9$ and $x > 5$

More-Same-Less

Instructions: Find the values that satisfy the inequality in the central box. Complete the remaining boxes trying to make the minimal change possible.

The number of integers that satisfy the inequality

Minimum possible value for *x*	Less	Same	More
More			
Same		$-2 \leq x < 3$	
Less			

Intelligent Practice

Solve the following inequalities:

1) $5x - 40 \leq 80$

2) $5x - 40 < 40$

3) $40 - 5x \geq 40$

4) $5(8 - x) < -40$

5) $5(8 - 2x) > -40$

6) $-5(8 - 2x) > -40$

7) $-2x + 5 < -35$

8) $5 - 2x < -35$

9) $-5 - 2x \leq -35$

10) $-7 - 2x \leq -35$

11) $-7 - 4x > -35$

12) $-7 - 7x > -35$

13) $4(x + 3) + 8(x + 1) < 44$

14) $7(x - 3) + 5(x + 2) \leq 37$

15) $3(x - 2) + 2(x - 5) > 24$

16) $2(2x - 1) - 4(3x - 1) > 26$

17) $5(2x + 3) - 6(x - 1) < 29$

18) $2(5x - 2) - 3(3x - 1) \geq 6$

Intelligent Practice

Solve the following inequalities:

1) $5x + 3 < 3x + 13$

2) $5x + 2 \leq 3x + 44$

3) $11x + 2 \geq 5x + 44$

4) $11x + 44 \geq 5x + 2$

5) $11x + 39 > 5x + 21$

6) $8x + 39 > 5x + 21$

7) $8x + 39 < 2x + 21$

8) $8x - 39 < 21 - 2x$

9) $8x - 39 \leq 21 - 17x$

10) $8x - 39 \geq 6 - 7x$

11) $39 - 8x \geq 6 - 7x$

12) $39 - 10x \geq 6 - 7x$

13) $6 - 10x \leq 39 - 7x$

14) $6 - 18x \leq 39 - 7x$

15) $3(x - 5) \leq 3(2x + 1)$

16) $3(x - 5) < -3(2x + 1)$

17) $-3(x + 5) \geq -3(2x + 1)$

18) $-3(x - 5) < -3(2x + 1)$

19) $-3(x - 5) > -3(2x - 1)$

20) $-3(2x - 1) > -3(x - 5)$

Fluency Practice

Solving Linear Inequalities			
(a)	**(b)**	**(c)**	**(d)**
Solve $x + 7 > 15$	Solve $3x \leq 21$	Solve $6 + x < 3$	Solve $\frac{x}{5} \geq 2.4$
(e)	**(f)**	**(g)**	**(h)**
Solve $4x - 1 < 19$	Solve $5 - x \leq 10$	Solve $\frac{x}{2} + 1.5 > 6$	Solve $8 - 2x \geq 14$
(i)	**(j)**	**(k)**	**(l)**
Solve $4x \leq 2x + 9$	Solve $3x - 1 < x + 11$	Solve $x + 3 > 5x - 19$	Solve $13 \leq 2(2x - 1)$
(m)	**(n)**	**(o)**	**(p)**
Solve $2(x - 3) \geq \frac{x}{2} - 5$	Solve $\frac{2x}{3} > 2(6 + x)$	Solve $-2(3x - 1) \leq 5 - x$	Solve $\frac{5-2x}{3} + 1 < 2(3 - 4x)$

Fluency Practice

Solving Compound Inequalities			
(a)	**(b)**	**(c)**	**(d)**
Solve $4 < 2x < 12$	Solve $-1 < x + 2 \leq 7$	Solve $5 \leq x - 1.5 < 8.5$	Solve $6 \leq -3x \leq 30$
(e)	**(f)**	**(g)**	**(h)**
Solve $3 \leq \frac{x}{5} < 3.2$	Solve $-3 \leq 2x - 1 \leq 7$	Solve $-1 < 5 - x < 0$	Solve $\frac{3}{4} < 1 - 2x \leq \frac{9}{2}$
(i)	**(j)**	**(k)**	**(l)**
Solve $-9 < 3(2 + x) \leq 6$	Solve $-4 < \frac{3x-5}{2} + 3 \leq 10$	Solve $x - 2 < 3x + 1 \leq 19$	Solve $-1 \leq 2x + 1 < x + 8$

Question 1: Solve each of the inequalities below

(a) $x + 4 > 9$ (b) $x - 3 < 2$ (c) $2x \leq 14$ (d) $8x < 16$

(e) $5x \geq 15$ (f) $\frac{x}{3} > 4$ (g) $\frac{x}{5} \leq 2$ (h) $x + 6 \geq 4$

Question 2: Solve each of the inequalities below

(a) $2x + 1 \leq 9$ (b) $3x - 5 > 16$ (c) $4x + 8 < 32$ (d) $5x - 2 \geq 68$

(e) $\frac{x}{2} + 1 \leq 5$ (f) $\frac{x}{9} - 6 > 4$ (g) $\frac{x+3}{2} \geq 5$ (h) $\frac{x-5}{4} > 2$

Question 3: Solve each inequality below and represent the solution on a number line.

(a) $4x + 7 < 11$ (b) $3x - 2 \geq 10$ (c) $\frac{x}{2} - 3 > 0$ (d) $\frac{x+18}{4} \leq 5$

Question 4: Solve each of the inequalities below

(a) $5(x - 3) \geq 40$ (b) $6(x + 2) < 42$ (c) $2(5x + 1) \leq 36$

(d) $4(x - 2) < 18$ (e) $2(2x - 9) \geq 22$ (f) $3(2x + 7) \leq 9$

Question 5: Solve each of the inequalities below

(a) $4x + 3 > 2x + 11$ (b) $x + 1 \geq 3x - 18$

(c) $13x - 12 < 3x + 13$ (d) $7x - 5 \geq 3x + 11$

Question 6: Find the largest integer that satisfies each inequality below.

(a) $x + 3 < 9$ (b) $2x + 5 < 12$ (c) $7x + 10 \leq 31$

(d) $3x - 5 \leq 9$ (e) $\frac{x}{4} + 3 \leq 8$ (f) $4x + 14 \leq 8$

Question 7: Find the smallest integer that satisfies each inequality below.

(a) $2x - 5 \geq 12$ (b) $4x > 9$ (c) $\frac{x+9}{3} \geq 7$

(d) $7x + 1 > 60$ (e) $10x - 16 \geq 76$ (f) $9x + 4 > 7x + 15$

Question 8: Solve each of the inequalities below

(a) $6 < x + 3 < 10$ (b) $4 \leq 2x \leq 7$ (c) $1 \leq 3x < 9$

(d) $4 < \frac{x}{5} < 6$ (e) $9 \leq 2x + 3 \leq 25$ (f) $-3 \leq \frac{x}{4} - 1 < 0$

Question 9: Find the integers that satisfy each of the inequalities below

(a) $5 < x < 9$ (b) $-3 < x \leq 1$ (c) $4 \leq 2x \leq 8$

(d) $16 \leq 5x + 1 < 31$ (e) $0 \leq \frac{x-6}{2} < 2$ (f) $-9 < \frac{x}{4} - 1 < -8$

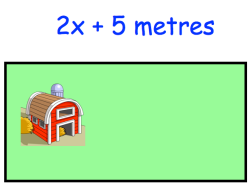
Apply

Question 1: Lauren goes shopping and has £50 to spend.
She bought a T-shirt and 3 pairs of leggings.
The T-shirt cost £23.
Each pair of leggings cost £x

(a) Form an inequality in terms of x.
(b) Solve the inequality to find the possible price of the leggings.

Question 2: Farmer Taylor is placing a fence around his field.
He has 300 metres of fencing but this is not enough.

(a) Form an inequality in terms of x.
(b) Solve the inequality to find the possible width of the field.

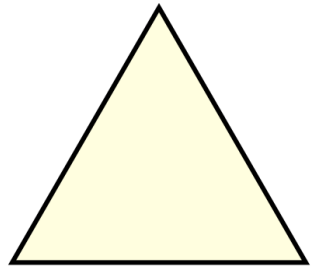


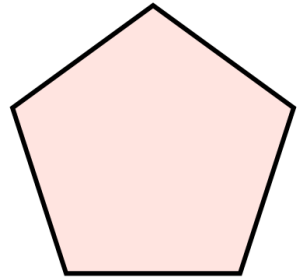
Fluency Practice

Question 3: The perimeter of the regular pentagon is larger than the perimeter of the equilateral triangle.

(a) Form an inequality in terms of x

(b) Solve the inequality to find the possible range of values for x.





Question 4: Find the range of values of x that satisfies **both**

$$3(x+2) \leq 30 \quad \textit{and} \quad 4x + 3 > 21$$

Question 5: y is a prime number and also satisfies $7 < 2y - 3 \leq 25$

List the possible values of y.

Solve these inequalities.

(a) $x + 5 > 11$

(b) $x + 11 < 5$

(c) $2x - 5 \geq 11$

(d) $5 + 2x < 11$

(e) $5x - 1 \leq 19$

(f) $4 - 5x < 19$

Solve these inequalities.

(a) $6x + 3 > 2x + 19$

(b) $x - 3 \leq 6x + 17$

(c) $7 - x < 3(x - 3)$

(d) $3(x + 3) \geq 4x + 5$

Solve these inequalities.

(a) $-5 < 5x < 25$

(b) $4 \leq 3x + 1 < 12$

(c) $2x < 3x + 1 \leq 13$

(d) $2x + 2 < 4x + 5 < 3x + 7$

The perimeter of a regular pentagon of side $(x + 2)$ is greater than the side of an equilateral triangle of side $(x + 6)$. Solve the inequality to find a possible range of values for x.

Megan bought seven crates of apple juice and Adil bought four crates of apple juice. Each crate contained the same number of bottles of apple juice.

When Megan gave Adil ten bottles of juice, Adil then had more bottles than Megan.

Find the maximum number of bottles of apple juice in a crate.

Fluency Practice

solving linear inequalities (a)

find the range of values of x that fit these inequalities

(1) solve $8x - 3 \geq 9$

(2) solve $5(3x - 2) \leq 125$

(3) solve $\frac{2x - 3}{5} > 9$

(4) solve $\frac{3}{8}(5x + 1) \leq 66$

(5) solve $-7 \leq 5x + 3 \leq 23$

(6) solve $1 \leq 6 - 5x \leq 41$

solve an inequation as you would a normal equation but reverse the direction of the inequality (e.g. from ≤ to ≥) when multiplying or dividing by a negative

example: $5 - 2x \geq 20 + 3x$

$-5x \geq 15$

$x \leq -3$

(note: changing the direction of the inequality sign could have been avoided, by moving the $-2x$)

(7) $2 \leq \frac{x}{3} - 4 \leq 3$ if x is an integer what values can it have?

(8) solve $1 < 3 - \frac{x}{5} < 8$

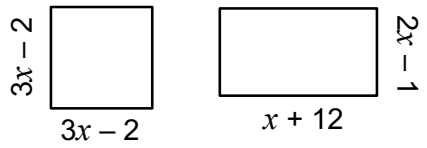
(9) $2x + 3 \leq 5x - 3 \leq 21 - x$ if x is an integer what values can it have?

(10) solve $\frac{x}{2} + 5 \geq x - 4 \geq \frac{x}{3} + 1$

Fluency Practice

solving linear inequalities (b)

(1) for what values of x is the perimeter of the square greater than the perimeter of the rectangle?



(2) solve $5(3x - 2) \geq 22 - x$

(3) solve $-2 - 7(x + 5) < 4(x - 1)$

(4) solve $5 - 3(1 - 2x) \geq 4(x - 2)$

(5) solve $68 \leq 5 - 9x \leq 86$

(6) solve $x + 4(3 - 2x) \leq 2 - 2(5 - 2x)$

(7) solve $\frac{5x - 14}{4} > 3x$

(8) solve $\frac{3(2x + 3)}{5} \geq 3(x - 3)$

(9) solve $5\left(\frac{x}{3} + 1\right) < 3\left(\frac{x}{2} + 2\right) + 1$

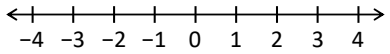
(10) solve $\frac{7(2x - 1)}{5} + 3 \geq \frac{8(5x - 2)}{3} - 130$

Fluency Practice

Represent each inequality on the number line.

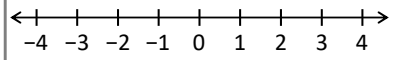
Linear Inequalities

① $-1 < x < 2$



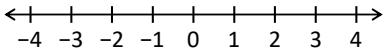
All integers that satisfy the inequality:

② $-2 < x \leqslant 3$



All integers that satisfy the inequality:

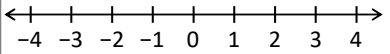
③ $4 > x \geqslant 0$



All integers that satisfy the inequality:

④ $-2.5 \geqslant x$

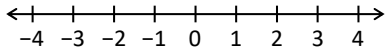
$x > 1$



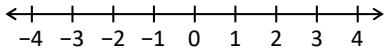
All integers that **don't** satisfy the inequality:

⑤ Represent the solutions to these inequalities on the number lines.

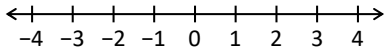
$2x + 4 > 8$



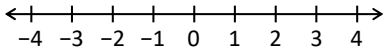
⑥ $\frac{x-4}{3} \geqslant -1$



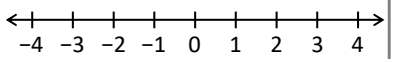
⑦ $3 \leqslant 3x - 6 < 6$



⑧ $2.5 \geqslant \frac{2x+6}{4} > 0$



⑨ $34 \geqslant 2(3x + 5) \geqslant -2$



⑩ Jay wants to send 3 necklaces in the post. The package shouldn't weigh more than half a kilogram. The box weighs 50 grams.

Form and solve an inequality to show how much one necklace must weigh.

⑪ Tam wants to send 4 watches via airmail. Each watch has its own case (40 grams). The box weighs 60 g.

The package can weigh between 0.7 and 1.5 kg.

Form and solve a double inequality to show how much one watch must weigh.

Fluency Practice

1. Every week Emma and Dario get at least £20.00 pocket money, between them, for helping with chores. Dario is older and helps more so he gets £4.00 more than Emma.

Form and solve an inequality to find out:

a. The minimum amount of money that Emma gets

b. The minimum amount of money that Dario gets.

2. Mum and dad can take their three children to the local theatre if the total cost does not exceed £83.00.

An adult ticket costs £4.00 more than a child ticket.

Form and solve an inequality to find out:

a. The maximum cost of a child ticket for the trip to be affordable for the family

b. The maximum cost of an adult ticket for the trip to be affordable for the family.

3. Anthony, Barry and Celina go to a local restaurant to celebrate Barry's birthday. They have £47.00 available for this occasion.

Anthony's favourite meal costs £3.40 more than Barry's. Celina's favourite meal costs £1.80 less than Anthony's.

Form and solve an inequality to find out if the three friends have enough money to order their favourite meals at the restaurant.

4. A big hotel lift has a maximum mass restriction of 1200 kg.

The average mass of a person is 75 kg and, on average, every second person has 25 kg luggage.

On average, how many people with a standard amount of luggage can safely fit into the lift?

Fluency Practice

A1 Write down the integers which satisfy both conditions:

$1 < x < 5$

$3 \leq x < 7$

A2 Write down the integers which satisfy both conditions:

$-4 \leq x \leq 3$

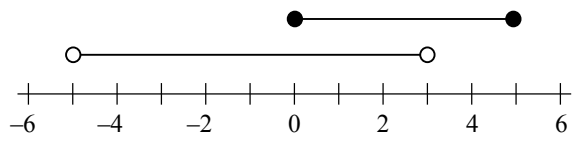
$-7 < x < -1$

A3 Write down the integers which satisfy both conditions:

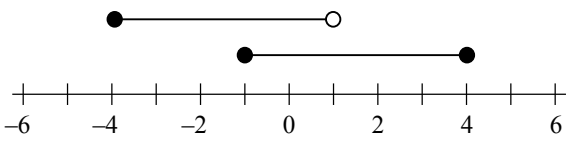
$-5 \leq x < 5$

$x < -2$

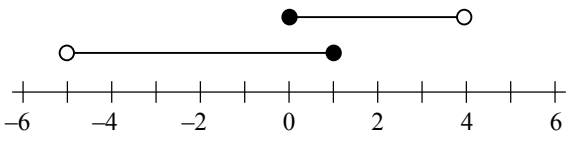
B1 Write down the integers which satisfy both conditions:



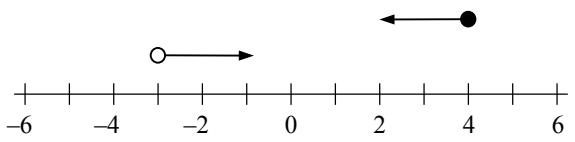
B2 Write down the integers which satisfy both conditions:



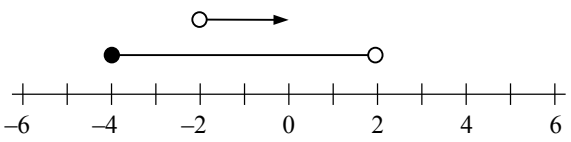
B3 Write down the integers which satisfy both conditions:



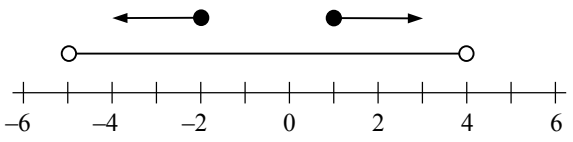
C1 Write down the integers which satisfy both conditions:



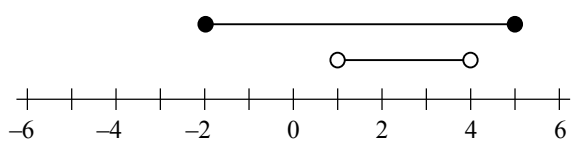
C2 Write down the integers which satisfy both conditions:



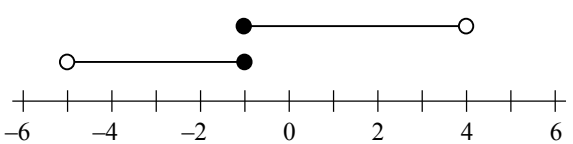
C3 Write down the integers which satisfy both conditions:



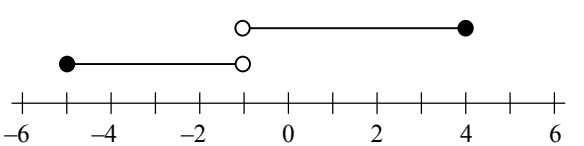
D1 Write down the integers which satisfy both conditions:



D2 Write down the integers which satisfy both conditions:



D3 Write down the integers which satisfy both conditions:



Fluency Practice

1 By drawing suitable number lines or otherwise, combine the following inequalities.

a $x < 3, \quad x < 4$ $\Rightarrow$?

b $0 < x < 3, \quad x < 2$ $\Rightarrow$?

c $x \geq 4, \quad -1 < x < 5$ $\Rightarrow$?

d $0 < x < 2, \quad 1 < x < 3$ $\Rightarrow$?

e $x < 1 \text{ or } x > 3, \quad x > 2$ $\Rightarrow$?

f $x < 2 \text{ or } x > 4, \ x < 0$ $\Rightarrow$?

g $x < 1 \text{ or } x > 3, \ 2 < x < 4$ $\Rightarrow$?

h $x < 1 \text{ or } x > 3, \ 0 < x < 4$ $\Rightarrow$?

i $x < 1 \text{ or } x > 3, \ x < 2 \text{ or } x > 4$ $\Rightarrow$?

j $x < 2 \text{ or } x > 3, \ x < 1 \text{ or } x > 4$ $\Rightarrow$?

2 Solve the following inequalities.

a $x + 1 < 5 < x + 7$ $\Rightarrow$?

b $x - 2 \leq 6 < x + 1$ $\Rightarrow$?

c $3 - x < x \leq 2x + 1$ $\Rightarrow$?

d $2x + 1 > 4, \ x \leq 2$ $\Rightarrow$?

e $5 - 2x > 3, \ x + 1 > 0$ $\Rightarrow$?

f $2 - x < x < 8 - x, \quad x \leq 3$ $\Rightarrow$?

2 Straight Line Graphs

1) y = 2x + 3

x	-2	-1	0	1	2
y					

2) y = 2x + 4

x	-2	-1	0	1	2
y					

3) y = 2x + 5

x	-2	-1	0	1	2
y					

4) y = 3x + 5

x	-2	-1	0	1	2
y					

5) y = 3x + 1

x	-2	-1	0	1	2
y					

6) y = 3x - 1

x	-2	-1	0	1	2
y					

7) y = 3x - 2

x	-2	-1	0	1	2
y					

8) y = 3x - 3

x	-2	-1	0	1	2
y					

9) y = 3x - 5

x	-2	-1	0	1	2
y					

10) y = 4x - 5

x	-2	-1	0	1	2
y					

11) y = -4x - 5

x	-2	-1	0	1	2
y					

12) y = -2x - 5

x	-2	-1	0	1	2
y					

13) y = -½x - 5

x	-2	-1	0	1	2
y					

14) y = ½x + ¾

x	-2	-1	0	1	2
y					

plotting linear graphs

1

(a) $y = x + 2$

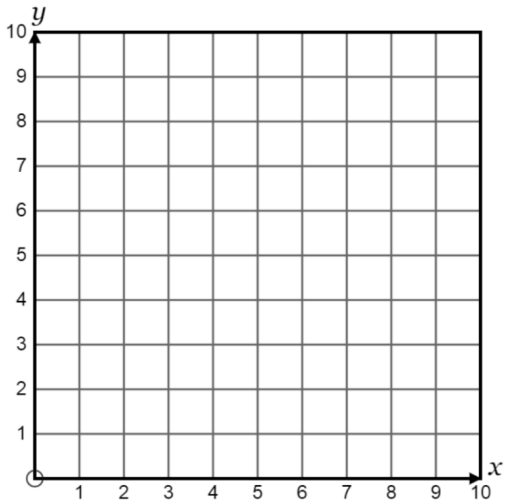
x	y
1	
2	
3	
4	
5	

(b) $y = 2x$

x	y
1	
2	
3	
4	
5	

(c) $y = 2x - 2$

x	y
1	
2	
3	
4	
5	



2

(a) $y = 1 + x$

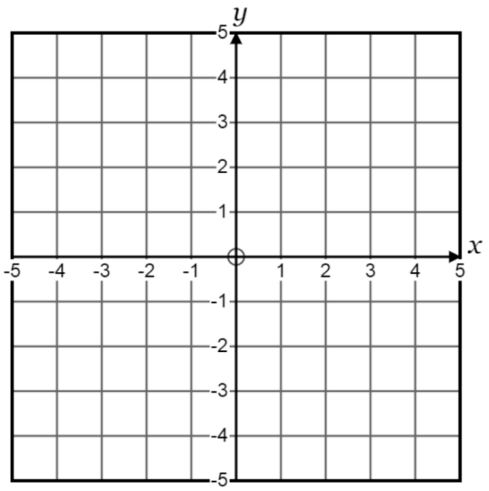
x	y
-1	
0	
1	
2	
3	

(b) $y = x - 3$

x	y
-1	
0	
1	
2	
3	

(c) $y = 3 - x$

x	y
-1	
0	
1	
2	
3	



3

(a) $y = x$

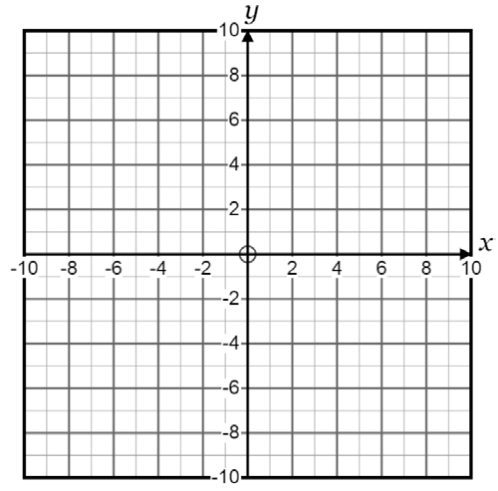
x	y
-2	
-1	
0	
1	
2	

(b) $y = 2x$

x	y
-2	
-1	
0	
1	
2	

(c) $y = 3x$

x	y
-2	
-1	
0	
1	
2	



4

(a) $y = 2x + 1$

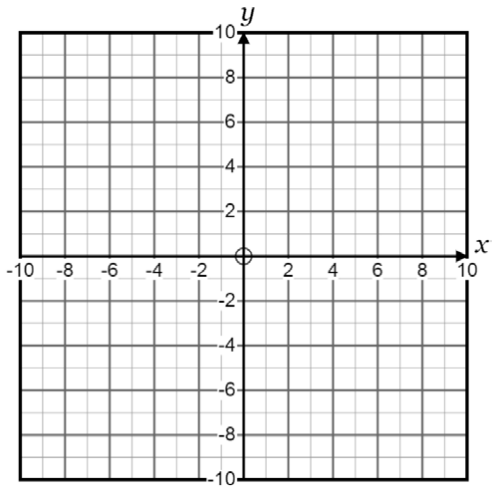
x	y
-2	
-1	
0	
1	
2	

(b) $y = 4 + 2x$

x	y
-2	
-1	
0	
1	
2	

(c) $y = 2x - 3$

x	y
-2	
-1	
0	
1	
2	



5

(a) $y = 4x - 1$

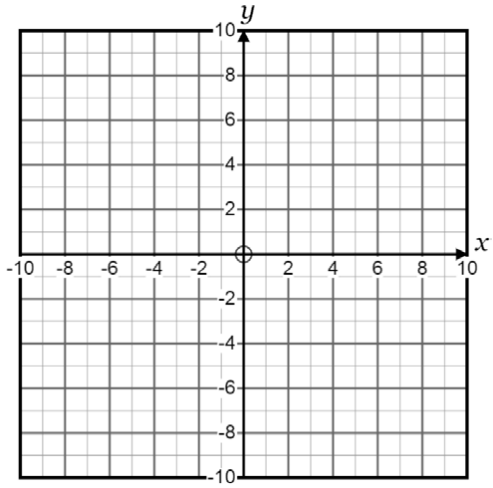
x	y
-2	
-1	
0	
1	
2	

(b) $y = 5 - x$

x	y
-2	
-1	
0	
1	
2	

(c) $y = 1 + 3x$

x	y
-2	
-1	
0	
1	
2	



6

(a) $y = 6 - 2x$

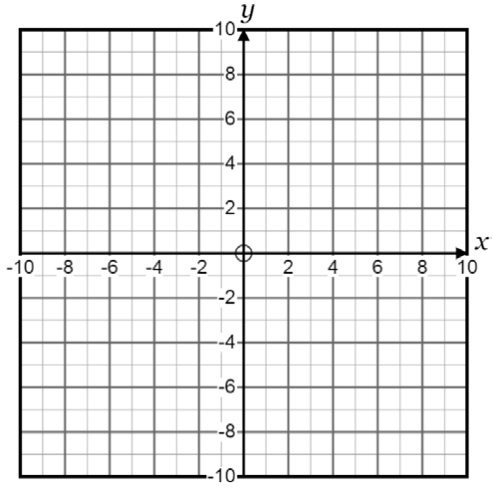
x	y
0	
1	
2	
3	
4	

(b) $y = 2(x + 1)$

x	y
0	
1	
2	
3	
4	

(c) $y = 0.5x$

x	y
0	
1	
2	
3	
4	



Bronze

Plot the following graphs on the axes. Fill in the tables to help you.

$x + y = 8$

x	y
0	
2	
4	
6	
8	

$x - y = 2$

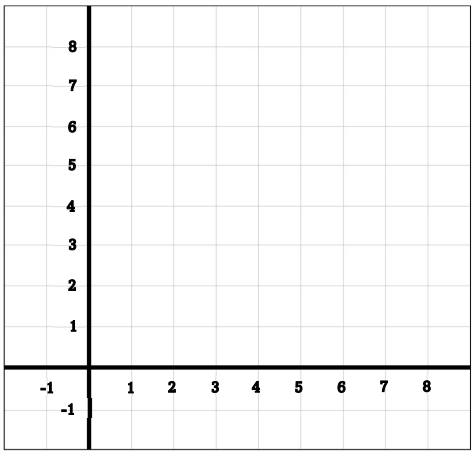
x	y
2	
3	
4	
5	
6	
7	

$x + y = 3$

x	y
0	
1	
2	
3	

$x - y = 1$

x	y
3	
4	
5	
6	



Silver

Plot the following graphs on the axes. Fill in the tables to help you.

$x + 2y = 10$

x	y
0	
2	
4	
6	
8	

$x + 3y = 6$

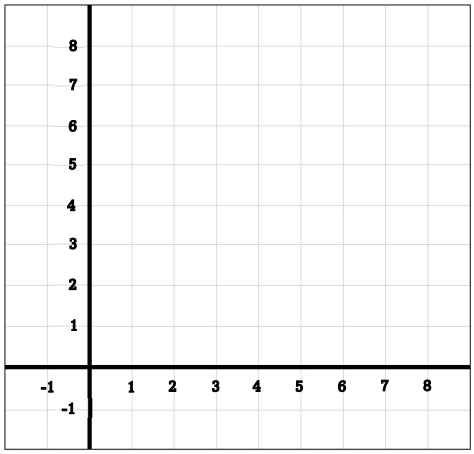
x	y
0	
3	
6	

$2x + y = 7$

x	y
0	
1	
2	
3	

$3x + y = 4$

x	y
0	
1	



Gold

Plot the following graphs on the axes. Fill in the tables to help you.

$4x + 2y = 16$

x	y
0	
1	
2	
3	

$5x + 3y = 15$

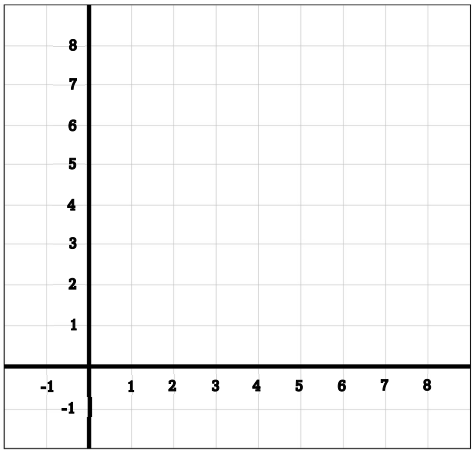
x	y
0	
3	

$6x + 4y = 24$

x	y
0	
2	
4	

$4x + 5y = 40$

x	y
0	
5	



Question 1: For each equation, complete the table of values and draw its graph for values of x from −1 to 3.

(a) $y = 2x + 1$

x	-1	0	1	2	3
y	-1	1			7

(b) $y = 3x - 1$

x	-1	0	1	2	3
y	-4			5	

(c) $y = 2x - 3$

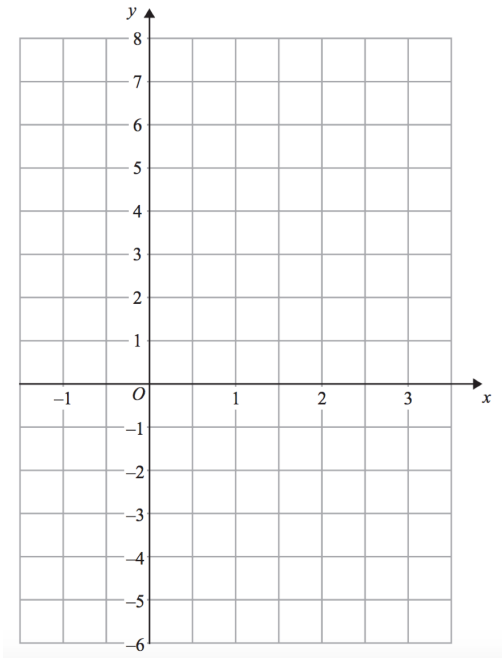
x	-1	0	1	2	3
y		-3	-1		

(d) $y = x + 4$

x	-1	0	1	2	3
y					7

(e) $y = 2x$

x	-1	0	1	2	3
y		0			6



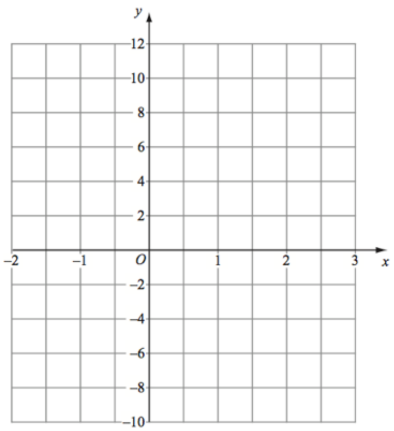
Question 2: For each equation, complete the table of values and draw its graph for values of x from −2 to 3.

(a) $y = 2x + 4$

x	-2	-1	0	1	2	3
y						

(b) $y = 4x - 2$

x	-2	-1	0	1	2	3
y						



Question 3: For each equation, complete the table of values and draw its graph for values of x from −2 to 2.

(a) $y = 3x + 3$

x	-2	-1	0	1	2
y					

(b) $y = x + 9$

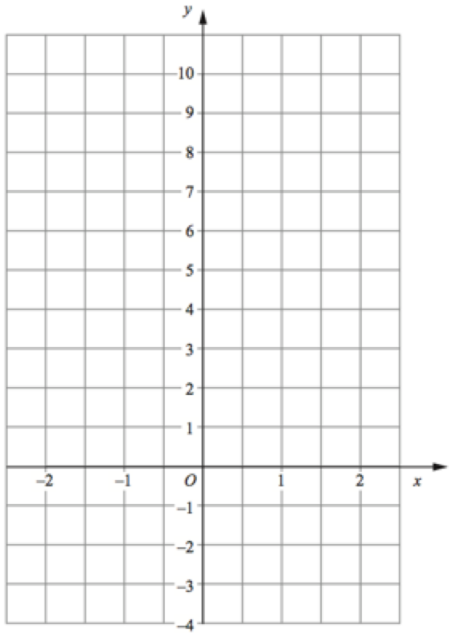
x	-2	-1	0	1	2
y					

(c) $y = x - 2$

x	-2	-1	0	1	2
y					

(d) $y = x$

x	-2	-1	0	1	2
y					



Question 4: For each equation, complete the table of values and draw its graph for values of x from −2 to 4.

(a) $y = \frac{1}{2}x + 1$

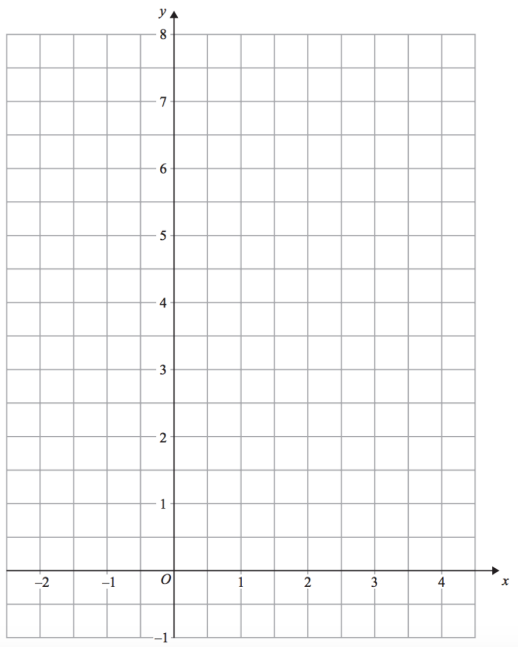
x	-2	-1	0	1	2	3	4
y							

(b) $y = \frac{1}{4}x + 5$

x	-2	-1	0	1	2	3	4
y							

(c) $y = \frac{1}{3}x + 1$

x	-2	-1	0	1	2	3	4
y							



Question 5: For each equation, complete the table of values and draw its graph for values of x from −1 to 3.

(a) $y = -2x + 5$

x	-1	0	1	2	3
y					

(b) $y = -x - 2$

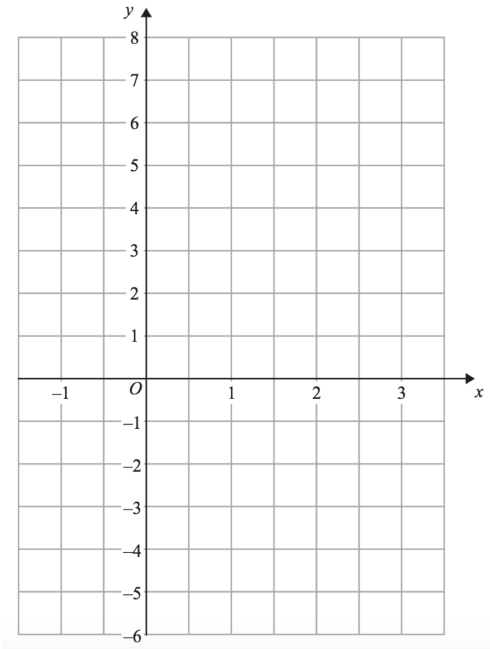
x	-1	0	1	2	3
y					

(c) $y = -2x$

x	-1	0	1	2	3
y					

(d) $y = 6 - x$

x	-1	0	1	2	3
y					



Question 6: For each equation, complete the table of values and draw its graph for values of x from −1 to 3.

(a) $x + y = 3$

x	-1	0	1	2	3
y					

(b) $2x + y = 4$

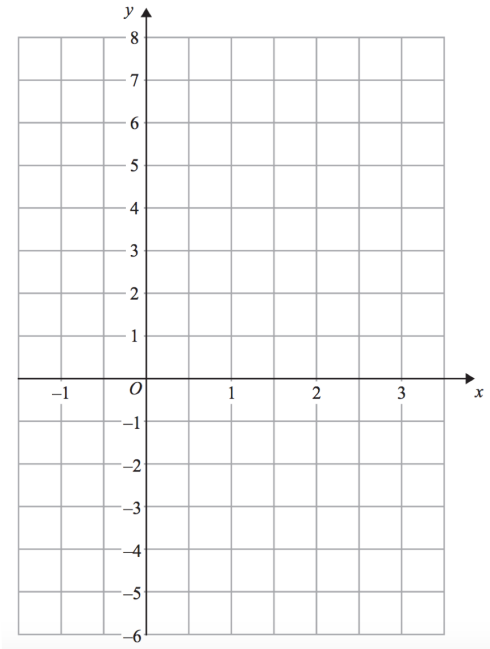
x	-1	0	1	2	3
y					

(c) $x + 2y = -2$

x	-1	0	1	2	3
y					

(d) $2x - y = 4$

x	-1	0	1	2	3
y					



Question 7: For each equation, draw its graph for values of x from −2 to 3.

(a) $y = 2x + 3$

(b) $y = 5x - 4$

(c) $y = x - 3$

(d) $y = 3x$

(e) $y = \frac{1}{2}x + 3$

(f) $y = -2x - 1$

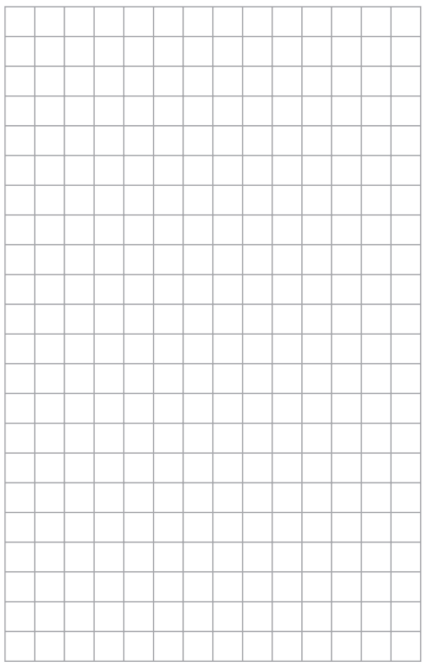
(g) $x + y = 8$

(h) $2x + y = 12$

(i) $x + 2y = 10$

(j) $2x + 3y = 12$

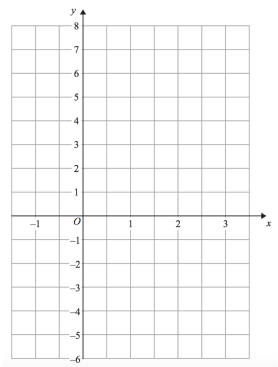
(k) $2x + 5y - 20 = 0$



Apply

Question 1: (a) Draw $y = x + 1$ and $y = 2x - 1$ on the same set of axes.

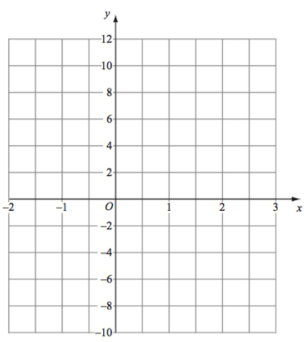
(b) Where do the two graphs intersect?



Question 2: (a) Draw $y = 3x - 4$

(b) Draw $x + y = 2$

The graph $y = 3x - 4$ crosses the y-axis at the point A
The graph $x + y = 2$ crosses the x-axis at the point B
O is the origin.



(c) Write down the coordinates of the point A

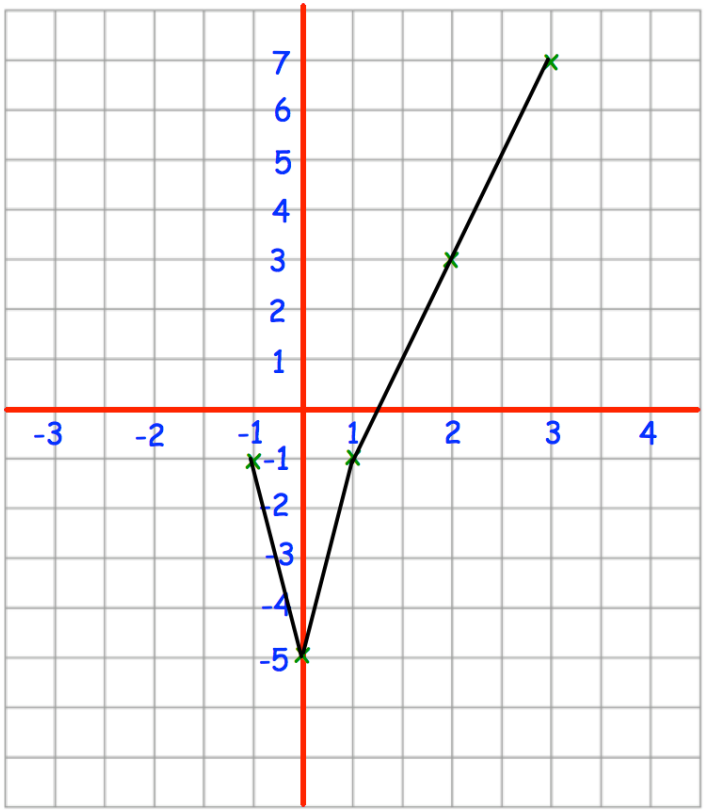
(d) Write down the coordinates of the point B

(e) Find the area of triangle OAB.

Fluency Practice

Question 3: Emma has tried to draw the graph of $y = 4x - 5$
Can you spot any mistakes?

Question: On the grid, draw $y = 4x - 5$ for values of x from –2 to 2.

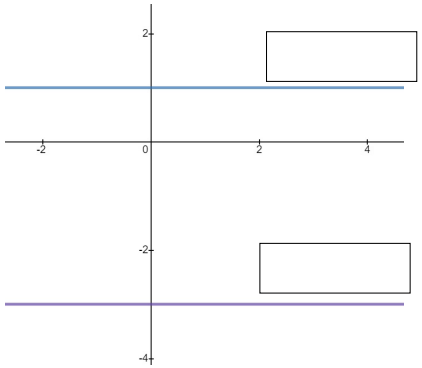


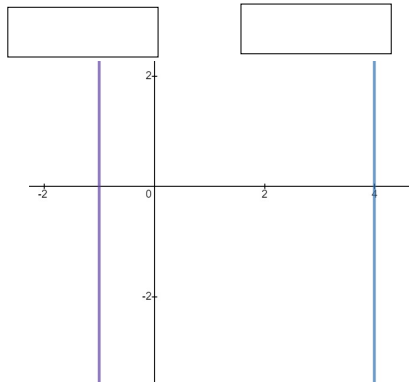
x	-1	0	1	2	3
y	-1	-5	-1	3	7

Fluency Practice

Vertical and horizontal lines.

1) Fill in the boxes with the equations of the straight lines.





2) Write the equation of the line that all of the following points will fall on.

(a) (4, 5), (4, 9), (4,0), (4,-3)

(b) (-10, 2), (173, 2), (10,2), (-0.3,2)

(c) (4.3, 0.1), (0, 0.1), (-9, 0.1)

(d) $(-\frac{1}{3}, 10)$, $(-\frac{1}{3}, -3)$, $(-\frac{1}{3}, 0.5)$, $(-\frac{1}{3}, -0.1)$

3) Thinking carefully about the coordinates can you find the equation of…

(a) The x-axis

(b) The y-axis

4) A point has the coordinates of (3, -5).

(a) What are the equations of the horizontal and vertical lines that this point is on?

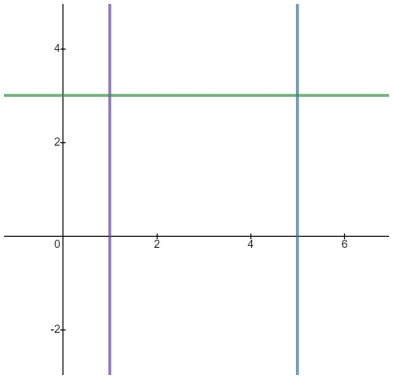
(b) The line is vertical. Which of those two equations from (a) will it be?

5) A shape is made by the area enclosed by the lines x = 1, x = 9, y = 2 and y = 5.

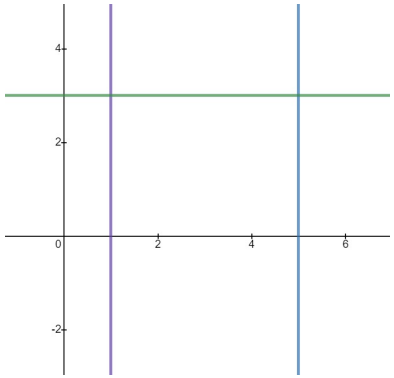
(a) What is the shape?

(b) What is the area of the shape?

6) Write down the equation of the straight line that would make the enclosed shape a square.

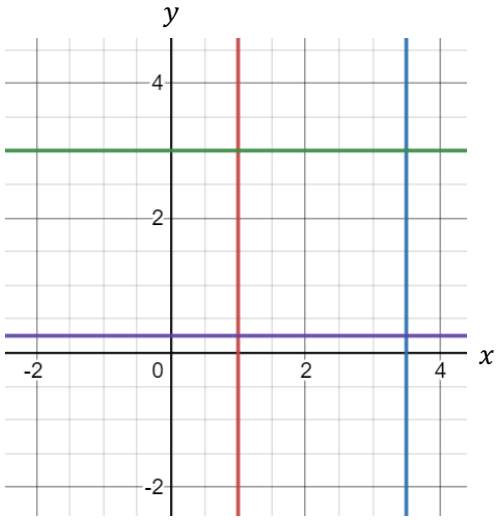


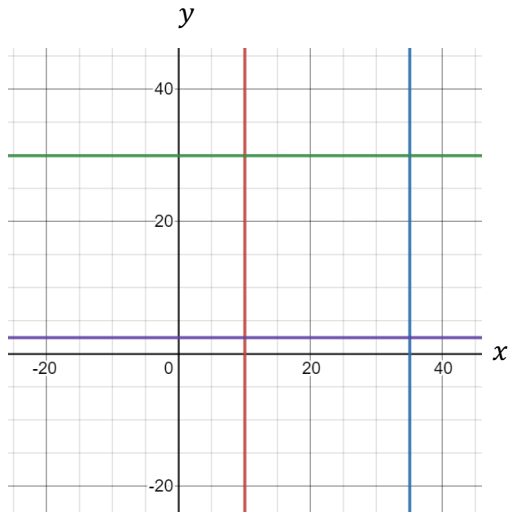
7) There is a rectangle below with a side missing. If the area of the rectangle is 24cm², what will be the equation of the missing line?

