Year 9
Mathematics
Unit 15
Tasks

Do Not Write Inside

Enlargements
Video 104 on www.corbettmaths.com

Fluency Prac

Corbett maths

Enlargements
Video 104 on www.corbettmaths.com
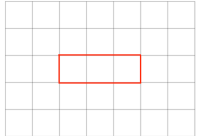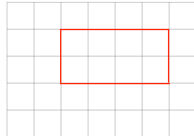
Question 1:   Copy these shapes and then enlarge by the scale factor given.
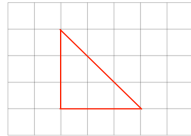
(a)
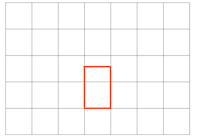

Enlarge by scale factor 3

(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)

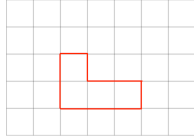Enlarge by scale factor 3

(c)

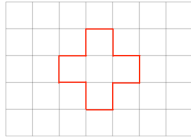Enlarge by scale factor 2

(d)

Enlarge by scale factor 2

(e)

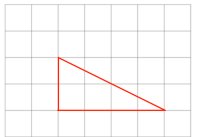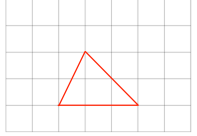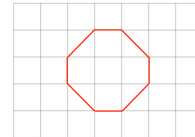

Enlarge by scale factor 3

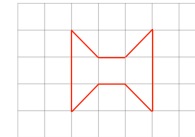(f)

Enlarge by scale factor 2

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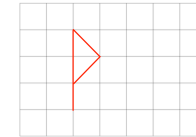
(a)

Enlarge by scale factor 4

(b)

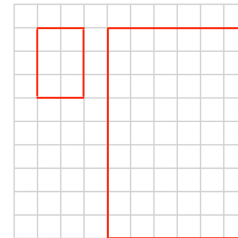

Enlarge by scale factor 2

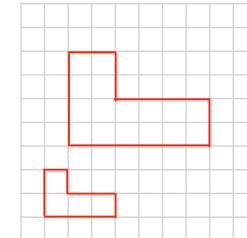(c)

Enlarge by scale factor 3

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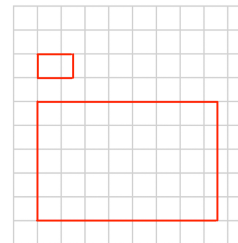For each, write down the scale factor of enlargement.

(a)
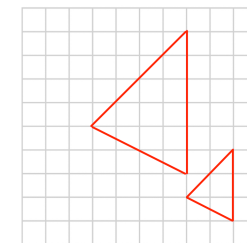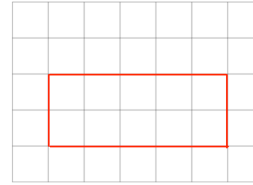

(b)

(c)

(d)

Page 2

Apply   **Fluency Practice**

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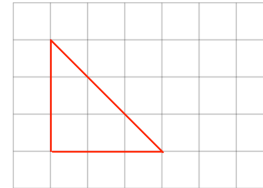
Question 3:   Shown is a shape drawn on a centimetre squared grid.

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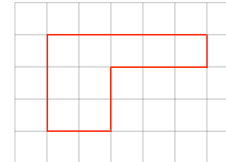
Question 4:   Charlie has enlarged the triangle by scale factor 2.
               Can you spot any mistakes?
               His answer is in green.
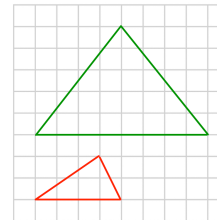
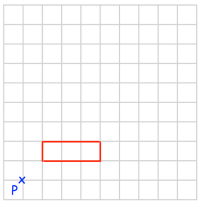Corbett mαths

Question 1: Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)

Enlarge by scale factor 2

(b)

Enlarge by scale factor 3

(c)

Enlarge by scale factor 2

(d)

Enlarge by scale factor 4

(e)

Enlarge by scale factor 2

(f)

Enlarge by scale factor 3

(g)

Enlarge by scale factor 2

(h)