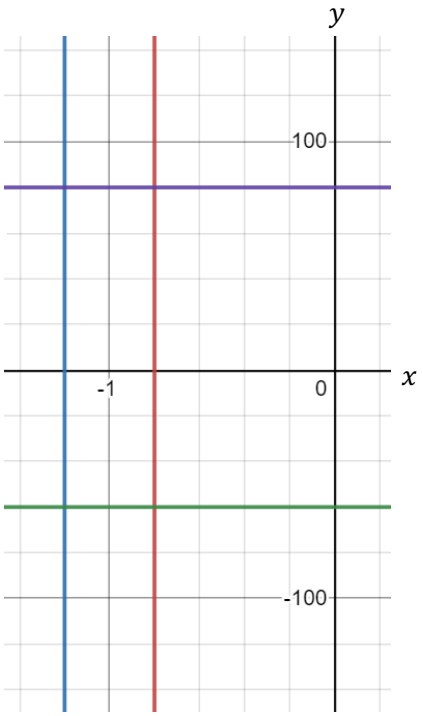


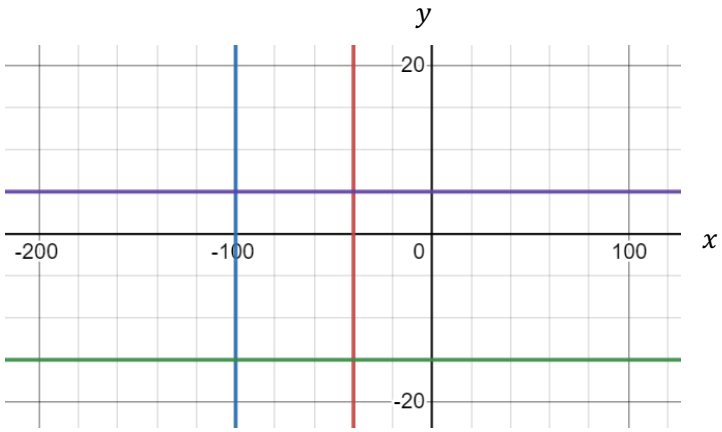
Fluency Practice

Write down the equation of each line on each graph









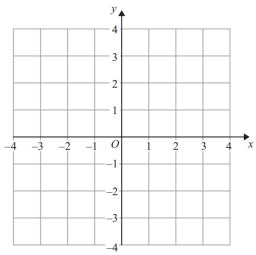
Question 1: Draw the following graphs

(a) x = 1

(b) x = 4

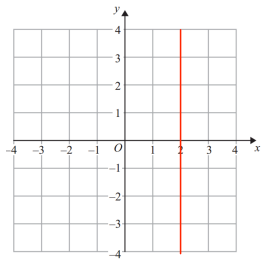
(c) x = −2

(d) x = 1.5

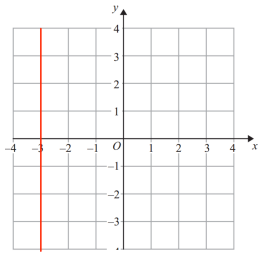


Question 2: Write down the equations of each of the lines shown below

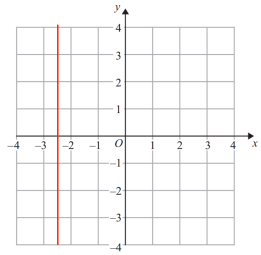
(a)



(b)



(c)



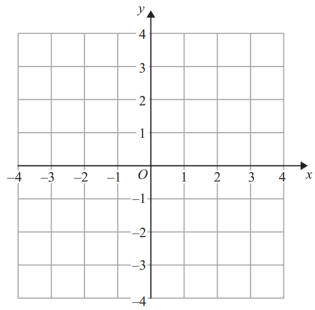
Question 3: Draw the following graphs

(a) y = 2

(b) y = −1

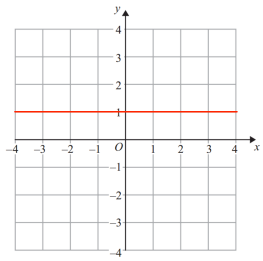
(c) y = −4

(d) y = 0.5

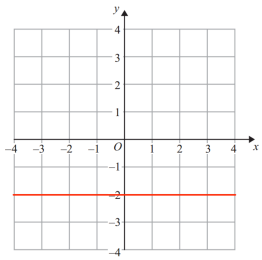


Question 4: Write down the equations of each of the lines shown below

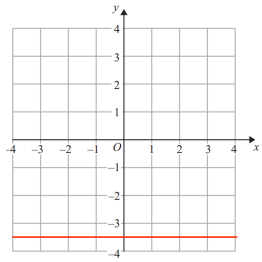
(a)



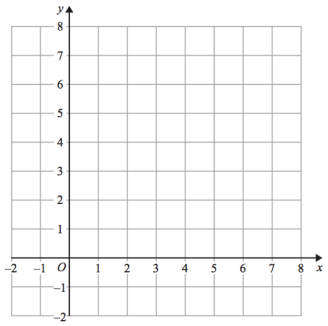
(b)



(c)



Apply

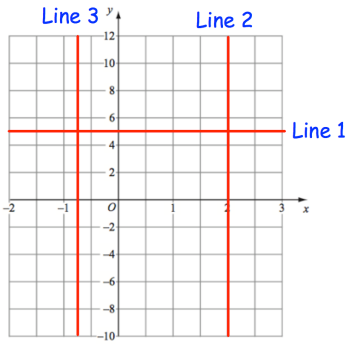


Question 1: On a copy of the grid shown

(a) draw y = 5

(b) draw x = 4

(c) Write down where the two lines meet.



Question 2: Write down the equation of

(a) Line 1

(b) Line 2

(c) Line 3

Question 3: From the box below, choose any coordinates that lie on:

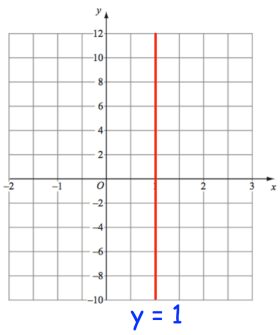
(a) y = 2 (b) x = 4

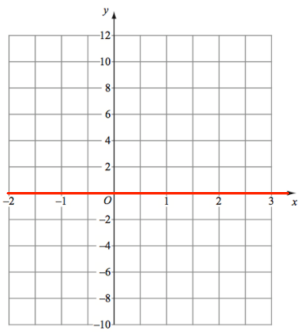
(c) x = 3 (d) y = −1

(e) the x−axis (f) the y−axis

(2, 3) (6, 0) (-1, 2)
(5, -6)
(4, -1)
(3, 4)
(0, 5)

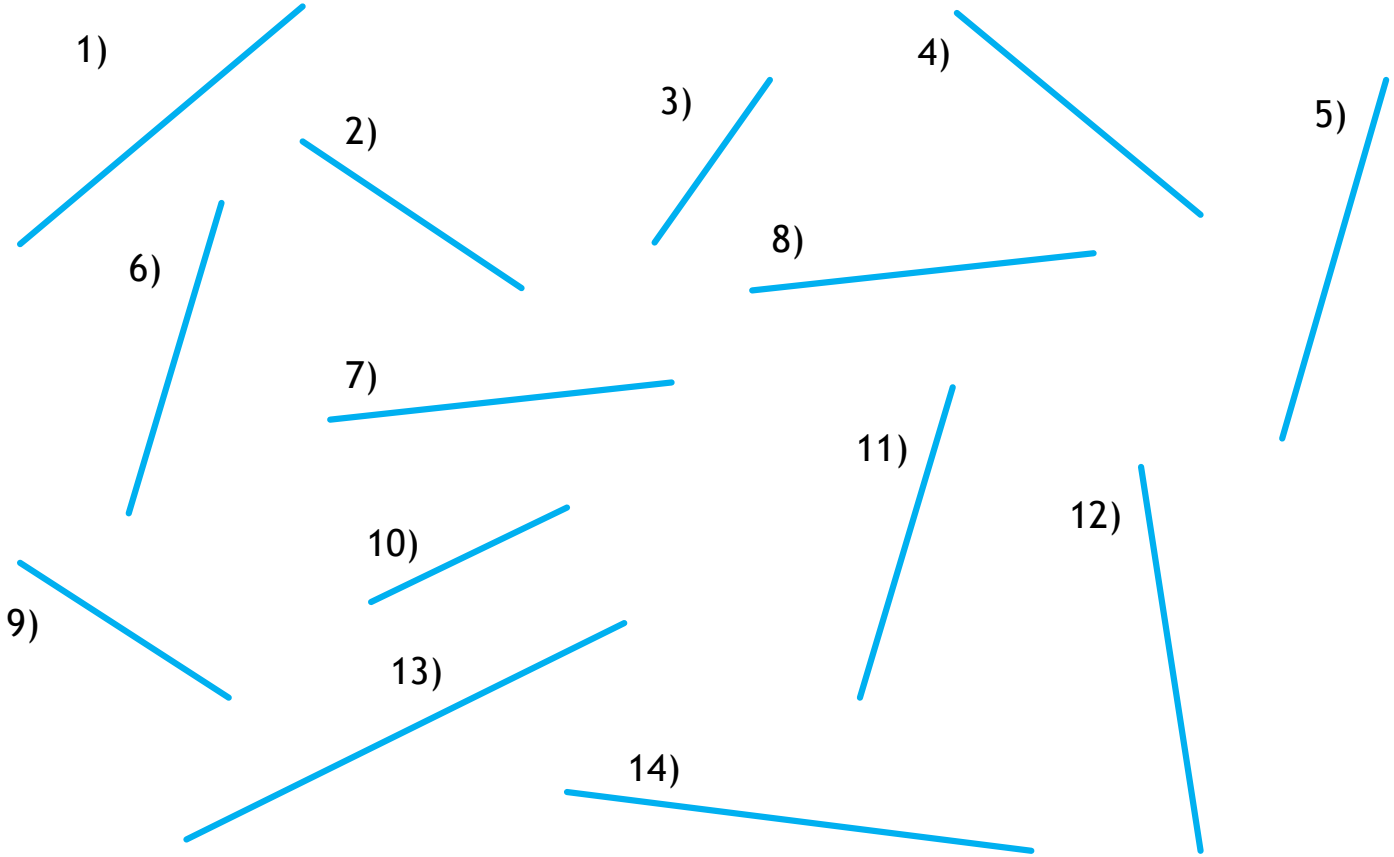
Question 4: Michael has completed his homework
Can you spot any mistakes?





Fluency Practice

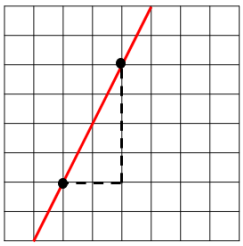
For each blue line, write down whether it has a positive or negative gradient.



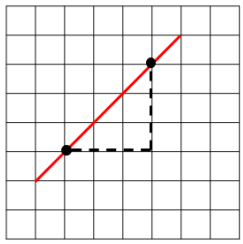
Finding Gradients

Using the gradient triangles shown, find the gradient of each of these lines.

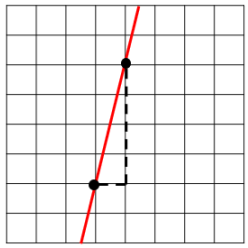
(a)



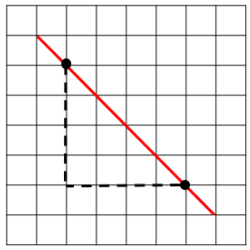
(b)



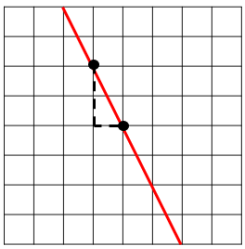
(c)



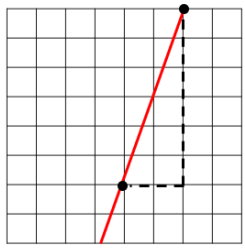
(d)



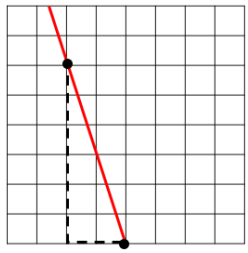
(e)



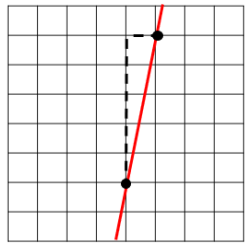
(f)



(g)

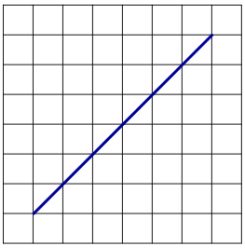


(h)

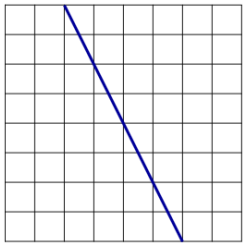


Now draw your own gradient triangles to find the gradient of each of these lines.

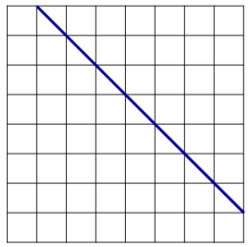
(i)



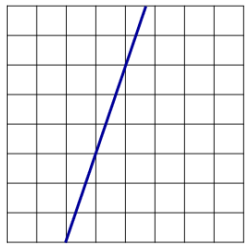
(j)



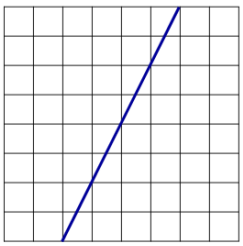
(k)



(l)



(m)



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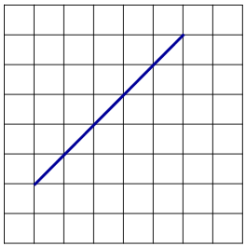
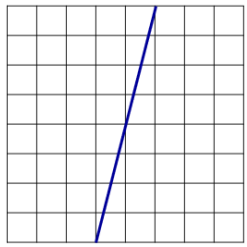
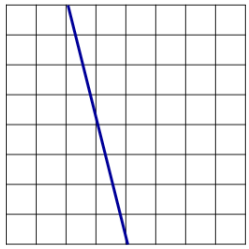


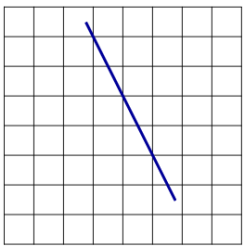
(o)



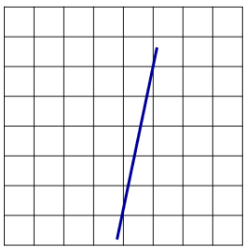
(p)



(q)



(r)



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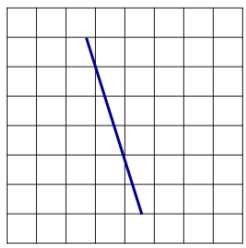

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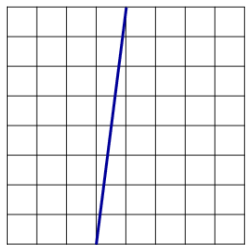
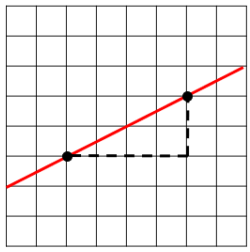


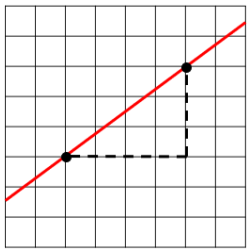
Finding Fractional Gradients

Using the gradient triangles shown, find the gradient of each of these lines.

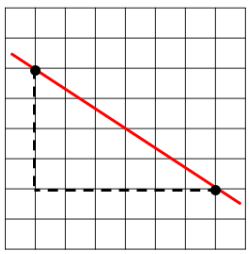
(a)



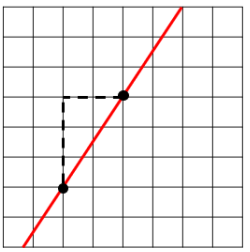
(b)



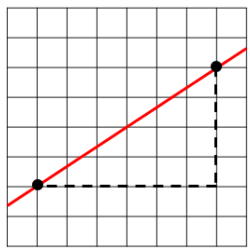
(c)



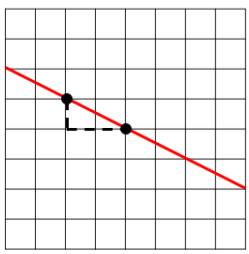
(d)



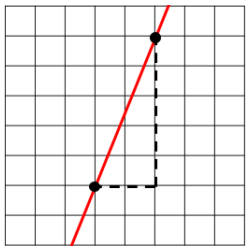
(e)



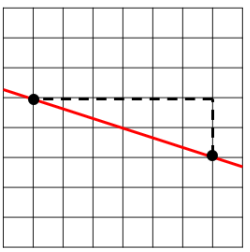
(f)



(g)

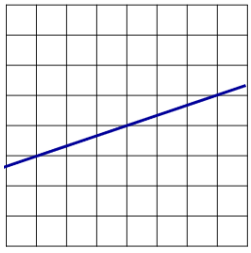


(h)

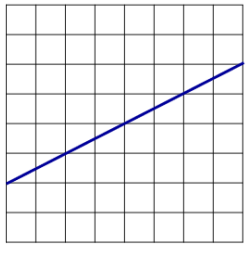


Now draw your own gradient triangles to find the gradient of each of these lines.

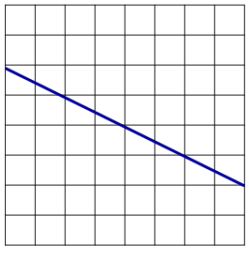
(i)



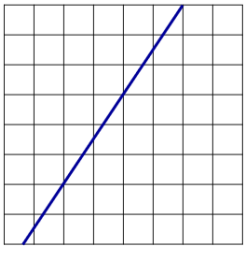
(j)



(k)



(l)



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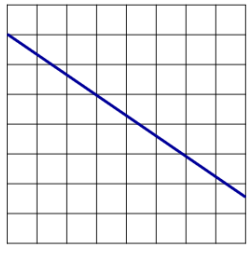

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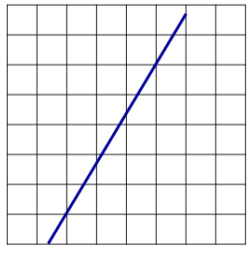

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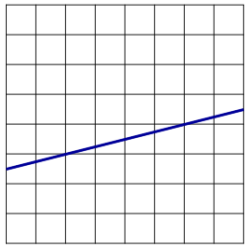
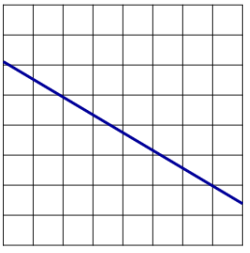
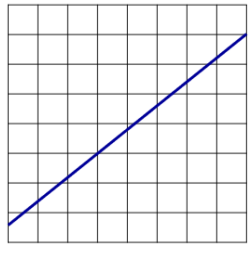


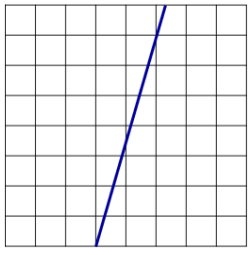
(p)



(q)



(r)



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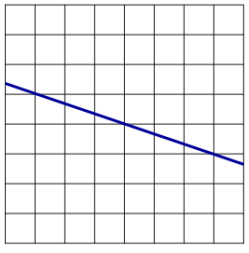
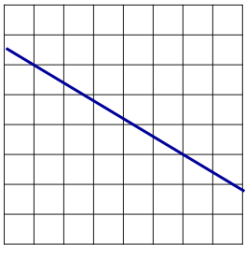
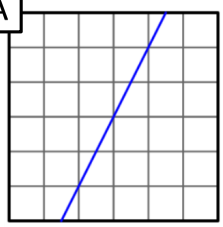


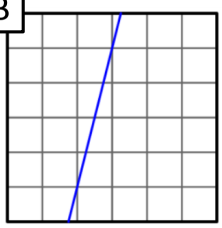
(t)

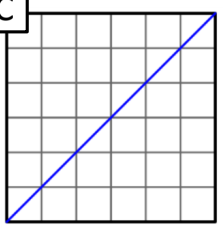


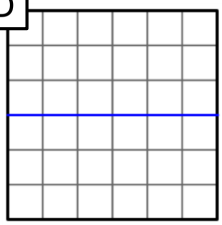
gradient

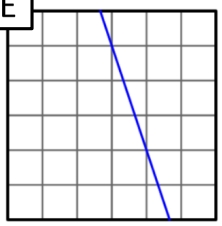
Match the lines with the gradients.

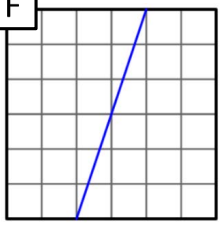
A 

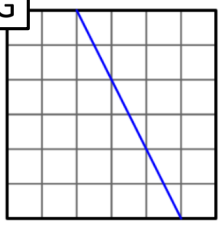
B 

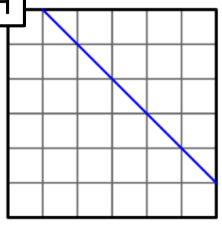
C 

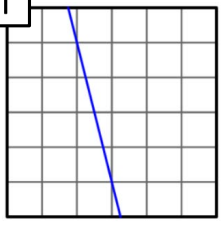
D 

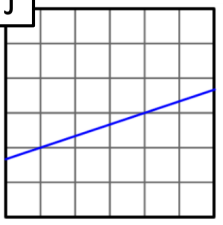
E 

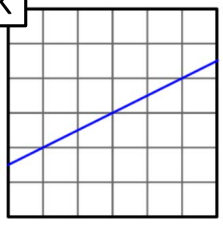
F 

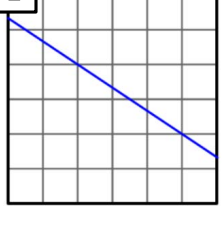
G 

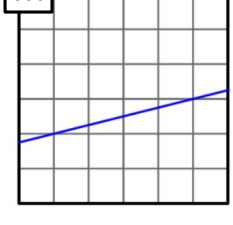
H 

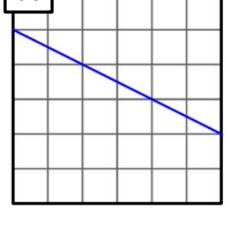
I 

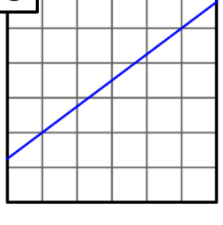
J 

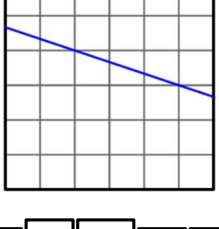
K 

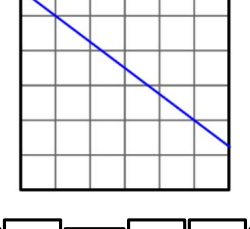
L 

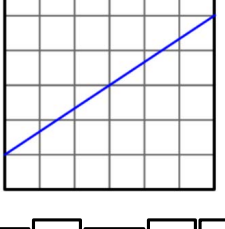
M 

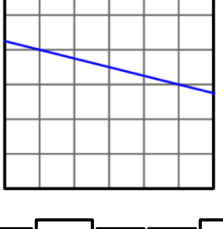
N 

O 

P 

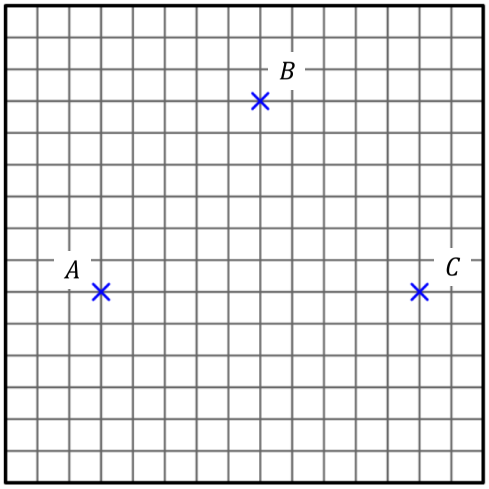
Q 

R 

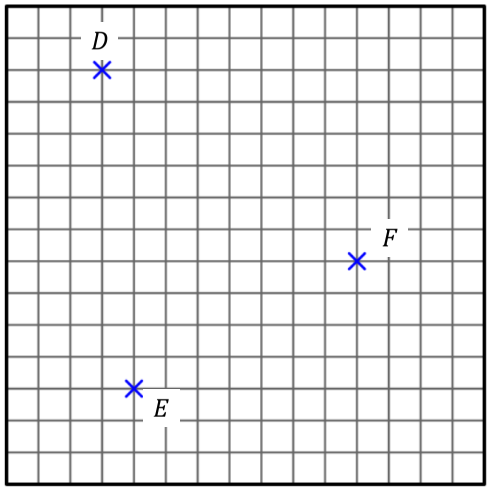
S 

1	$\frac{1}{3}$	$-\frac{1}{3}$	4	-2	$-\frac{1}{2}$	-3	$-\frac{1}{4}$	$-\frac{3}{4}$	-4	$\frac{2}{3}$	-1	$\frac{1}{2}$	$\frac{1}{4}$	2	$-\frac{2}{3}$	3	0	$\frac{3}{4}$

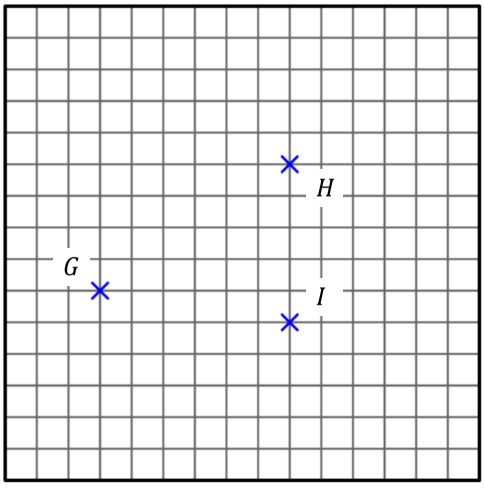
1. Draw:
(a) a line with gradient 2 through point A.
(b) a line with gradient 0 through point B.
(c) a line with gradient -3 through point C.



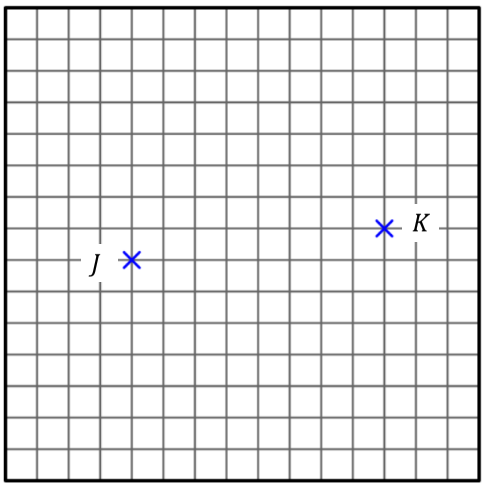
2. Draw:
(a) a line with gradient $-\frac{1}{2}$ through point D.
(b) a line with gradient 3 through point E.
(c) a line with gradient $\frac{1}{3}$ through point F.



3. Draw:
(a) a line with gradient $\frac{3}{2}$ through point G.
(b) a line with gradient 0.75 through point H.
(c) a line with gradient $-\frac{4}{3}$ through point I.



4. Draw:
(a) a line with gradient -2 through point J.
(b) a line with gradient -2 through point K.
(c) a line with gradient $\frac{1}{2}$ through point J.
(d) a line with gradient $\frac{1}{2}$ through point K.
What shape have you made?



5. Hailey draws a line with gradient $\frac{1}{4}$.
Bob draws a different line with gradient $\frac{1}{5}$.
Hailey says the two lines never meet.
Do you agree?

6. Thomas draws a line with gradient 3.
Sarah draws a different line with gradient -3.
Thomas says the two lines meet at right angles. Do you agree?

Find the gradients of the straight lines through these pairs of points.

(a) (0, 0) and (2, 8)

(b) (0, 0) and (8, 2)

(c) (3, 0) and (5, 6)

(d) (3, 0) and (5, 5)

(e) (0, 8) and (4, 0)

(f) (1, 5) and (3, 1)

(g) (1, 5) and (3, -1)

(h) (3, 3) and (9, -3)

(i) (2, 4) and (-2, 16)

(j) (4, 4) and (-8,-2)

(k) A line with a gradient of 3 passes through the points (2, 6) and (4, a). Find the value of a.

(l) A line with gradient -2 passes through the points (5, 5) and (b, 9). Find the value of b.

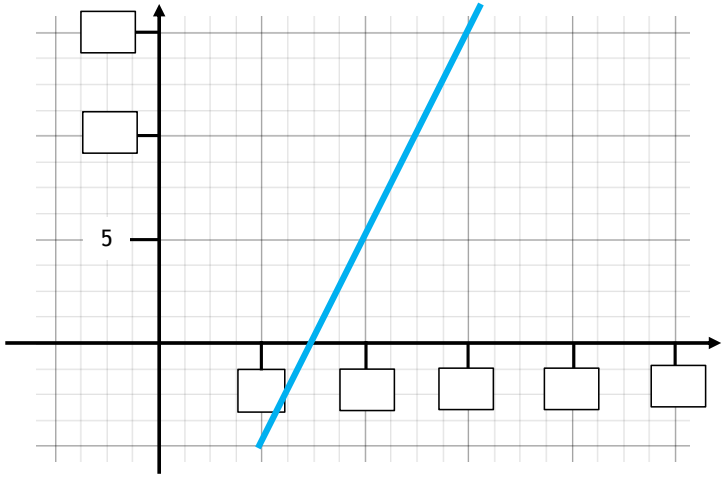
(m) A line with gradient ½ passes through the points (c, 8) and (-1, 5). Find the value of c.

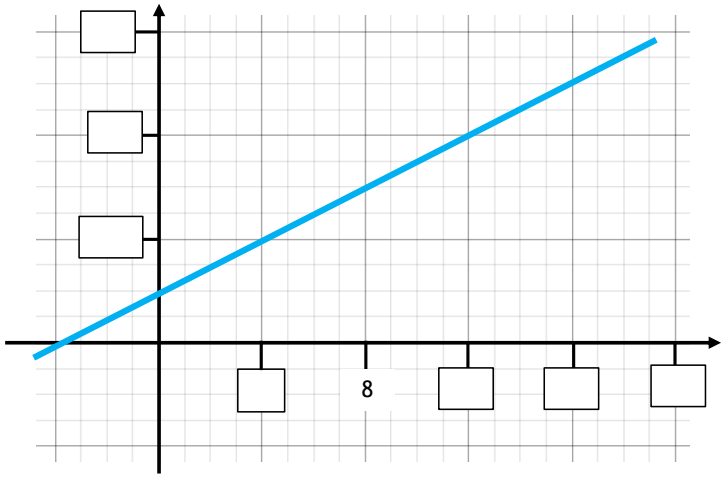
(n) Find the gradient of the line joining the points (4, 5) and (6, 5). What is the equation of this line?

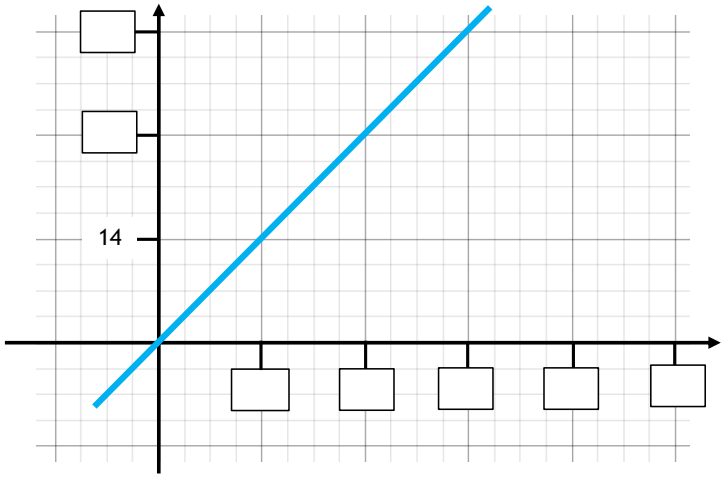
(o) Find the gradient of the line joining (9, -1) and (9, 5). What is the equation of this line?

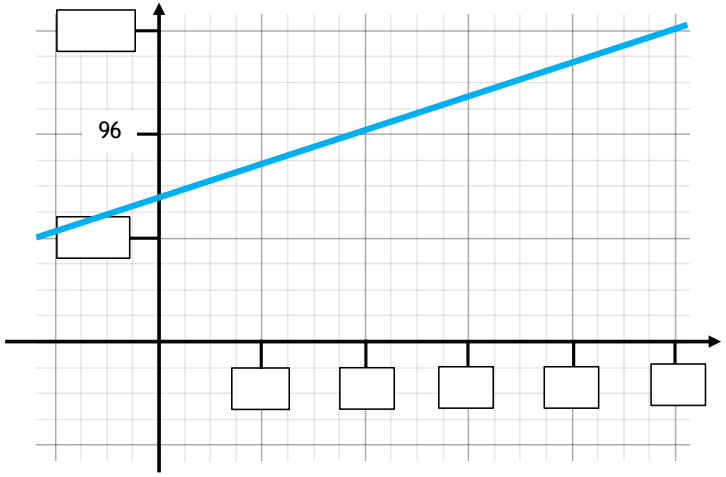
Problem Solving

Every line has a gradient of 2. Complete the missing values on each axis.



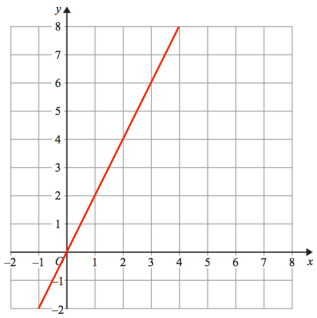




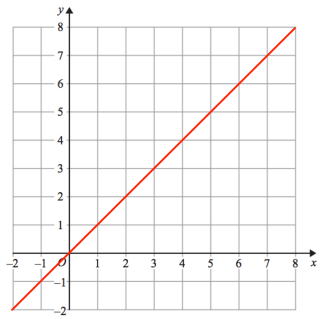


Question 1: Find the gradient of each of these lines

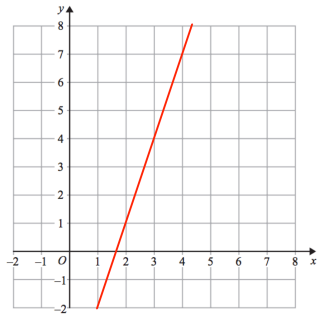
(a)



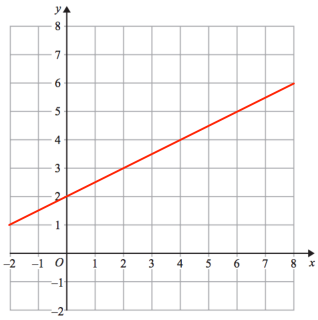
(b)



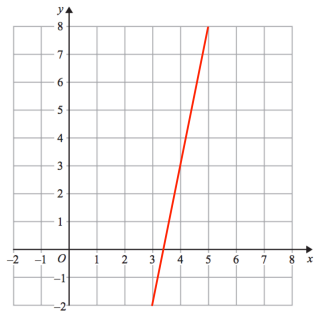
(c)



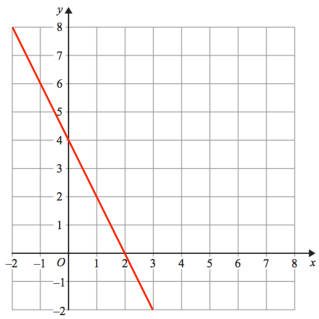
(d)



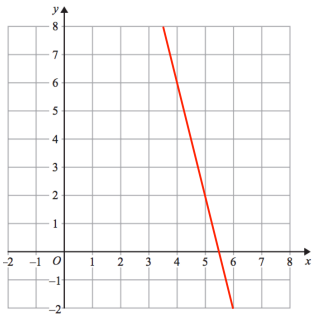
(e)



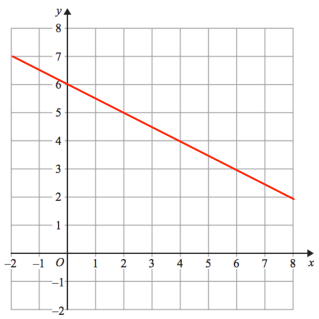
(f)



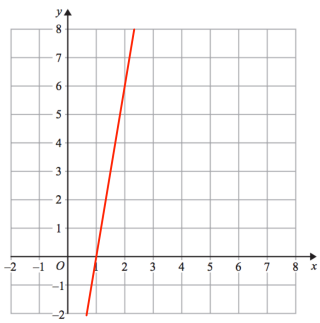
(g)



(h)



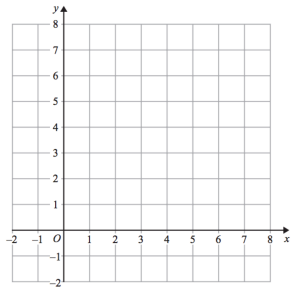
(i)



Question 2: Draw lines with the following gradients

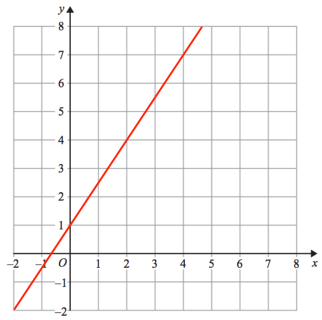
(a) 2 (b) 4 (c) 7 (d) −1

(e) −3 (f) −5 (g) $\frac{1}{2}$ (h) 10

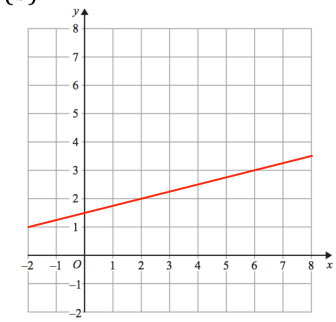


Question 3: Find the gradient of each of these lines

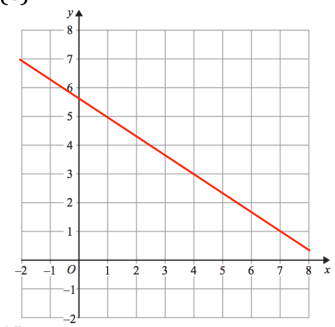
(a)



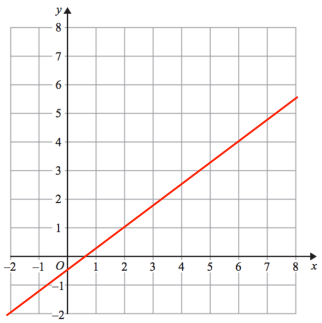
(b)



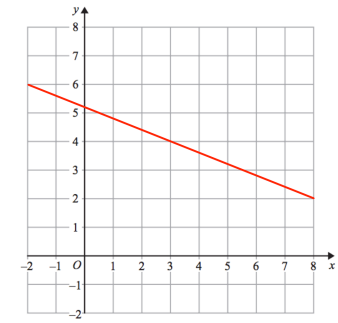
(c)



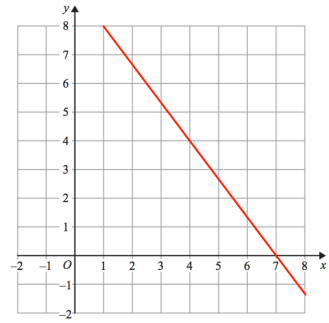
(d)



(e)



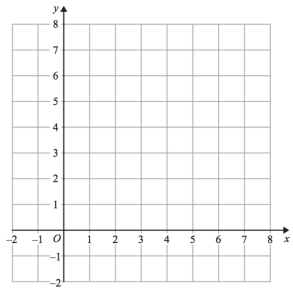
(f)



Question 4: Draw lines with the following gradients

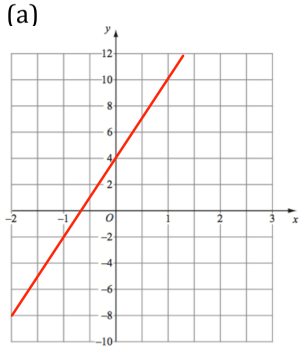
(a) $2\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{5}$ (d) $-\frac{1}{6}$

(e) $\frac{3}{10}$ (f) $\frac{4}{5}$ (g) $1\frac{1}{3}$ (h) $-\frac{3}{5}$

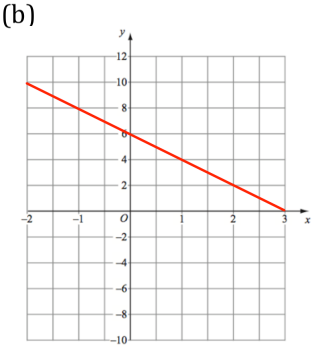


Question 5: Find the gradient of each of these lines

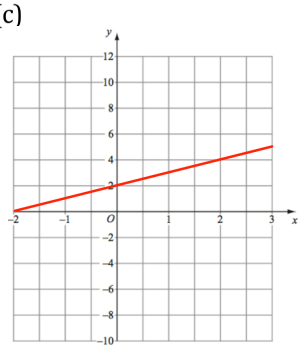
(a)



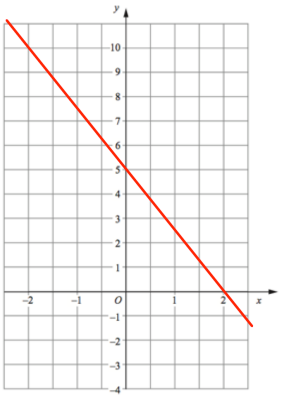
(b)



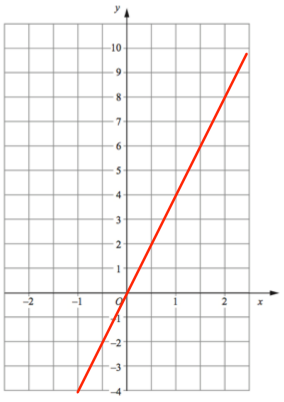
(c)



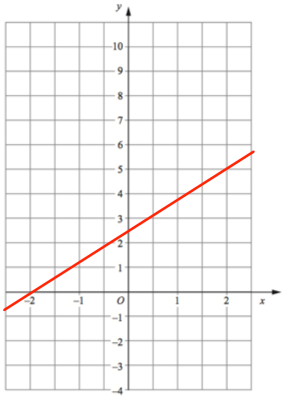
(d)



(e)

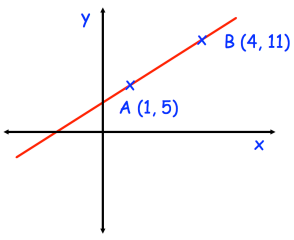


(f)

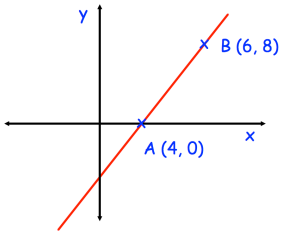


Question 6: Find the gradient of each line shown below

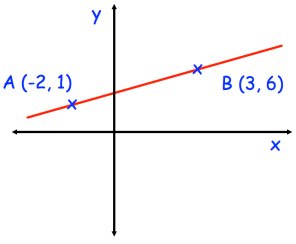
(a)



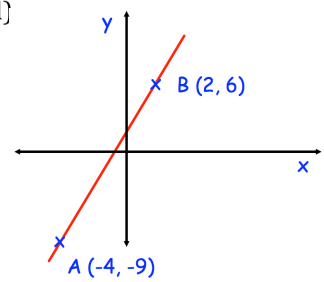
(b)



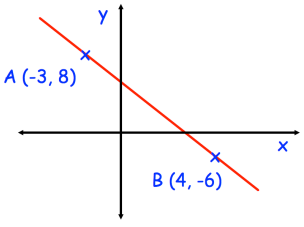
(c)



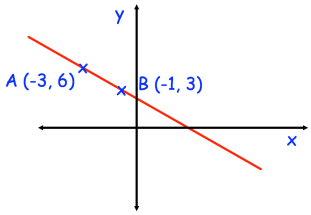
(d)



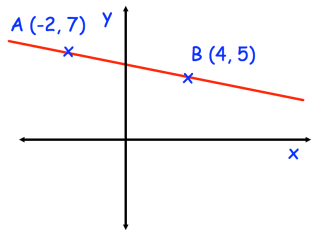
(e)



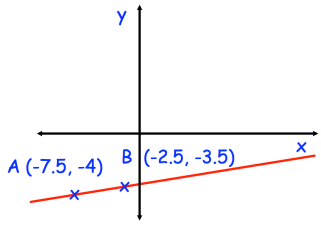
(f)



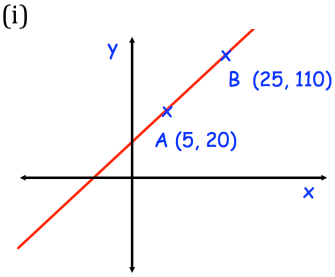
(g)



(h)



(i)



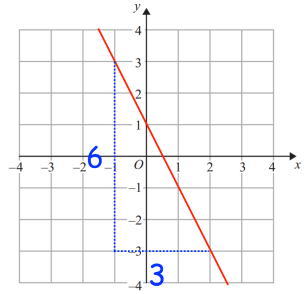
Question 7: Work out the gradient of the line passing through these pairs of points

(a) (1, 4) and (3, 10) (b) (0, 0) and (3, 12) (c) (5, −2) and (9, 14)

(d) (−8, 6) and (0, −2) (e) (−5, −9) and (1, 3) (f) (−7, −2) and (1, −4)

(g) (−2, 1) and (8, −7) (h) (−2, 9) and (4, 7) (i) (−4.5, 3) and (6, −7.5)

Apply



Question 1: Alisha says that the gradient of the line is 2.
Explain her mistake.

Question 2: Find the gradient of the line passing through the points (4a, −a) and (6a, 5a)

Question 3: The line passing through (5, −2) and (8, c) has a gradient of 3.
Find c.

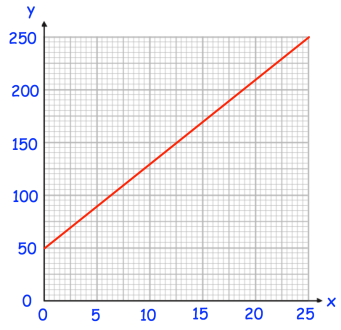
Question 4: The line passing through (−8, −9) and (−2, h) has a gradient of 4.
Find h.

Question 5: The line passing through (3, −4) and (m, 10) has a gradient of 2.
Find m.

Question 6: The line passing through (−2, 5) and (2, n) has a gradient of −½
Find n.

Question 7: The line passing through (1, p) and (5, 1) has a gradient of 0.75
Find p.

Question 8: Find the equation of the line shown



More-Same-Less

Instructions: Find the gradient on the middle box. Choose a value of x and y for the blank co-ordinate to complete the grid. Try and make your questions and answers as similar as possible to the middle.

Value of the Gradient

Value of the x - coordinate

	Less	Same	More
Less	$(2\,,5)$ and (,)	$(2\,,5)$ and (,)	$(2\,,5)$ and (,)
Same	$(2\,,5)$ and (,)	$(2\,,5)$ and ($\mathbf{5}\,,\mathbf{14}$)	$(2\,,5)$ and (,)
More	$(2\,,5)$ and (,)	$(2\,,5)$ and (,)	$(2\,,5)$ and (,)

Extension: Try the same with different y values instead of x values, try make one yourself with negative and fractional gradients

More-Same-Less

Instructions: Find the gradient on the middle box. Choose a value of x and y for the blank co-ordinate to complete the grid. Try and make your questions and answers as similar as possible to the middle.

Value of the Gradient

Distance between the coordinates	Less	Same	More
Less	$(2\,,5)$ and (,)	$(2\,,5)$ and (,)	$(2\,,5)$ and (,)
Same	$(2\,,5)$ and (,)	$(2\,,5)$ and ($\mathbf{5}$, $\mathbf{9}$)	$(2\,,5)$ and (,)
More	$(2\,,5)$ and (,)	$(2\,,5)$ and (,)	$(2\,,5)$ and (,)

Extension: Try the same with different y values instead of x values, try make one yourself with negative and fractional gradients

Gradient and intercept from an equation

$y = mx + c$	Gradient	Intercept
$y = 2x + 1$		
$y = 3x - 5$		
$y = -4x + 7$		
$y = x + 111$		
$y = \frac{1}{2}x - 4$		
$y = -x + 3$		
$y = 1$		
$y = 8x$		

<u>Extension</u>

These equations are not currently in form $y = mx + c$ so you need to rearrange them

~~$y = mx + c$~~	$y = mx + c$	Gradient	Intercept
$2y = 4x + 10$			
$3y = 9x - 18$			
$y - x = 5$			
$y - 2x = 7$			
$y + 3x = 1$			

Rearrange these equations into the form $y = mx + c$

(a) $y = 5 + 3x$ (b) $2x + y = 15$

(c) $y - 4x = 9$ (d) $x + y - 5 = 0$

Rearrange these equations into the form $y = mx + c$

(a) $2y = 6x + 10$ (b) $3y = 12 - 9x$

(c) $4x + 2y = 12$ (d) $2x + 3y - 7 = 0$

For each of these equations, rearrange into the form $y = mx + c$ and find the gradient and y-intercept.

(a) $y = 6 + 2x$ (b) $y = 1 - 3x$

(c) $x + y = 5$ (d) $3x + y = 7$

(e) $4x = y - 2$ (f) $2x - y = 3$

(g) $5x - y - 1 = 0$

For each of these equations, rearrange into the form $y = mx + c$ and find the gradient and y-intercept.

(a) $2y = 4x + 6$ (b) $3y = 12 - 6x$

(c) $8x + 2y = 20$ (d) $12x + 4y = 16$

(e) $2y = 3x + 7$ (f) $3x + 4y = 9$

(g) $3x - 6y - 12 = 0$

Rearrange these equations into the form $y = mx + c$

(a) $y = 5 + 3x$ (b) $3y = 12 - 9x$

(c) $2y = 6x + 10$ (d) $2x + y = 15$

(e) $y - 4x = 9$ (f) $4x + 2y = 12$

(g) $x + y - 5 = 0$ (h) $2x + 3y - 7 = 0$

Rearrange these equations into the form $ax + by + c = 0$

(a) $y = x - 5$ (b) $y = 2x + 5$

(c) $y = -4x + 7$ (d) $y = -x - 3$

(e) $y = \frac{1}{2}x + 4$ (f) $y = \frac{1}{3}x - \frac{5}{3}$

Rearrange these equations into the form $ax + by = c$

(a) $y = x - 6$ (b) $y = 3x - 1$

(c) $y = -5x - 7$ (d) $y = -x + 8$

(e) $y = \frac{1}{2}x - 5$ (f) $y = -\frac{2}{3}x - \frac{1}{3}$

For each of these equations, rearrange into the form $y = mx + c$ and find the gradient and y-intercept.

(a) $y = 6 + 2x$ (b) $y = 1 - 3x$

(c) $2y = 4x + 6$ (d) $3y = 12 - 6x$

(e) $x + y = 5$ (f) $3x + y = 7$

(g) $2x - y = 3$ (h) $4x = y - 2$

(i) $8x + 2y = 20$ (j) $12x + 4y = 16$

(k) $2y = 3x + 7$ (l) $3x + 4y = 9$

(m) $3x - 6y - 12 = 0$

(n) $5x - y - 1 = 0$

Find the gradient and the coordinates of the y-intercept for the straight lines given by these equations:

(a) $y = 2x + 1$ (b) $y = 2x + 3$

(c) $y = 3x + 2$ (d) $y = -3x + 2$

(e) $y = -3x - 2$ (f) $y = -3x - 7$

(g) $y = -3x$ (h) $y = 5x$

Find the gradient and the coordinates of the y-intercept for the straight lines given by these equations:

(a) $y = x + 1$ (b) $y = x - 5$

(c) $y = -x + 5$ (d) $y = \frac{1}{2}x + 2$

(e) $y = -\frac{1}{2}x + 5$ (f) $y = \frac{1}{3}x - 6$

(g) $y = -\frac{2}{3}x$ (h) $y = -\frac{2}{3}x + \frac{5}{3}$

Find the gradient and the coordinates of the y-intercept for the straight lines given by these equations:

(a) $y = 1 + 2x$ (b) $y = 1 - 2x$

(c) $y = 5 + 2x$ (d) $y = -5 + 2x$

(e) $y = 7 - \frac{1}{2}x$ (f) $y = -6 + \frac{2}{3}x$

Write down the equations of each straight line, given the following information:

(a) The gradient is 5 and the coordinates of the y-intercept are (0, 7).

(b) The gradient is -1 and the coordinates of the y-intercept are (0, 9).

(c) The gradient is $\frac{3}{4}$ and the coordinates of the y-intercept are (0, 0).

Fluency Practice

Reading

equation	gradient	y-intercept
$y = 3x$		(,)
$y = -4x$		
$y = 2x + 5$		
$y = -2x + 3$		
$y = 10 - x$		
$y = 7x - 1$		
$y = 6 - 2x$		
$y = \frac{x}{2}$		
$2y = 4x + 6$		
$y = \frac{x}{3} - 8$		
$y = 9 - 0.1x$		
$2x + y = 7$		
$3y - 6x = 2$		

Forming

equation	gradient	y-intercept
	$+5$	$(0, 0)$
	$+4$	$(0, 3)$
	-3	$(0, 0)$
	$+6$	$(0, -5)$
	-1	$(0, 8)$
	$+0.5$	$(0, 0)$
	-4	$(0, 7)$
	-2	$(0, -2)$
	-0.25	$(0,1)$
$2y =$	$+3$	$(0, 1)$
	-0.2	$(0, -3)$
$-y =$	$+5$	$(0, 7)$
$+ 2y =$	-1.5	$(0, 6)$

Plotting

equation	y-intercept	1st Integer Coordinates
$y = 4x$		$(1, \ )$
$y = -2x$		
$y = x + 5$		
$y = 2x + 3$		
$y = 5x - 4$		
$y = 4 - x$		
$y = \frac{x}{2}$		
$y = 7x + 8$		
$y = \frac{x}{3} + 2$		
$y = -6 - 4x$		
$y = 7 - \frac{1}{5}x$		
$x + 3y = 6$		
$3x - 2y = 24$		

More-Same-Less

Instructions: Complete the remaining boxes by making the minimum change possible to the centre box.

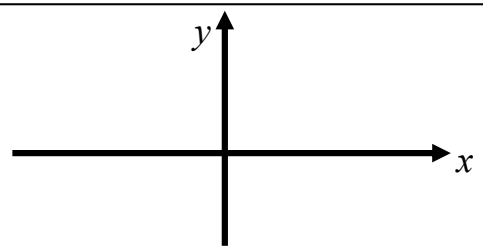
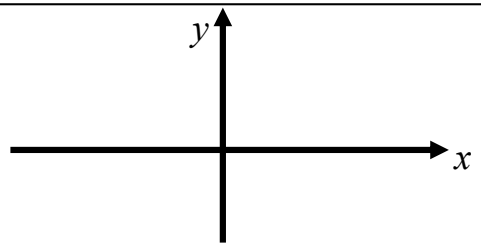
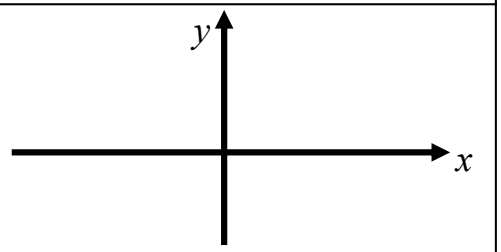
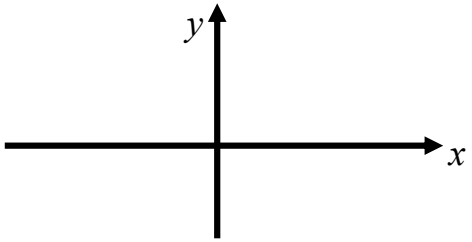
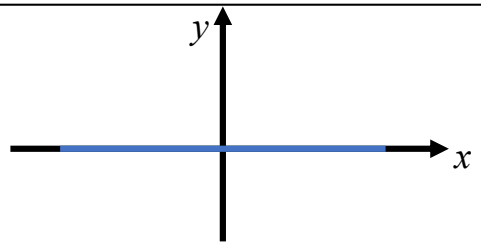
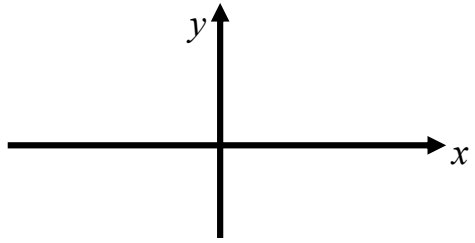
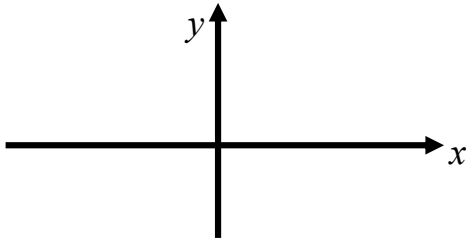
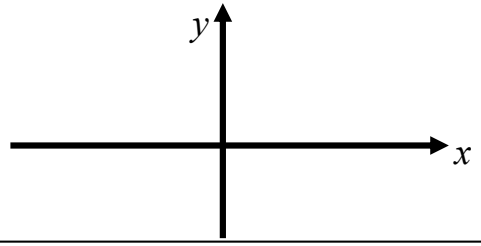
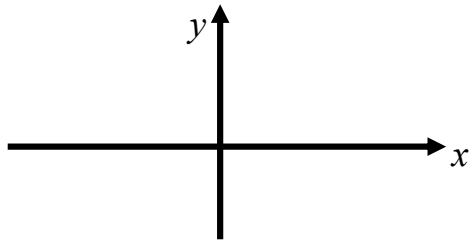
Gradient

Y-intercept	Less	Same	More
More			
Same		$y = 3x + 2$	
Less			

More-Same-Less

Instructions: Complete the remaining boxes by making the minimum change possible to the centre box.

Gradient

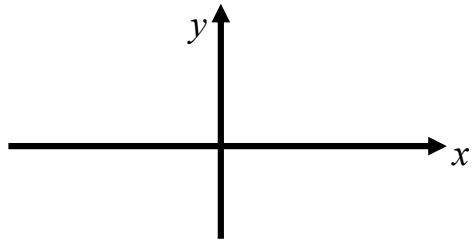
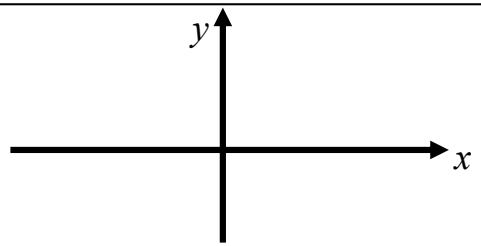
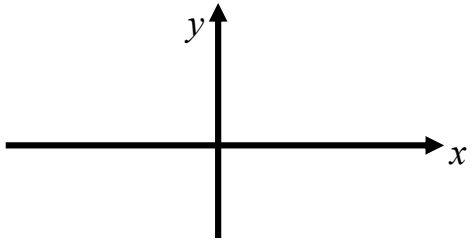
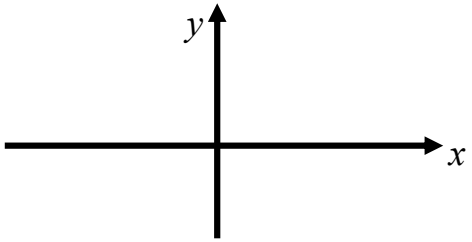
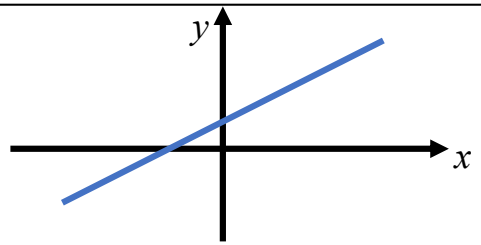
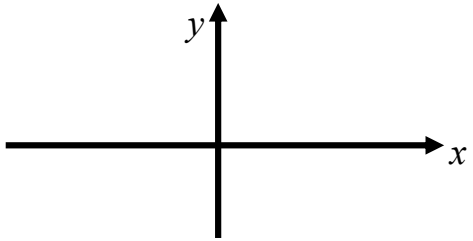
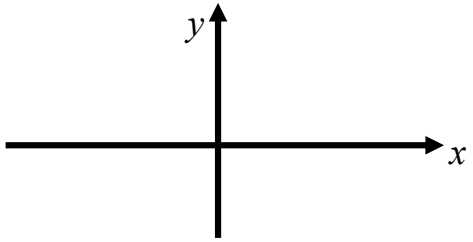
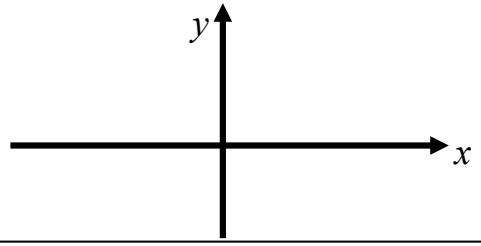
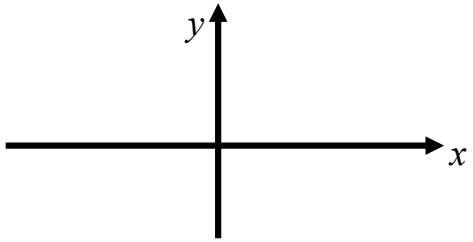
Y-intercept	Negative	0	Positive
Positive			
Zero			
Negative			

More-Same-Less

Instructions: Complete the remaining boxes by making the minimum change possible to the centre box.

Gradient

Y-intercept

	Less	Same	More
More			
Same			
Less			

More-Same-Less

Instructions: Calculate the value in the middle box. The complete the remaining boxes trying to make the minimal change possible.

Gradient

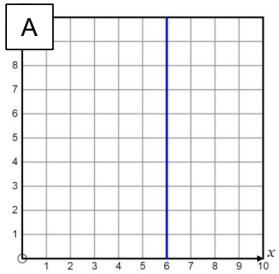
Y-intercept	Less	Same	More
More	(0,) and (,)	(0,) and (,)	(0,) and (,)
Same	(0,) and (,)	(0, 4) and (2, 6)	(0,) and (,)
Less	(0,) and (,)	(0,) and (,)	(0,) and (,)

Fluency Practice

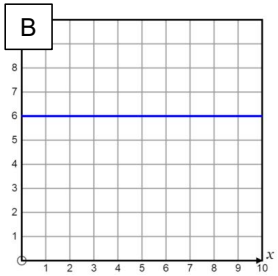
match each graph with its equation

- $y = 3x$
- $x = 2$
- $x = 6$
- $y = -x$
- $y = -2$
- $y = -2x$
- $y = 6$
- $x = -5$
- $y = 2x$
- $x = -2$
- $y = x$
- $y = -5$

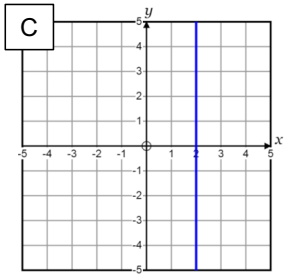
A



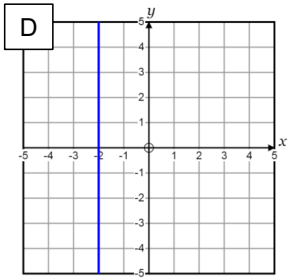
B



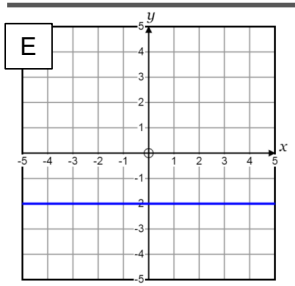
C



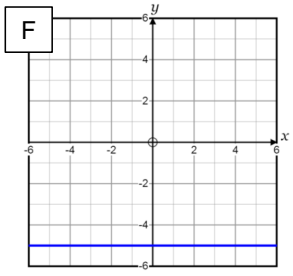
D



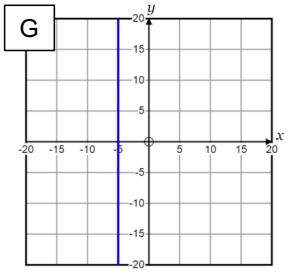
E



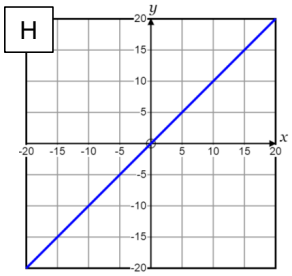
F



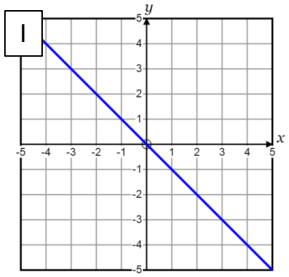
G



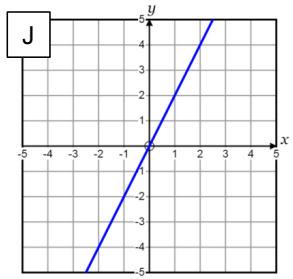
H



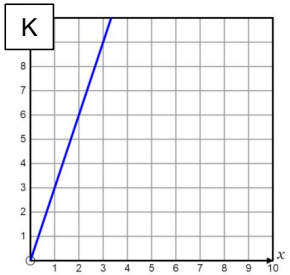
I



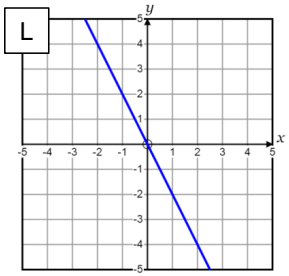
J



K



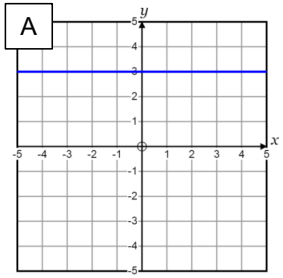
L



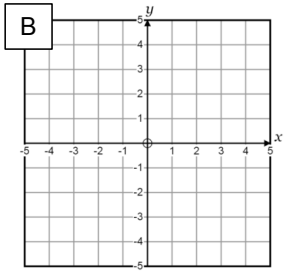
Fluency Practice

complete the equation or graph

A

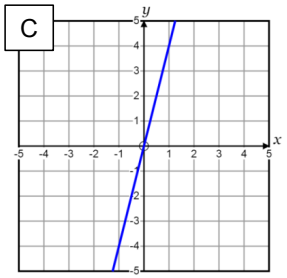


B

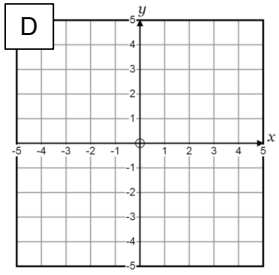


$x = 1$

C

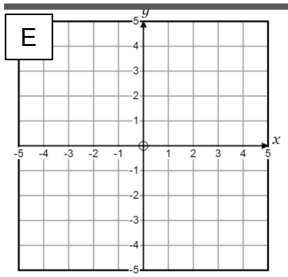


D



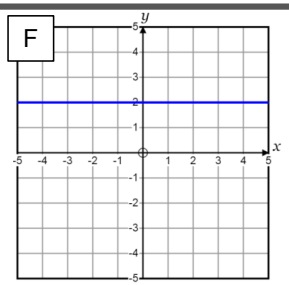
$y = -3$

E

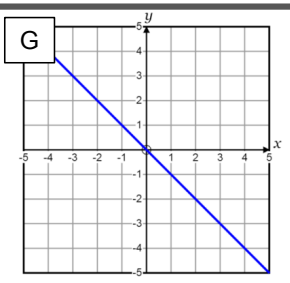


$y = -4x$

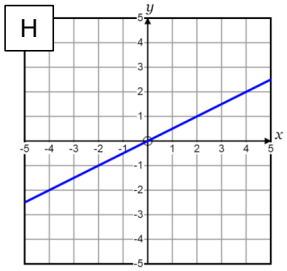
F



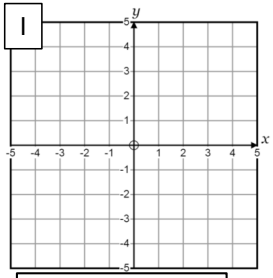
G



H

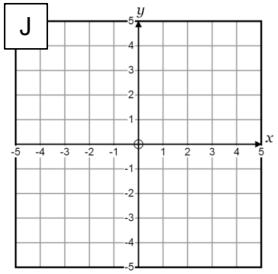


I



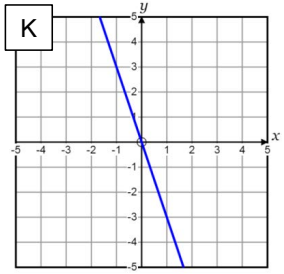
$y = 0$

J

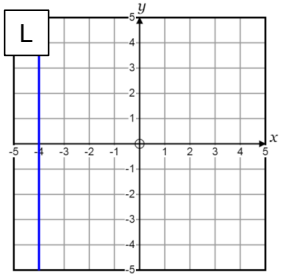


$y = x$

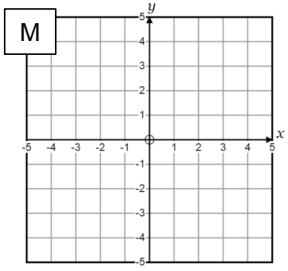
K



L

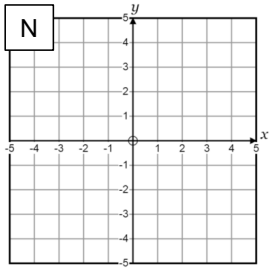


M



$y = 5x$

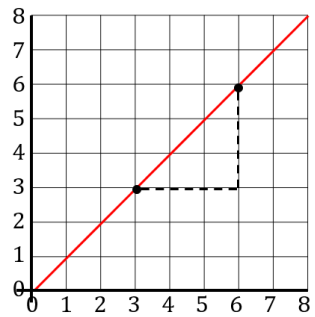
N



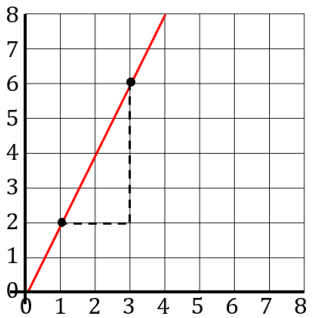
$y = 1.5$

Finding Equations of Straight Lines

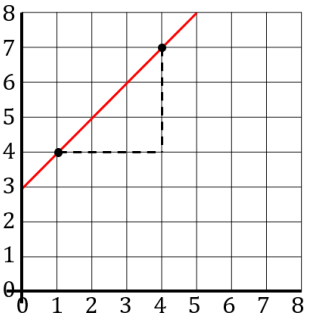
(a)



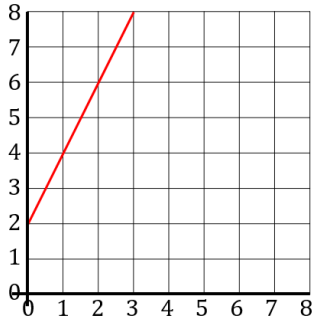
(b)



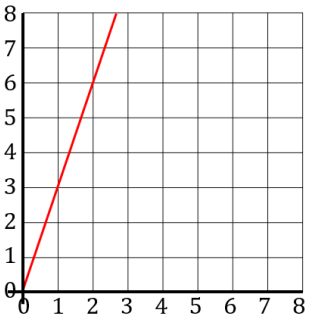
(c)



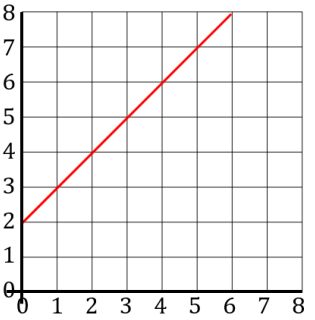
(d)



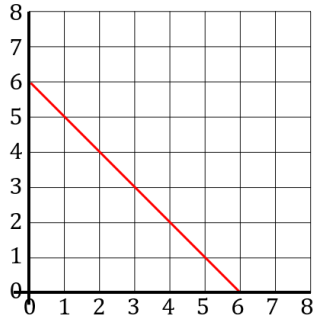
(e)



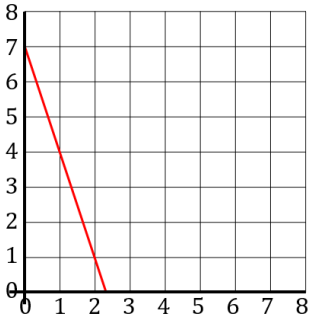
(f)



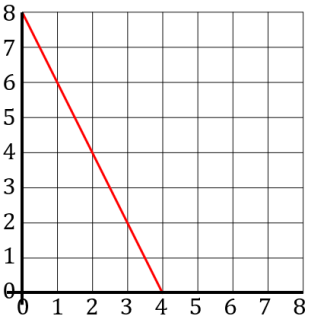
(g)



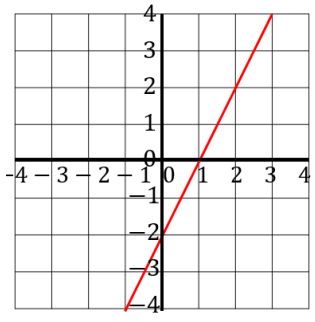
(h)



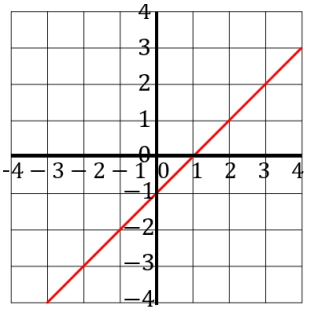
(i)



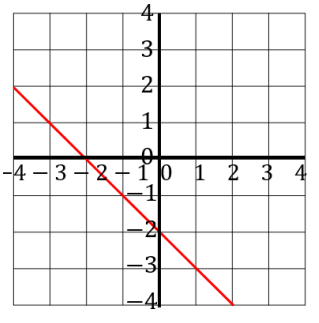
(j)



(k)

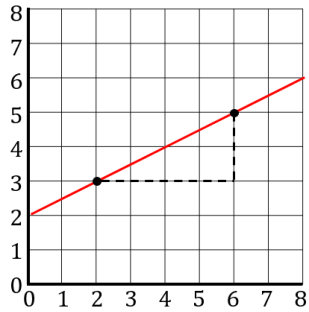


(l)

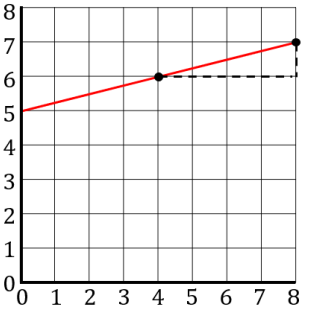


Finding Harder Equations of Straight Lines

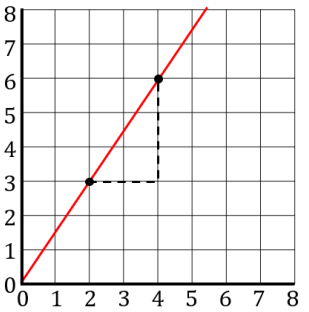
(a)



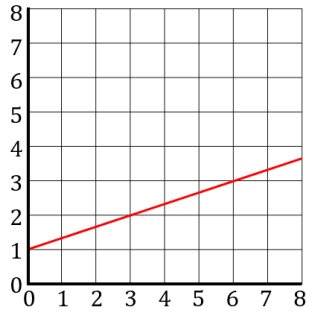
(b)



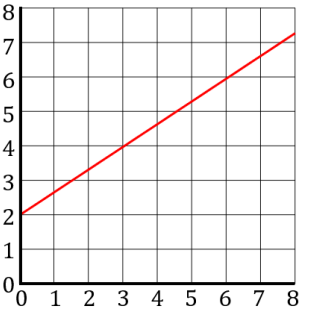
(c)



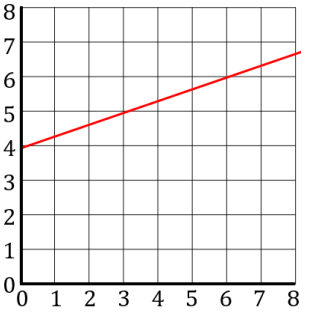
(d)



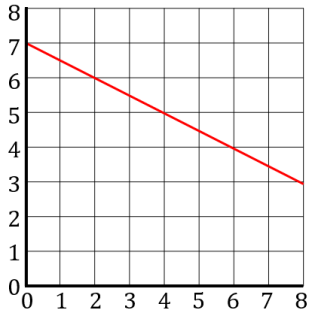
(e)



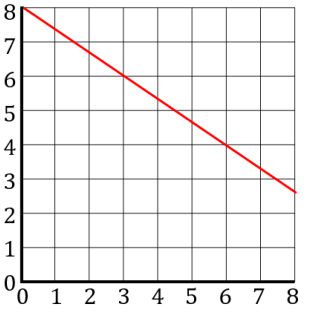
(f)



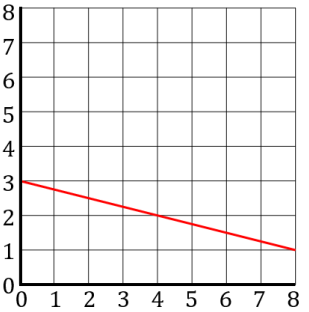
(g)



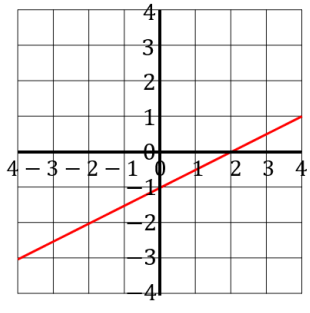
(h)



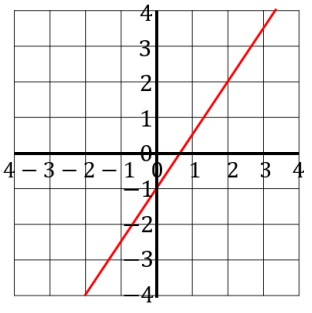
(i)



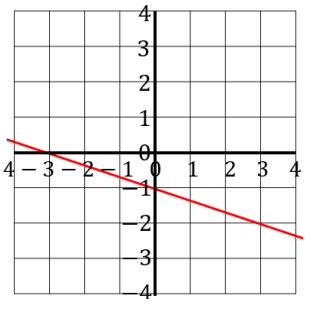
(j)



(k)



(l)



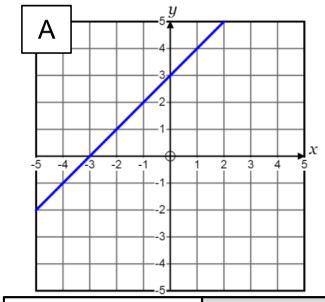
y=mx+c (integers only)

match each graph with its equation and find a coordinate that lies on each line.

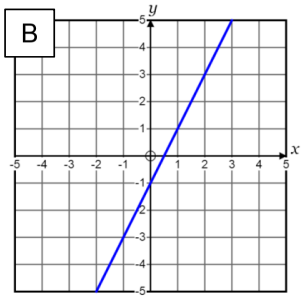
$y = -2x - 4$	$y = 1 - 2x$	$y = 2x - 1$
$y = x + 3$	$y = 4 - 2x$	$x + y = 3$
$y = -x - 1$	$y = -3x$	$y = 4 + 2x$

$(8, -15)$	$(8, 11)$	$(8, 15)$	$(8, -12)$
$(-8, 24)$	$(-8, 12)$	$(-8, 11)$	$(-8, -12)$	$(-8, 7)$

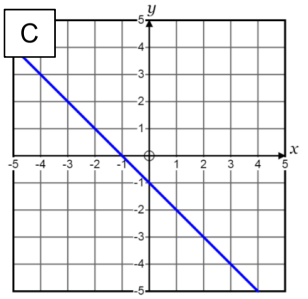
A



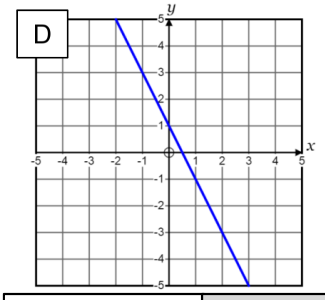
B



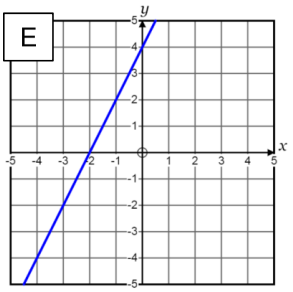
C



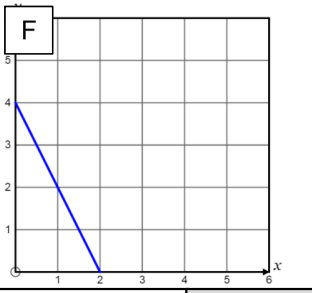
D



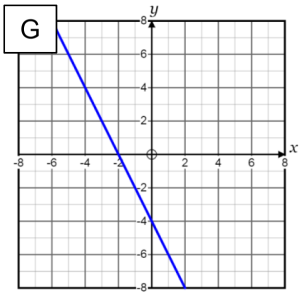
E



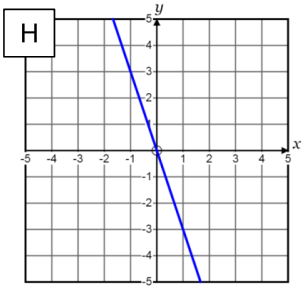
F



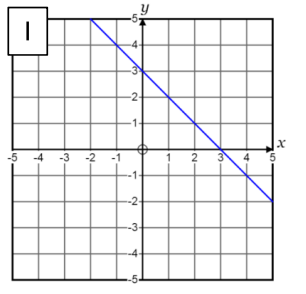
G



H

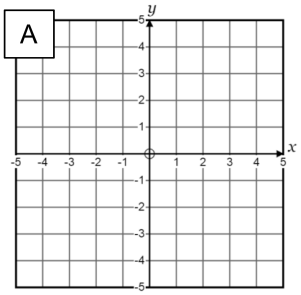


I



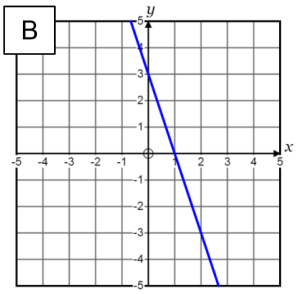
complete the graph or equation and work out the missing value in the coordinate of a point on the line.

A



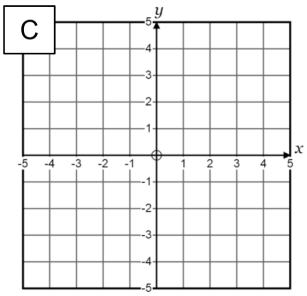
$y = 2x + 1$	(10,)

B



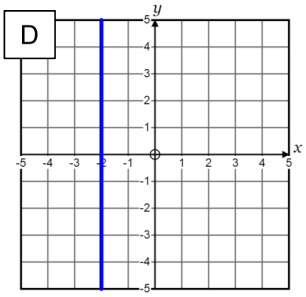
	(4,)

C



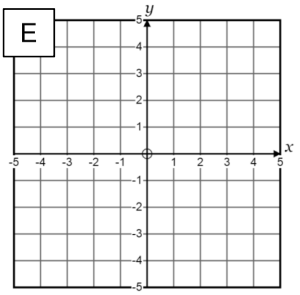
$y = 2 - x$	$(-4,\ )$

D



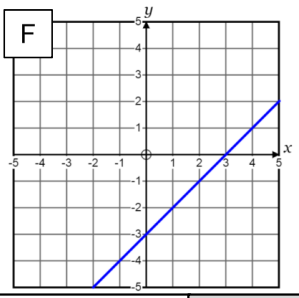
	$(\ , -6)$

E



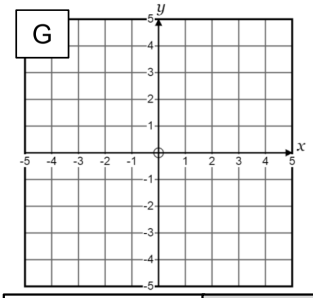
$y = -2x - 3$	(2,)

F



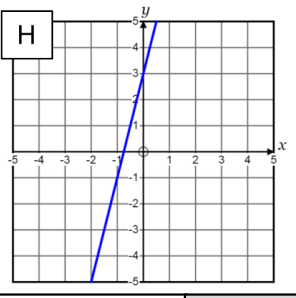
	$(\ , 14)$

G



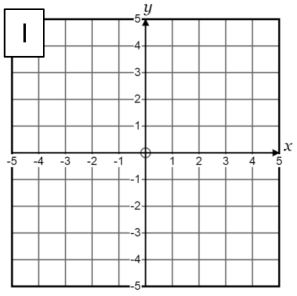
$y = 3x - 2$	$(\ , 10)$

H



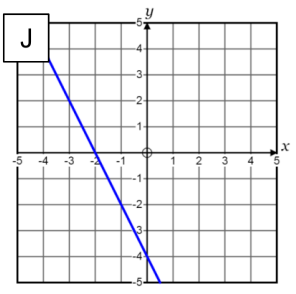
	$(\ , 35)$

I



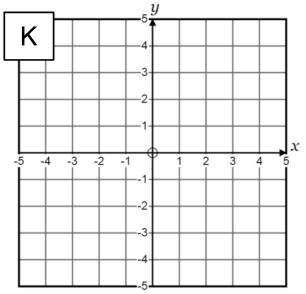
$y = 4$	(9,)

J



	(3,)

K



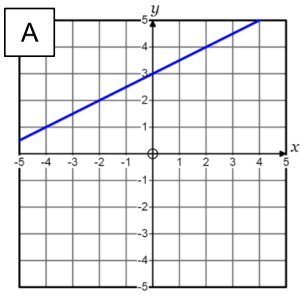
$y = 3x + 3$	$(\ , -9)$

y=mx+c (fractional)

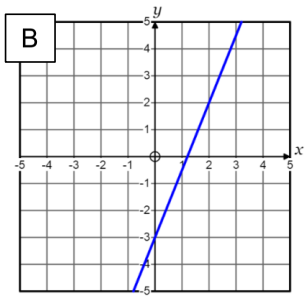
match each graph with its equation.

$y = \frac{1}{2}x + 3$	$y = \frac{5}{2}x - 3$	$y = \frac{2}{5}x - 3$
$y = \frac{x}{3} + 3$	$y = 0.6x - 3$	$y = \frac{2x}{3} - 3$
$y = 3 - \frac{4}{3}x$	$y = -\frac{x}{2} - 3$	$y = 1.5(2 + x)$

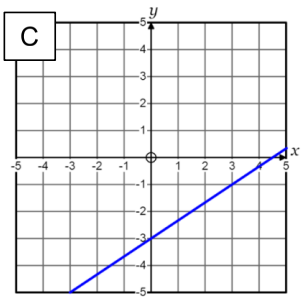
A



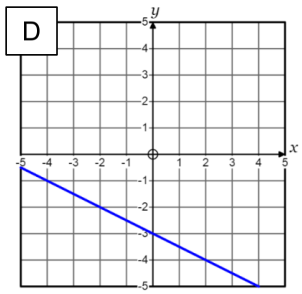
B



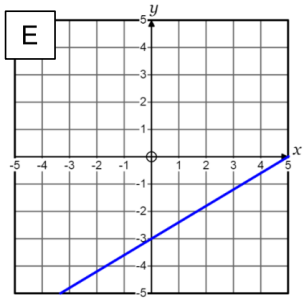
C



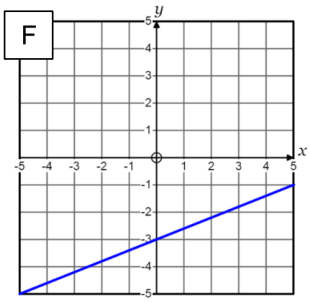
D



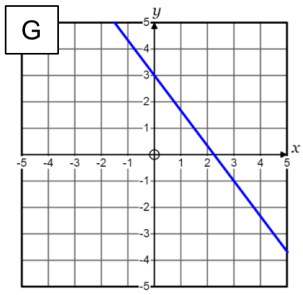
E



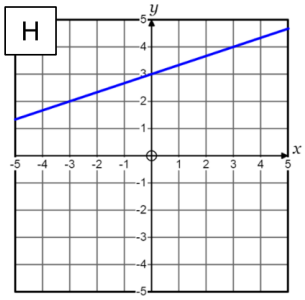
F



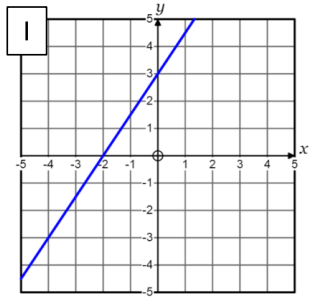
G



H



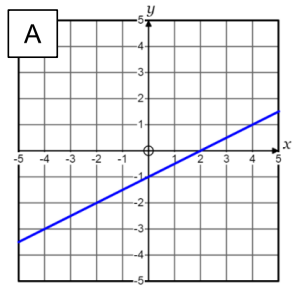
I



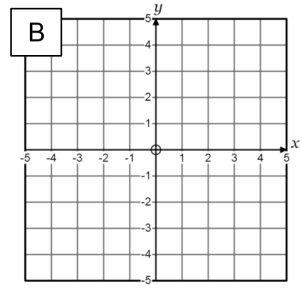
y=mx+ c (fractional)

complete the graph or equation.

A

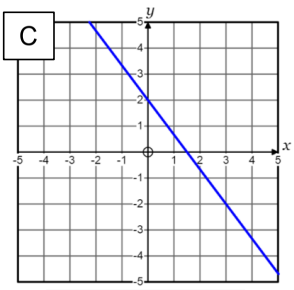


B

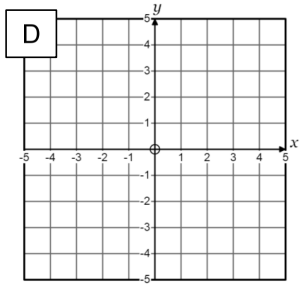


$y = 1 + \frac{2}{3}x$

C

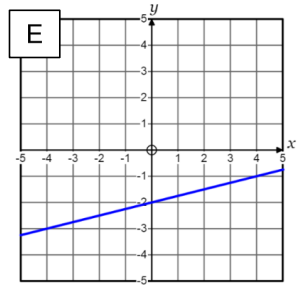


D

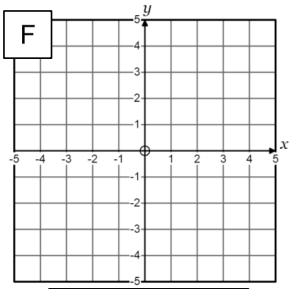


$y = -\frac{x}{3}$

E

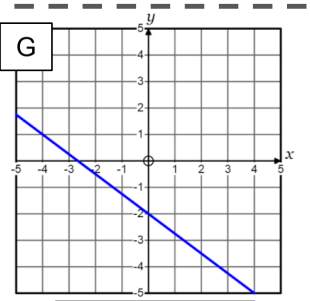


F

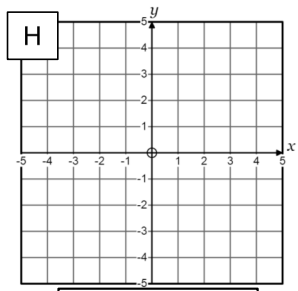


$y = 2 + \frac{2x}{5}$

G

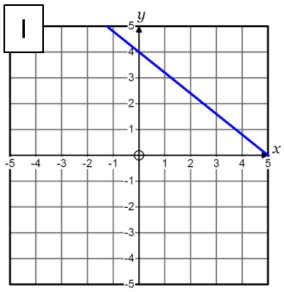


H

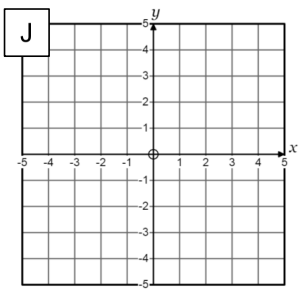


$y = \frac{3x}{2} - 3$

I

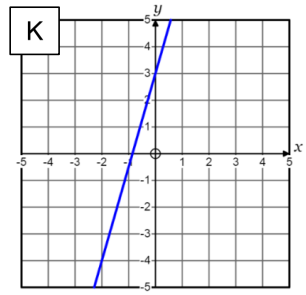


J



$y = 2 - 0.2x$

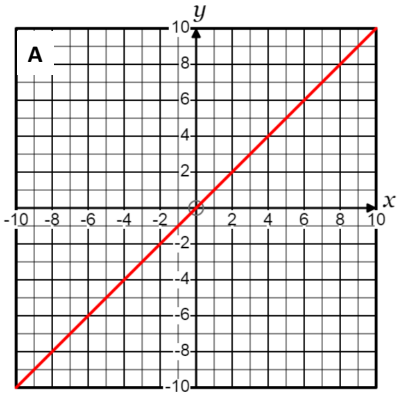
K



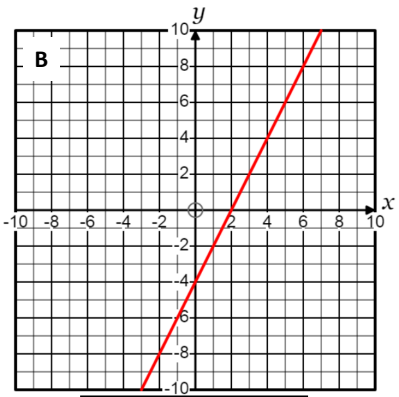
Fluency Practice

Match each graph to its equation.

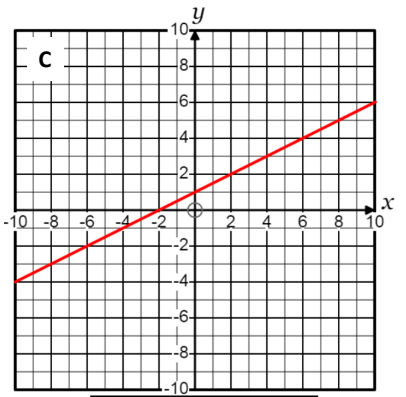
A



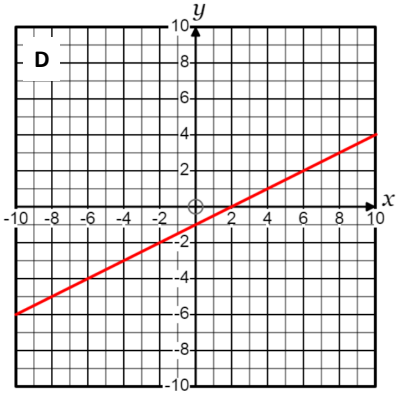
B



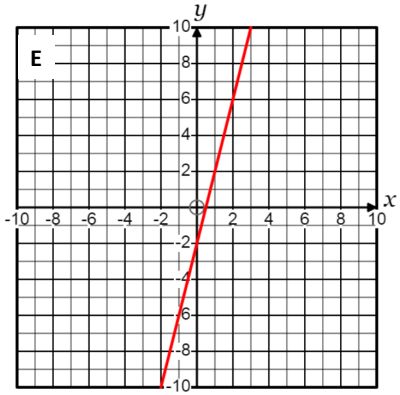
C



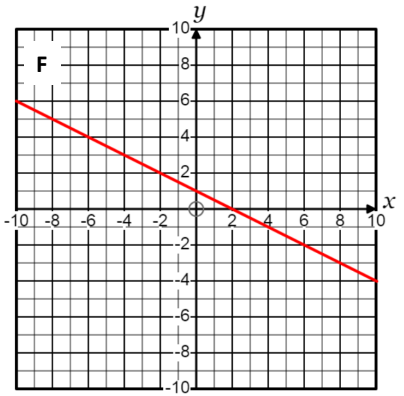
D



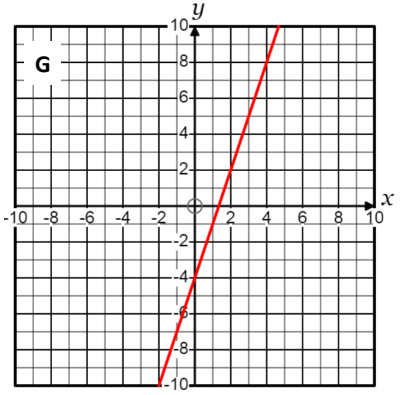
E



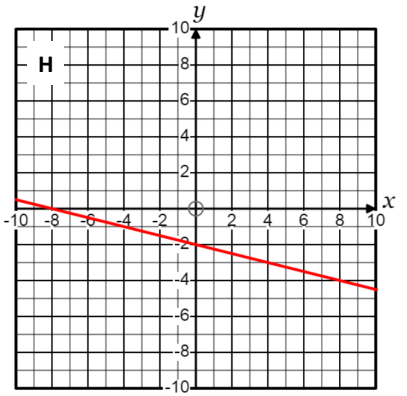
F



G



H



$y = 2x - 4$ | $y = 3x - 4$ | $y = \frac{1}{2}x - 1$ | $y = \frac{1}{2}x + 1$ | $y = -2 - \frac{1}{4}x$ | $y = x$ | $y = 1 - \frac{1}{2}x$ | $y = 4x - 2$

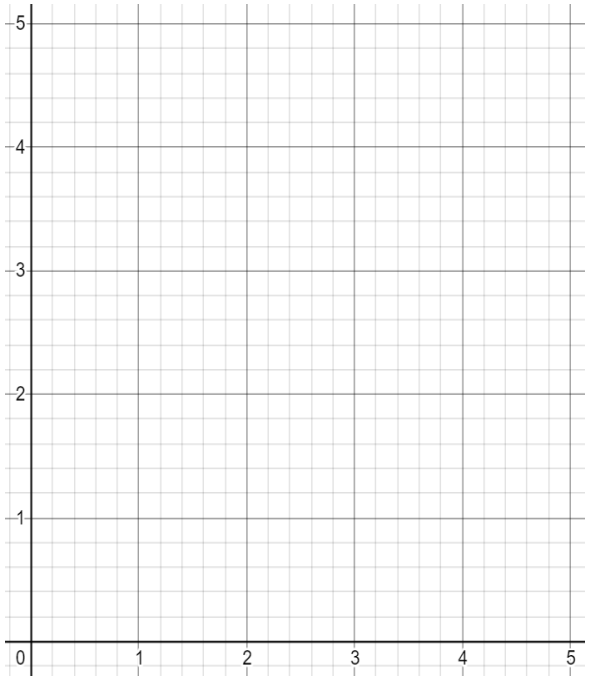
Fluency Practice

Finding the Equation of a Line from Coordinates Complete each column from left to right to find the equation of each line.

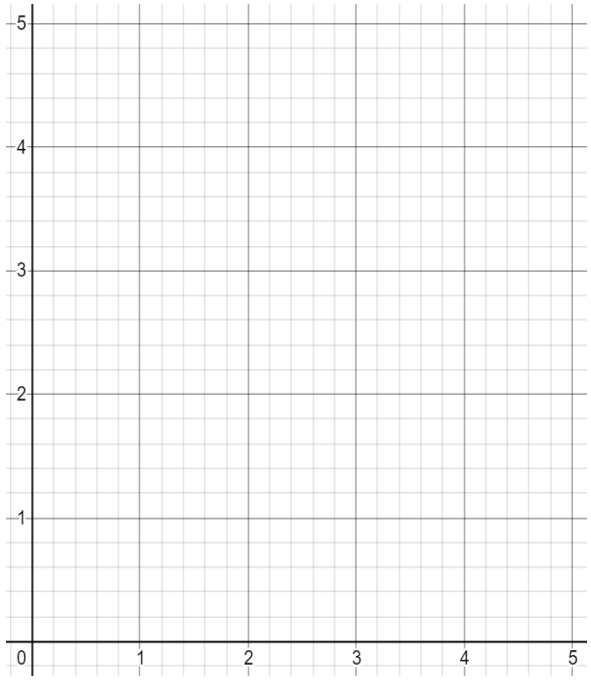
Point **A** coordinates	Point **B** coordinates	Change in x	Change in y	Gradient	Substitute **A** coordinates into $y = mx + c$ →	Solve to find c	Equation of the line **AB**
(4, 9)	(5, 11)	+1	+2	+2	$(\mathbf{9}) = 2(\mathbf{4}) + c$	+1	$y = 2x + 1$
(1, 5)	(2, 8)						
(4, 5)	(7, 11)						
(3, 8)	(−1, −4)						
(−1, −6)	(3, 10)						
(−2, −3)	(−4, −13)						
(4, −5)	(0, 3)						
(−2, −3)	(6, −11)						
(4, −19)	(−2, −1)						

Fluency Practice

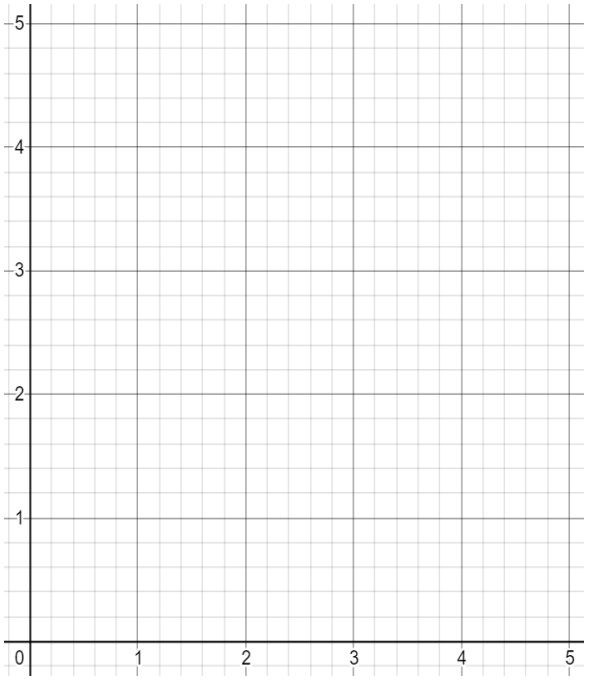
Sketch the graph that matches each description.