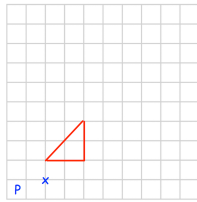Enlarge by scale factor 2

Question 2: Enlarge each shape by the scale factor given
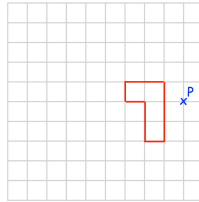Use P as the centre of enlargement.
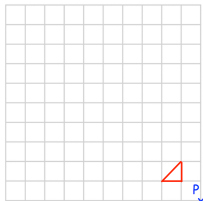
(a)

Enlarge by scale factor 2
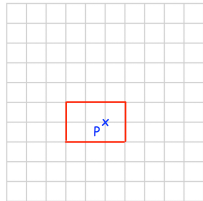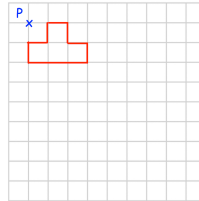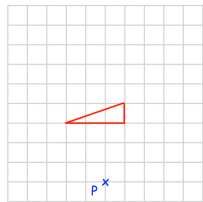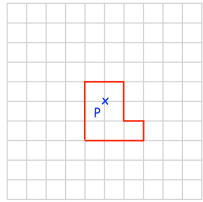
(b)

Enlarge by scale factor 3

(c)

Enlarge by scale factor 3

(d)

Enlarge by scale factor 2

Enlargements: Centre of Enlargement
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Enlargements: Centre of Enlargement
Video 104a on www.corbettmaths.com

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Question 3: Enlarge each shape by the scale factor given
The coordinates for each centre of enlargement are given.

(a)
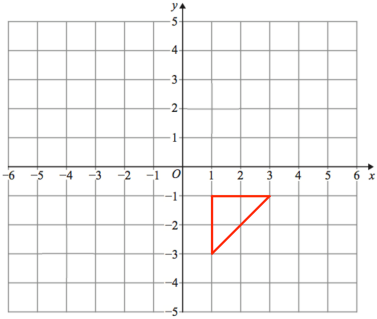
Enlarge by scale factor 2 using
(4, -3) as the centre of enlargement

(b)
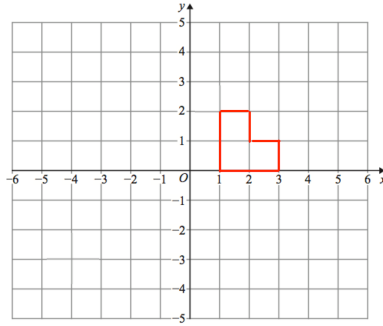
Enlarge by scale factor 3 using
(3, 2) as the centre of enlargement

(c)
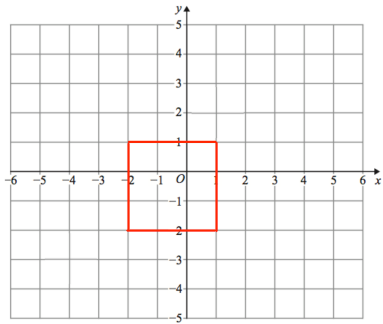
Enlarge by scale factor 2 using
(0, -1) as the centre of enlargement

(d)

Enlarge by scale factor 2 using
the origin as the centre of enlargement

Question 4: Describe fully the single transformation that takes shape A to shape B.
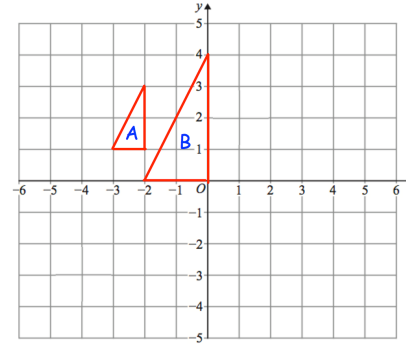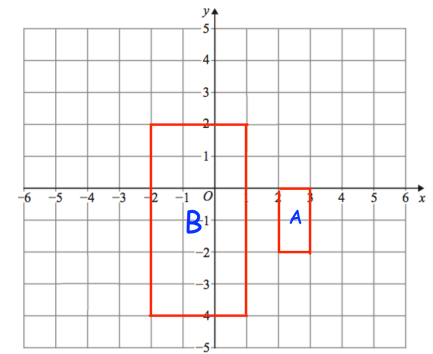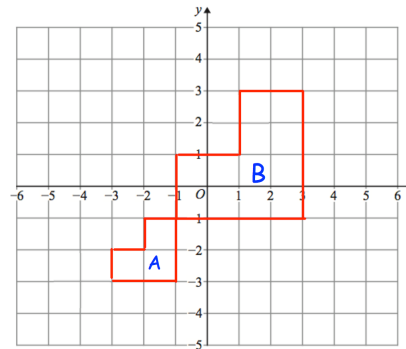
(a)