- Goes through the point $(2, 1)$
- Has a gradient of 3



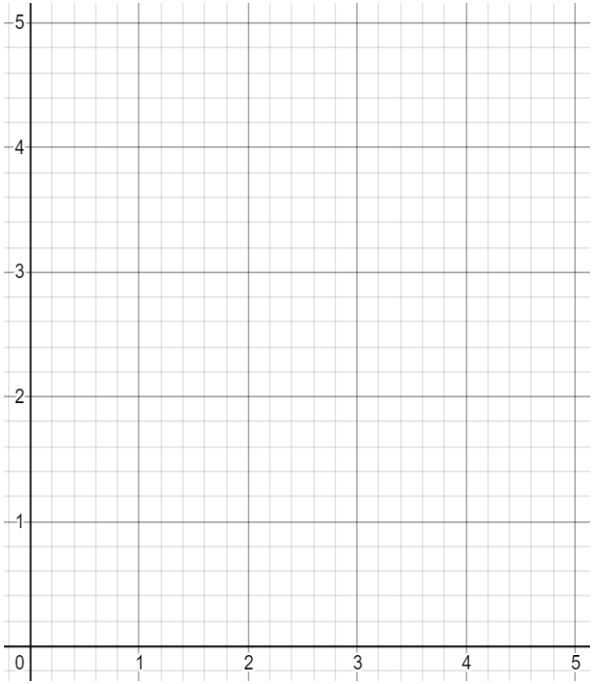
- Goes through the point $(2, 1)$
- Has a gradient of $\frac{1}{3}$



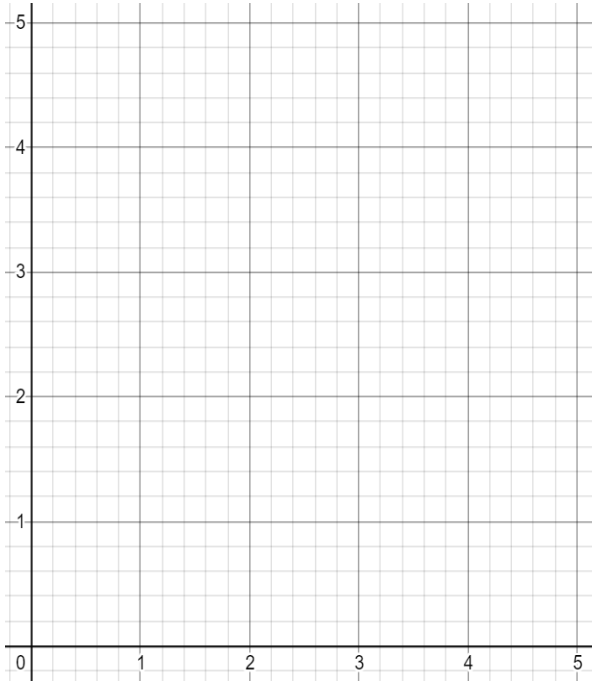
- Goes through the point $(1, 2)$
- Has a gradient of -3

Fluency Practice

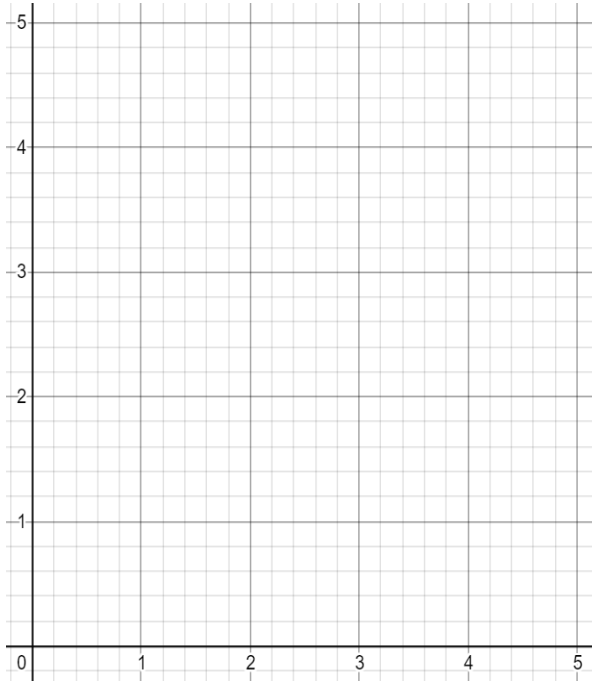
Sketch the graph that matches each equation.



$y = 5 - 2x$



$y = 3 - 2x$

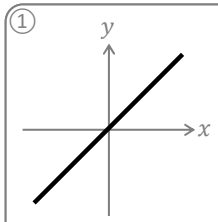


$y = \frac{1}{2}x + 1$

Fluency Practice

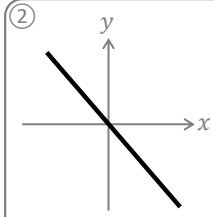
Identifying Gradient & Y-Intercept

Match each graph to its equation, then rearrange the equation to find the gradient and y-intercept.
Watch out! The x-axis and y-axis may not be at the same scale!

① 

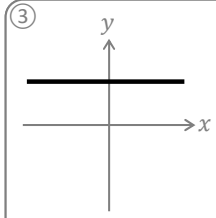
$y = x + 2$
$y = 1$
$y = x$
$y = -x$

Gradient: y-intercept:

② 

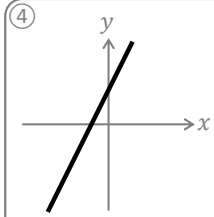
$y = 3x$
$y = -3x$
$y = 2$
$y = x - 3$

Gradient: y-intercept:

③ 

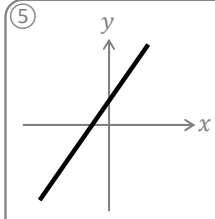
$x = 5$
$y = 2x$
$y = 2x + 2$
$y = 4$

Gradient: y-intercept:

④ 

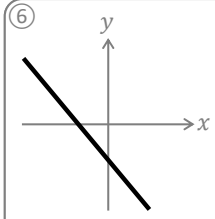
$y = x + 2$
$y = 3x$
$y = x - 3$
$2y = 5x$

Gradient: y-intercept:

⑤ 

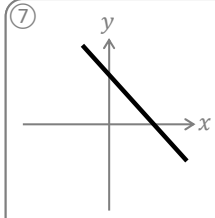
$y = -x + 2$
$y = 4x$
$y = 3x + 5$
$y = 2x - 4$

Gradient: y-intercept:

⑥ 

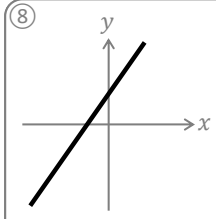
$y = -x$
$2y = -2x - 8$
$y = 5 - 2x$
$2y = 4x + 4$

Gradient: y-intercept:

⑦ 

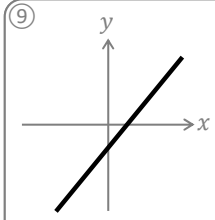
$y - x = 8$
$y = 2x + 4$
$y - 4 = x$
$x + y = 8$

Gradient: y-intercept:

⑧ 

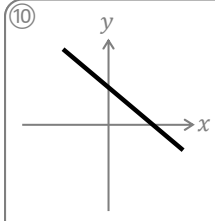
$\frac{y}{2} = 4 - x$
$2y = x - 2$
$\frac{y}{2} = x + 3$
$y = 5 - 3x$

Gradient: y-intercept:

⑨ 

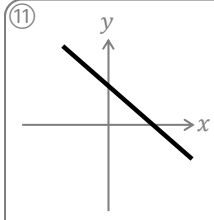
$y - 3x = -4$
$y - 4 = 3x$
$3y = -6x - 3$
$0.5y = 2x + 1$

Gradient: y-intercept:

⑩ 

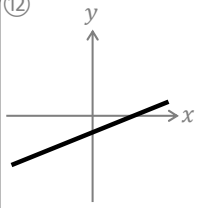
$y = \frac{x}{2} + 4$
$2y - 4x = 6$
$2y + x = -5$
$2y + 4x = 8$

Gradient: y-intercept:

⑪ 

$2y = 6x + 4$
$4y - 2x = 12$
$y + 2x = -12$
$2y + 2x = 3$

Gradient: y-intercept:

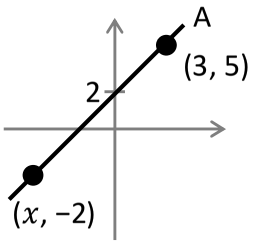
⑫ 

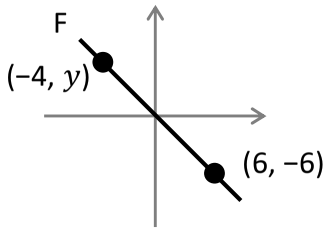
$3y - 2x = 9$
$6y - 2x = -12$
$2y = 6 - 3x$
$3y = 2x + 12$

Gradient: y-intercept:

Linear Graph Matchup

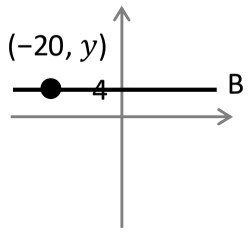
Match each graph to its equation.
Complete the missing coordinates on each graph.

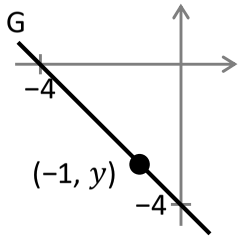




$y = 4$

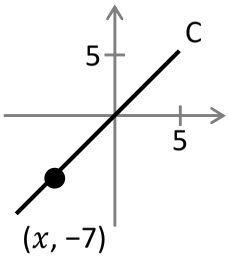
$y = x + 2$

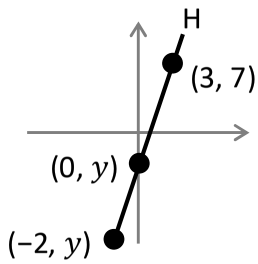




$y = 2x$

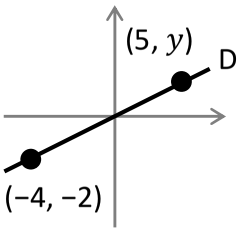
$y = -x$

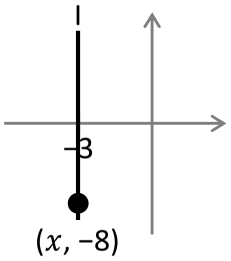




$x = -3$

$y + x = 4$

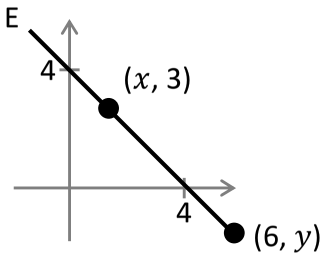


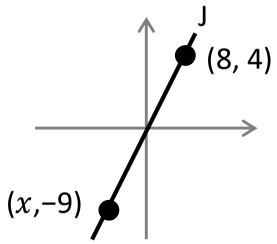


$y = \frac{x}{2}$

$y + x = -4$

$y = x$





$y = 3x - 2$

Question 1: Write down the gradient of each of these lines.

(a) $y = 3x + 1$ (b) $y = 2x - 5$ (c) $y = 7x + 4$ (d) $y = 10x + 5$

(e) $y = x - 2$ (f) $y = 6x$ (g) $y = -4x + 3$ (h) $y = -3x - 7$

(i) $y = \frac{1}{2}x + 3$ (j) $y = -\frac{4}{5}x - 9$

Question 2: Write down where each of these lines cross the y-axis (y-intercept)

(a) $y = 2x + 3$ (b) $y = 7x + 1$ (c) $y = 3x - 2$ (d) $y = x - 5$

(e) $y = 2x$ (f) $y = -4x + 6$ (g) $y = -5x - 3$ (h) $y = -3x$

(i) $y = \frac{4}{3}x + \frac{2}{5}$ (j) $y = -\frac{2}{3}x - \frac{1}{2}$

Question 3: Write down the equation of the lines below

(a) gradient of 3 and y–intercept of 6

(b) gradient of 2 and y–intercept of –1

(c) gradient of –4 and y–intercept of 3

(d) gradient of 8 and y–intercept of 4

(e) gradient of 1 and passing though (0, 4)

(f) passing through (0, –2) with gradient 4

(g) gradient of –5 and passing through the origin.

Question 4:

(a) Does the point (2, 5) lie on the line $y = 3x - 1$?

(b) Does the point (4, 1) lie on the line $y = 3x + 1$?

(c) Does the point (3, 1) lie on the line $y = x - 3$?

(d) Does the point (5, 7) lie on the line $y = -3x + 22$?

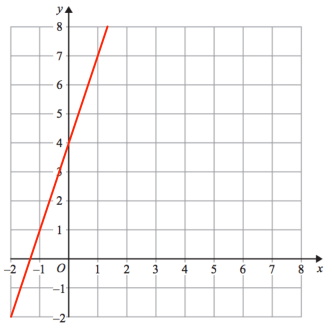
(e) Does the point (–4, –8) lie on the line $y = -2x$?

(f) Does the point (–1, 8) lie on the line $y = 2x + 11$?

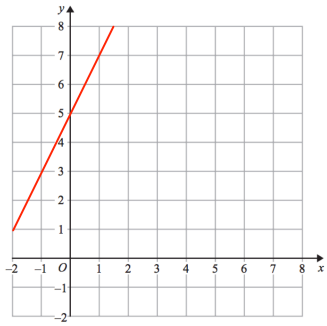
(g) Does the point (12, 60) lie on the line $y = 7x - 18$?

Question 5: Find the equation of each line

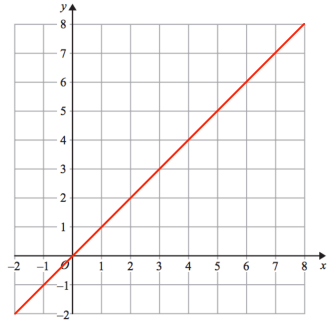
(a)



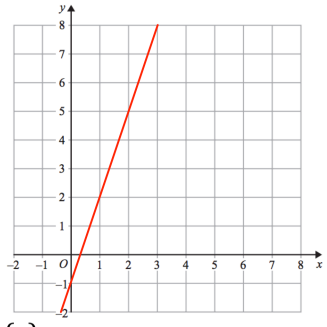
(b)



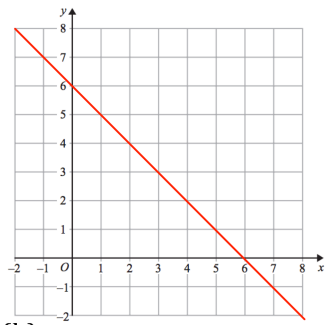
(c)



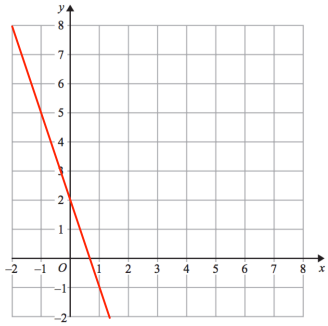
(d)



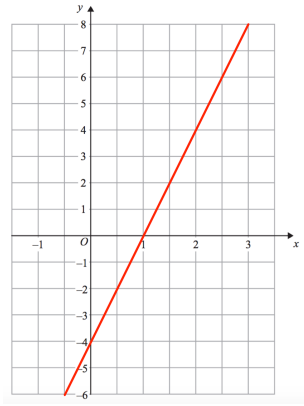
(e)



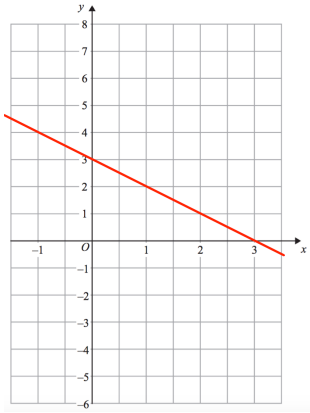
(f)



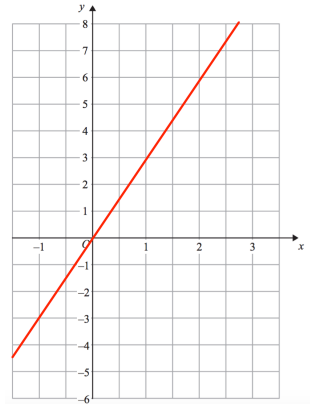
(g)



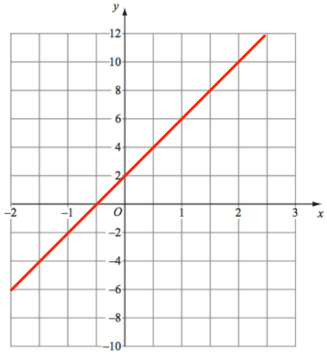
(h)



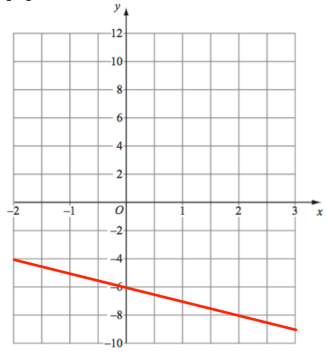
(i)



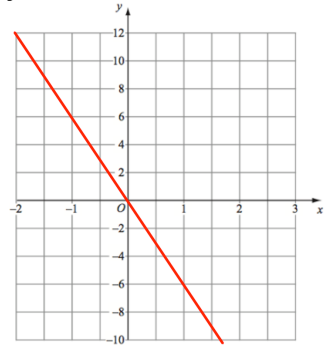
(j)



(k)

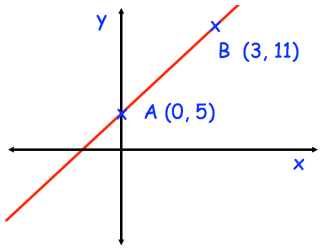


(l)

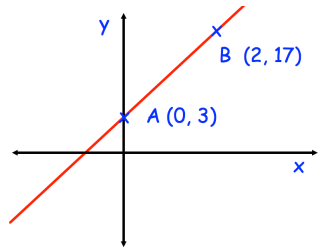


Question 6: Find the equation of each line below.

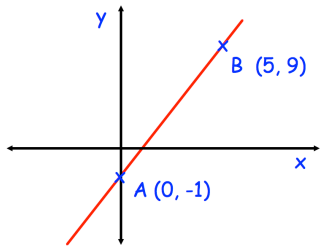
(a)



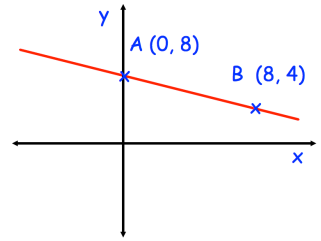
(b)



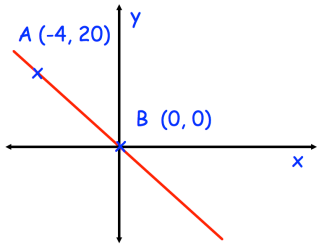
(c)



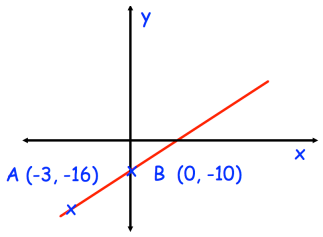
(d)



(e)



(f)



Question 7: Find the equation of the straight line that passes through the points

(a) (0, 3) and (4, 19) (b) (0, 2) and (6, 20) (c) (0, 0) and (1, 4)

(d) (0, −9) and (9, 0) (e) (0, −6) and (7, 8) (f) (−8, −10) and (0, 14)

(g) (0, 2) and (10, 7) (h) (−4, 1) and (0, 7) (i) (−4, 0) and (0, 18)

Question 8: Find the equation of the straight line that:

(a) has a gradient of 4 and passes through the point (1, 10)

(b) has a gradient of 2 and passes through the point (−3, 3)

(c) has a gradient of 1 and passes through the point (5, 2)

(d) has a gradient of −3 and passes through the point (−2, 8)

(e) has a gradient of −5 and passes through the point (3, −1)

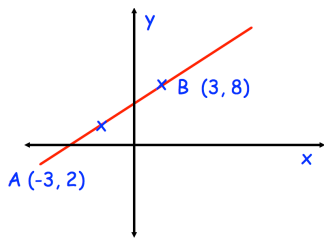
(f) has a gradient of ½ and passes through the point (4, 5)

(g) has a gradient of ⅖ and passes through the point (−5, −5)

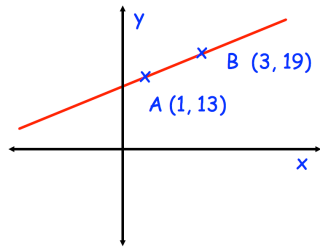
(h) has a gradient of −⅔ and passes through the point (9, 15)

Question 9: Find the equations of the lines below

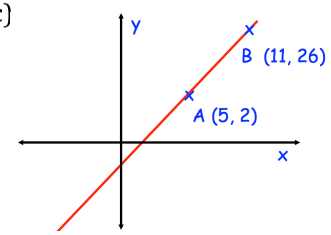
(a)



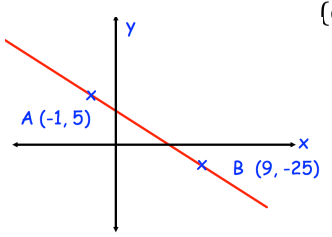
(b)



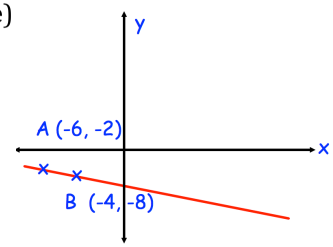
(c)



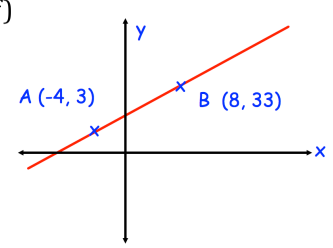
(d)



(e)



(f)



Question 10: Find the equation of the straight line that passes through these pairs of points

(a) (2, 5) and (4, 11) (b) (−4, 2) and (1, 7) (c) (−5, −8) and (−4, −4)

(d) (−1, −2) and (−6, 3) (e) (−6, −4) and (−3, 2) (f) (3, 5) and (4, 1)

(g) (−5, 4) and (5, 2) (h) (1, 6) and (5, 4) (i) (−10, −5) and (−7, 4)

Question 11: Find the coordinates where the following lines cross the x-axis

(a) $y = 2x + 6$ (b) $y = -x + 4$ (c) $y = 3x + 9$

(d) $y = x - 5$ (e) $y = 4x + 1$ (f) $y = -2x + 10$

(g) $y = -4x - 10$ (h) $y = 5x + 3$ (i) $y = \frac{1}{2}x + 3$

(j) $x + y = 8$ (k) $4x + 2y + 7 = 0$ (l) $3x + 2y - 8 = 0$

Question 12: Find the gradients and the y-intercepts of each of these lines

(a) $x + y = 10$ (b) $x - y = 4$ (c) $2x + y = 6$

(d) $3x - y = -1$ (e) $8x + 2y + 9 = 0$ (f) $5x - 2y - 4 = 0$

(g) $7x = 1 - 2y$ (h) $15y - 6x = 8$ (i) $\frac{2}{3}x + 2y = 5$

(j) $\frac{1}{5}y - \frac{1}{2}x = 1$ (k) $\frac{2}{3}x + \frac{3}{4}y = 1\frac{1}{2}$

Apply

Question 1: The point (5, −2) lies on which lines below

Line A $y = x + 7$

Line B $y = -3x + 13$

Line C $y = 4x - 18$

Line D $y = -2x - 8$

Line E $y = 2x - 12$

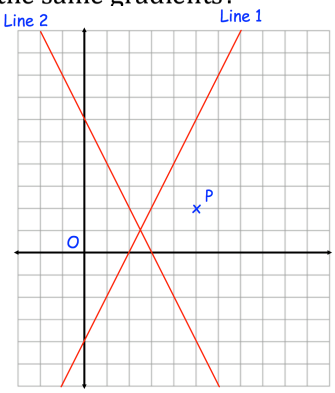
Question 2: Do the points (1, 4), (4, 10) and (9, 20) lie in a straight line?

Question 3: A line has equation y = 2x + 6
The line crosses the x−axis at the point A
The line crosses the y−axis at the point B
The point C has coordinates (1, 8)

(a) Find the coordinates of the point A
(b) Find the coordinates of the point B
(c) Find the equation of the straight line passing through the points A and C.

Question 4: Do the lines y = 3x + 1 and 4x − 2y + 3 = 0 have the same gradients?

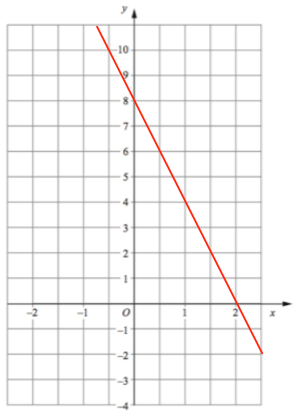
Question 5: Line 1 has equation y = 3x − 12



(a) Find the coordinates of P

(b) Find the equation of Line 2

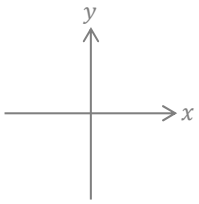
Question 6: Lexi says the line below has an equation of y = −2x +8
Explain her mistake.



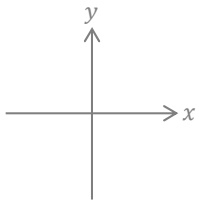
Fluency Practice

Sketch It!

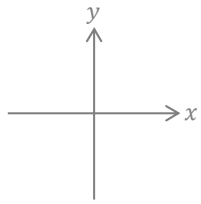
Sketch each graph… variables are positive!



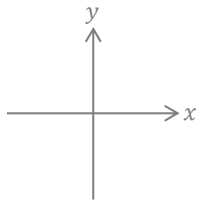
$x = a$



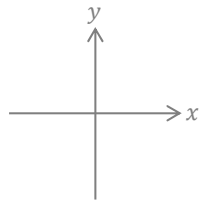
$y = x$



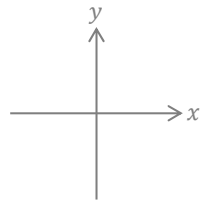
$y = -a$



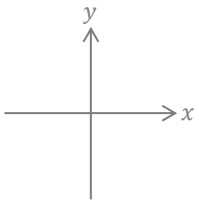
$y = mx + c$



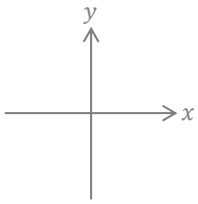
$x = -a$



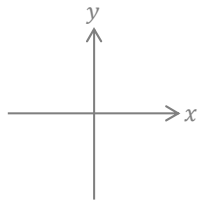
$y = mx - c$



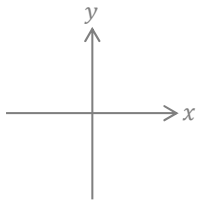
$y = c$



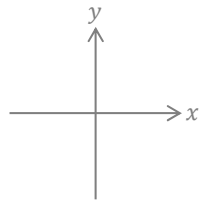
$y = -x$



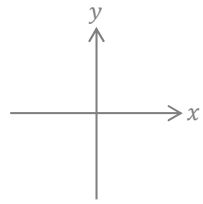
$y = c - mx$



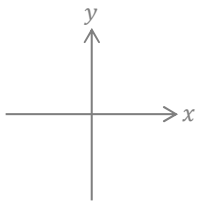
$x + y = c$



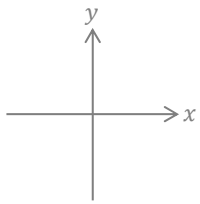
$y = -c - mx$



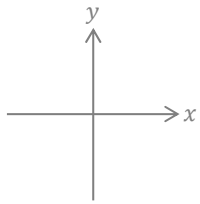
$x - y = c$



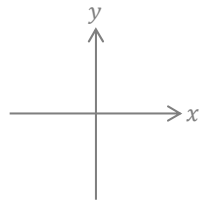
$y = x + c$
&
$y = x - c$



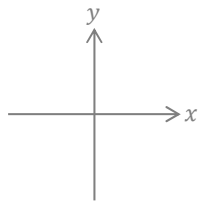
$y = mx - c$
&
$y = 2mx - c$



$y = mx + c$
&
$y = \frac{x}{m} + c$

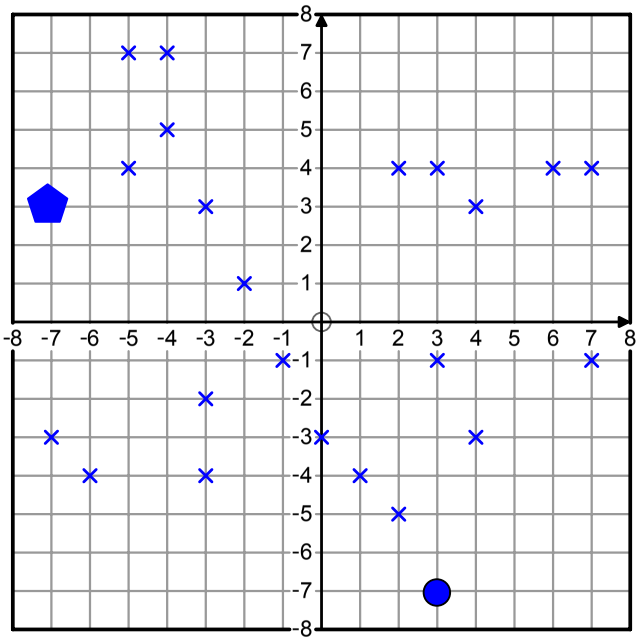


$y = mx + c$
&
$y = -mx - c$



$ax + 2ay = -c$

collecting crosses



1 Which of these equations collects the most crosses?

A $y = 4$ **C** $x = -1$

B $x = 4$ **D** $y = -1$

2 Which vertical line collects the most crosses? State its equation.

_____

3 State the equation that has a gradient of 0 and collects 5 crosses.

_____

4 Which of these equations collects zero crosses?

A $y = x$ **C** $y = -2x$

B $y = 2x$ **D** $y = -x$

5 The equation $y = -x$ collects ____ cross(es)

6 State the equation of a line that has a y-intercept of 5, a negative gradient and collects exactly 2 crosses.

_____

7 Find the equation of the diagonal line that passes through 6 crosses.

_____

8 State the equation of a line that passes through the x axis at 6 and collects at least two crosses.

_____

9 Which equation collects both the circle and the pentagon?

_____

10 State the equation of a line with a negative gradient and a negative y-intercept that collects exactly 3 crosses

_____

11 The equation which collects the pentagon and has an x-intercept of -5 collects ____ cross(es)

12 State an equation that has a gradient of ∞ and collects 3 crosses

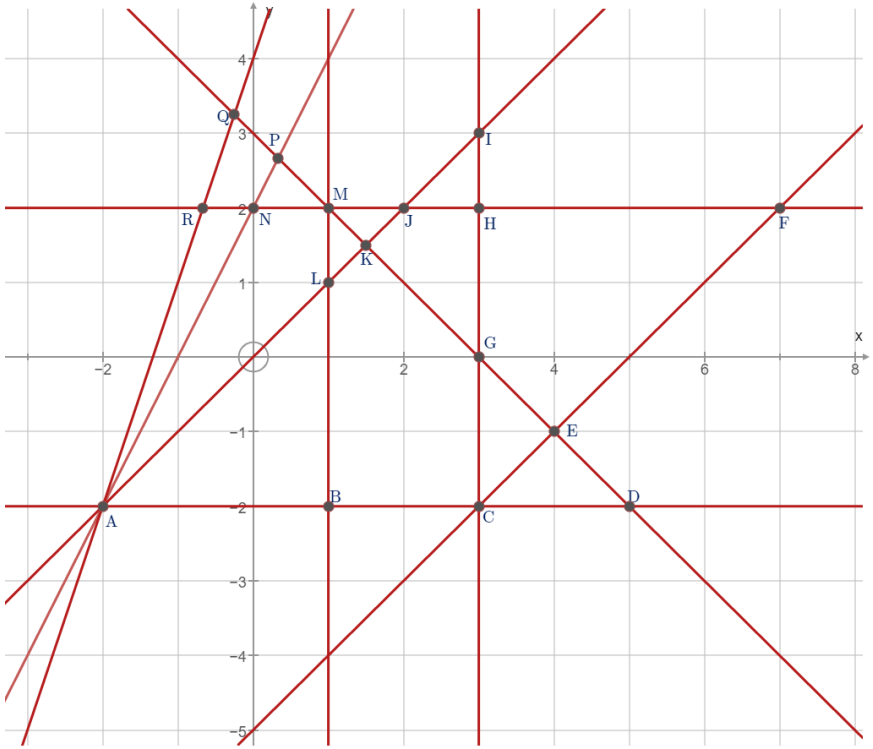
_____

13 The equation $y = \frac{x}{2} - 0.5$ collects ____ cross(es)

14 Find the equation of a line that passes through the origin and exactly 2 crosses

_____

Area with... Equations of Straight Lines



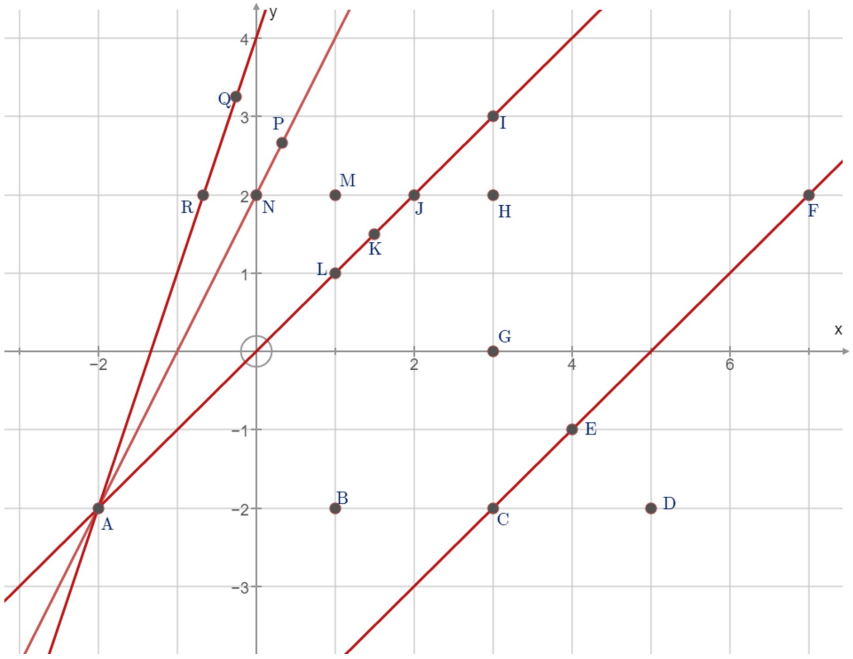
The lines above are drawn on a centimetre grid.
Complete the table with:

- the name of each shape,
- the area of each shape,
- the lettered vertices of each shape,
- the equations of the line segments that form each shape's perimeter.

The first shape in the table has been completed as an example.

	Shape	Area	Vertices	Equations
1	Rectangle	$8\ \text{cm}^2$	*BCHM*	$x = 1$ $x = 3$ $y = -2$ $y = 2$
2	Trapezium		*BCGM*	
3			*CHF*	
4	Parallelogram			
5	Isosceles Triangle	$9\ \text{cm}^2$		
6			*ADK*	
7	Trapezium	$16\ \text{cm}^2$		
8			*ADMR*	

Area with... Equations of Straight Lines



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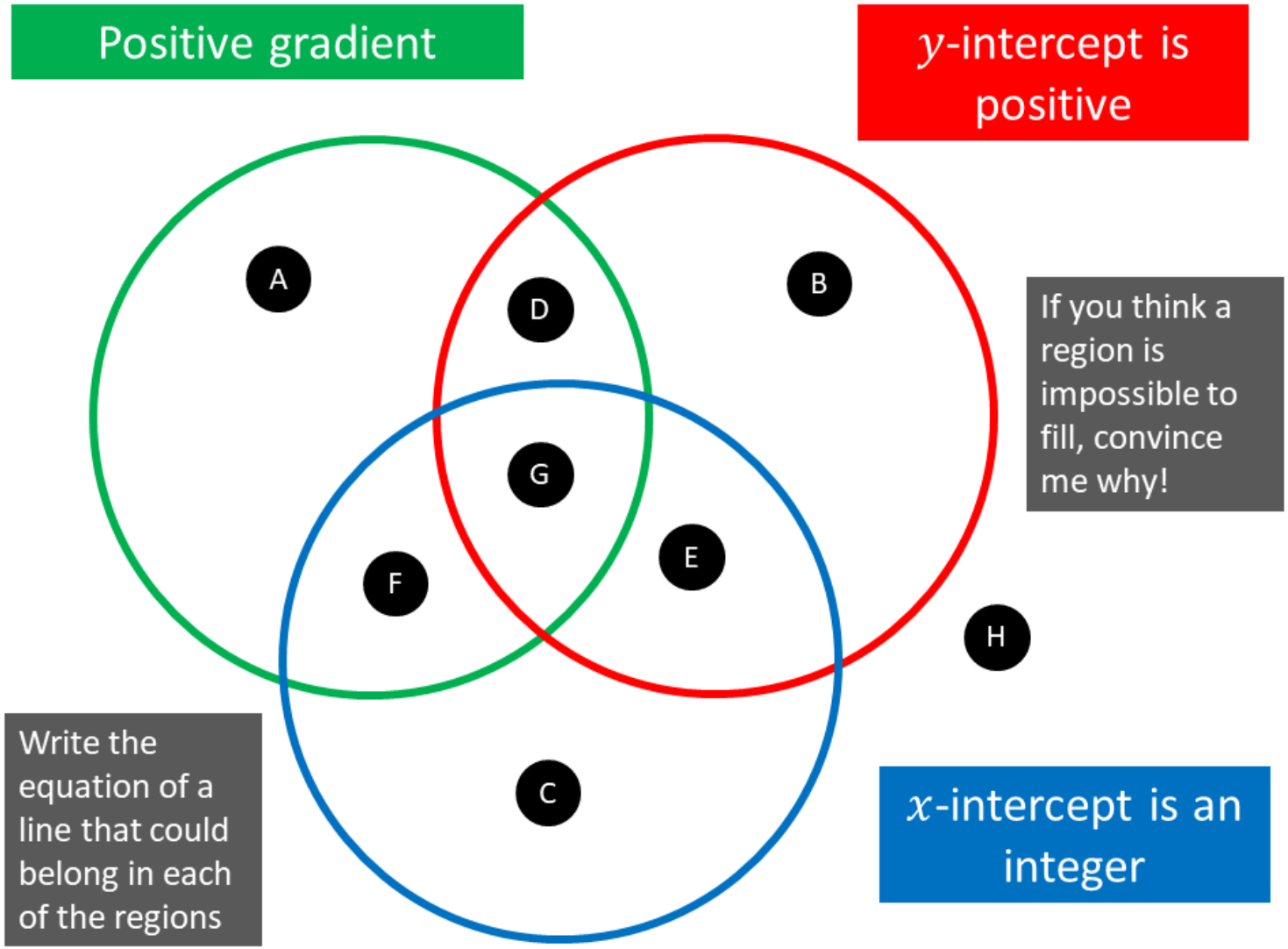
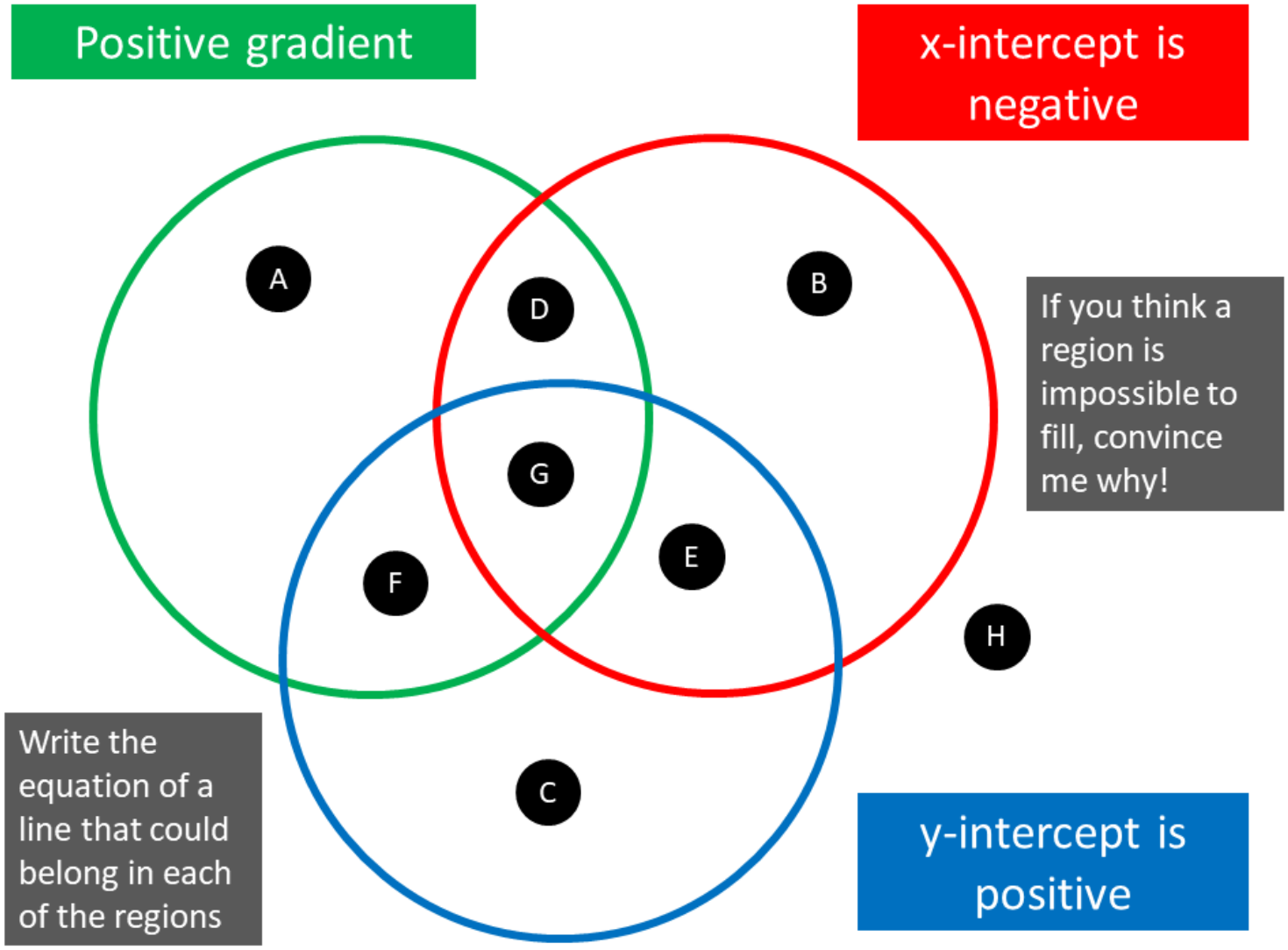
The first shape in the table has been completed as an example.

	Shape	Area	Vertices	Equations
1	Rectangle	8 cm^2	*BCHM*	$x = 1$ $x = 3$ $y = -2$ $y = 2$
2	Trapezium		*BCGM*	
3			*CHF*	
4	Parallelogram	20 cm^2		
5	Isosceles Triangle	9 cm^2		
6			*ADK*	
7	Trapezium	16 cm^2		
8			*ADMR*	

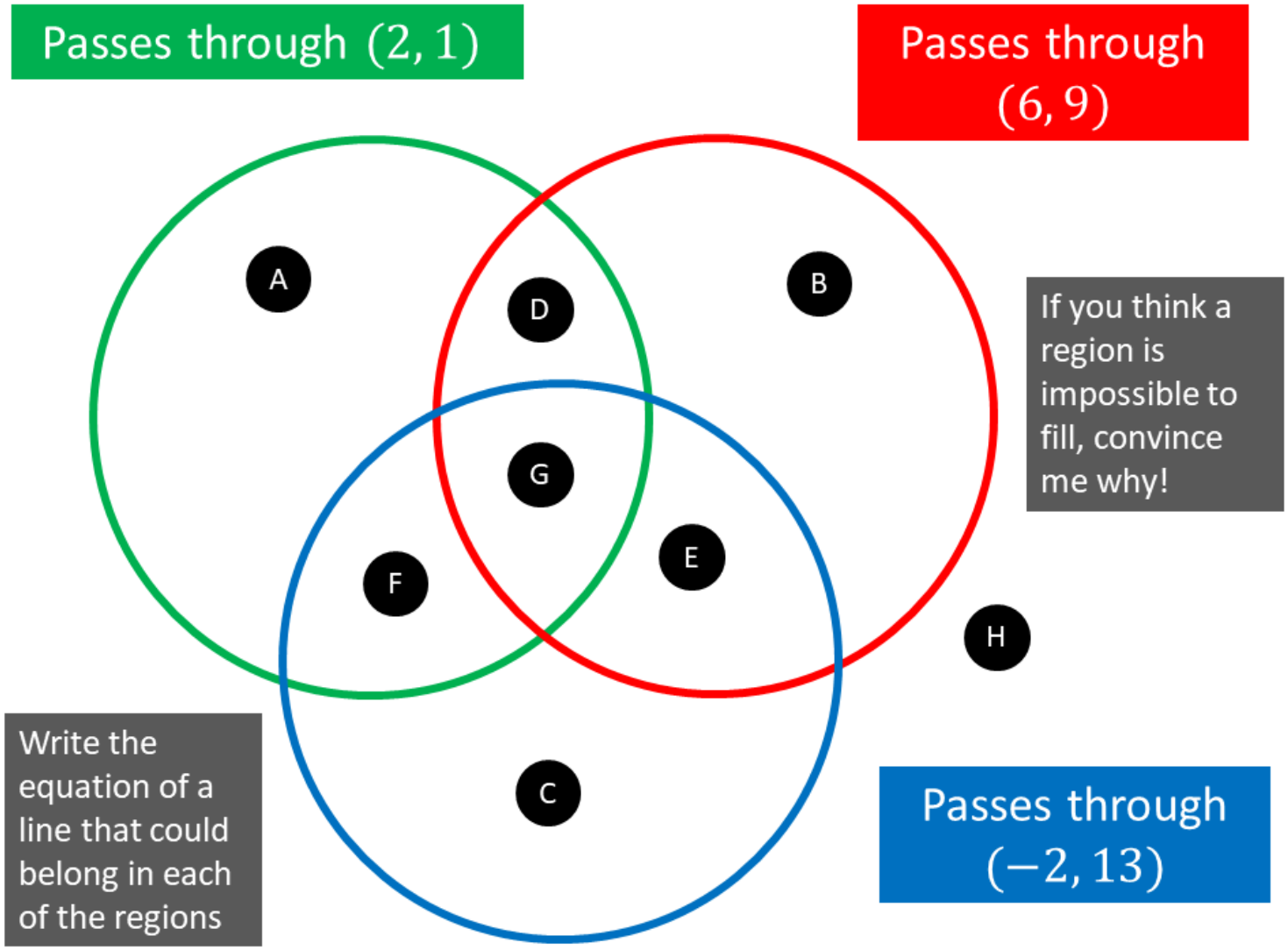
Maths Venns


Positive gradient
y-intercept is positive
A
D
B
If you think a region is impossible to fill, convince me why!
G
E
F
H
Write the equation of a line that could belong in each of the regions
C
x-intercept is an integer

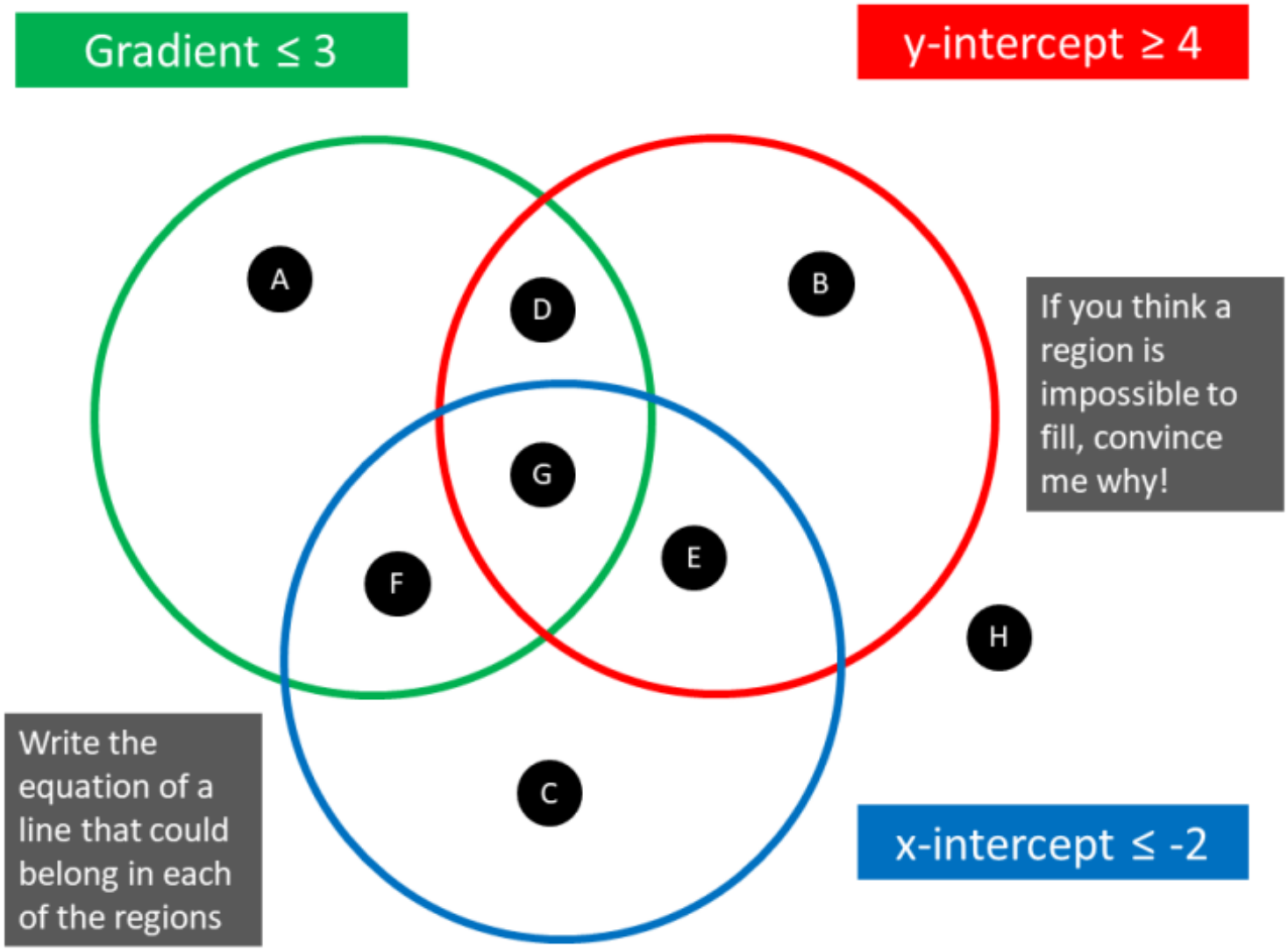
Maths Venns


Positive gradient
x-intercept is negative
A
D
B
If you think a region is impossible to fill, convince me why!
G
E
F
H
Write the equation of a line that could belong in each of the regions
C
y-intercept is positive

Maths Venns


Passes through $(2, 1)$
Passes through $(6, 9)$
A
D
B
G
E
F
H
C
If you think a region is impossible to fill, convince me why!
Write the equation of a line that could belong in each of the regions
Passes through $(-2, 13)$

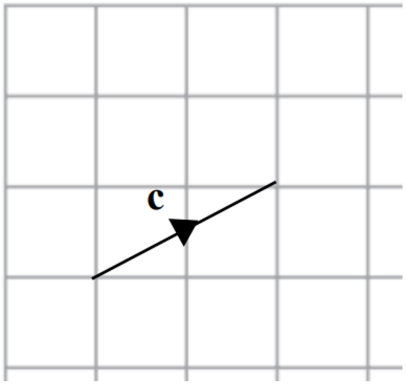
Maths Venns


Gradient ≤ 3
y-intercept ≥ 4
A
D
B
G
F
E
H
C
If you think a region is impossible to fill, convince me why!
Write the equation of a line that could belong in each of the regions
x-intercept ≤ -2

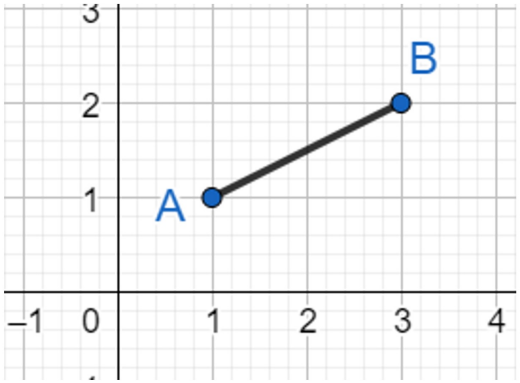
3 Basic Vectors

Fluency Practice

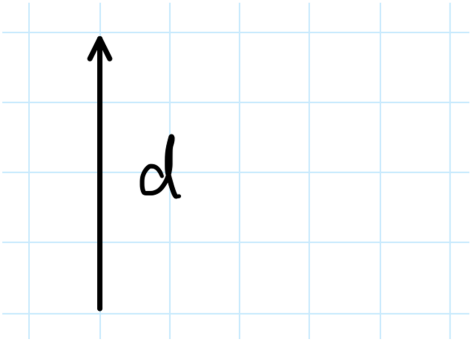
Write down the column vector **c**.



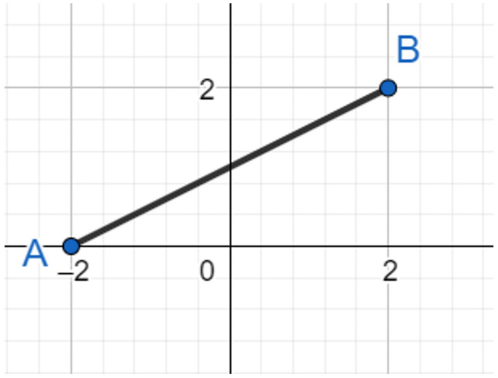
Write down the column vector $\overrightarrow{BA}$.



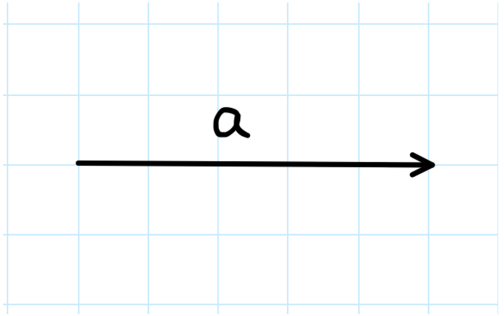
Write down the column vector **d**.



Write down the column vector $\overrightarrow{AB}$.



Write down the column vector **a**.

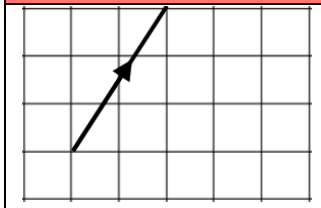


Fluency Practice

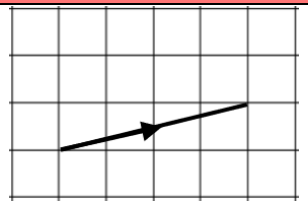
Describing Vectors

Describe the following vectors as column vectors.

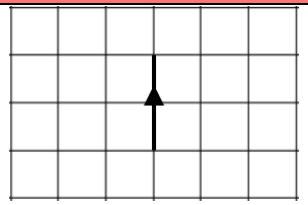
(a)



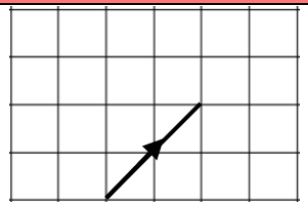
(b)



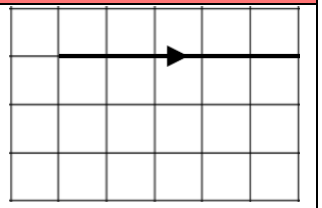
(c)



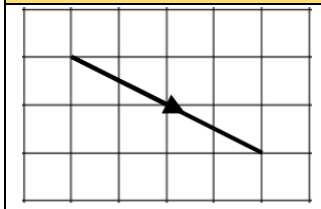
(d)



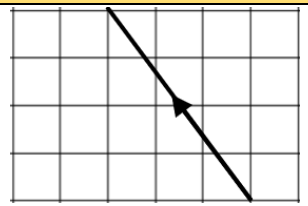
(e)



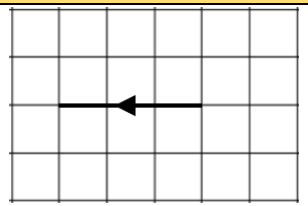
(f)



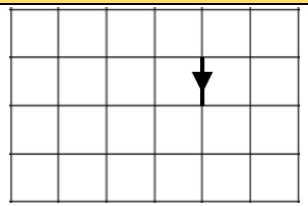
(g)



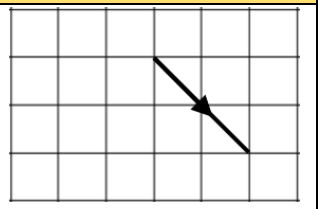
(h)



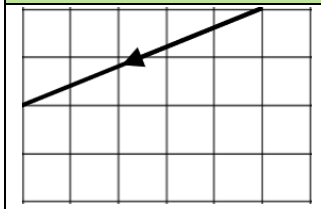
(i)



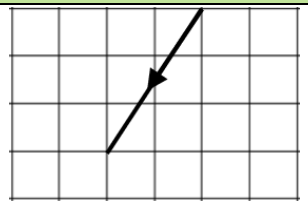
(j)



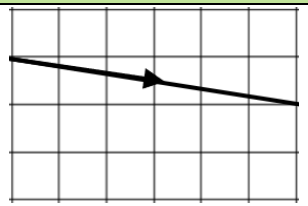
(k)



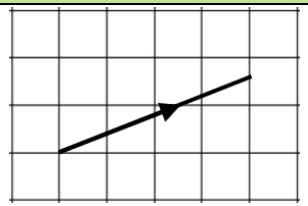
(l)



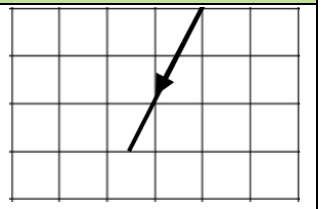
(m)



(n)



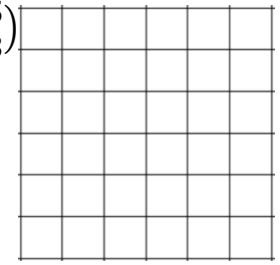
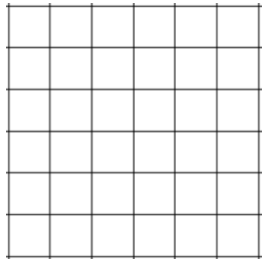
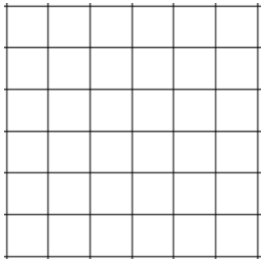
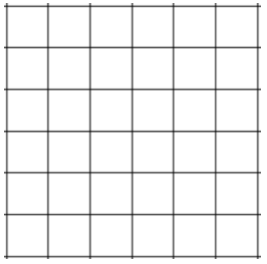
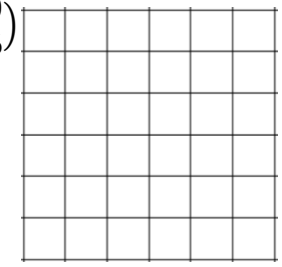
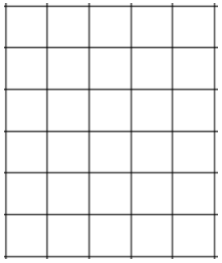
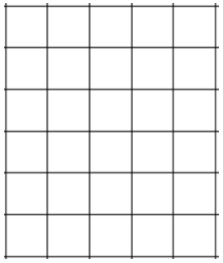
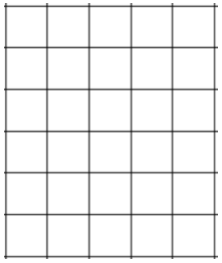
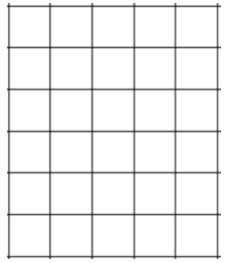
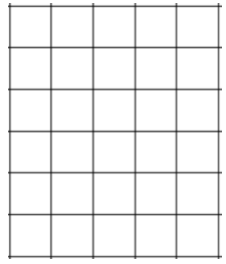
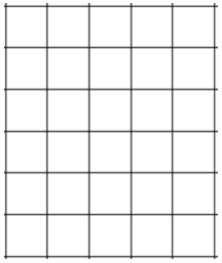
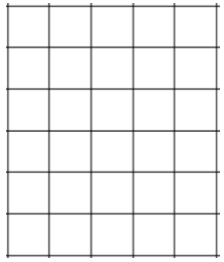
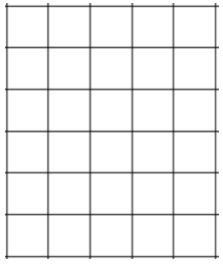
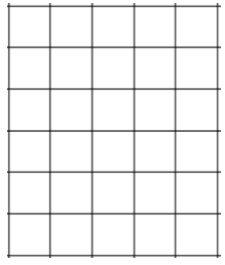
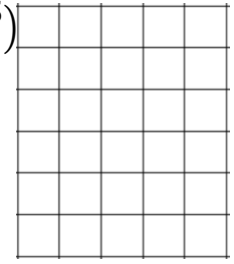
(o)



Fluency Practice

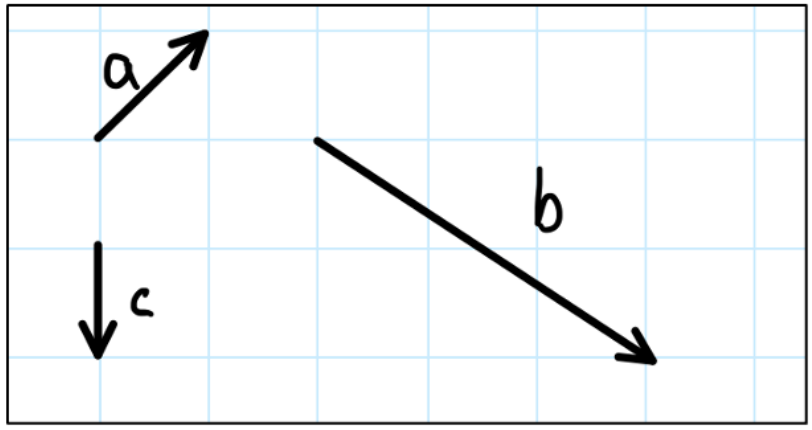
Representing Column Vectors

Show the following column vectors on the each of the grids.

(a)	(b)	(c)	(d)	(e)
$\begin{pmatrix}5\\3\end{pmatrix}$ 	$\begin{pmatrix}2\\4\end{pmatrix}$ 	$\begin{pmatrix}4\\0\end{pmatrix}$ 	$\begin{pmatrix}1\\1\end{pmatrix}$ 	$\begin{pmatrix}0\\6\end{pmatrix}$ 
(f)	**(g)**	**(h)**	**(i)**	**(j)**
$\begin{pmatrix}-1\\4\end{pmatrix}$ 	$\begin{pmatrix}2\\-3\end{pmatrix}$ 	$\begin{pmatrix}5\\-4\end{pmatrix}$ 	$\begin{pmatrix}0\\-2\end{pmatrix}$ 	$\begin{pmatrix}-4\\0\end{pmatrix}$ 
(k)	**(l)**	**(m)**	**(n)**	**(o)**
$\begin{pmatrix}-3\\-2\end{pmatrix}$ 	$\begin{pmatrix}-1\\-5\end{pmatrix}$ 	$\begin{pmatrix}-4\\-4\end{pmatrix}$ 	$\begin{pmatrix}0.5\\-2\end{pmatrix}$ 	$\begin{pmatrix}-3.5\\4\end{pmatrix}$ 

Fluency Practice

Write each vector in column form



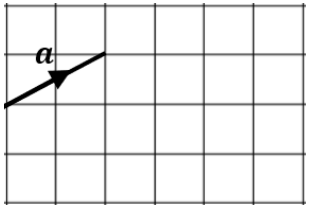
1) $2\mathbf{a}$	2) $-4\mathbf{a}$	3) $\frac{1}{2}\boldsymbol{a}$	4) $\frac{3}{2}\boldsymbol{a}$	5) $2\mathbf{c}$
6) $-2\mathbf{c}$	7) $-\mathbf{c}$	8) $-\mathbf{b}$	9) $-\frac{1}{2}\boldsymbol{b}$	10) $\frac{3}{2}\boldsymbol{b}$

Fluency Practice

Multiplying Vectors

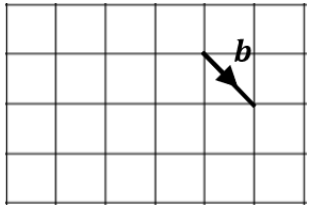
(a)

The vector $\boldsymbol{a}$ is shown. Draw the vector $2\boldsymbol{a}$.



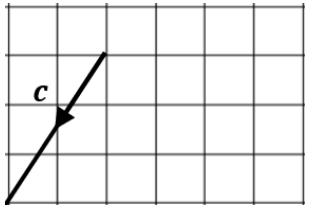
(b)

The vector $\boldsymbol{b}$ is shown. Draw the vector $3\boldsymbol{b}$.



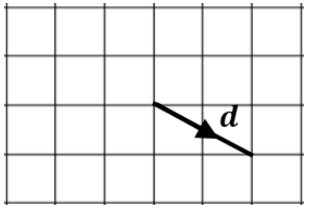
(c)

The vector $\boldsymbol{c}$ is shown. Draw the vector $-\boldsymbol{c}$.



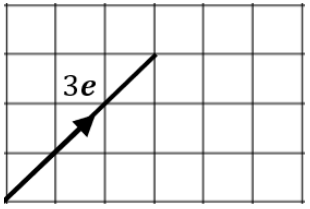
(d)

The vector $\boldsymbol{d}$ is shown. Draw the vector $-2\boldsymbol{d}$.



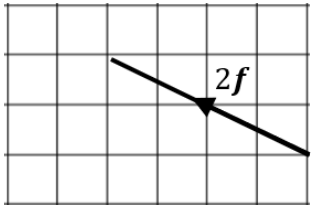
(e)

The vector $3\boldsymbol{e}$ is shown. Draw the vector $2\boldsymbol{e}$.

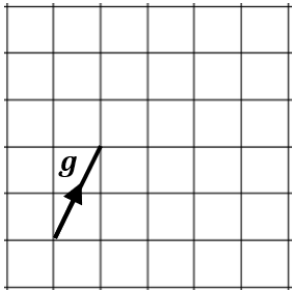


(f)

The vector $2\boldsymbol{f}$ is shown. Draw the vector $-\boldsymbol{f}$.



(g)



$\boldsymbol{g} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$

Draw and write down the column vector for

(i) $2\boldsymbol{g}$ (ii) $-\boldsymbol{g}$ (iii) $-3\boldsymbol{g}$

(i)

$\boldsymbol{a} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$

Find $4\boldsymbol{a}$

(j)

$\boldsymbol{b} = \begin{pmatrix} 6 \\ -3 \end{pmatrix}$

Find $-2\boldsymbol{b}$

(k)

$\boldsymbol{c} = \begin{pmatrix} -3 \\ -12 \end{pmatrix}$

Find $\frac{2}{3}\boldsymbol{c}$

(l)

$-3\boldsymbol{d} = \begin{pmatrix} 3\sqrt{2} \\ -6 \end{pmatrix}$

Find $\boldsymbol{d}$

Fluency Practice

Write these vectors in column form. Can you spot any links between questions?

$$\boldsymbol{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \quad \boldsymbol{b} = \begin{pmatrix} -2 \\ 1 \end{pmatrix} \quad \boldsymbol{c} = \begin{pmatrix} 9 \\ -5 \end{pmatrix} \quad \boldsymbol{d} = \begin{pmatrix} -6 \\ 4 \end{pmatrix}$$

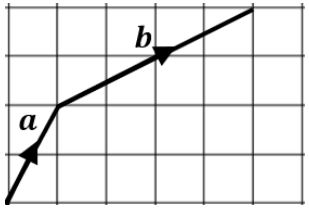
1) **a** + **b**	2) **a** - **b**	3) **b** - **a**	4) **c** - **d**	5) **d** - **c**
6) **a** - **a**	7) **b** - **b**	8) **a** + **b** + **c**	9) **a** + **b** - **c**	10) **a** - **b** + **c**
11) 2**a** + 2**b**	12) 2**a** - 2**b**	13) 2**c** – 3**d**	14) 4**c** – 6**d**	15) 20**c** – 30**d**

Fluency Practice

Adding and Subtracting Vectors

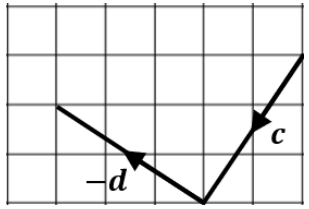
(a)

The vectors $\boldsymbol{a}$ and $\boldsymbol{b}$ are shown.
Draw the vector $\boldsymbol{a}+\boldsymbol{b}$.

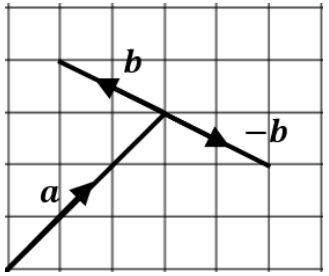


(b)

The vectors $\boldsymbol{c}$ and $-\boldsymbol{d}$ are shown.
Draw the vector $\boldsymbol{c}+(-\boldsymbol{d})$.



(c)



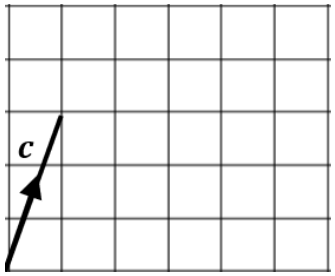
The vectors $\boldsymbol{a}, \boldsymbol{b}$ and $-\boldsymbol{b}$ are shown.

Draw the vectors

(i) $\boldsymbol{a}+\boldsymbol{b}$

(ii) $\boldsymbol{a}+(-\boldsymbol{b})$.

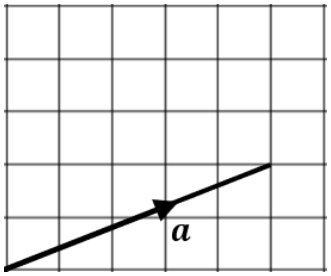
(d)



$\boldsymbol{c}=\begin{pmatrix}1\\3\end{pmatrix}$ $\boldsymbol{d}=\begin{pmatrix}4\\-1\end{pmatrix}$

Draw the vector $\boldsymbol{c}+\boldsymbol{d}$ and find its column vector.

(e)



$\boldsymbol{a}=\begin{pmatrix}5\\2\end{pmatrix}$ $\boldsymbol{b}=\begin{pmatrix}2\\-1\end{pmatrix}$

Draw the vector $\boldsymbol{a}-\boldsymbol{b}$ and find its column vector.

(f)

$\boldsymbol{e}=\begin{pmatrix}7\\1\end{pmatrix}$ $\boldsymbol{f}=\begin{pmatrix}-3\\4\end{pmatrix}$

Find $\boldsymbol{e}+\boldsymbol{f}$

(g)

$\boldsymbol{c}=\begin{pmatrix}-2\\5\end{pmatrix}$ $\boldsymbol{d}=\begin{pmatrix}1\\4\end{pmatrix}$

Find $\boldsymbol{c}-\boldsymbol{d}$

(h)

$\boldsymbol{a}=\begin{pmatrix}0\\4\end{pmatrix}$ $\boldsymbol{b}=\begin{pmatrix}6\\-3\end{pmatrix}$

Find $\boldsymbol{b}-\boldsymbol{a}$

(i)

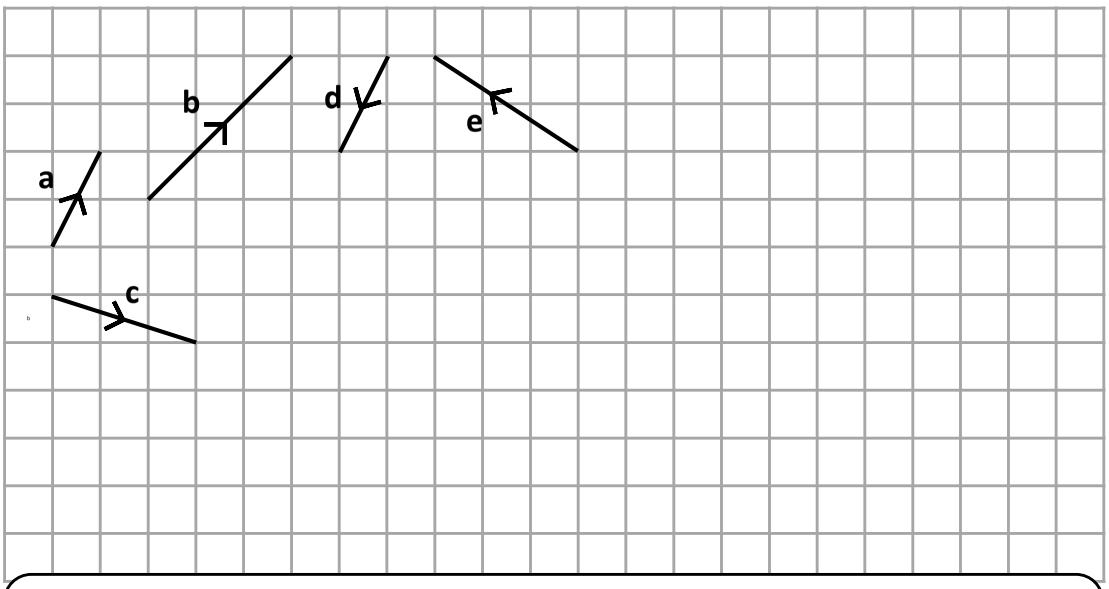
$\boldsymbol{e}=\begin{pmatrix}-6\\1\end{pmatrix}$ $\boldsymbol{f}=\begin{pmatrix}2\\-1\end{pmatrix}$

Find $-\boldsymbol{e}+\boldsymbol{f}$

(j)

$\boldsymbol{a}=\begin{pmatrix}8\\0\end{pmatrix}$ $\boldsymbol{b}=\begin{pmatrix}-2\\-5\end{pmatrix}$ $\boldsymbol{c}=\begin{pmatrix}-3\\7\end{pmatrix}$

Find (i) $\boldsymbol{a}+\boldsymbol{b}+\boldsymbol{c}$ (ii) $\boldsymbol{a}+\boldsymbol{b}-\boldsymbol{c}$ (iii) $\boldsymbol{a}-\boldsymbol{b}-\boldsymbol{c}$



Write down each vector as a column vector.
If you want, sketch on the grid to help.

1) $2\mathbf{a} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$

2) $2\mathbf{c} =$

3) $3\mathbf{d} =$

4) $5\mathbf{e} =$

5) $\mathbf{a} + \mathbf{b} =$

6) $\mathbf{a} + \mathbf{d} =$

7) $\mathbf{a} + \mathbf{c} =$

8) $\mathbf{e} + \mathbf{d} =$

9) $\mathbf{d} + 2\mathbf{c} =$

10) $-3\mathbf{b} =$

11) $\mathbf{a} - \mathbf{e} =$

12) $2\mathbf{b} - \mathbf{c} =$

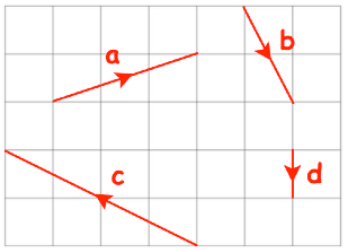
13) $\mathbf{e} - 2\mathbf{c} =$

14) $2\mathbf{b} - \mathbf{e} + \mathbf{c} =$

15) $2(\mathbf{e} - \mathbf{d}) =$

16) $\frac{1}{2}(\mathbf{e} + \mathbf{c} - \mathbf{b} - \mathbf{d}) =$

Question 1: The vectors **a**, **b**, **c** and **d** are shown on the grid.



(a) Write **a** as a column vector

(b) Write **b** as a column vector

(c) Write **c** as a column vector

(d) Write **d** as a column vector

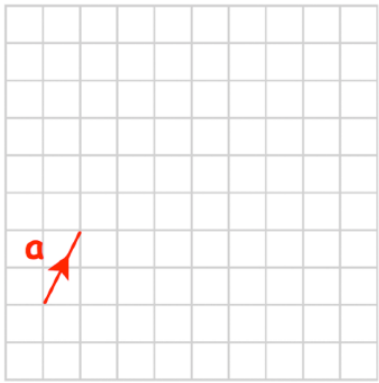
Question 2: On a grid, draw and label the following vectors.

(a) $\mathbf{a} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ (b) $\mathbf{b} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$ (c) $\mathbf{c} = \begin{pmatrix} -3 \\ -7 \end{pmatrix}$ (d) $\mathbf{d} = \begin{pmatrix} 0 \\ -6 \end{pmatrix}$

(e) $\mathbf{e} = \begin{pmatrix} 8 \\ -1 \end{pmatrix}$ (f) $\mathbf{f} = \begin{pmatrix} -4 \\ 0 \end{pmatrix}$

Question 3: Shown on the grid is the vector **a**

$\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$



(a) Draw the vector 2**a** on the grid.

(b) Write 2**a** as a column vector

(c) Draw the vector 3**a** on the grid.

(d) Write 3**a** as a column vector

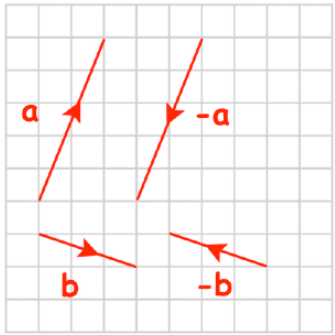
(e) Write 5**a** as a column vector

Question 4: Given $\mathbf{a} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -9 \\ -7 \end{pmatrix}$

Write the following as column vectors

(a) 3**a** (b) 2**b** (c) 5**c** (d) $\frac{1}{2}\mathbf{a}$ (e) $\frac{1}{4}\mathbf{b}$

Question 5: Shown on the grid are vectors **a**, **−a**, **b** and **−b**



(a) Write **a** as a column vector
(b) Write **−a** as a column vector

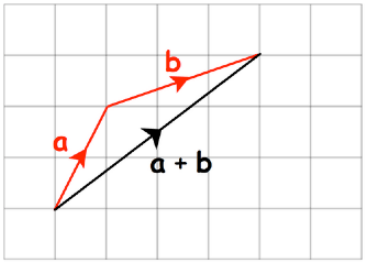
(c) Write **b** as a column vector
(d) Write **−b** as a column vector

Question 6: Given $\mathbf{a} = \begin{pmatrix} 2 \\ 11 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -8 \\ 3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -4 \\ -6 \end{pmatrix}$

Write the following as column vectors

(a) **−a** (b) **−b** (c) **−c** (d) **−2a** (e) **−4b** (f) $-\frac{1}{2}\mathbf{b}$

Question 7: Shown on the grid are the vector **a**, **b** and **a + b**



(a) Write **a** as a column vector

(b) Write **b** as a column vector

(c) Write **a + b** as a column vector

Question 8: Given $\mathbf{a} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ $\mathbf{d} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$ and $\mathbf{e} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$

Work out the following as column vectors

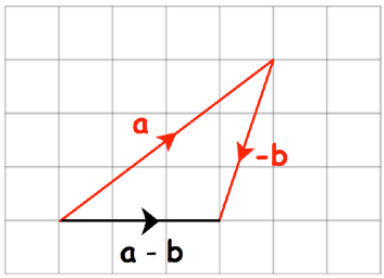
(a) **a + b** (b) **b + c** (c) **a + c** (d) **c + d**

(e) **b + e** (f) **d + a** (g) **e + d** (h) **2a + b**

(i) **3c + b** (j) **a + 5b** (k) **4b + 3c** (l) **7c + d**

(m) **a + 2e** (n) **8e + 3d** (o) **a + c + e** (p) **2b + 3d + 10e**

Question 9: $\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$



Shown on the grid are the vector **a**, **−b** and **a − b**

Write down the vector **a − b** as a column vector.

Question 10: Given $\mathbf{a} = \begin{pmatrix} 12 \\ 15 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 7 \\ 3 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 1 \\ 8 \end{pmatrix}$ $\mathbf{d} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$ and $\mathbf{e} = \begin{pmatrix} -8 \\ -9 \end{pmatrix}$

Work out the following as column vectors

(a) **a − b** (b) **a − c** (c) **b − c** (d) **c − b**

(e) **a − d** (f) **e − b** (g) **e − d** (h) 3**a − b**

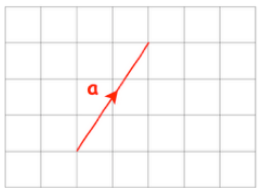
(i) 2**c − 2b** (j) 6**b − 4a** (k) 3**d − 4b** (l) 7**e − 10d**

Question 11: $\mathbf{a} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 8 \\ -1 \end{pmatrix}$

Work out **2a + b** as a column vector

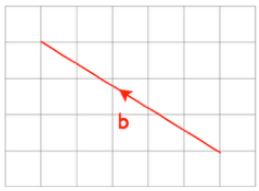
Apply

Question 1: Mark has been asked to draw the vector $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$



What mistake(s) has Mark made?

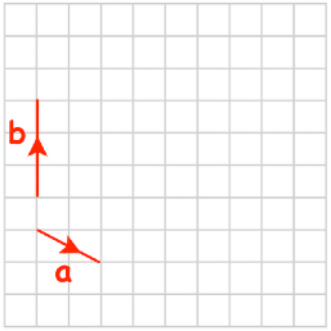
Question 2: Abby has been asked to draw the vector $\mathbf{b} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$



What mistake(s) has Abby made?

Fluency Practice

Question 3: The vectors $\mathbf{a}$ and $\mathbf{b}$ are shown on the grid.



(a) On the grid, draw the vector $-2\mathbf{a}$

(b) On the grid, draw the vector $\mathbf{a} + \mathbf{b}$

(c) Work out $3\mathbf{a} + 4\mathbf{b}$ as a column vector

Question 4: $\mathbf{a} = \begin{pmatrix} -5 \\ p \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} q \\ 1 \end{pmatrix}$

Given $\mathbf{a} + \mathbf{b} = \begin{pmatrix} 1 \\ -7 \end{pmatrix}$

Work out the values of p and q

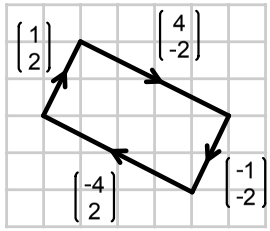
Question 5: $\mathbf{c} = \begin{pmatrix} -3 \\ q \end{pmatrix}$ $\mathbf{d} = \begin{pmatrix} p \\ 2 \end{pmatrix}$

Given $4\mathbf{d} - \mathbf{c} = \begin{pmatrix} 1 \\ -7 \end{pmatrix}$

Work out the values of p and q

vectors & quadrilaterals - easier

Match the sequences of vectors to the six different types of quadrilateral they trace out.



1. Square | Rectangle | Trapezium | Parallelogram | Rhombus | Kite

a) $\begin{bmatrix}4\\0\end{bmatrix}$ $\begin{bmatrix}0\\6\end{bmatrix}$ $\begin{bmatrix}-4\\0\end{bmatrix}$ $\begin{bmatrix}0\\-6\end{bmatrix}$

b) $\begin{bmatrix}3\\3\end{bmatrix}$ $\begin{bmatrix}2\\0\end{bmatrix}$ $\begin{bmatrix}3\\-3\end{bmatrix}$ $\begin{bmatrix}-8\\0\end{bmatrix}$

c) $\begin{bmatrix}3\\2\end{bmatrix}$ $\begin{bmatrix}5\\0\end{bmatrix}$ $\begin{bmatrix}-3\\-2\end{bmatrix}$ $\begin{bmatrix}-5\\0\end{bmatrix}$

d) $\begin{bmatrix}2\\1\end{bmatrix}$ $\begin{bmatrix}2\\-1\end{bmatrix}$ $\begin{bmatrix}-2\\-3\end{bmatrix}$ $\begin{bmatrix}-2\\3\end{bmatrix}$

e) $\begin{bmatrix}5\\0\end{bmatrix}$ $\begin{bmatrix}0\\5\end{bmatrix}$ $\begin{bmatrix}-5\\0\end{bmatrix}$ $\begin{bmatrix}0\\-5\end{bmatrix}$

f) $\begin{bmatrix}3\\4\end{bmatrix}$ $\begin{bmatrix}3\\-4\end{bmatrix}$ $\begin{bmatrix}-3\\-4\end{bmatrix}$ $\begin{bmatrix}-3\\4\end{bmatrix}$

2. Square | Rectangle | Trapezium | Parallelogram | Rhombus | Kite

a) $\begin{bmatrix}3\\3\end{bmatrix}$ $\begin{bmatrix}3\\-3\end{bmatrix}$ $\begin{bmatrix}-3\\-3\end{bmatrix}$ $\begin{bmatrix}-3\\3\end{bmatrix}$

b) $\begin{bmatrix}3\\5\end{bmatrix}$ $\begin{bmatrix}3\\-5\end{bmatrix}$ $\begin{bmatrix}-3\\-1\end{bmatrix}$ $\begin{bmatrix}-3\\1\end{bmatrix}$

c) $\begin{bmatrix}4\\1\end{bmatrix}$ $\begin{bmatrix}4\\-1\end{bmatrix}$ $\begin{bmatrix}-4\\-1\end{bmatrix}$ $\begin{bmatrix}-4\\1\end{bmatrix}$

d) $\begin{bmatrix}2\\1\end{bmatrix}$ $\begin{bmatrix}2\\-4\end{bmatrix}$ $\begin{bmatrix}-2\\-1\end{bmatrix}$ $\begin{bmatrix}-2\\4\end{bmatrix}$

e) $\begin{bmatrix}-1\\4\end{bmatrix}$ $\begin{bmatrix}2\\0\end{bmatrix}$ $\begin{bmatrix}1\\-4\end{bmatrix}$ $\begin{bmatrix}-2\\0\end{bmatrix}$

f) $\begin{bmatrix}0\\4\end{bmatrix}$ $\begin{bmatrix}4\\0\end{bmatrix}$ $\begin{bmatrix}4\\-4\end{bmatrix}$ $\begin{bmatrix}-8\\0\end{bmatrix}$

What's missing?

A Square: $\begin{bmatrix}4\\0\end{bmatrix}$ $\begin{bmatrix}0\\4\end{bmatrix}$ [ ] [ ]

B Rectangle: $\begin{bmatrix}0\\5\end{bmatrix}$ $\begin{bmatrix}-2\\0\end{bmatrix}$ [ ] [ ]

C Parallelogram: $\begin{bmatrix}2\\3\end{bmatrix}$ $\begin{bmatrix}5\\0\end{bmatrix}$ [ ] [ ]

D Rhombus: $\begin{bmatrix}2\\3\end{bmatrix}$ $\begin{bmatrix}2\\-3\end{bmatrix}$ [ ] [ ]

E Kite: $\begin{bmatrix}-2\\4\end{bmatrix}$ $\begin{bmatrix}2\\2\end{bmatrix}$ [ ] [ ]

F Trapezium: $\begin{bmatrix}2\\3\end{bmatrix}$ $\begin{bmatrix}3\\0\end{bmatrix}$ $\begin{bmatrix}1\\-3\end{bmatrix}$ [ ]

G Square: $\begin{bmatrix}2\\-2\end{bmatrix}$ $\begin{bmatrix}2\\2\end{bmatrix}$ [ ] [ ]

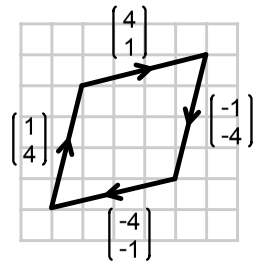
H Rectangle: $\begin{bmatrix}3\\1\end{bmatrix}$ $\begin{bmatrix}2\\-6\end{bmatrix}$ [ ] [ ]

I Rhombus: $\begin{bmatrix}-1\\3\end{bmatrix}$ [ ] [ ] $\begin{bmatrix}-1\\-3\end{bmatrix}$

J Parallelogram: $\begin{bmatrix}0\\-3\end{bmatrix}$ $\begin{bmatrix}2\\4\end{bmatrix}$ [ ] [ ]

vectors & quadrilaterals - harder

Match the sequences of vectors to the six different types of quadrilateral they trace out.



1. Square | Rectangle | Trapezium | Parallelogram | Rhombus | Kite

a) $\begin{pmatrix}0\\3\end{pmatrix}$ $\begin{pmatrix}2\\3\end{pmatrix}$ $\begin{pmatrix}0\\-3\end{pmatrix}$ $\begin{pmatrix}-2\\-3\end{pmatrix}$

b) $\begin{pmatrix}2\\4\end{pmatrix}$ $\begin{pmatrix}6\\-3\end{pmatrix}$ $\begin{pmatrix}-2\\-4\end{pmatrix}$ $\begin{pmatrix}-6\\3\end{pmatrix}$

c) $\begin{pmatrix}3\\4\end{pmatrix}$ $\begin{pmatrix}4\\-3\end{pmatrix}$ $\begin{pmatrix}-3\\-4\end{pmatrix}$ $\begin{pmatrix}-4\\3\end{pmatrix}$

d) $\begin{pmatrix}3\\4\end{pmatrix}$ $\begin{pmatrix}3\\-4\end{pmatrix}$ $\begin{pmatrix}-3\\-4\end{pmatrix}$ $\begin{pmatrix}-3\\4\end{pmatrix}$

e) $\begin{pmatrix}0\\3\end{pmatrix}$ $\begin{pmatrix}4\\3\end{pmatrix}$ $\begin{pmatrix}0\\-7\end{pmatrix}$ $\begin{pmatrix}-4\\1\end{pmatrix}$

f) $\begin{pmatrix}0\\2\end{pmatrix}$ $\begin{pmatrix}5\\3\end{pmatrix}$ $\begin{pmatrix}-3\\-5\end{pmatrix}$ $\begin{pmatrix}-2\\0\end{pmatrix}$

2. Square | Rectangle | Trapezium | Parallelogram | Rhombus | Kite

a) $\begin{pmatrix}3\\4\end{pmatrix}$ $\begin{pmatrix}5\\0\end{pmatrix}$ $\begin{pmatrix}-3\\-4\end{pmatrix}$ $\begin{pmatrix}-5\\0\end{pmatrix}$

b) $\begin{pmatrix}1\\3\end{pmatrix}$ $\begin{pmatrix}5\\3\end{pmatrix}$ $\begin{pmatrix}-3\\-5\end{pmatrix}$ $\begin{pmatrix}-3\\-1\end{pmatrix}$

c) $\begin{pmatrix}3\\2\end{pmatrix}$ $\begin{pmatrix}4\\0\end{pmatrix}$ $\begin{pmatrix}-6\\-4\end{pmatrix}$ $\begin{pmatrix}-1\\2\end{pmatrix}$

d) $\begin{pmatrix}1\\3\end{pmatrix}$ $\begin{pmatrix}-6\\2\end{pmatrix}$ $\begin{pmatrix}-1\\-3\end{pmatrix}$ $\begin{pmatrix}6\\-2\end{pmatrix}$

e) $\begin{pmatrix}1\\4\end{pmatrix}$ $\begin{pmatrix}4\\-1\end{pmatrix}$ $\begin{pmatrix}-1\\-4\end{pmatrix}$ $\begin{pmatrix}-4\\1\end{pmatrix}$

f) $\begin{pmatrix}4\\3\end{pmatrix}$ $\begin{pmatrix}1\\2\end{pmatrix}$ $\begin{pmatrix}-4\\-3\end{pmatrix}$ $\begin{pmatrix}-1\\-2\end{pmatrix}$

What's missing?

A Rectangle: $\begin{pmatrix}2\\3\end{pmatrix}$ $\begin{pmatrix}6\\-4\end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$

B Parallelogram: $\begin{pmatrix}-3\\4\end{pmatrix}$ $\begin{pmatrix}2\\-1\end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$

C Kite: $\begin{pmatrix}3\\0\end{pmatrix}$ $\begin{pmatrix}2\\5\end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$

D Rhombus: $\begin{pmatrix}-3\\-2\end{pmatrix}$ $\begin{pmatrix}3\\-2\end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$

E Square: $\begin{pmatrix}5\\-2\end{pmatrix}$ $\begin{pmatrix}2\\5\end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$

F Parallelogram: $\begin{pmatrix}4\\-1\end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}3\\-2\end{pmatrix}$

G Rectangle: $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}3\\2\end{pmatrix}$ $\begin{pmatrix}-4\\ \ \end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$

H Kite: $\begin{pmatrix}1\\2\end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$ $\begin{pmatrix}-3\\-4\end{pmatrix}$ $\begin{pmatrix}\ \\ \ \end{pmatrix}$

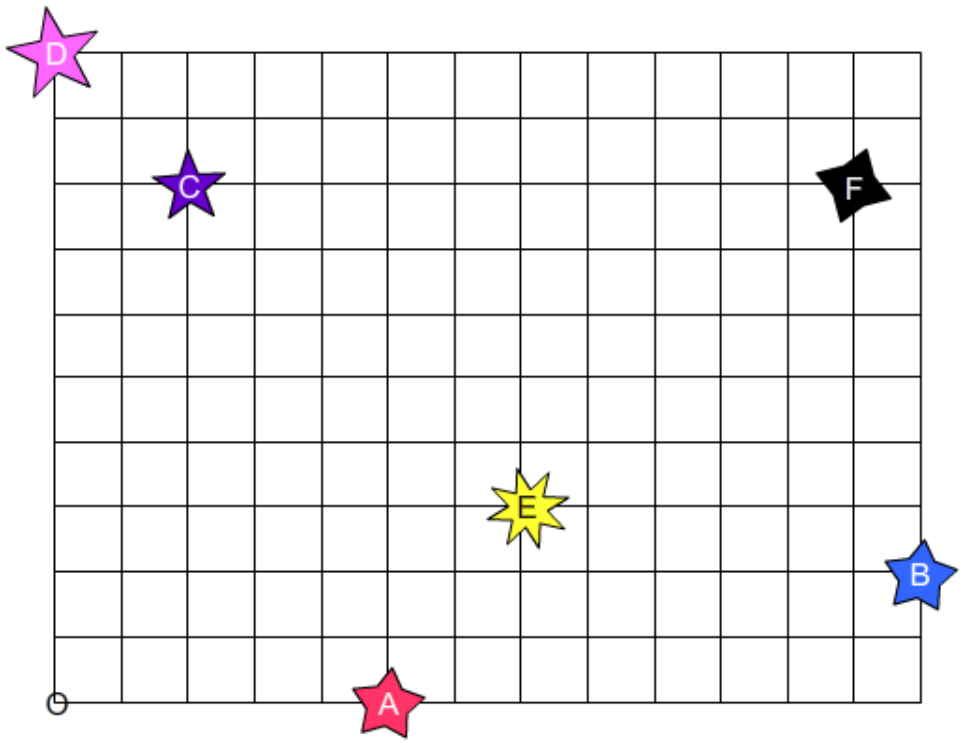
I Square: $\begin{pmatrix}4\\ \ \end{pmatrix}$ $\begin{pmatrix}2\\ \ \end{pmatrix}$ $\begin{pmatrix}-4\\ \ \end{pmatrix}$ $\begin{pmatrix}-2\\ \ \end{pmatrix}$

J Trapezium: $\begin{pmatrix}3\\4\end{pmatrix}$ $\begin{pmatrix}2\\ \ \end{pmatrix}$ $\begin{pmatrix}-1\\ \ \end{pmatrix}$ $\begin{pmatrix}-4\\2\end{pmatrix}$

Your task is to start at the origin, bottom left, and find a way of getting to each of the stars on the grid.

To move across the grid you must use vectors, and you are only allowed to use the vectors $\begin{pmatrix}3\\2\end{pmatrix}$ and $\begin{pmatrix}2\\-2\end{pmatrix}$, but you can use them as many times as you like. You can also add them together, subtract them, or multiply them by a scalar.

Is it possible to get to all of the stars?



Challenge

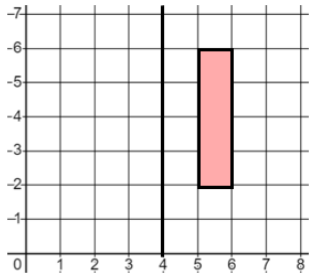
Why would it have been impossible to reach any of the stars if we had given you the vectors $\begin{pmatrix}2\\2\end{pmatrix}$ and $\begin{pmatrix}6\\6\end{pmatrix}$?

4 Transformations

Reflecting Shapes

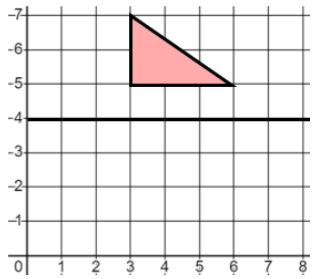
(a)

Reflect in the line shown.



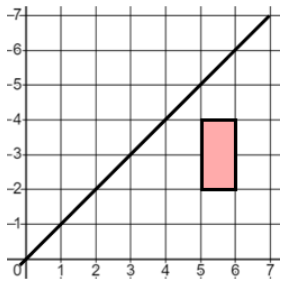
(b)

Reflect in the line shown.



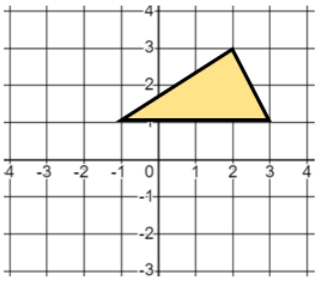
(c)

Reflect in the line shown.



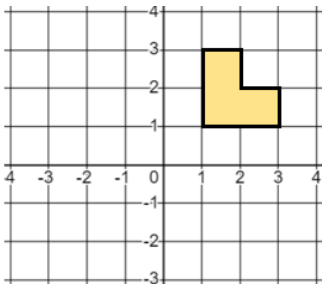
(d)

Reflect in the x-axis.



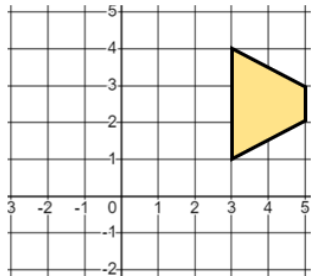
(e)

Reflect in the y-axis.



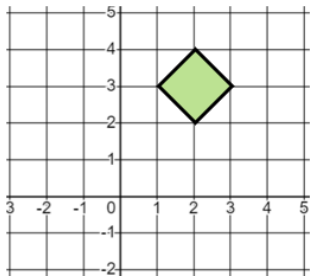
(f)

Reflect in the line $x = 1$.



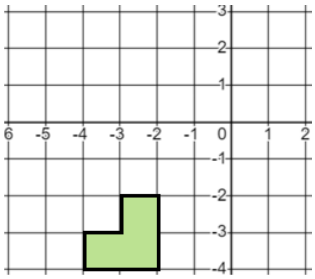
(g)

Reflect in the line $y = 2$.



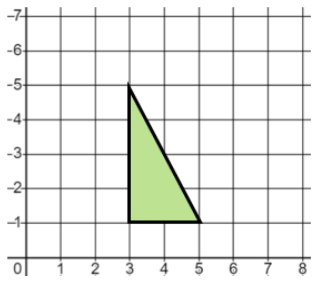
(h)

Reflect in the line $x = -2$.



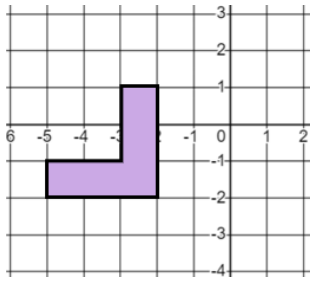
(i)

Reflect in the line $y = 3$.



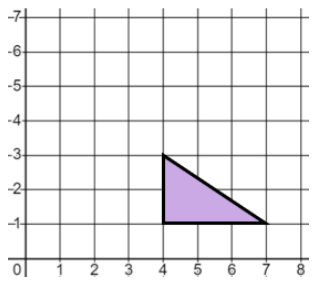
(j)

Reflect in the line $y = -1$.



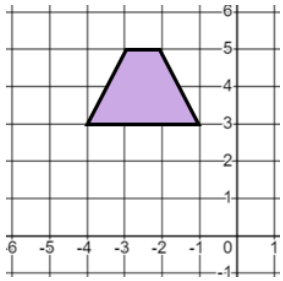
(k)

Reflect in the line $y = x$.



(l)

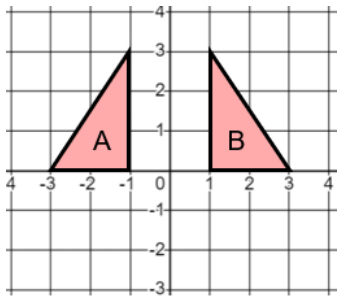
Reflect in the line $y = -x$.