(b)

(c)

(d)

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

(a)

Enlarge by scale factor $\frac{1}{2}$

(b)

Enlarge by scale factor $\frac{1}{3}$

(c)
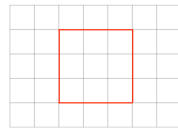
Enlarge by scale factor $\frac{2}{3}$

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

(a)

Enlarge by scale factor $\frac{1}{4}$

(b)

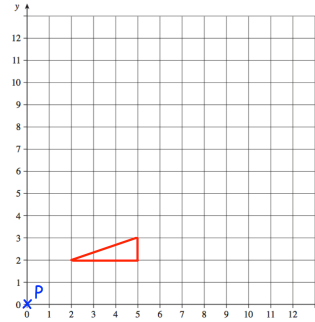Enlarge by scale factor $\frac{1}{2}$

(c)
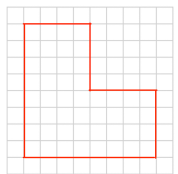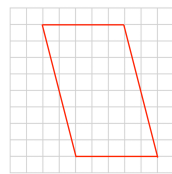
Enlarge by scale factor $1\frac{1}{3}$
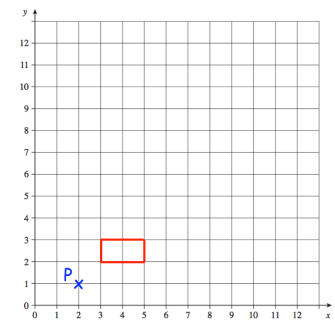
Question 3:   Enlarge each shape by the scale factor given
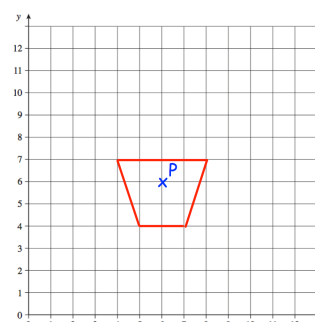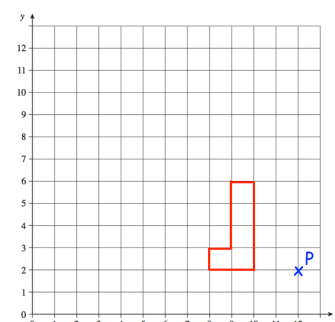   Use P as the centre of enlargement.

(a)

Enlarge by scale factor $\frac{1}{2}$

(b)

Enlarge by scale factor $\frac{1}{3}$

(c)

Enlarge by scale factor $\frac{2}{3}$

Question 4:   Enlarge each shape by the scale factor given
                Use P as the centre of enlargement.
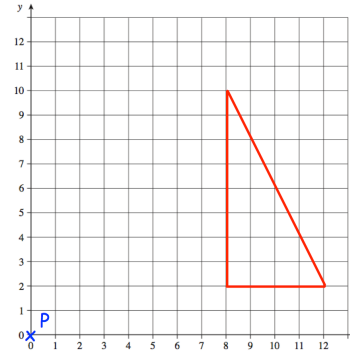
(a)

Enlarge by scale factor $\frac{1}{4}$

(b)