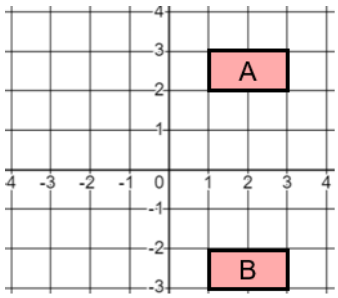
Describing Reflections

Describe fully the single transformation which maps shape A to shape B

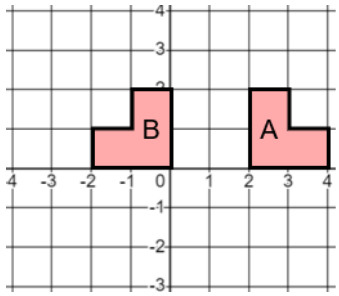
(a)



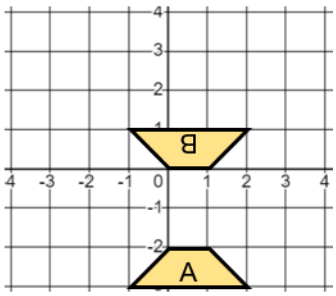
(b)



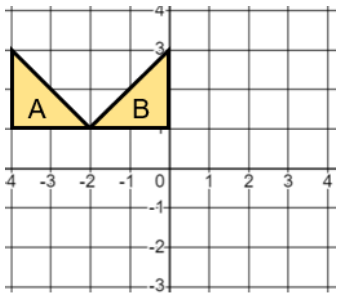
(c)



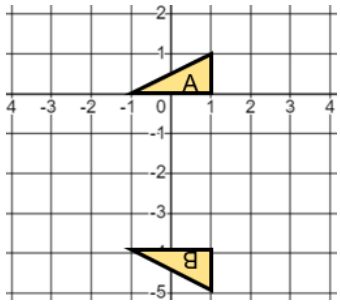
(d)



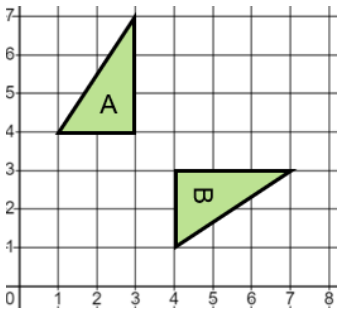
(e)



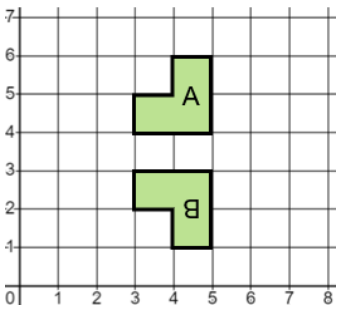
(f)



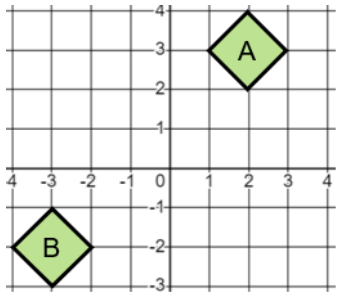
(g)



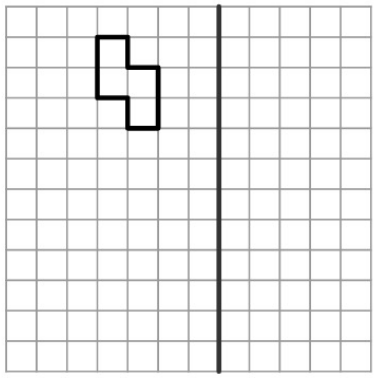
(h)



(i)

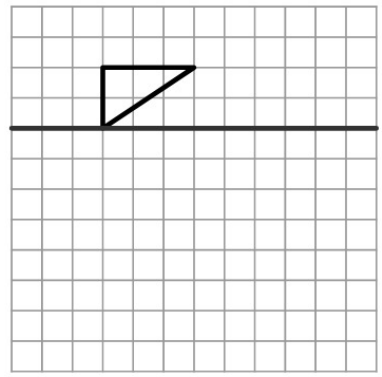


1.



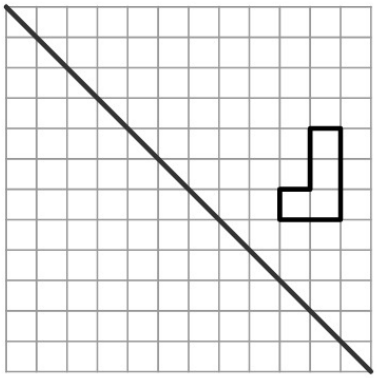
Reflect the shape in the line.

2.



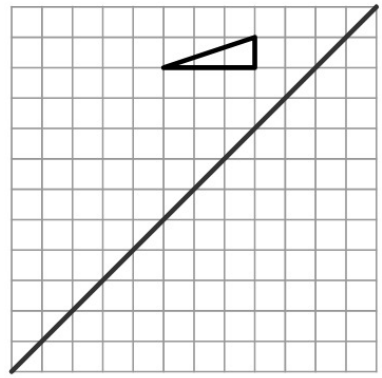
Reflect the shape in the line.

3.



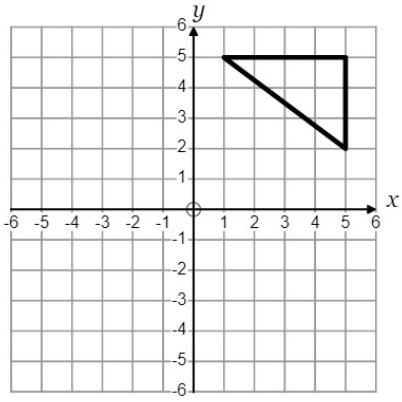
Reflect the shape in the line.

4.



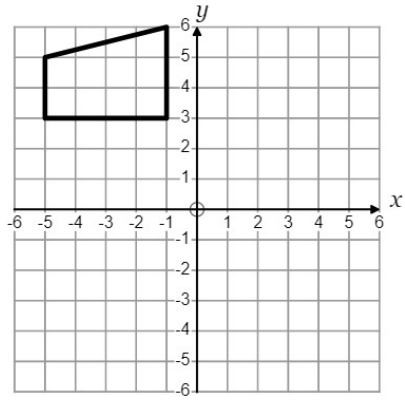
Reflect the shape in the line.

5.



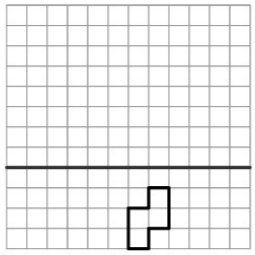
Reflect the shape in the y-axis.

6.



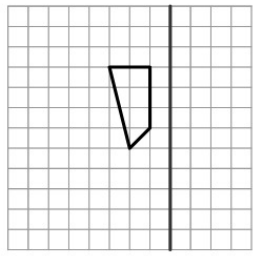
Reflect the shape in the x-axis.

7.



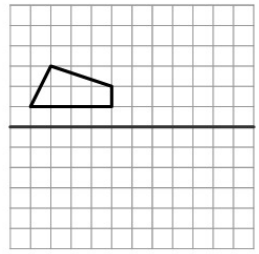
Reflect the shape in the line.

8.



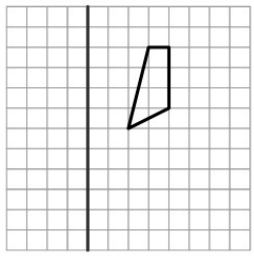
Reflect the shape in the line.

9.



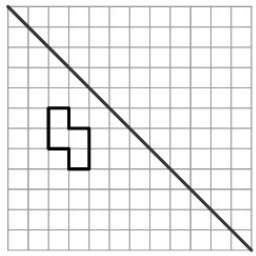
Reflect the shape in the line.

10.



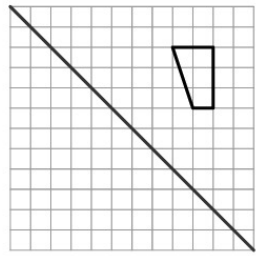
Reflect the shape in the line.

11.



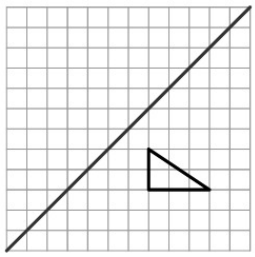
Reflect the shape in the line.

12.



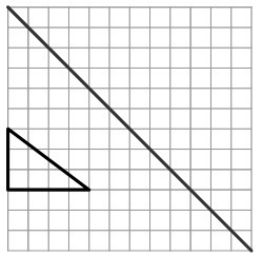
Reflect the shape in the line.

13.



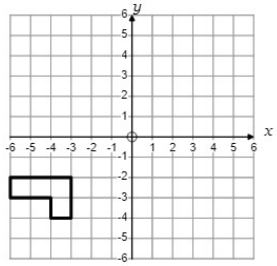
Reflect the shape in the line.

14.



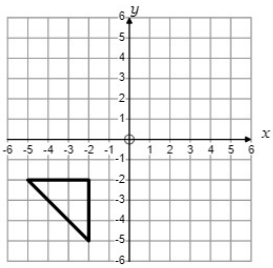
Reflect the shape in the line.

15.



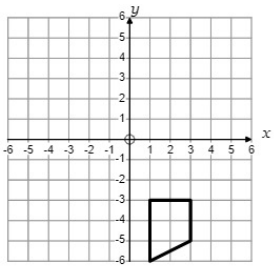
Reflect the shape in the y-axis.

16.



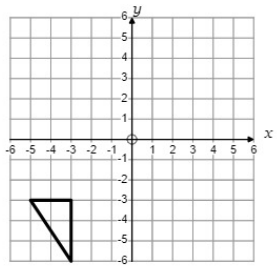
Reflect the shape in the x-axis.

17.



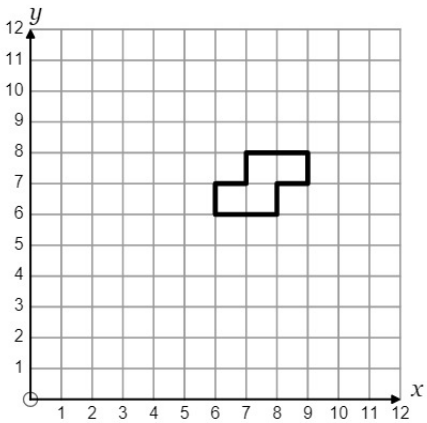
Reflect the shape in the x-axis.

18.



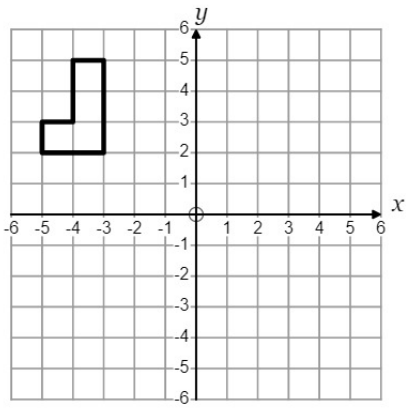
Reflect the shape in the y-axis.

1.



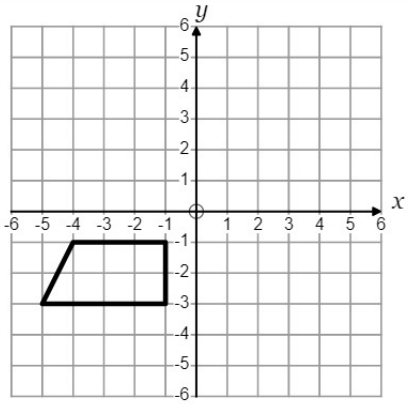
Reflect the shape in the line with equation $y = 4$.

2.



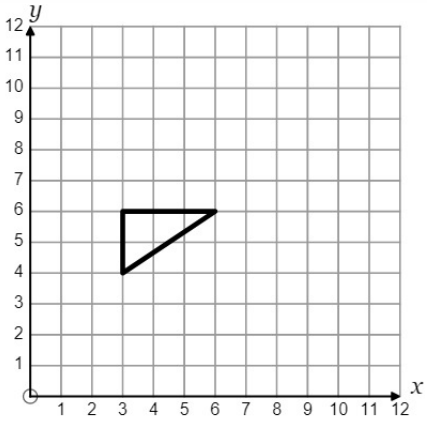
Reflect the shape in the line with equation $x = -1$.

3.



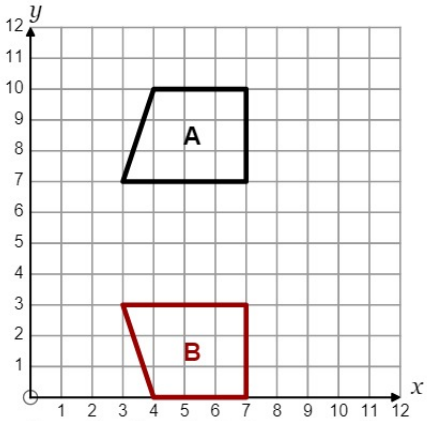
Reflect the shape in the line with equation $y = -x$.

4.



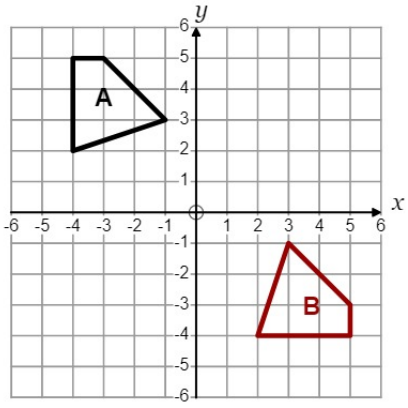
Reflect the shape in the line with equation $x = 6$.

5.



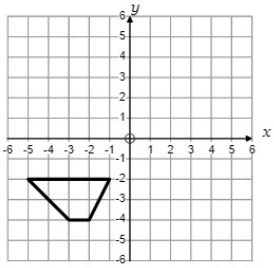
Describe the single transformation from shape A to shape B.

6.



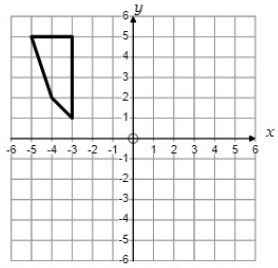
Describe the single transformation from shape A to shape B.

7.



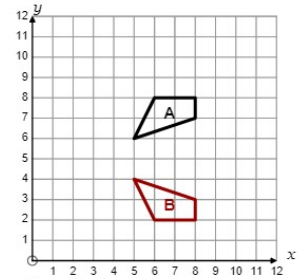
Reflect the shape in the line with equation $y = -1$.

8.



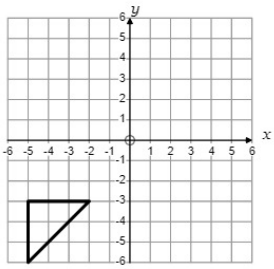
Reflect the shape in the line with equation $y = x$.

9.



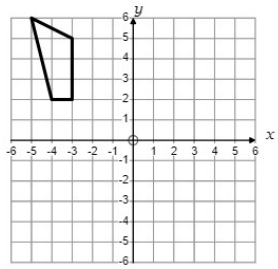
Describe the single transformation from shape A to shape B.

10.



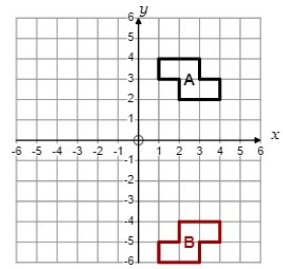
Reflect the shape in the line with equation $y = -2$.

11.



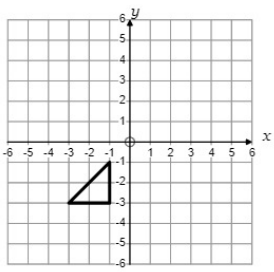
Reflect the shape in the line with equation $y = 0$.

12.



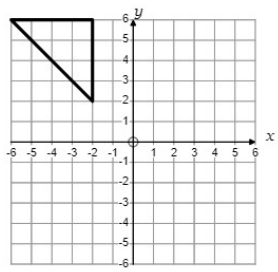
Describe the single transformation from shape A to shape B.

13.



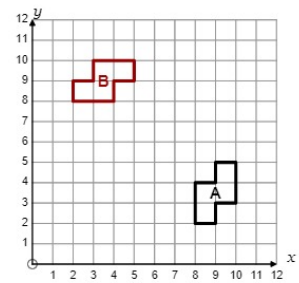
Reflect the shape in the line with equation $x = 1$.

14.



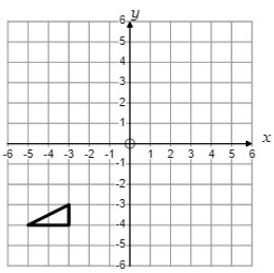
Reflect the shape in the line with equation $y = x$.

15.



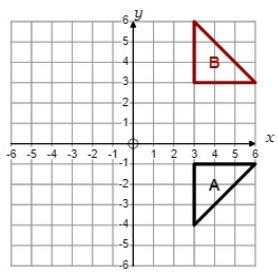
Describe the single transformation from shape A to shape B.

16.



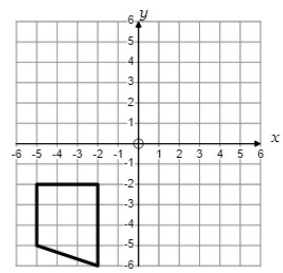
Reflect the shape in the line with equation $x = 0$.

17.



Describe the single transformation from shape A to shape B.

18.



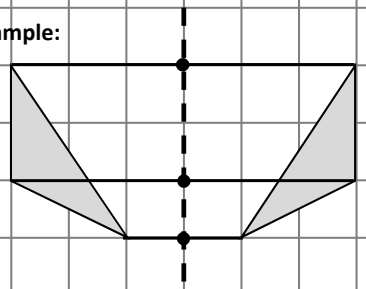
Reflect the shape in the line with equation $y = -x$.

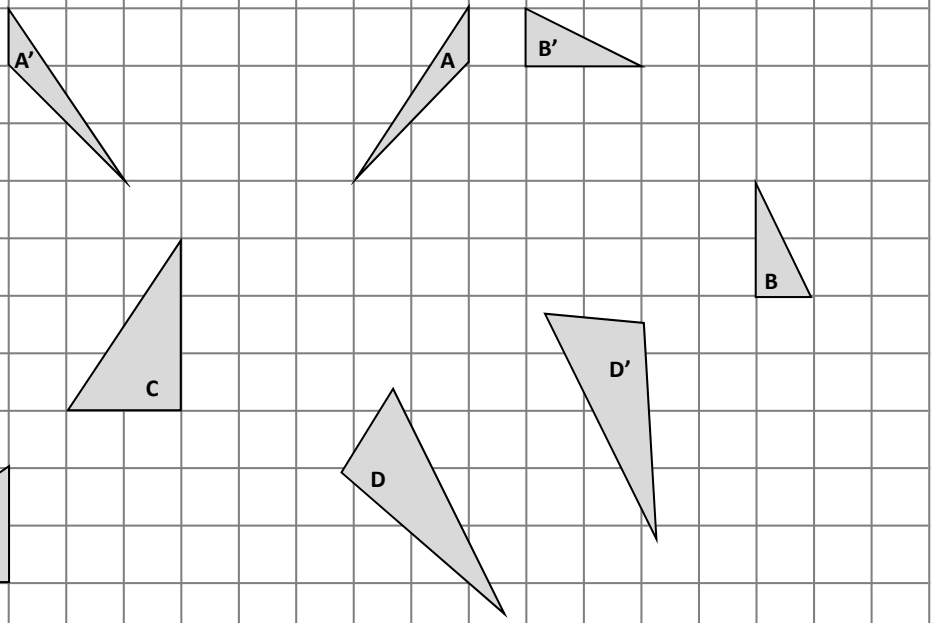
Fluency Practice

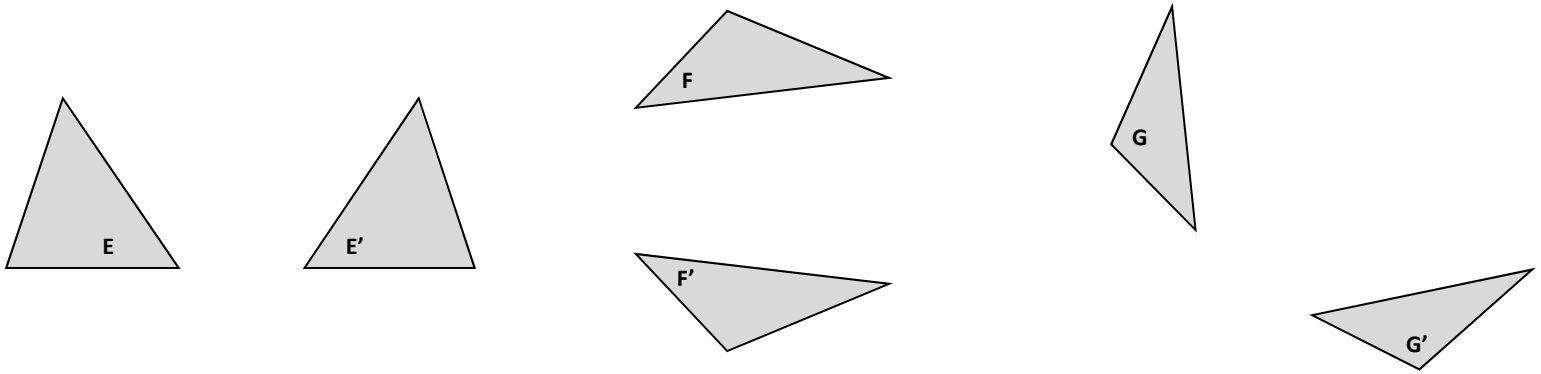
To find the **line of symmetry**, join corresponding vertices with a line & mark the midpoints.

Connect the midpoints to draw the line of symmetry.

Example:







Reflection with Horizontal & Vertical Lines

Label the axes below (x & y) and sketch lines to help find each reflected point.

Point **A** (2, 1) is reflected in the x-axis. Reflected point (**A'**) = _____

Point **B** (4, 1) reflected in the y-axis.
B': _____

Point **C** (2, 2) reflected in $x = 1$
C': _____

Point **D** (6, 2) reflected in $x = 5$
D': _____

Point **E** (0, 4) reflected in $x = 3$
E': _____

Point **F** (5, 0) reflected in $y = 2$
F': _____

Point **G** (−2, 1) reflected in $y = 4$
G': _____

Point **H** (1, 1) reflected in $y = -1$
H': _____

Point **I** (−5, 4) reflected in $x = -2$
I': _____

J (−2, −6) reflected in $y = -2$
J': _____

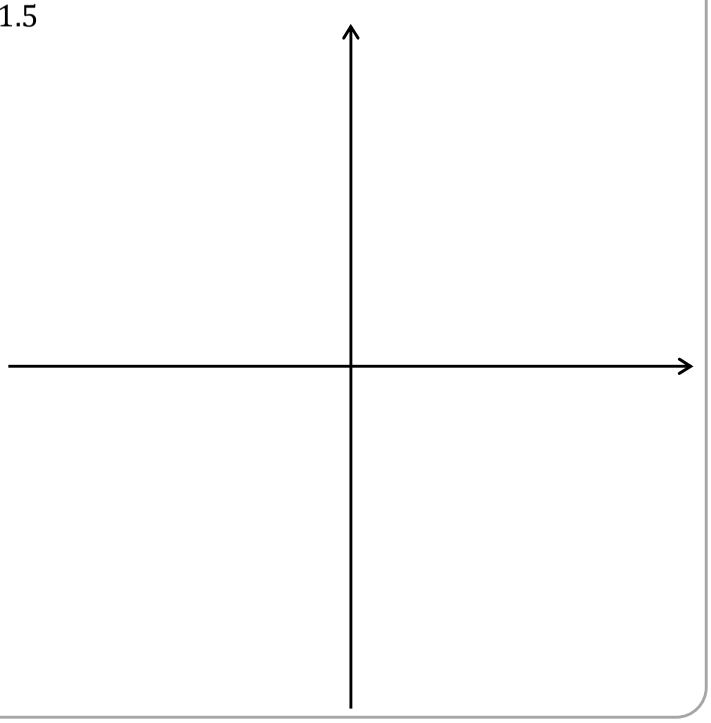
K (4, −6) reflected in $x = -3$
K': _____

L (−1, 7) reflected in $x = 1.5$
L': _____

M (2, 8)
reflected in $y = 2$,
then reflected in $y = 0$
M': _____

N (−4, 5)
reflected in $x = 5$,
then reflected in $y = 2$
N': _____

O (−5, −9)
reflected in $y = -3$,
then reflected in $x = 4$
O': _____



More-Same-Less

Instructions: Complete the remaining boxes with line equations by making the minimum change possible to the centre box. You must be able to write down the full coordinate of the image points. If there are boxes that cannot be filled in, say why.

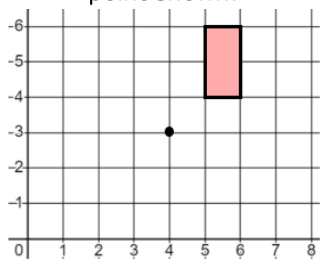
Value of the *x* coordinate of the image

Value of the *y* coordinate of the image	Less	Same	More
More	(1, 0) Reflected in the line	(1, 0) Reflected in the line	(1, 0) Reflected in the line
Same	(1, 0) Reflected in the line	(1, 0) Reflected in the line $x = 2$	(1, 0) Reflected in the line
Less	(1, 0) Reflected in the line	(1, 0) Reflected in the line	(1, 0) Reflected in the line

Rotating Shapes

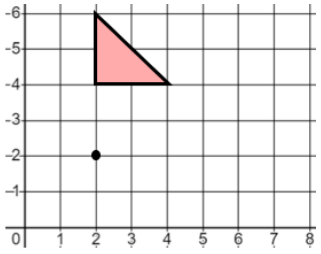
(a)

Rotate $180°$ about the point shown.



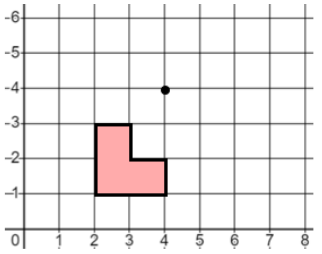
(b)

Rotate $90°$ clockwise about the point shown.



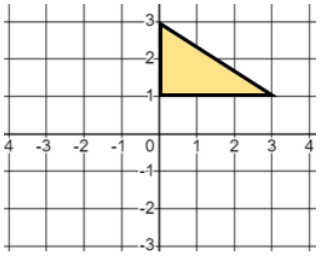
(c)

Rotate $90°$ anti-clockwise about the point shown.



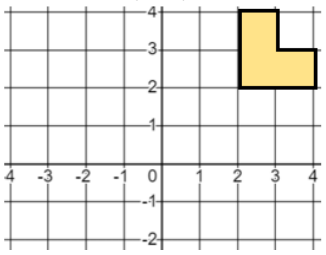
(d)

Rotate $180°$ about the origin.



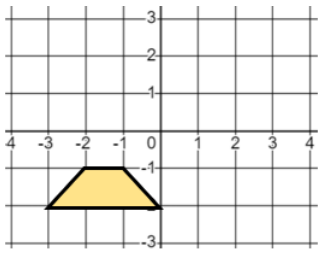
(e)

Rotate $180°$ about the point $(2,1)$.



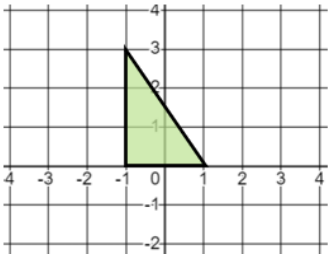
(f)

Rotate $90°$ clockwise about the origin.



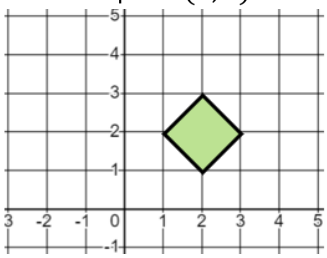
(g)

Rotate $90°$ anti-clockwise about the origin.



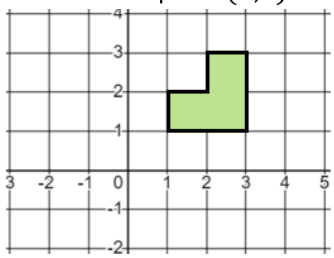
(h)

Rotate $90°$ clockwise about the point $(1,3)$.



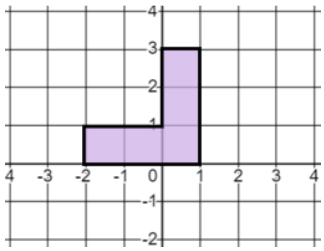
(i)

Rotate $90°$ anti-clockwise about the point $(2,0)$.



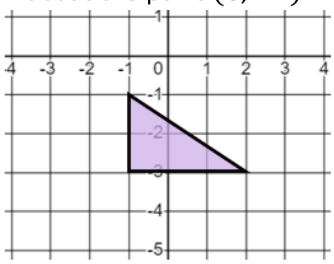
(j)

Rotate $180°$ about the point $(-1,1)$.



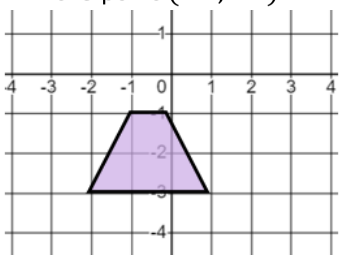
(k)

Rotate $90°$ anti-clockwise about the point $(0,-2)$.



(l)

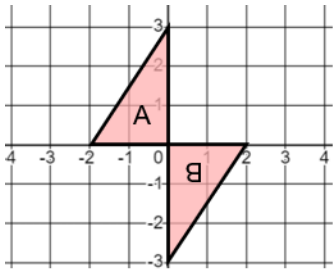
Rotate $90°$ clockwise about the point $(-1,-2)$.



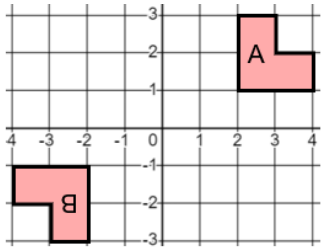
Describing Rotations

Describe fully the single transformation which maps shape A to shape B

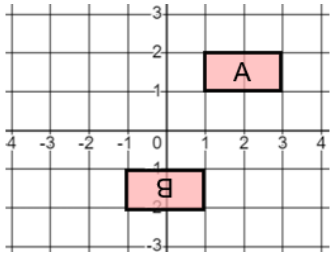
(a)



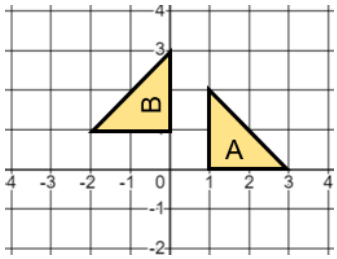
(b)



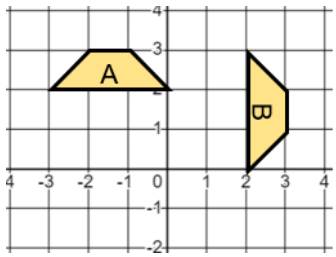
(c)



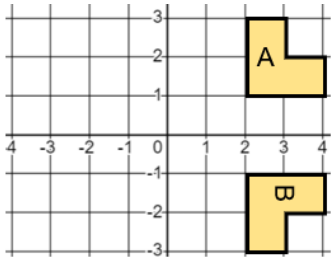
(d)



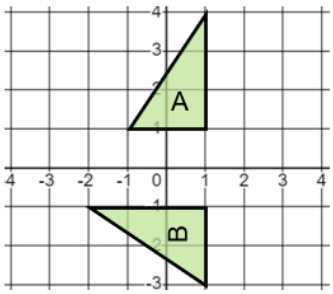
(e)



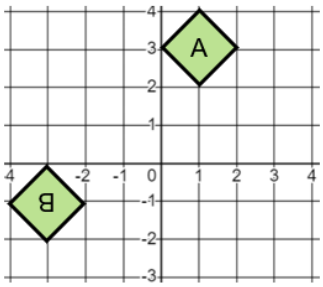
(f)



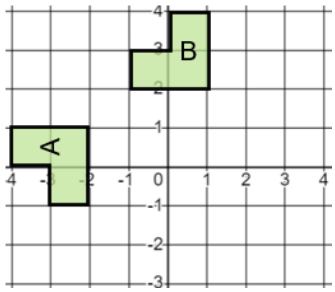
(g)



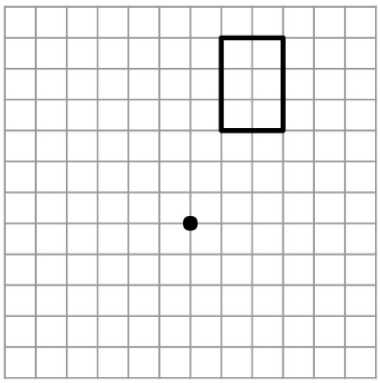
(h)



(i)

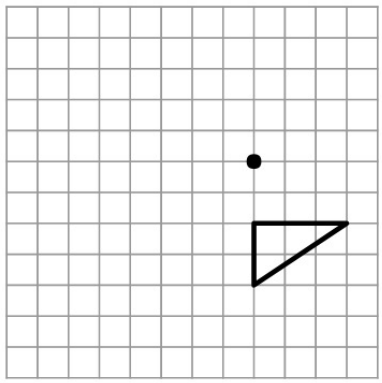


1.



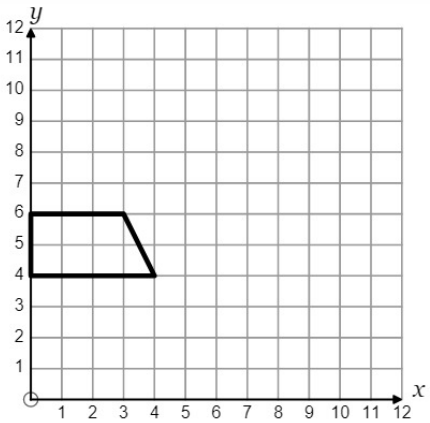
Rotate the shape 90° clockwise about the point.

2.



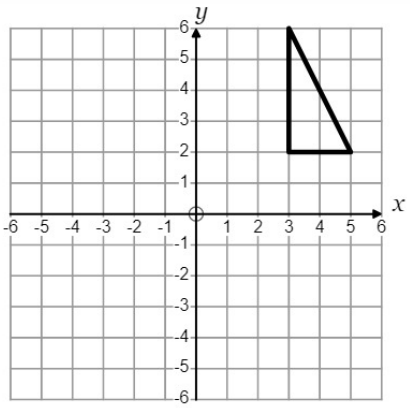
Rotate the shape 180° about the point.

3.



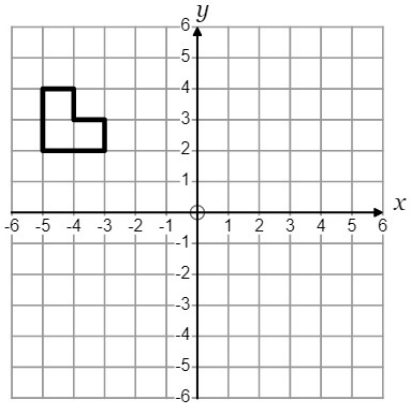
Rotate the shape 270° anti-clockwise about the point with coordinates (5, 7).

4.



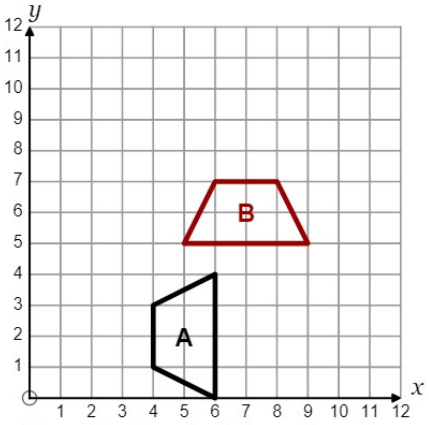
Rotate the shape 90° anti-clockwise about the point with coordinates (2, 3).

5.



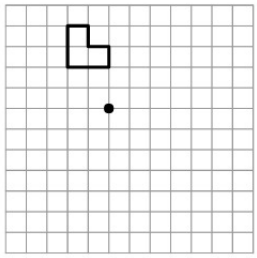
Rotate the shape 270° anti-clockwise about the point with coordinates (-3, 2).

6.



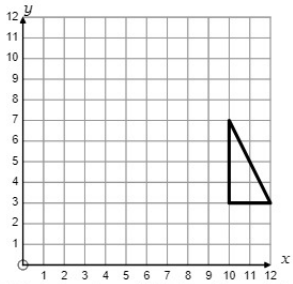
Describe the single transformation from shape A to shape B.

7.



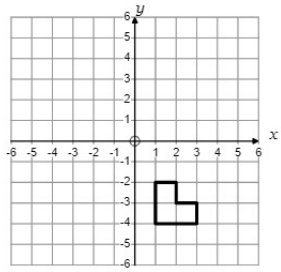
Rotate the shape 90° anti-clockwise about the point.

8.



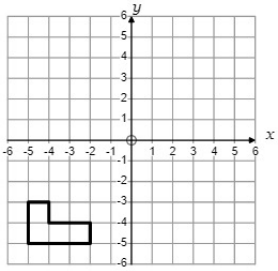
Rotate the shape 180° about the point with coordinates (7, 7).

9.



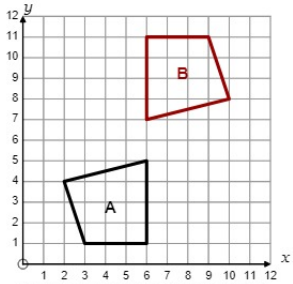
Rotate the shape 90° clockwise about the origin.

10.



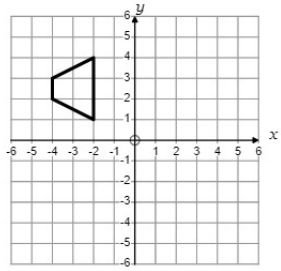
Rotate the shape 180° about the point with coordinates (0, -1).

11.



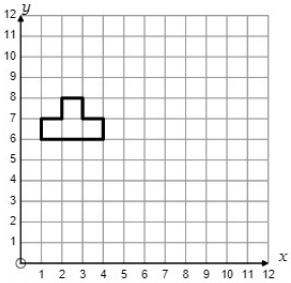
Describe the single transformation from shape A to shape B.

12.



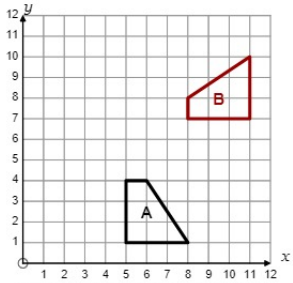
Rotate the shape 270° anti-clockwise about the origin.

13.



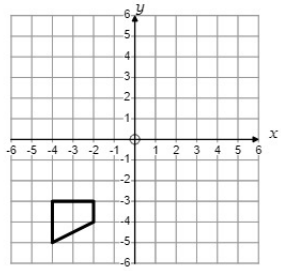
Rotate the shape 180° about the point with coordinates (3, 8).

14.



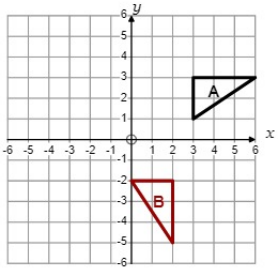
Describe the single transformation from shape A to shape B.

15.



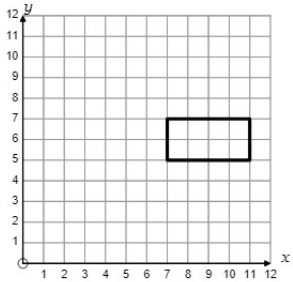
Rotate the shape 270° clockwise about the point with coordinates (-1, -1).

16.



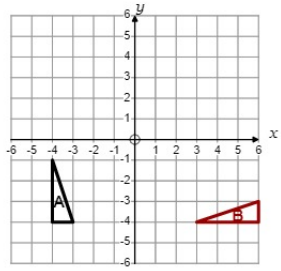
Describe the single transformation from shape A to shape B.

17.



Rotate the shape 90° anti-clockwise about the point with coordinates (8, 5).

18.



Describe the single transformation from shape A to shape B.

More-Same-Less

Instructions: Complete the remaining boxes with line equations by making the minimum change possible to the centre box. You must be able to write down the full coordinate of the image points. If there are boxes that cannot be filled in, say why.

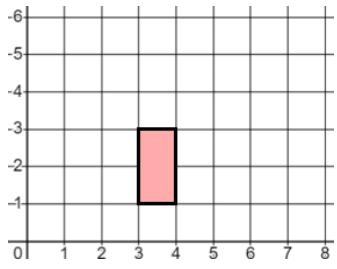
Value of the *x* coordinate of the image

Value of the *x* coordinate of the centre	Less	Same	More
More	(2, 1) Rotated centre	(2, 1) Rotated centre	(2, 1) Rotated centre
Same	(2, 1) Rotated centre	(2, 1) Rotated 90^{o} anticlockwise centre (0, 0)	(2, 1) Rotated centre
Less	(2, 1) Rotated centre	(2, 1) Rotated centre	(2, 1) Rotated centre

Translating Shapes

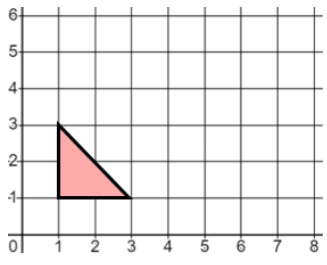
(a)

Translate the shape 3 units to the right.



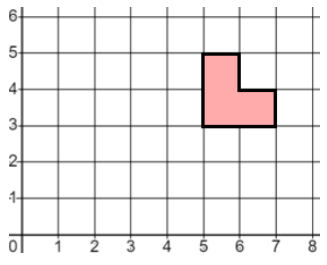
(b)

Translate the shape 4 units right and 1 unit up.



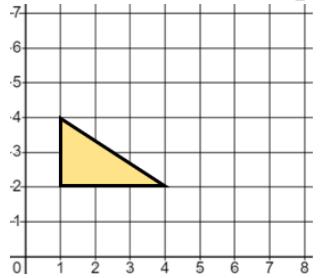
(c)

Translate the shape 3 units left and 2 units down.



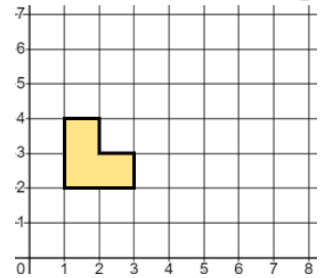
(d)

Translate the shape by $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$



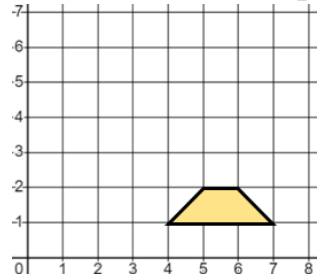
(e)

Translate the shape by $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$



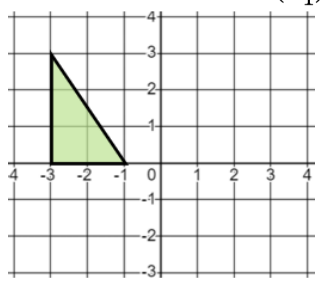
(f)

Translate the shape by $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$



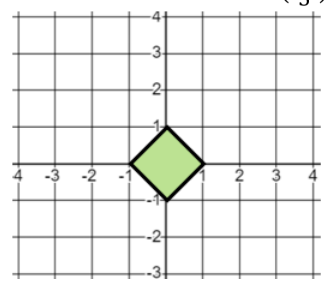
(g)

Translate the shape by $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$



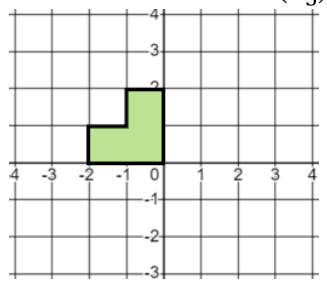
(h)

Translate the shape by $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$



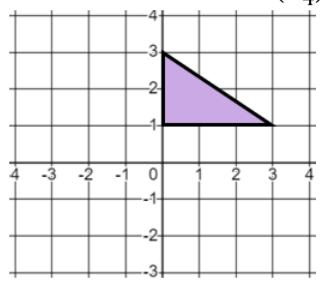
(i)

Translate the shape by $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$



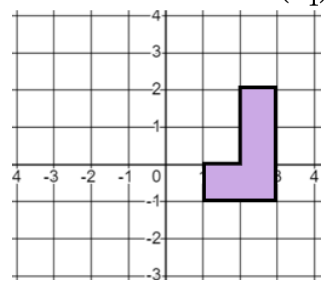
(j)

Translate the shape by $\begin{pmatrix} -2 \\ -4 \end{pmatrix}$



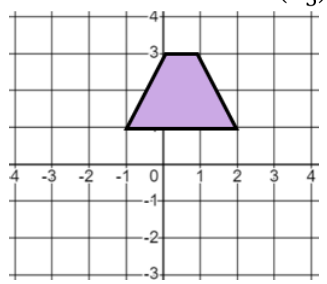
(k)

Translate the shape by $\begin{pmatrix} -5 \\ -1 \end{pmatrix}$



(l)

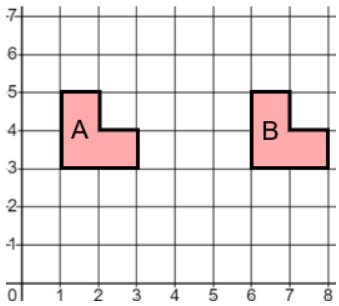
Translate the shape by $\begin{pmatrix} 0.5 \\ -3 \end{pmatrix}$



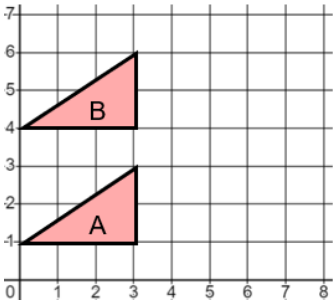
Describing Translations

Describe fully the single transformation which maps shape A to shape B

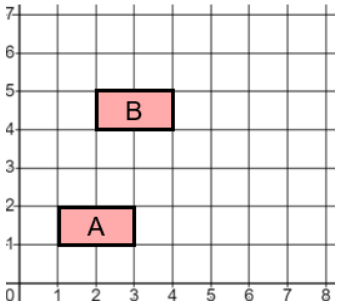
(a)



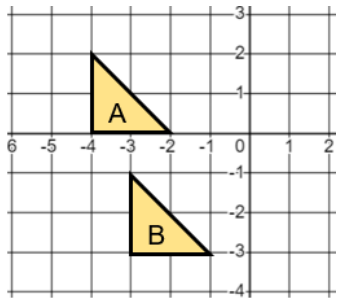
(b)



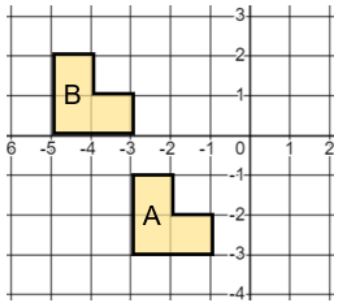
(c)



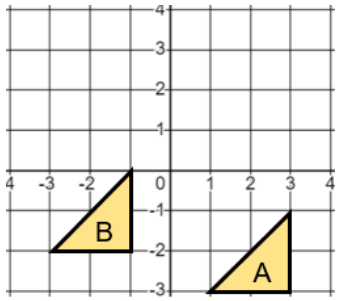
(d)



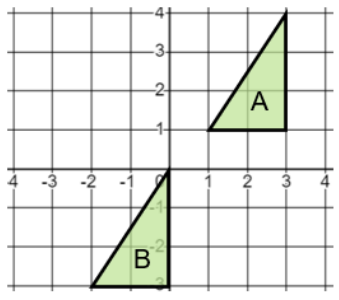
(e)



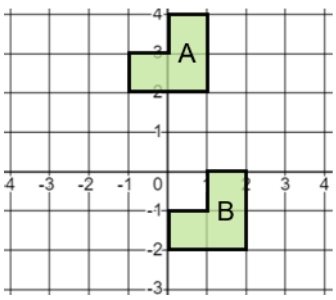
(f)



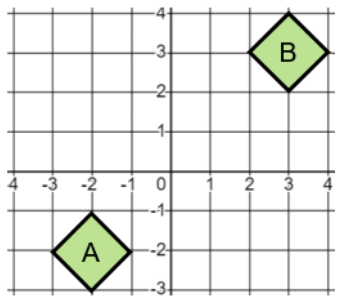
(g)



(h)



(i)



Write down the vectors which represent the following translations.

(a) 4 right then 6 up

(b) 5 right then 2 up

(c) 2 up then 5 right

(d) 1 left then 7 up

(e) 5 left then 8 down

(f) 2 left then 1 down

(g) 5 right then 5 down

(h) 6 right

(i) 9 up

(j) 3 left

Write in words the translations described by each of these vectors.

(a) $\begin{pmatrix}3\\5\end{pmatrix}$ (b) $\begin{pmatrix}6\\2\end{pmatrix}$

(c) $\begin{pmatrix}4\\0\end{pmatrix}$ (d) $\begin{pmatrix}0\\7\end{pmatrix}$

(e) $\begin{pmatrix}-2\\4\end{pmatrix}$ (f) $\begin{pmatrix}-5\\-1\end{pmatrix}$

(g) $\begin{pmatrix}8\\-2\end{pmatrix}$ (h) $\begin{pmatrix}-3\\3\end{pmatrix}$

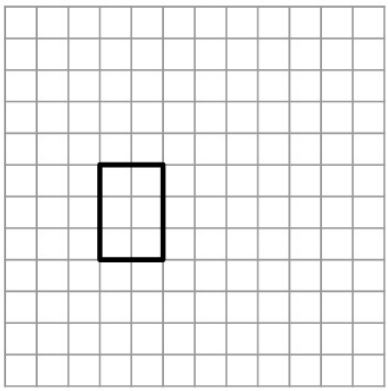
(i) $\begin{pmatrix}-5\\-5\end{pmatrix}$ (j) $\begin{pmatrix}-10\\0\end{pmatrix}$

(a) The point (5, 4) is translated with the vector $\begin{pmatrix}2\\1\end{pmatrix}$. Write down the new coordinates of the point.

(b) The point (2, 10) is translated with the vector $\begin{pmatrix}-1\\-5\end{pmatrix}$. Write down the new coordinates of the point.

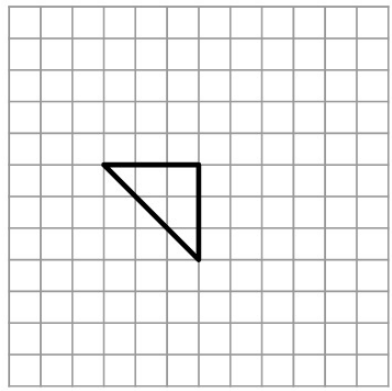
(c) The point (-3, 6) is translated with the vector $\begin{pmatrix}2\\-3\end{pmatrix}$. Write down the new coordinates of the point.

1.



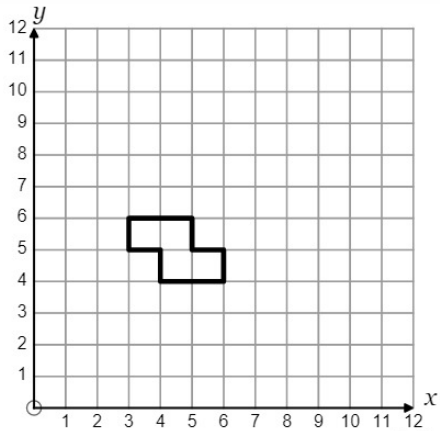
Translate the shape by the vector $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$.

2.



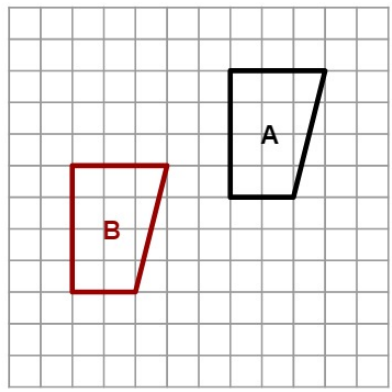
Translate the shape by the vector $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$.

3.



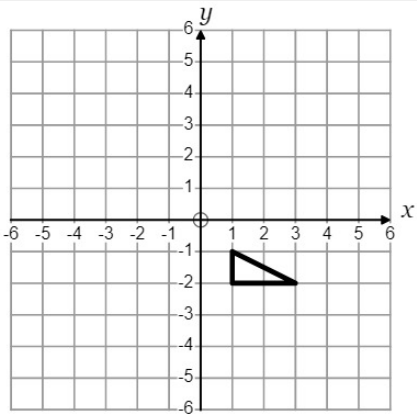
Translate the shape by the vector $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$.

4.



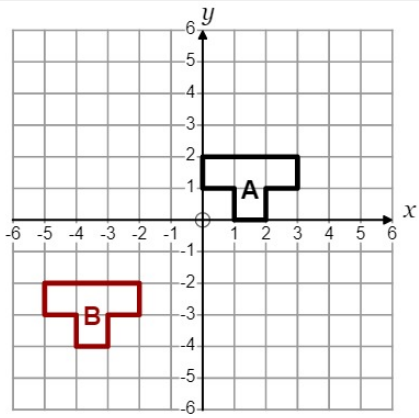
Describe the single transformation from shape A to shape B.

5.



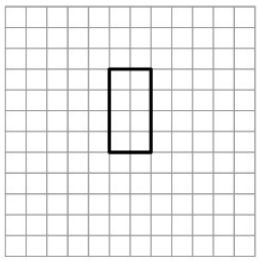
Translate the shape by the vector $\begin{pmatrix} -5 \\ 4 \end{pmatrix}$.

6.



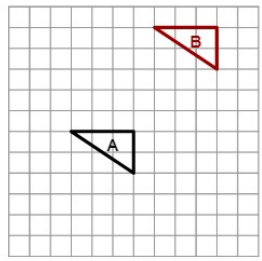
Describe the single transformation from shape A to shape B.

7.



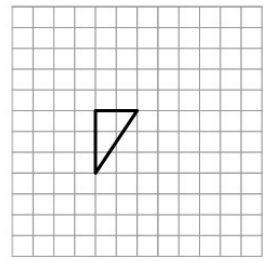
Translate the shape by the vector $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$.

8.



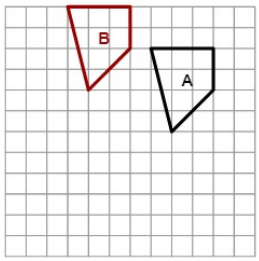
Describe the single transformation from shape A to shape B.

9.



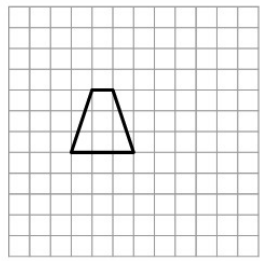
Translate the shape by the vector $\begin{pmatrix} 0 \\ 5 \end{pmatrix}$.

10.



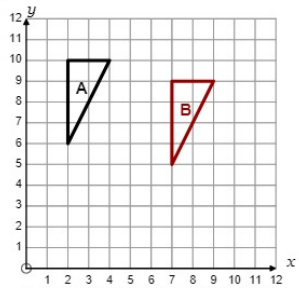
Describe the single transformation from shape A to shape B.

11.



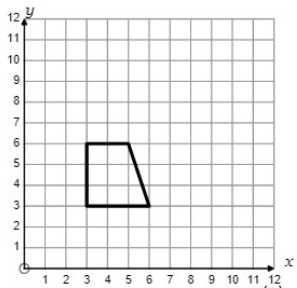
Translate the shape by the vector $\begin{pmatrix} 4 \\ -4 \end{pmatrix}$.

12.



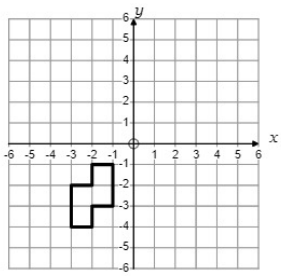
Describe the single transformation from shape A to shape B.

13.



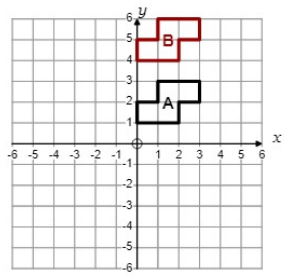
Translate the shape by the vector $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$.

14.



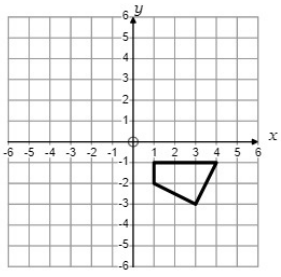
Translate the shape by the vector $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$.

15.



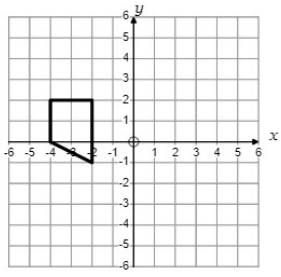
Describe the single transformation from shape A to shape B.

16.



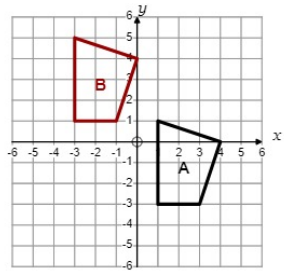
Translate the shape by the vector $\begin{pmatrix} -5 \\ -2 \end{pmatrix}$.

17.



Translate the shape by the vector $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$.

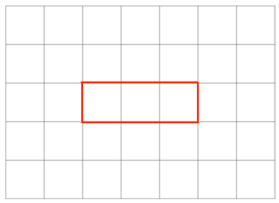
18.



Describe the single transformation from shape A to shape B.

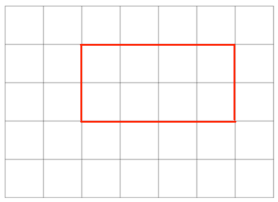
Question 1: Copy these shapes and then enlarge by the scale factor given.

(a)



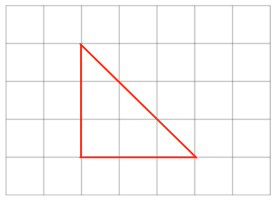
Enlarge by scale factor 3

(b)



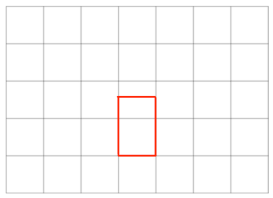
Enlarge by scale factor 2

(c)



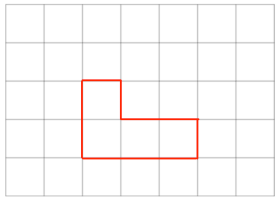
Enlarge by scale factor 3

(d)



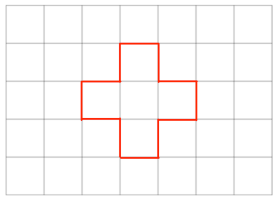
Enlarge by scale factor 4

(e)



Enlarge by scale factor 2

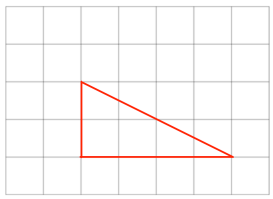
(f)



Enlarge by scale factor 4

Question 2: Copy these shapes and then enlarge by the scale factor given.

(a)



Enlarge by scale factor 2

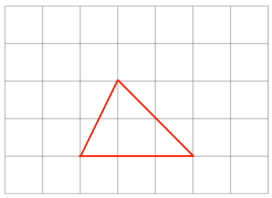
(b)

Enlarge by scale factor 3

(c)

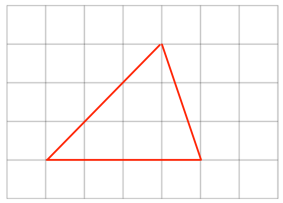
Enlarge by scale factor 2

(d)



Enlarge by scale factor 2

(e)



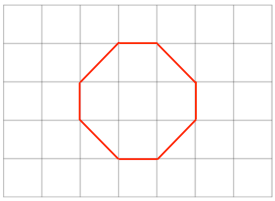
Enlarge by scale factor 3

(f)

Enlarge by scale factor 2

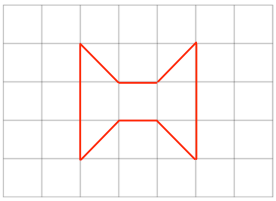
Question 3: Copy these shapes and then enlarge by the scale factor given.

(a)



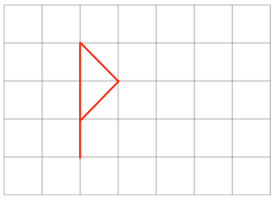
Enlarge by scale factor 4

(b)



Enlarge by scale factor 2

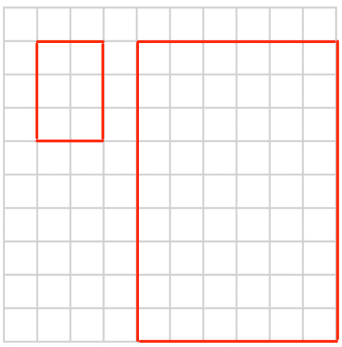
(c)



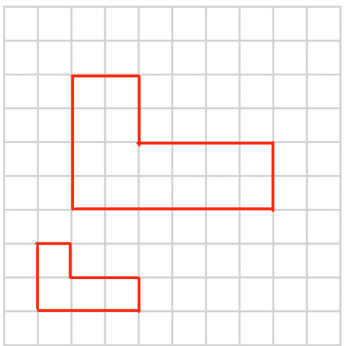
Enlarge by scale factor 3

Question 4: Shown below is an object and its enlargement.
For each, write down the scale factor of enlargement.

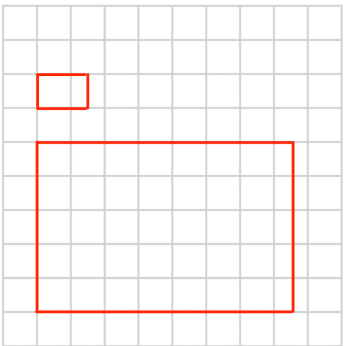
(a)



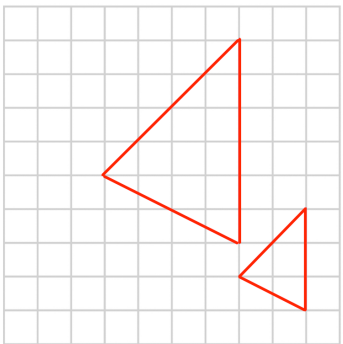
(b)



(c)

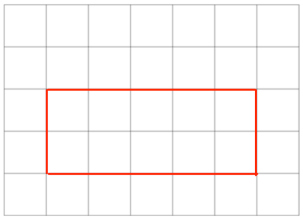


(d)



Apply

Question 1: Shown is a rectangle drawn on a centimetre squared grid.



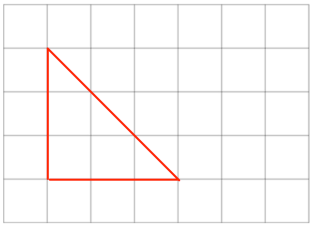
(a) Find the area of the rectangle.

(b) Enlarge the rectangle by scale factor 2 on centimetre squared paper.

(c) Find the area of the enlarged rectangle.

(d) How many times larger is the area of the enlarged rectangle than the original?

Question 2: Shown is a triangle drawn on a centimetre squared grid.



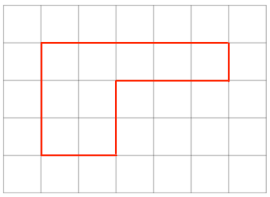
(a) Find the area of the triangle.

(b) Enlarge the triangle by scale factor 3 on centimetre squared paper.

(c) Find the area of the enlarged triangle.

(d) How many times larger is the area of the enlarged triangle than the original?

Question 3: Shown is a shape drawn on a centimetre squared grid.

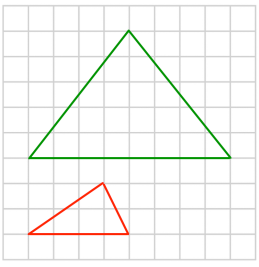


Reg is going to enlarge the shape by scale factor 5.

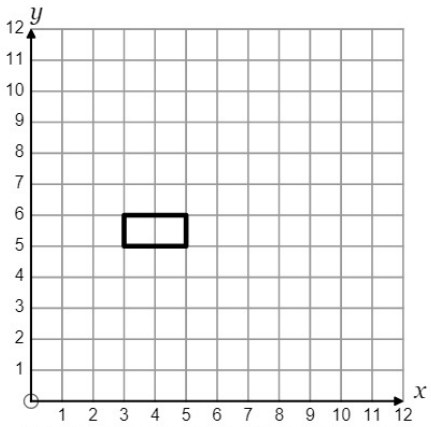
(a) Without enlarging the shape, can you predict what the area of the enlarged shape will be?

(b) Enlarge the shape by scale factor 5 and check your prediction.

Question 4: Charlie has enlarged the triangle by scale factor 2.
Can you spot any mistakes?
His answer is in green.

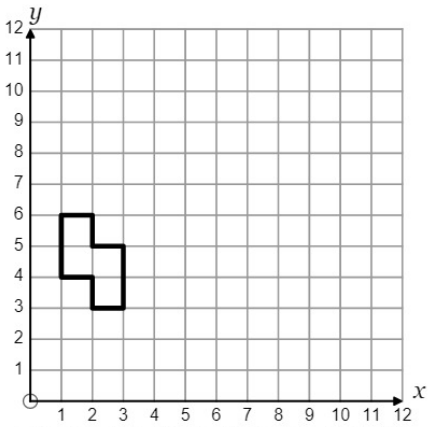


1.



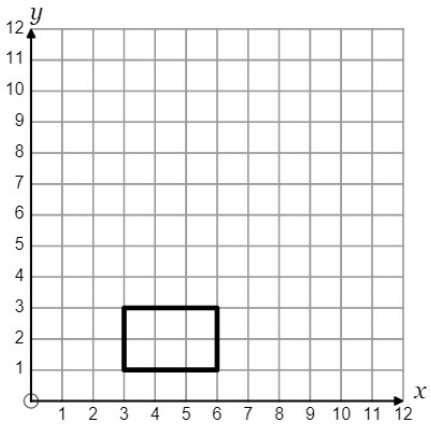
Enlarge the shape by scale factor 2 about the centre (2, 8).

2.



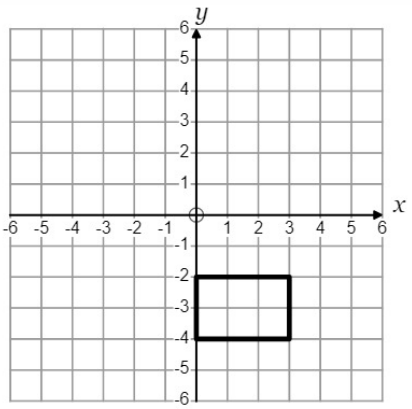
Enlarge the shape by scale factor 4 about the centre (0, 4).

3.



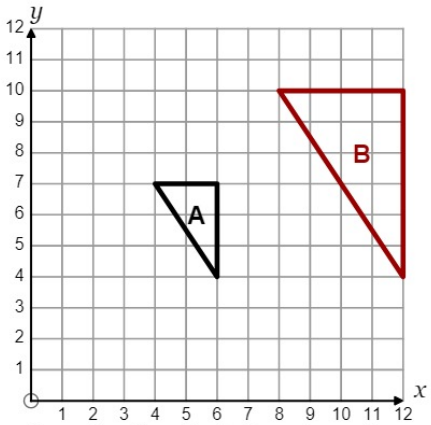
Enlarge the shape by scale factor 3 about the centre (4, 0).

4.



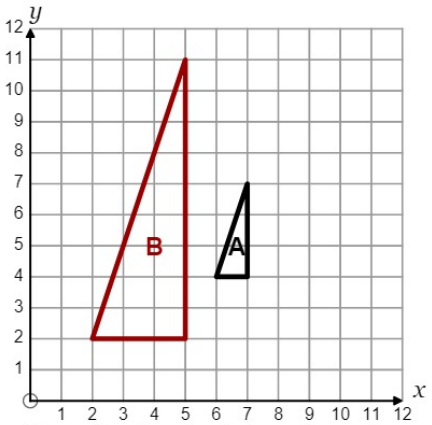
Enlarge the shape by scale factor 2 about the centre (1, -5).

5.



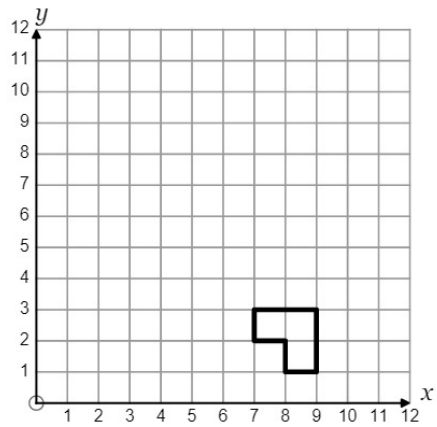
Describe the single transformation from shape A to shape B.

6.



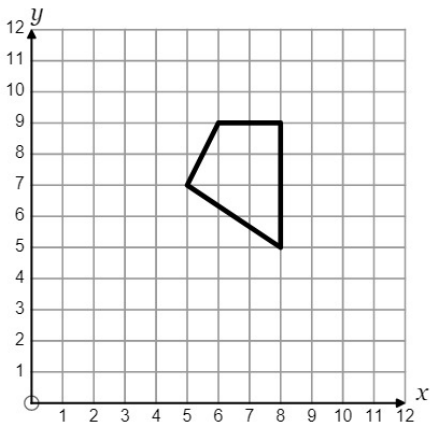
Describe the single transformation from shape A to shape B.

7.



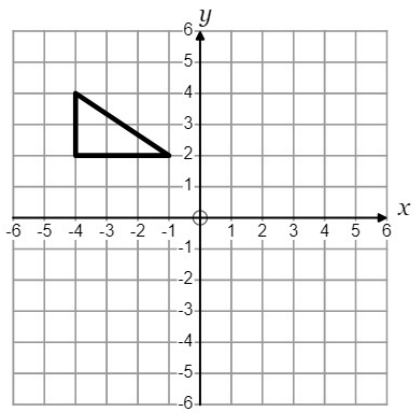
Enlarge the shape by scale factor 3 about the centre (9, 1).

8.



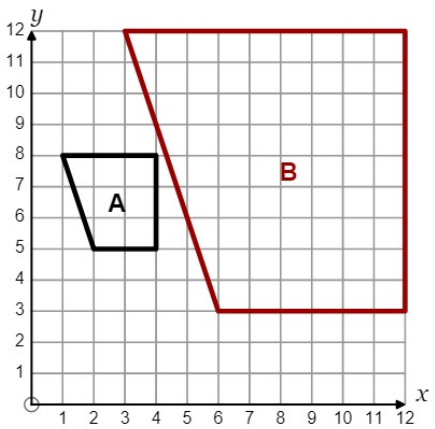
Enlarge the shape by scale factor 2 about the centre (7, 8).

9.



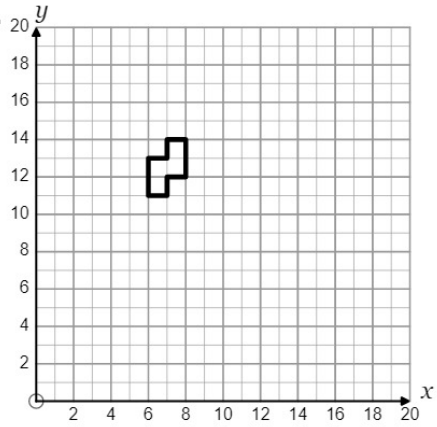
Enlarge the shape by scale factor 2 about the centre (-5, 4).

10.



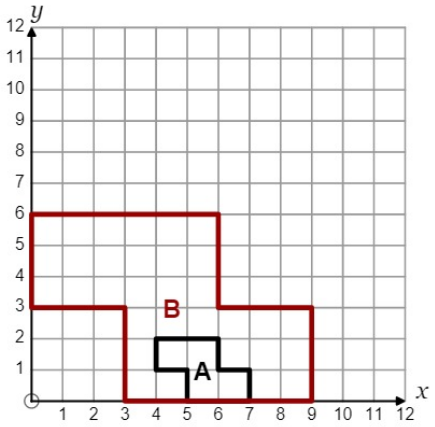
Describe the single transformation from shape A to shape B.

11.



Enlarge the shape by scale factor 3 about the centre (3, 14).

12.

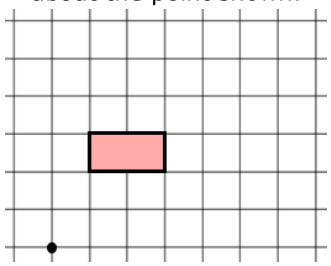


Describe the single transformation from shape A to shape B.

Enlarging Shapes

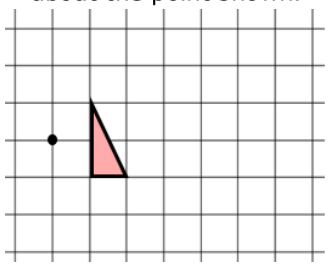
(a)

Enlarge by scale factor 2 about the point shown.



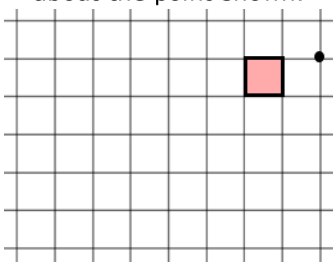
(b)

Enlarge by scale factor 3 about the point shown.



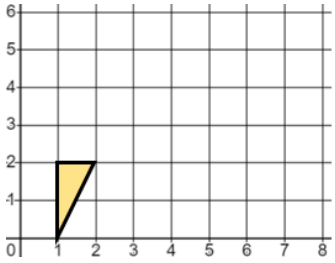
(c)

Enlarge by scale factor 4 about the point shown.



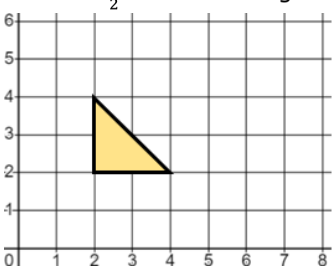
(d)

Enlarge the shape by scale factor 3 about the origin.



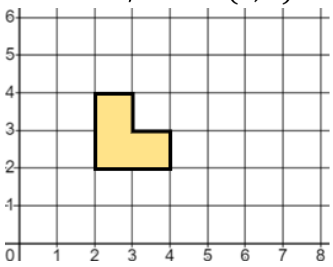
(e)

Enlarge the shape by scale factor $1\frac{1}{2}$ about the origin.



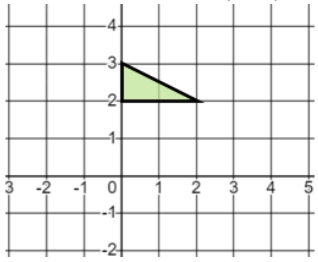
(f)

Enlarge the shape by scale factor 2, centre $(0, 3)$.



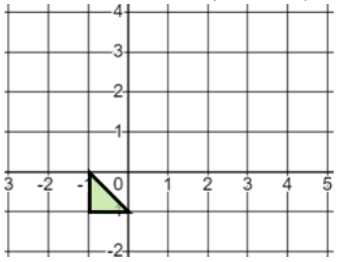
(g)

Enlarge the shape by scale factor 3, centre $(1, 4)$.



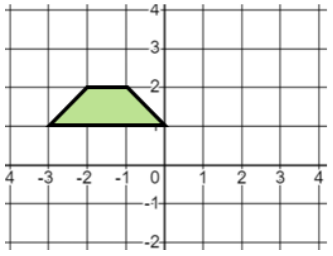
(h)

Enlarge the shape by scale factor 4, centre $(-1, -1)$.



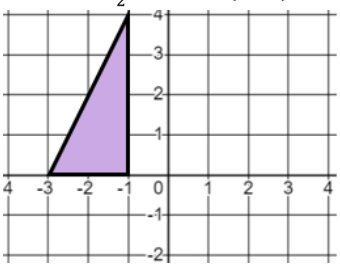
(i)

Enlarge the shape by scale factor 2, centre $(-3, 2)$.



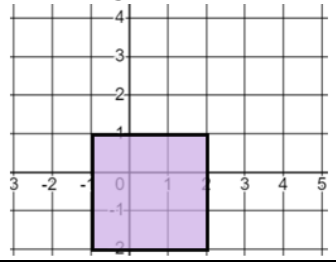
(j)

Enlarge the shape by scale factor $\frac{1}{2}$, centre $(1, 0)$.



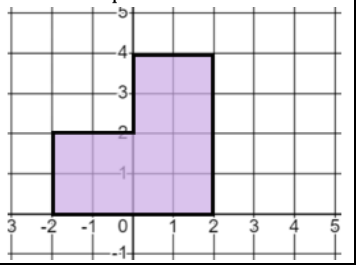
(k)

Enlarge the shape by scale factor $\frac{1}{3}$, centre $(5, 4)$.



(l)

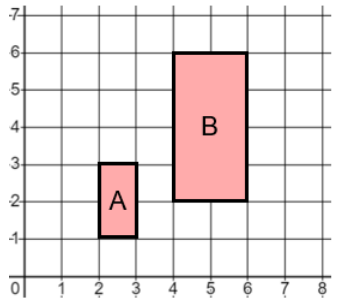
Enlarge the shape by scale factor $\frac{1}{4}$, centre $(-2, 4)$.



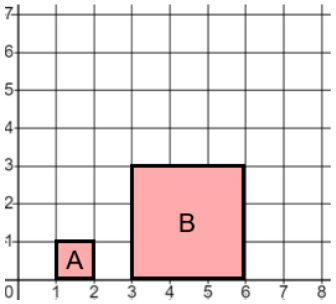
Describing Enlargements

Describe fully the single transformation which maps shape A to shape B

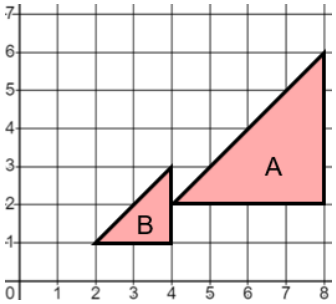
(a)



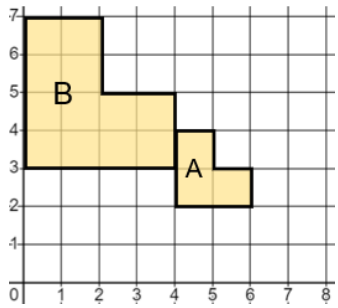
(b)



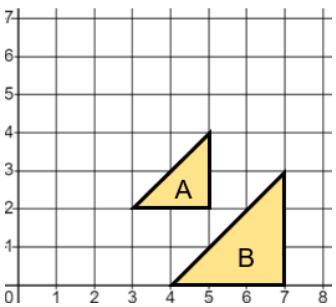
(c)



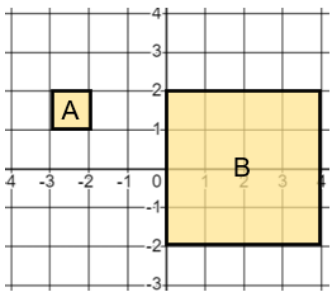
(d)



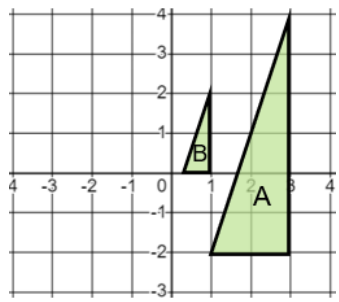
(e)



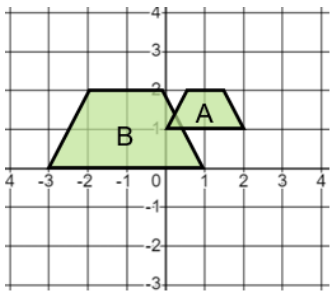
(f)



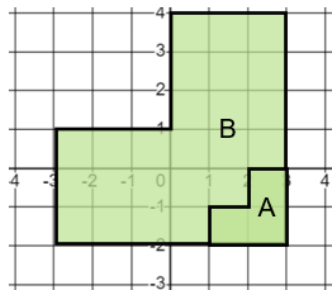
(g)



(h)



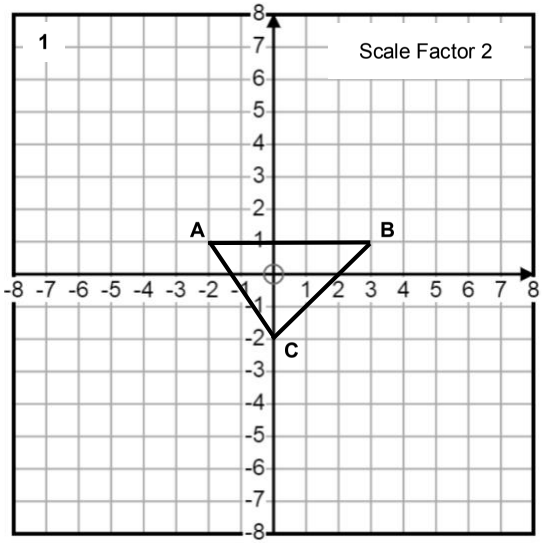
(i)



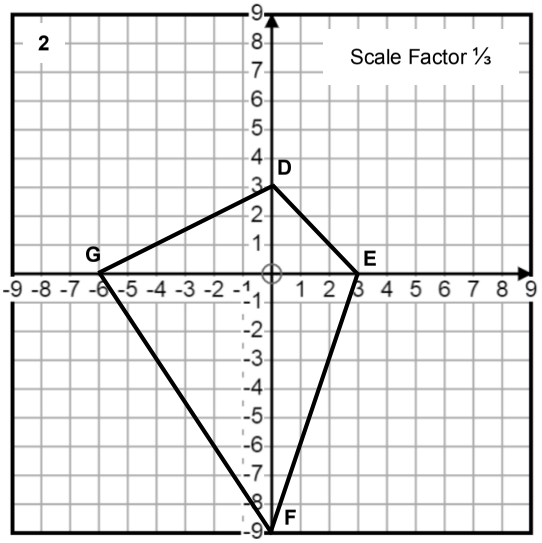
enlargement on the co-ordinate plane

Enlarge each of these shapes by the scale factor indicated. Use the origin as the centre of the enlargement.

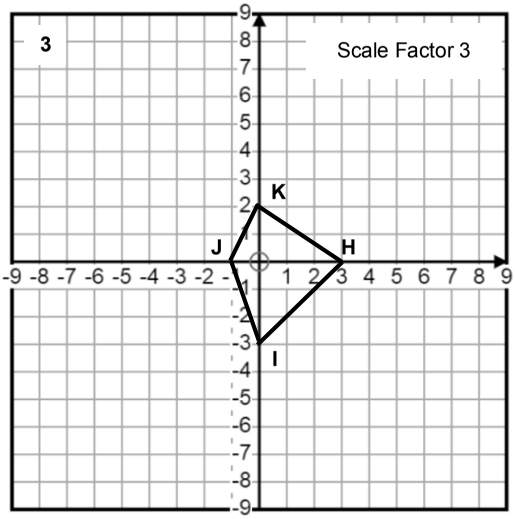
1



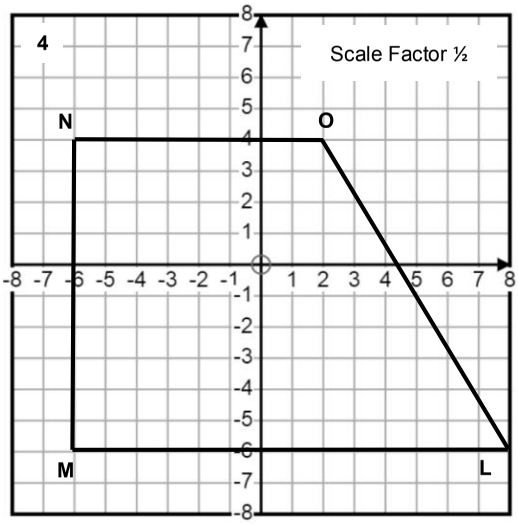
2



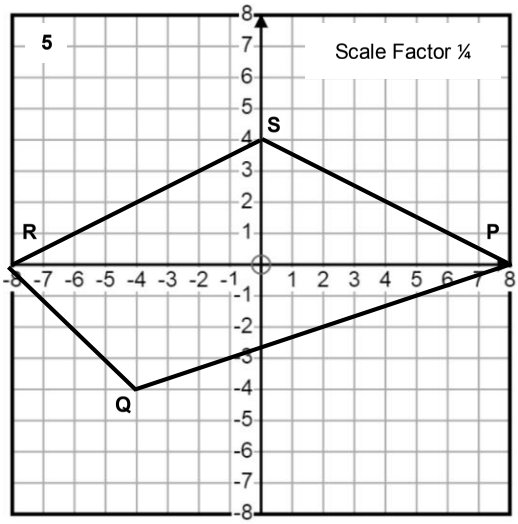
3



4



5



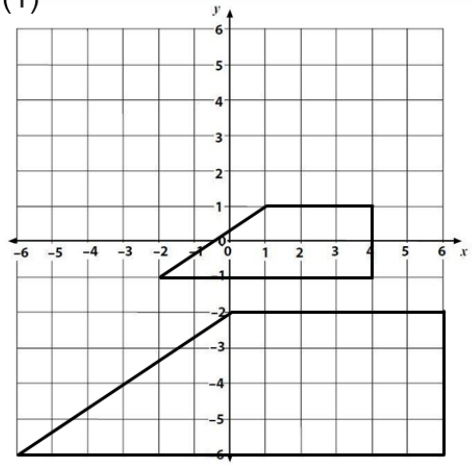
tHink!

1. There are **six** vertices which have the same value of **x** before and after the enlargement. What are they?

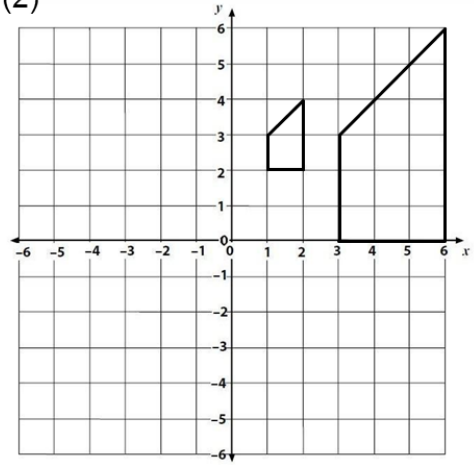
2. There are **six** vertices which have the same value of **y** before and after the enlargement. What are they?

Fluency Practice

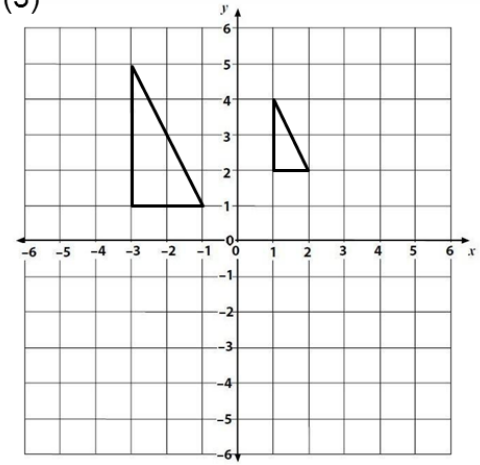
(1)



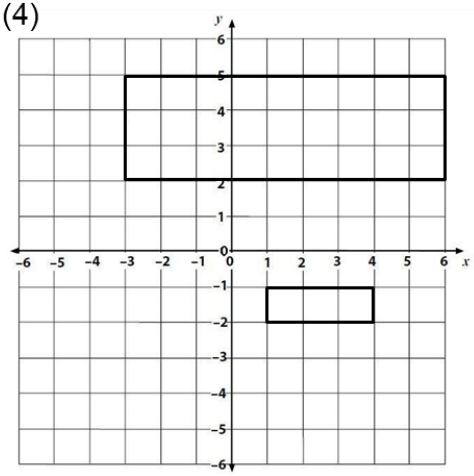
(2)



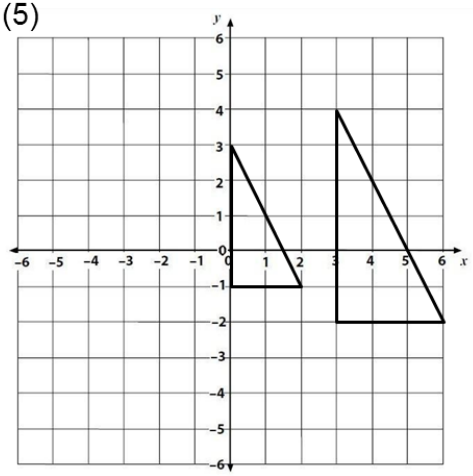
(3)



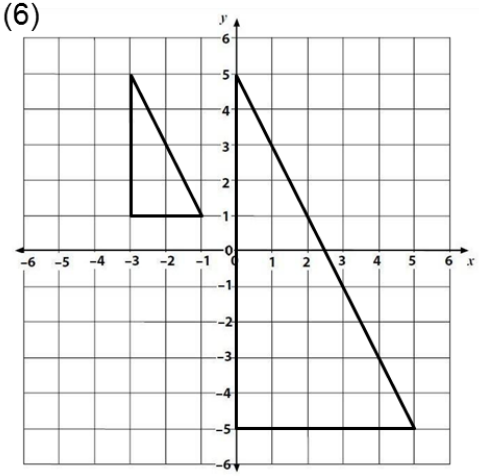
(4)



(5)

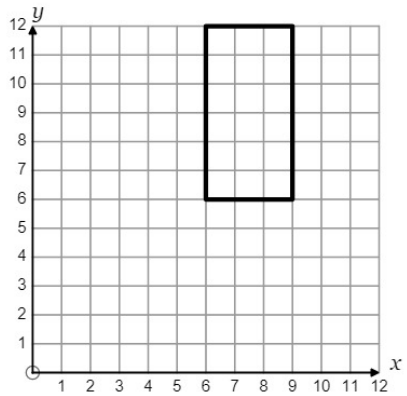


(6)



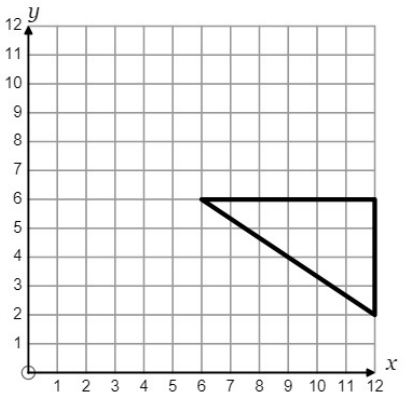
fully describe the transformation from the smaller to the larger shape

1.



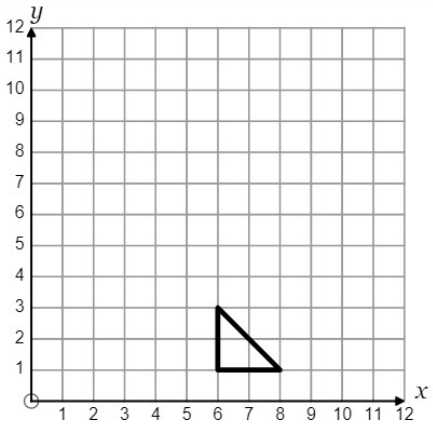
Enlarge the shape by scale factor $\frac{1}{3}$ about the centre (3, 9).

2.



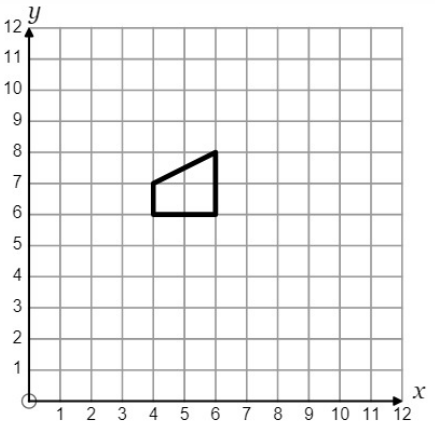
Enlarge the shape by scale factor $\frac{1}{2}$ about the centre (6, 12).

3.



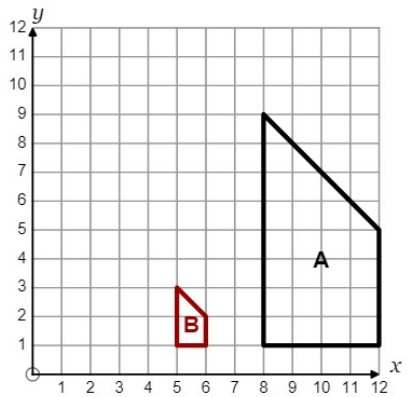
Enlarge the shape by scale factor -2 about the centre (8, 4).

4.



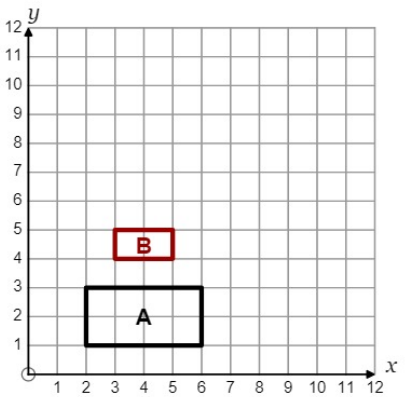
Enlarge the shape by scale factor -1 about the centre (7, 4).

5.



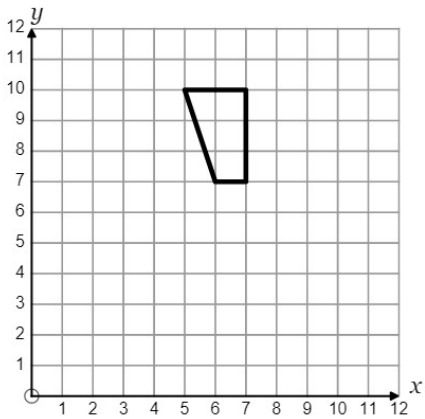
Describe the single transformation from shape A to shape B.

6.



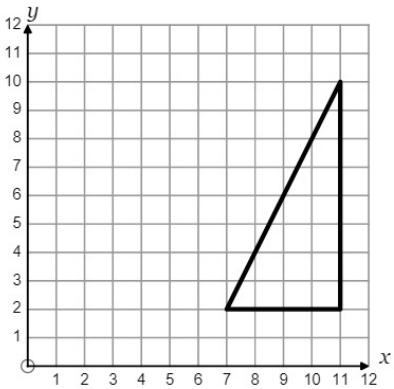
Describe the single transformation from shape A to shape B.

7.



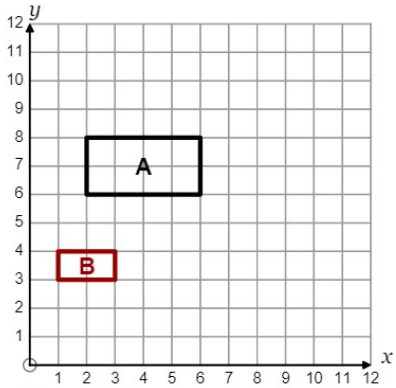
Enlarge the shape by scale factor -2 about the centre (5, 8).

8.



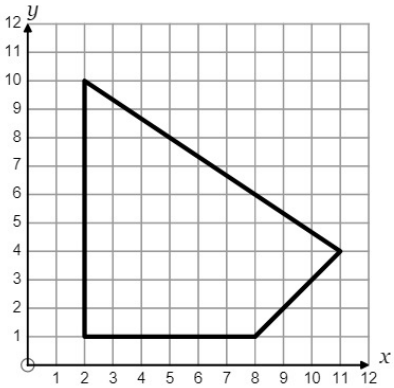
Enlarge the shape by scale factor $\frac{1}{2}$ about the centre (3, 0).

9.



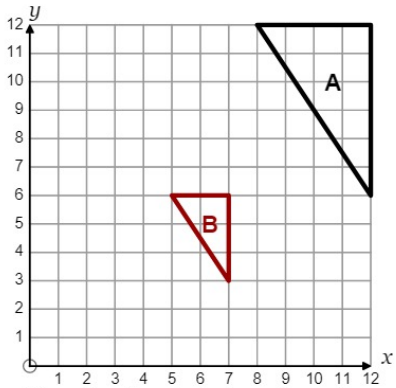
Describe the single transformation from shape A to shape B.

10.



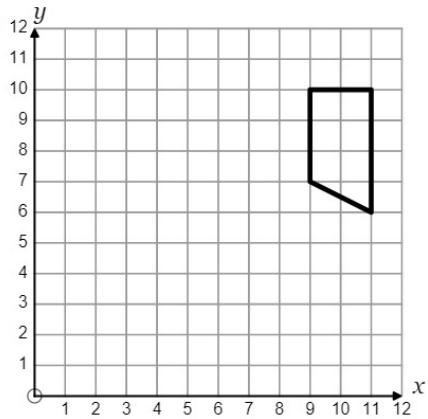
Enlarge the shape by scale factor $\frac{1}{3}$ about the centre (5, 4).

11.



Describe the single transformation from shape A to shape B.

12.

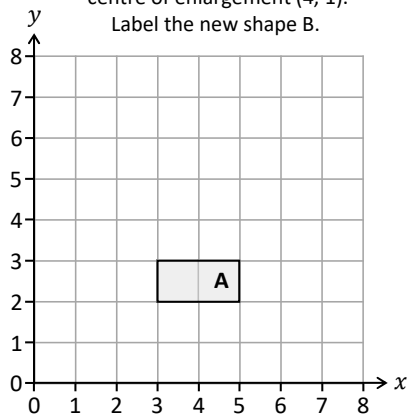


Enlarge the shape by scale factor -1 about the centre (6, 9).

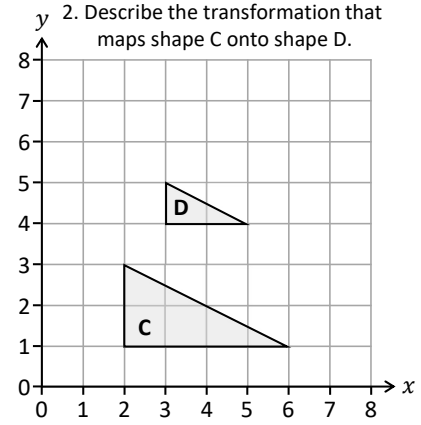
Fluency Practice

Enlargement

1. Enlarge shape A by scale factor 3 & centre of enlargement (4, 1). Label the new shape B.



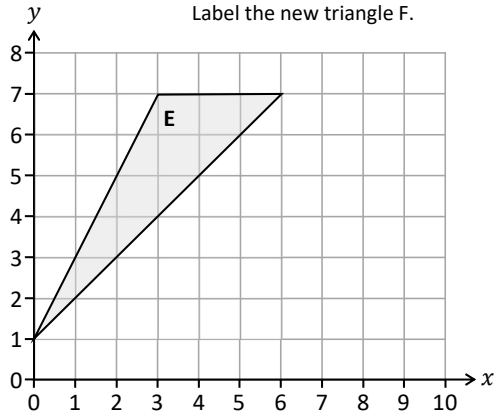
2. Describe the transformation that maps shape C onto shape D.



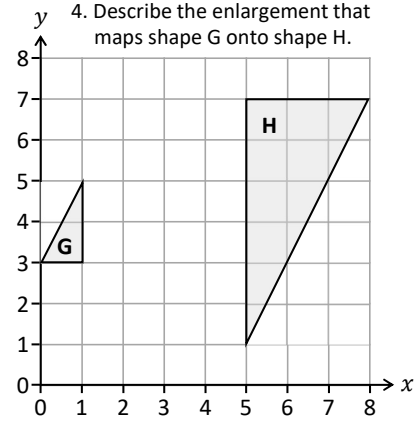
Centre of enlargement:

Scale factor:

3. Enlarge triangle E by scale factor $\frac{1}{3}$ with centre of enlargement (9, 4). Label the new triangle F.



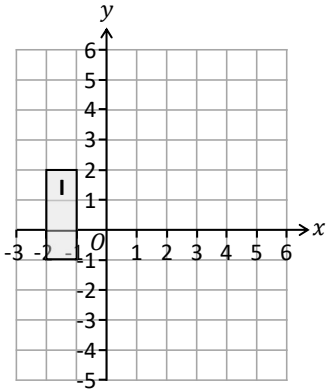
4. Describe the enlargement that maps shape G onto shape H.



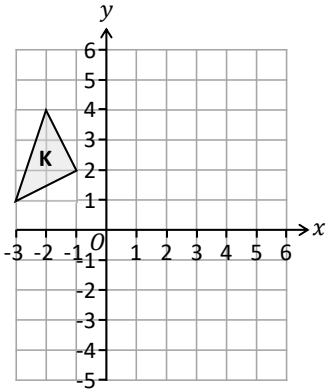
Centre of enlargement:

Scale factor:

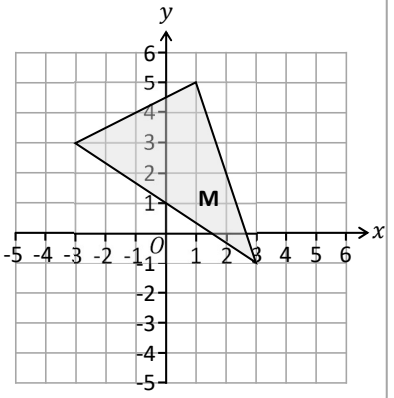
5. Enlarge shape I by scale factor −2 with the origin as the centre of enlargement. Label the new shape J.



6. Enlarge triangle K by scale factor −3 with (−1, 2) as the centre of enlargement. Label the new triangle L.

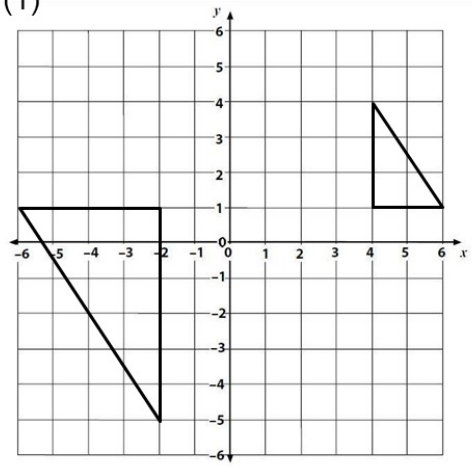


7. Enlarge triangle M by scale factor $-\frac{1}{2}$ with centre of enlargement (−1, −1). Label the new triangle N.

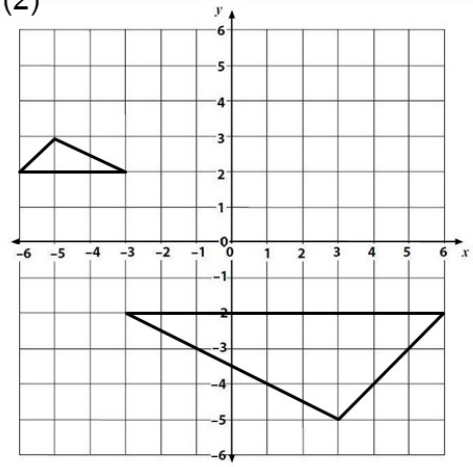


Fluency Practice

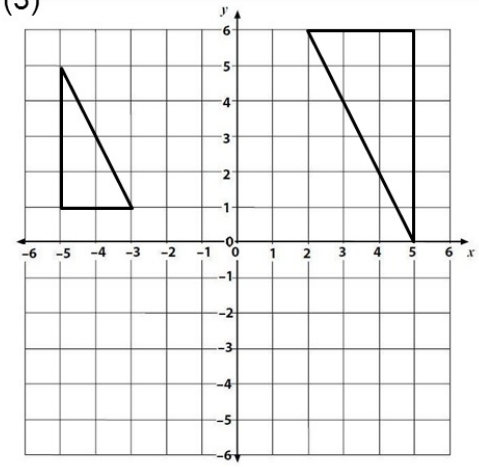
(1)



(2)

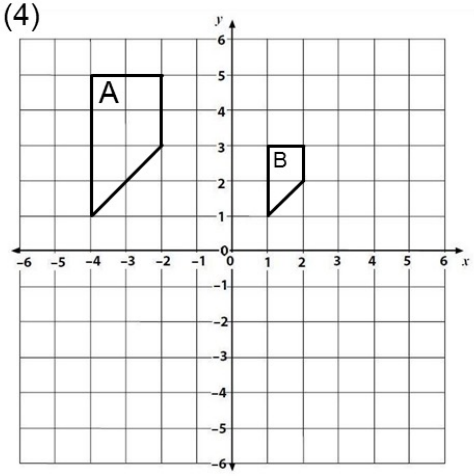


(3)

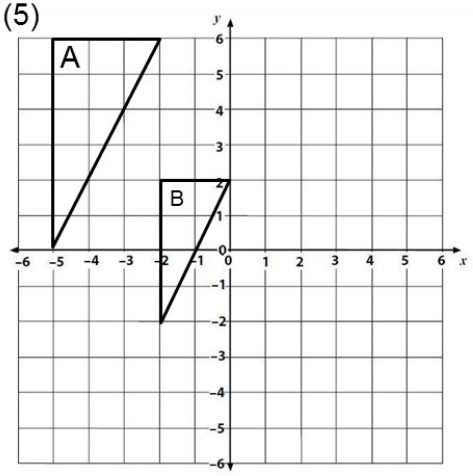


fully describe the transformation from the smaller to the larger shape

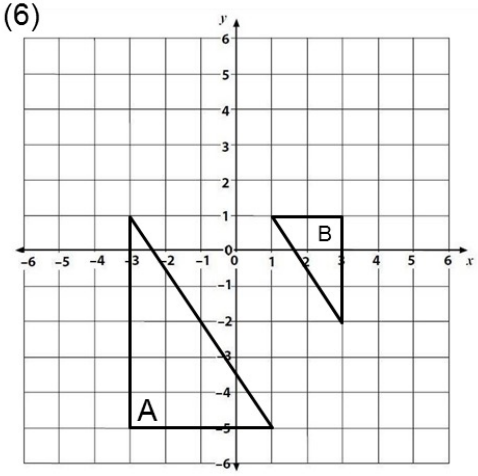
(4)



(5)



(6)

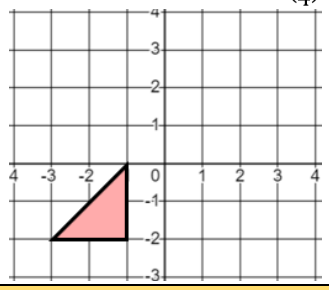


fully describe the transformation from shape A to shape B

Transforming Shapes

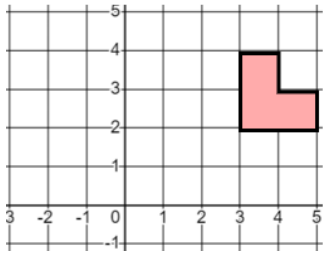
(a)

Translate the shape by $\begin{pmatrix}3\\4\end{pmatrix}$



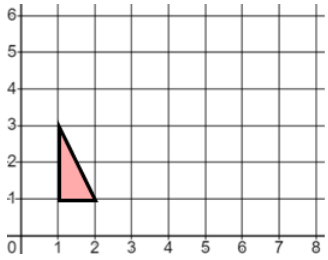
(b)

Reflect the shape in the line $x = 2$



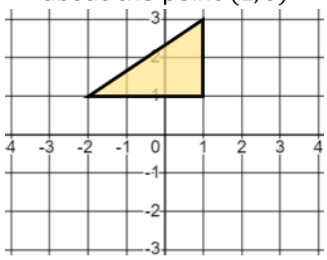
(c)

Enlarge the shape by scale factor 2 about the origin



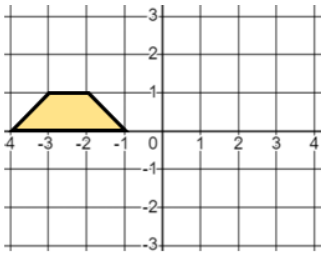
(d)

Rotate the shape by $180°$ about the point $(1, 0)$



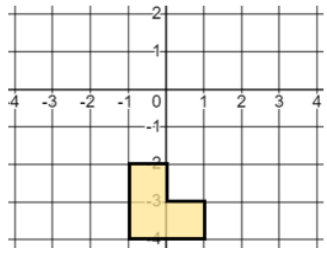
(e)

Translate the shape by $\begin{pmatrix}5\\-2\end{pmatrix}$



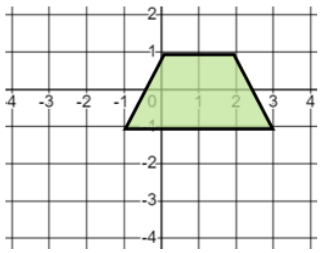
(f)

Reflect the shape in the line $y = -1$



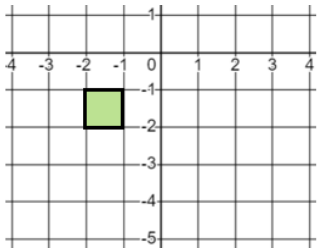
(g)

Translate the shape by $\begin{pmatrix}-2\\-3\end{pmatrix}$



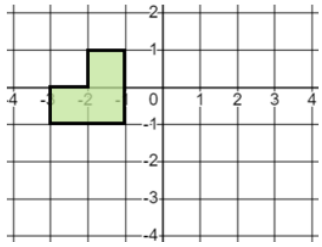
(h)

Enlarge the shape by scale factor 3 about $(-3, -1)$



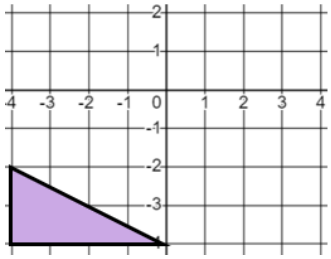
(i)

Rotate the shape $90°$ clockwise about $(0, -2)$



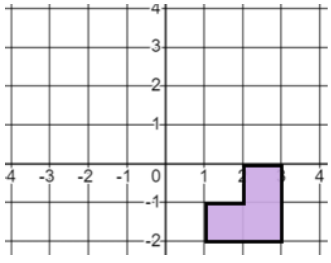
(j)

Enlarge the shape by scale factor $\frac{1}{2}$ about $(2, 2)$



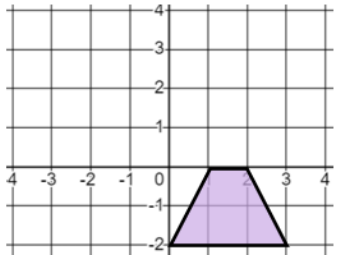
(k)

Reflect the shape in the line $y = x$



(l)

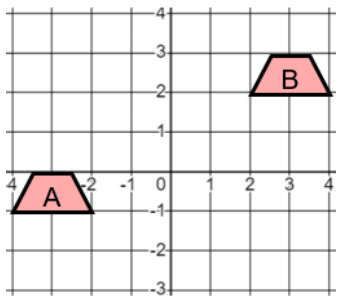
Rotate the shape $90°$ anti-clockwise about $(-1, 0)$



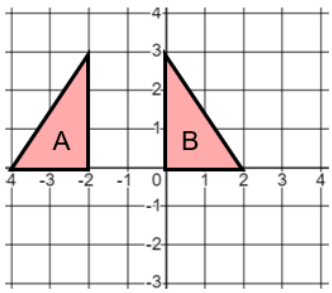
Describing Transformations

Describe fully the single transformation which maps shape A to shape B

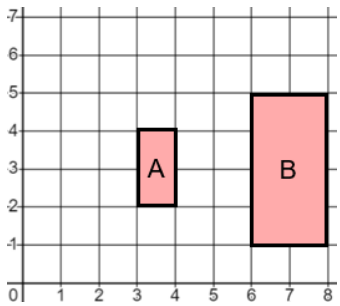
(a)



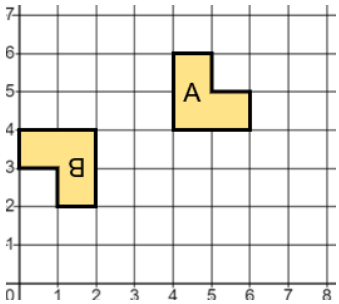
(b)



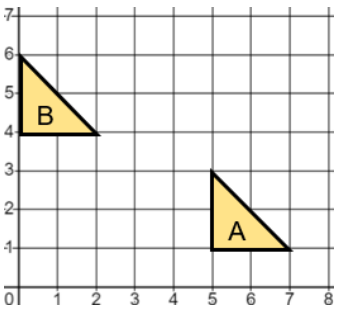
(c)



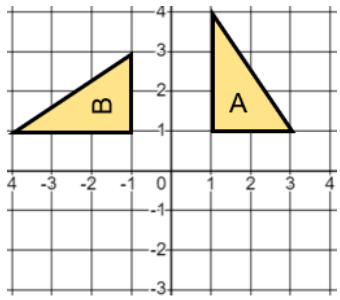
(d)



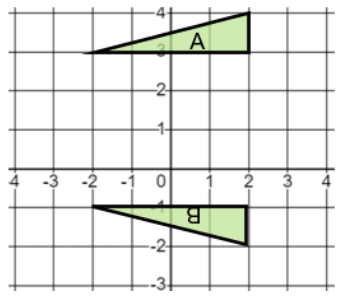
(e)



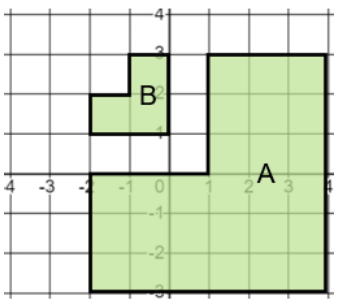
(f)



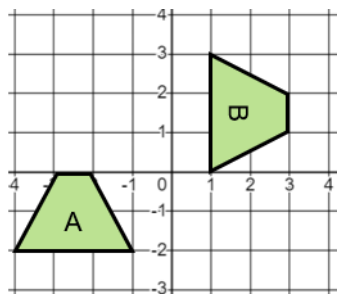
(g)



(h)



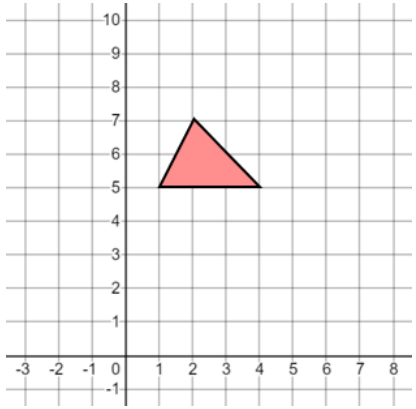
(i)



Fluency Practice

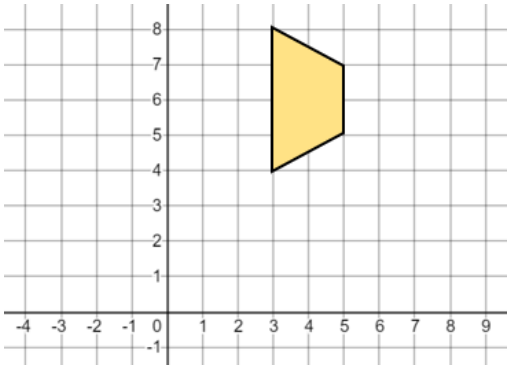
(a)

Translate the triangle by $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$



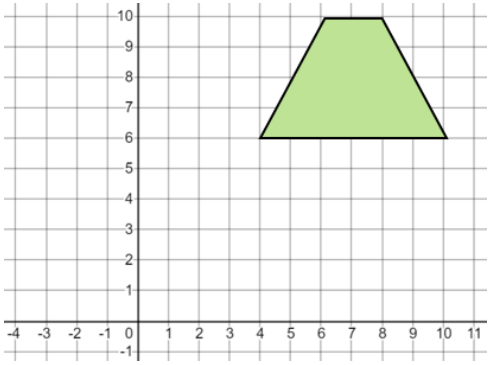
(b)

Rotate the shape $90°$ anti-clockwise about the point $(2, 2)$



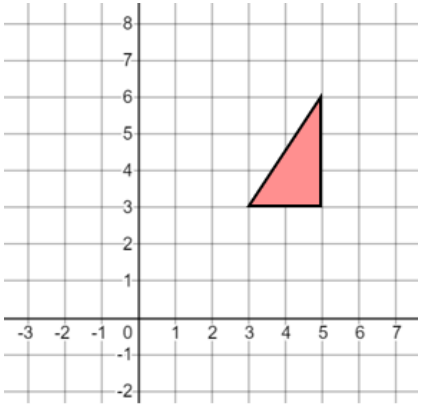
(c)

Enlarge the shape by a scale factor $\frac{1}{2}$ with centre $(-2, 0)$



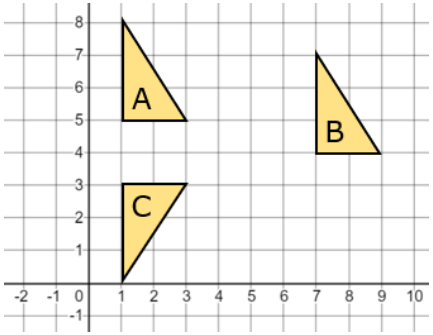
(e)

Reflect the triangle in the line $x = 1$



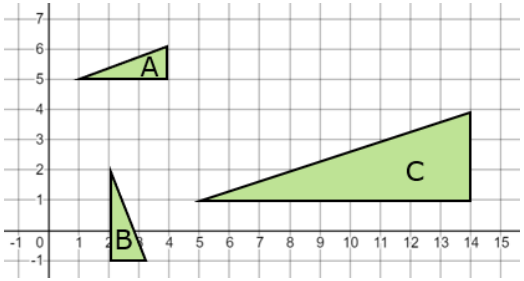
(f)

Describe fully the single transformation that maps:
(a) triangle A onto triangle B
(b) triangle A onto triangle C

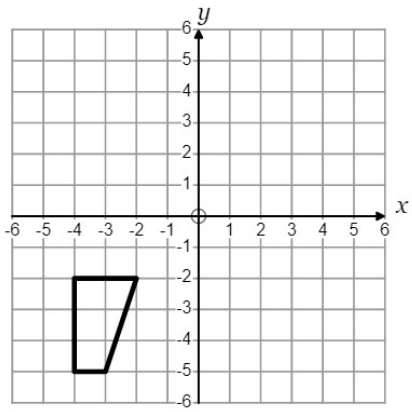


(g)

Describe fully the single transformation that maps:
(a) triangle A onto triangle B
(b) triangle A onto triangle C

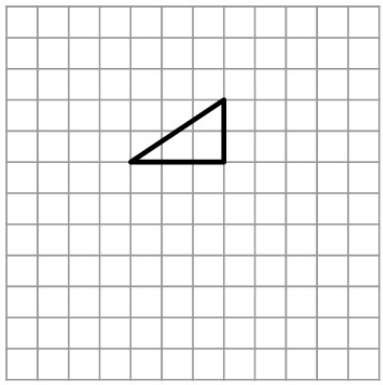


1.



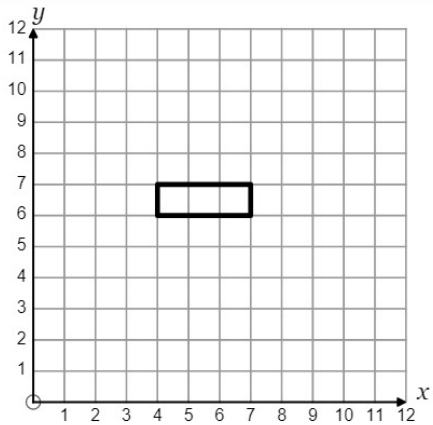
Reflect the shape in the line with equation $x = 1$.

2.



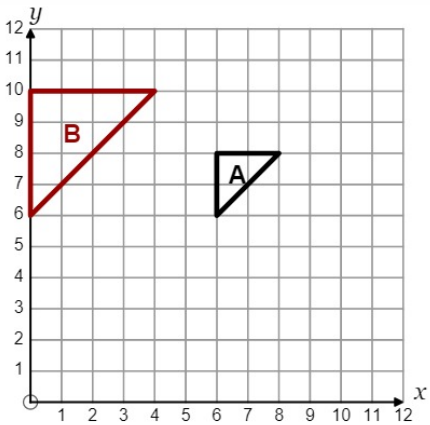
Translate the shape by the vector $\begin{bmatrix} 5 \\ -4 \end{bmatrix}$.

3.



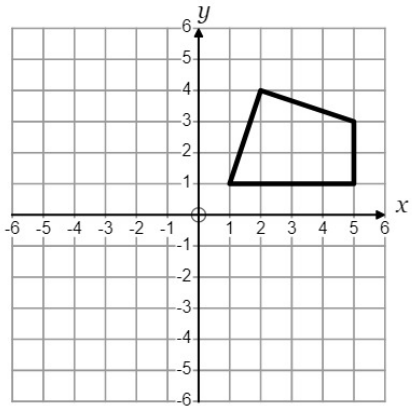
Enlarge the shape by scale factor 2 about the centre (2, 3).

4.



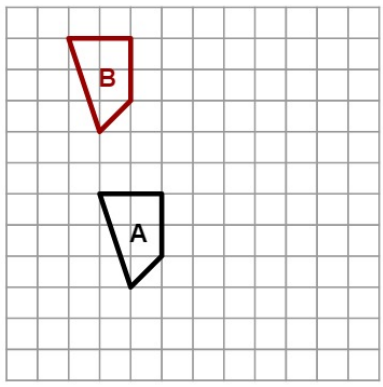
Describe the single transformation from shape A to shape B.

5.



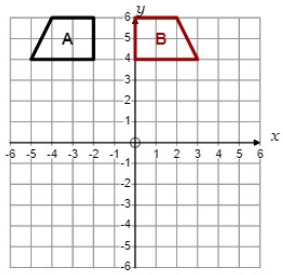
Rotate the shape 270° anti-clockwise about the origin.

6.



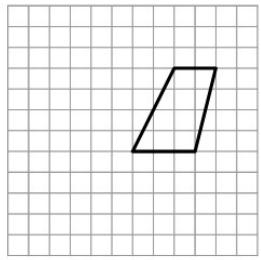
Describe the single transformation from shape A to shape B.

7.



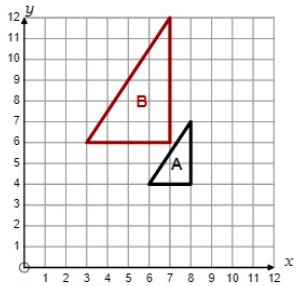
Describe the single transformation from shape A to shape B.

8.



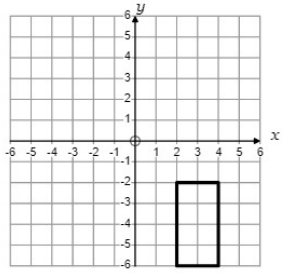
Translate the shape by the vector $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$.

9.



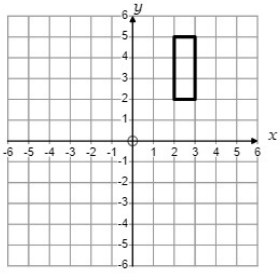
Describe the single transformation from shape A to shape B.

10.



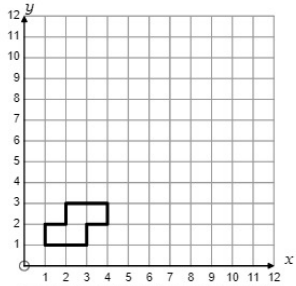
Reflect the shape in the line with equation $y = 0$.

11.



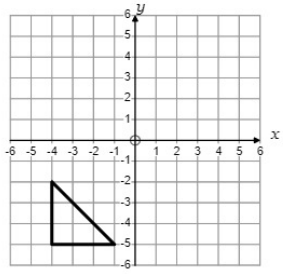
Rotate the shape 270° clockwise about the point with coordinates (3, 2).

12.



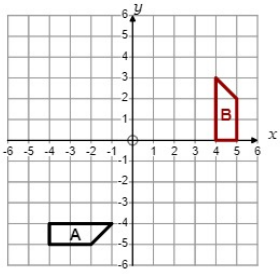
Enlarge the shape by scale factor 3 about the centre (1, 0).

13.



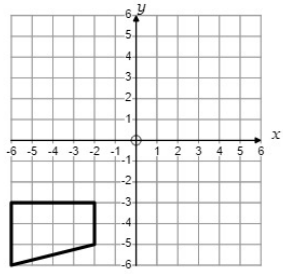
Rotate the shape 270° anti-clockwise about the point with coordinates (-3, -2).

14.



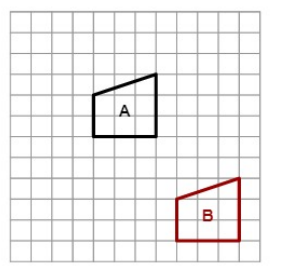
Describe the single transformation from shape A to shape B.

15.



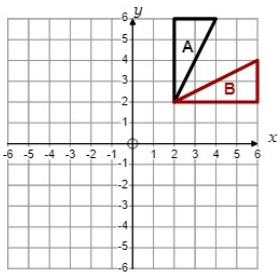
Reflect the shape in the line with equation $y = -x$.

16.



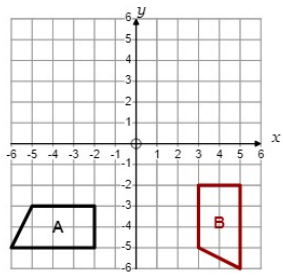
Describe the single transformation from shape A to shape B.

17.



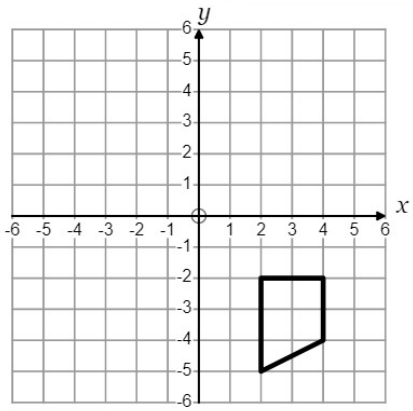
Describe the single transformation from shape A to shape B.

18.



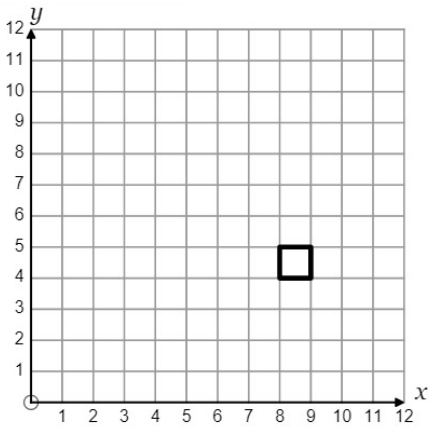
Describe the single transformation from shape A to shape B.

1.



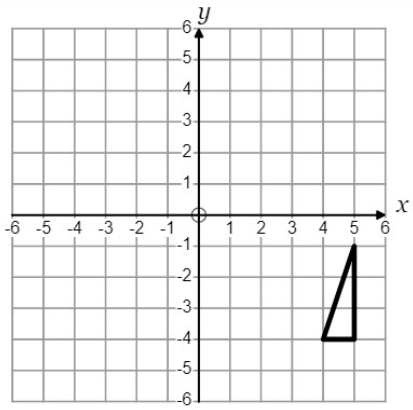
Rotate the shape 90° anti-clockwise about the point with coordinates (1, 0).

2.



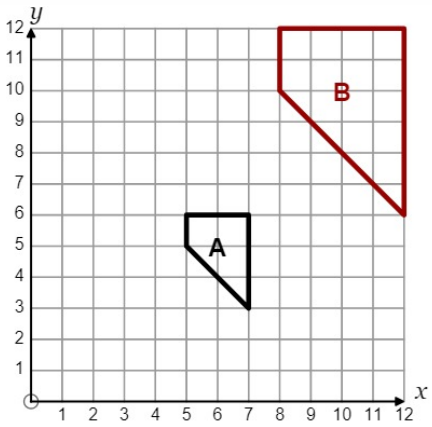
Enlarge the shape by scale factor 3 about the centre (10, 3).

3.



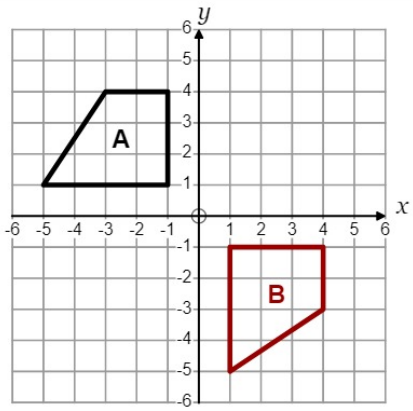
Reflect the shape in the line with equation $x = 1$.

4.



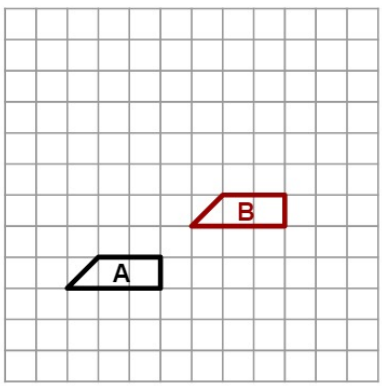
Describe the single transformation from shape A to shape B.

5.



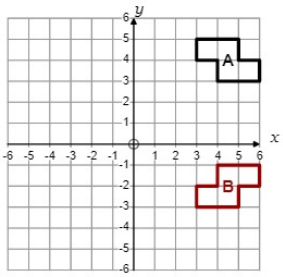
Describe the single transformation from shape A to shape B.

6.



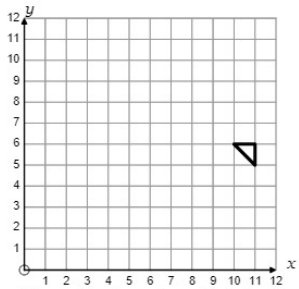
Describe the single transformation from shape A to shape B.

7.



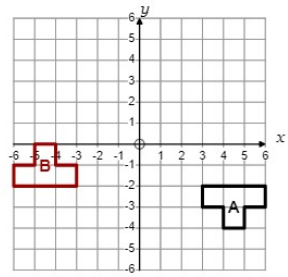
Describe the single transformation from shape A to shape B.

8.



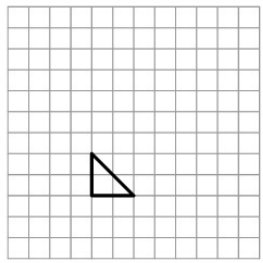
Enlarge the shape by scale factor 5 about the centre (12, 6).

9.



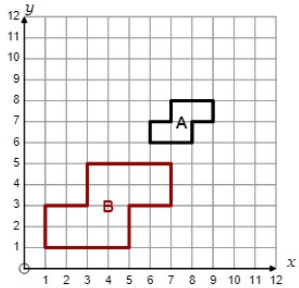
Describe the single transformation from shape A to shape B.

10.



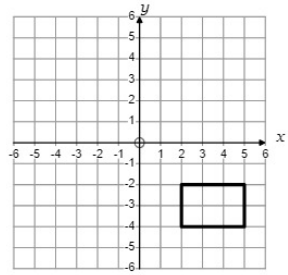
Translate the shape by the vector $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$.

11.



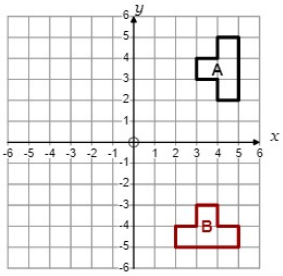
Describe the single transformation from shape A to shape B.

12.



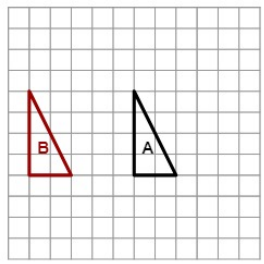
Reflect the shape in the line with equation $y = x$.

13.



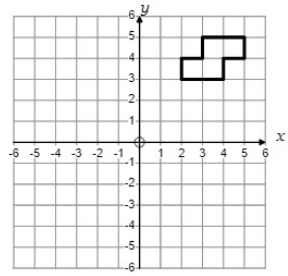
Describe the single transformation from shape A to shape B.

14.



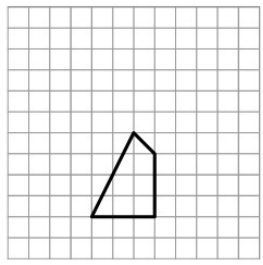
Describe the single transformation from shape A to shape B.

15.



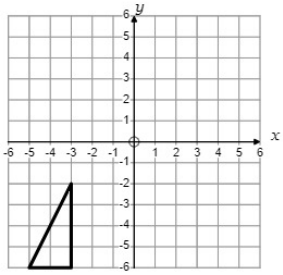
Rotate the shape 270° clockwise about the point with coordinates (2, 1).

16.



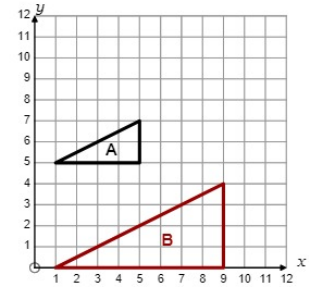
Translate the shape by the vector $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$.

17.



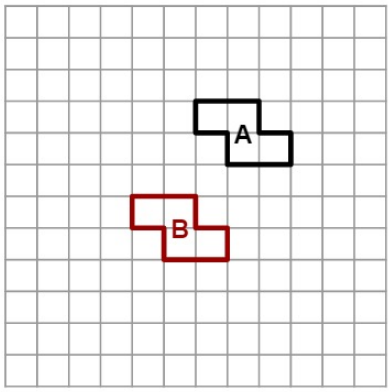
Reflect the shape in the line with equation $y = -x$.

18.



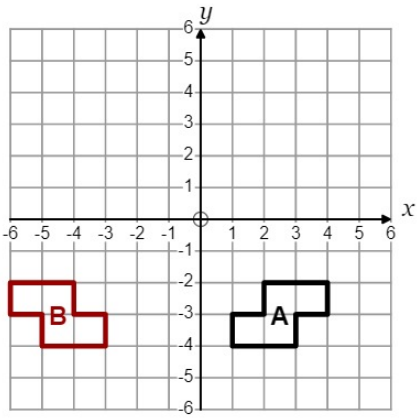
Describe the single transformation from shape A to shape B.

1.



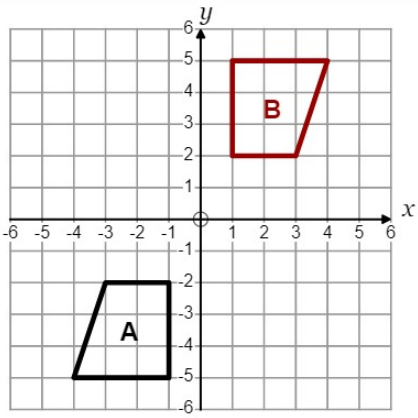
Describe the single transformation from shape A to shape B.

2.



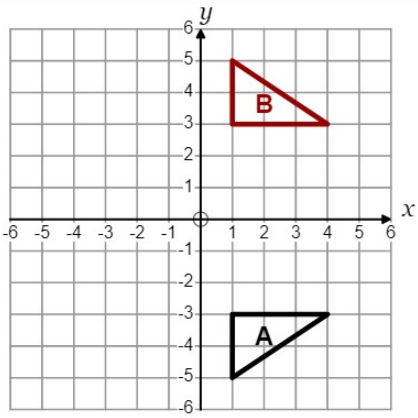
Describe the single transformation from shape A to shape B.

3.



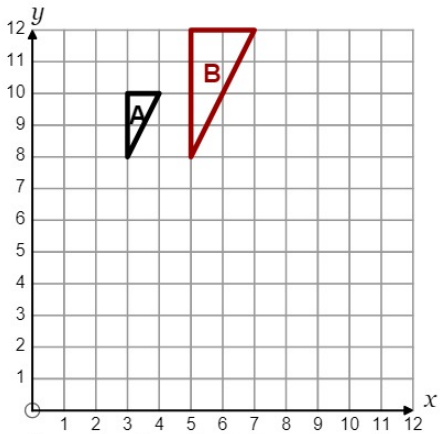
Describe the single transformation from shape A to shape B.

4.



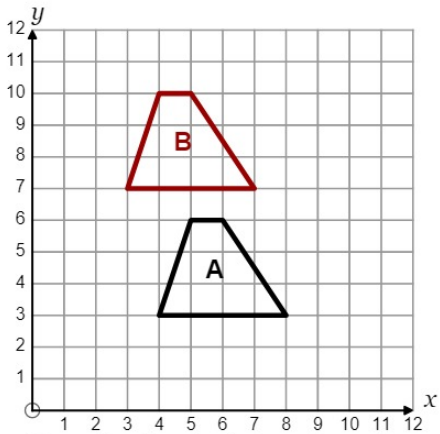
Describe the single transformation from shape A to shape B.

5.



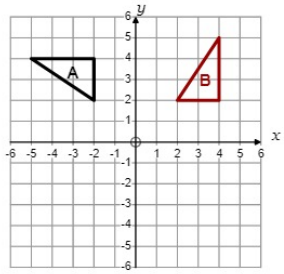
Describe the single transformation from shape A to shape B.

6.



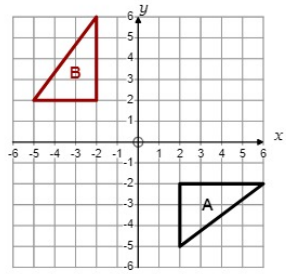
Describe the single transformation from shape A to shape B.

7.



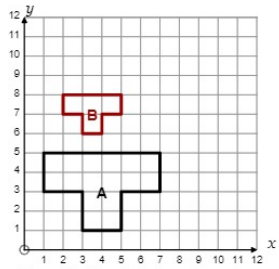
Describe the single transformation from shape A to shape B.

8.



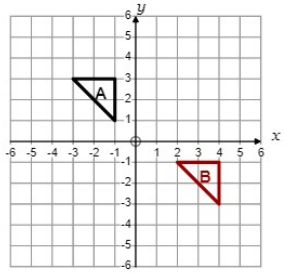
Describe the single transformation from shape A to shape B.

9.



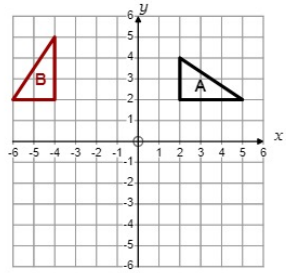
Describe the single transformation from shape A to shape B.

10.



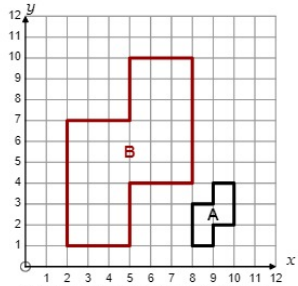
Describe the single transformation from shape A to shape B.

11.



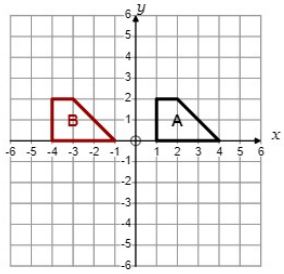
Describe the single transformation from shape A to shape B.

12.



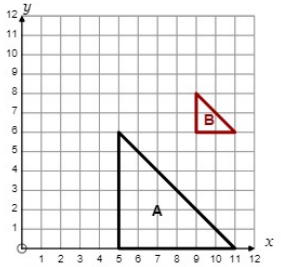
Describe the single transformation from shape A to shape B.

13.



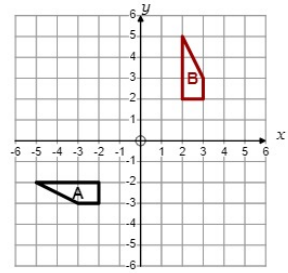
Describe the single transformation from shape A to shape B.

14.



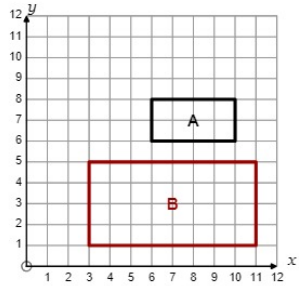
Describe the single transformation from shape A to shape B.

15.



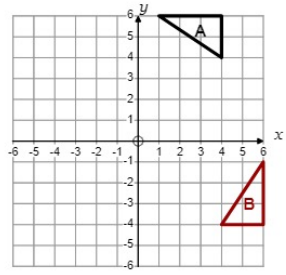
Describe the single transformation from shape A to shape B.

16.



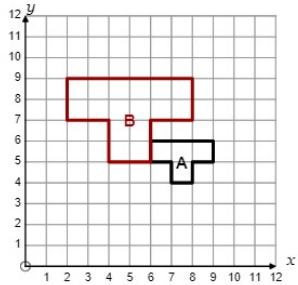
Describe the single transformation from shape A to shape B.

17.



Describe the single transformation from shape A to shape B.

18.



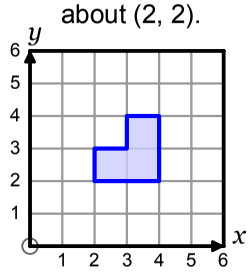
Describe the single transformation from shape A to shape B.

5 Invariant Points

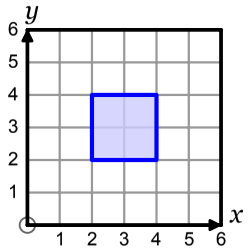
Transformations: invariant points 1

Match the invariant points for each transformation with the answers below.

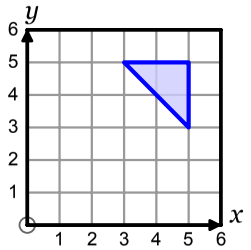
A Rotate 90° clockwise about (2, 2).



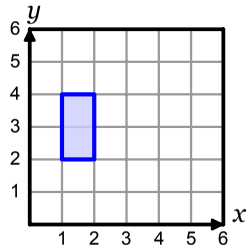
B Reflect in the line $x = 2$.



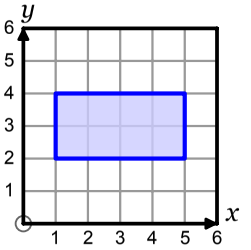
C Rotate 180° about (3, 3).



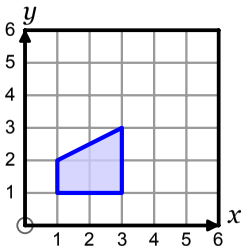
D Translate by $\begin{bmatrix} 1 \\ -2 \end{bmatrix}$.



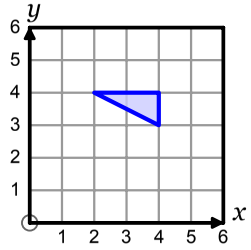
E Reflect in the line $y = x$.



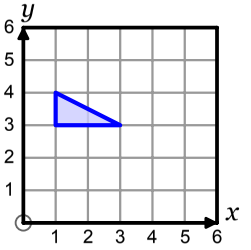
F Reflect in the line $y = 3$.



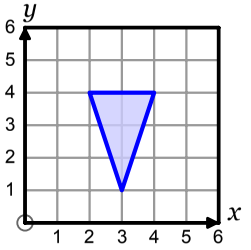
G Enlarge by scale factor 2 with centre (4, 4).



H Enlarge by scale factor 2 with centre (2, 2).



I Translate by $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$.



Answers to match:

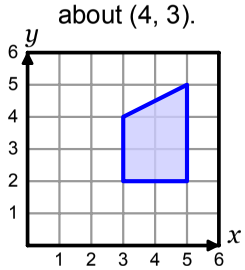
J All points on the line segment from (2, 2) to (4, 4).	**K** The point (2, 2).	**L** The point (4, 4)
M The point (3, 3).	**N** No invariant points.	**O** All points on the line segment from (2, 2) to (2, 4).
P No invariant points.	**Q** No invariant points.	**R** No invariant points.

Fluency Practice

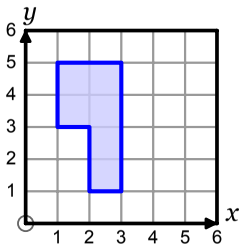
Transformations: invariant points 2

Describe the invariant points for each transformation:

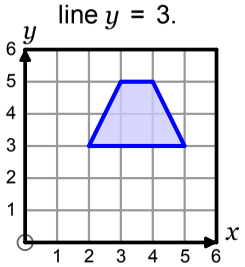
A Rotate 90° anticlockwise about (4, 3).



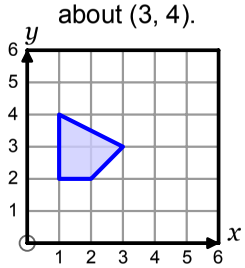
B Translate by $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$.



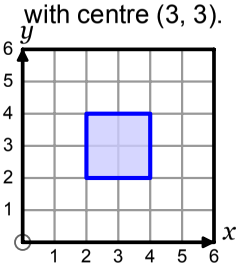
C Reflect in the line $y = 3$.



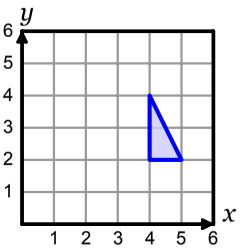
D Rotate 180° about (3, 4).



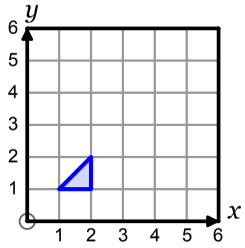
E Enlarge by scale factor 2 with centre (3, 3).



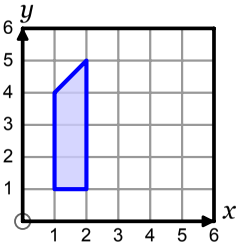
F Reflect in the line $y = x$.



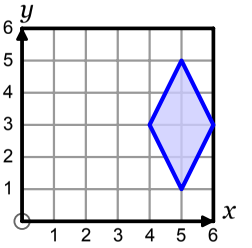
G Enlarge by scale factor 3 with centre (0, 0).



H Rotate 90° clockwise about (2, 2).



I .Reflect in the line $x = 3$.

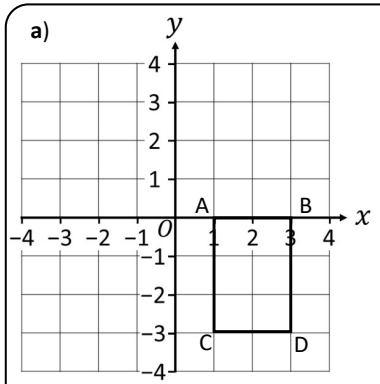


Fluency Practice

Fluency Practice

Invariant Points

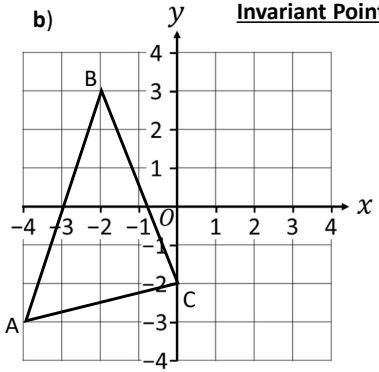
a)



Square ABCD is translated by the vector $\begin{pmatrix} -5 \\ 4 \end{pmatrix}$

Invariant points:

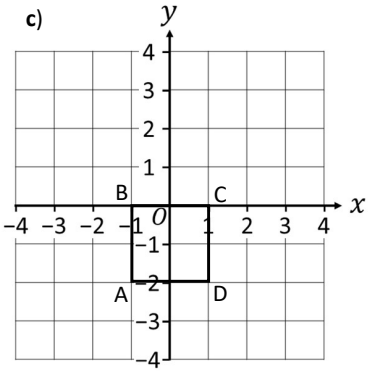
b)



Triangle ABC is reflected in the y-axis.

Invariant points:

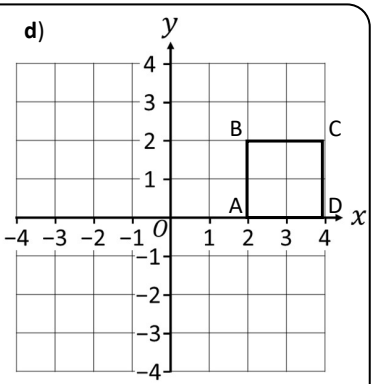
c)



Square ABCD is enlarged by scale factor 2, centre of enlargement (−1,−2).

Invariant points:

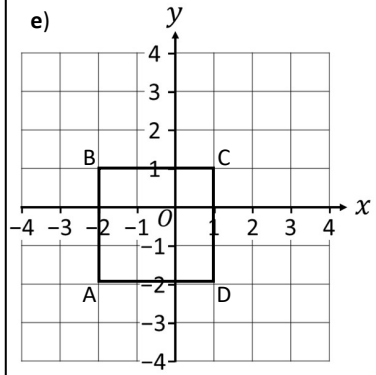
d)



Square ABCD is rotated 180° about (2,0)

Invariant points:

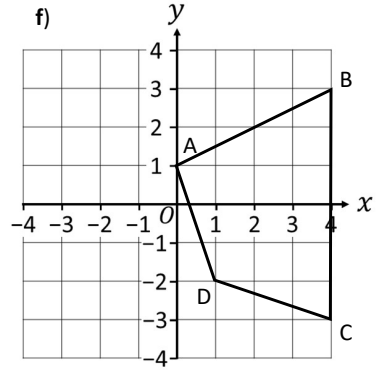
e)



Square ABCD is reflected in the line $y = x$

Invariant points:

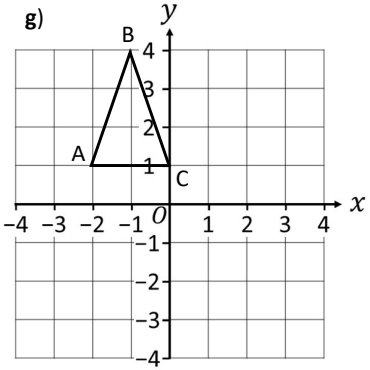
f)



Shape ABCD is reflected in the line $x = 1$

Invariant points:

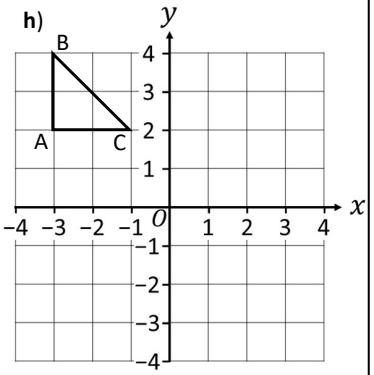
g)



Triangle ABC is rotated 90° clockwise about (−1, −1), then translated by the vector $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$

Invariant points:

h)

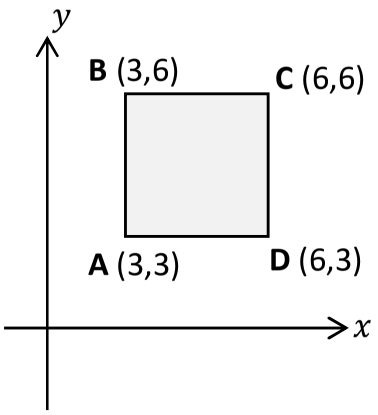


Triangle ABC is enlarged by scale factor −2, centre of enlargement (−1,2).

Invariant points:

Invariant Points

1) For each translation, which vertices (if any) are invariant?



a) Rotation 90° clockwise about the point (3,3)

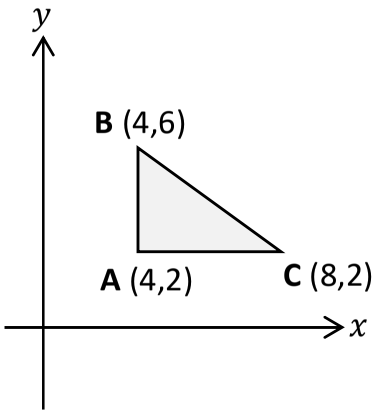
b) Reflection in the line $x = 3$

c) Translation by the vector $\begin{pmatrix} -3 \\ -3 \end{pmatrix}$

d) Enlargement by SF 2 with centre (6,3)

e) Reflection in the line $y = x$

2) For each translation, which vertices (if any) are invariant?



a) Reflection in the line $y = 6$

b) Enlargement by SF 0.5 with centre (4,2)

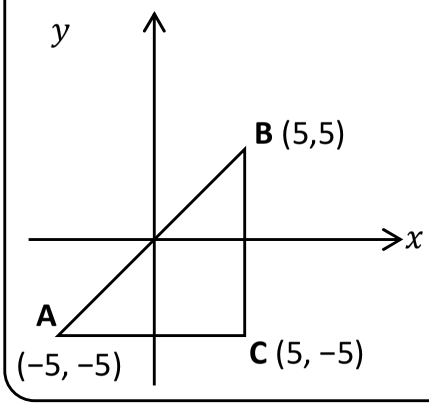
c) Reflection in the line $y = x$

d) Rotation 180° about the point (1,1)

e) Translation by the vector $\begin{pmatrix} 0 \\ 4 \end{pmatrix}$

f) Reflection in the line $y = 2$

3) For shape **ABC**, describe a **single** transformation so that…



a) Only **A** is invariant.

b) No vertices are invariant.

c) Only **C** & **B** are invariant.

d) Only **C** is invariant.

e) Exactly one vertex is invariant.

f) Every point along line **AB** is invariant.

Fluency Practice

Invariant Points

Fill in each section with an example that will result in the desired number of invariant points.

Are there any sections that are impossible? Explain.

	No invariant points	One invariant point	Infinite number of invariant points
Translations			
Rotations			
Reflections			
Enlargements			

Problem Solving