Enlarge by scale factor $\frac{1}{2}$

(c)
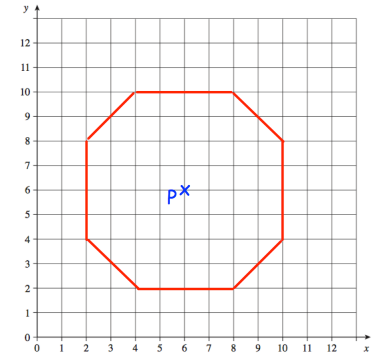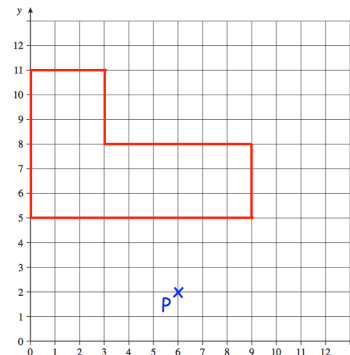
Enlarge by scale factor $\frac{2}{3}$
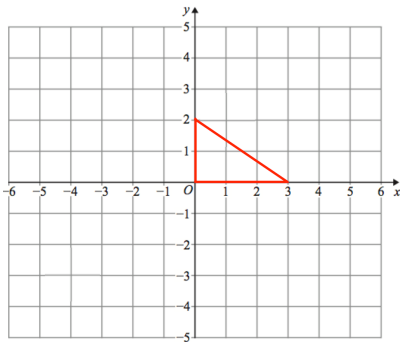
(d)
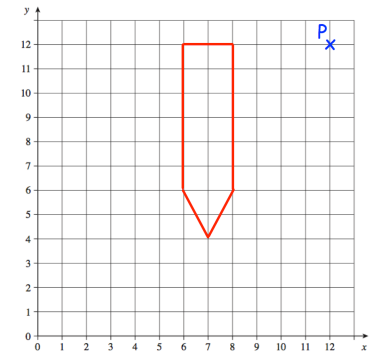
Enlarge by scale factor $1\frac{1}{2}$

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Question 5: Enlarge each shape by the scale factor given
The coordinates for each centre of enlargement are given.

(a)
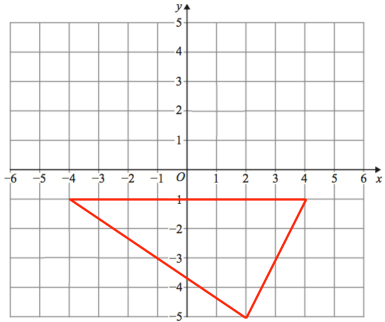
Enlarge by scale factor $\frac{1}{2}$ using
(0, 1) as the centre of enlargement

(b)
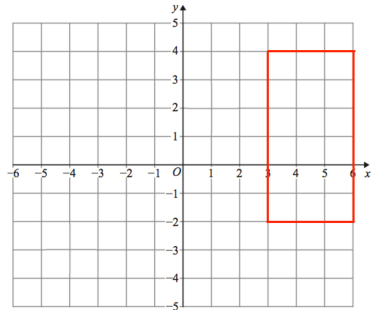
Enlarge by scale factor $\frac{1}{3}$ using
(-3, 1) as the centre of enlargement

(c)
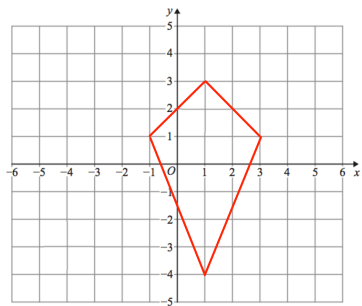
Enlarge by scale factor $\frac{1}{2}$ using
(-5, -5) as the centre of enlargement

(d)
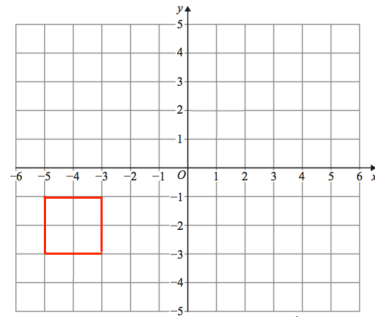
Enlarge by scale factor $2\frac{1}{2}$ using
(-5, -3) as the centre of enlargement

Question 6: Describe fully the single transformation that takes shape A to shape B.

(a)

(b)

(c)

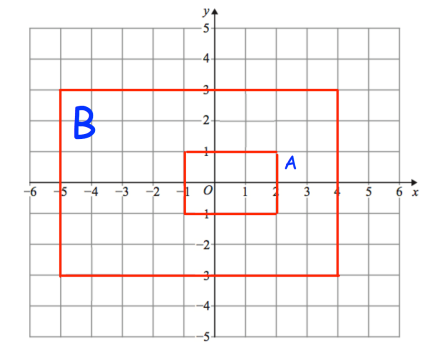(d)
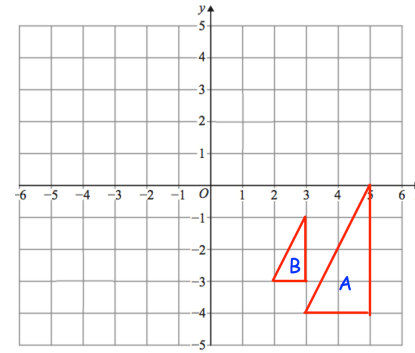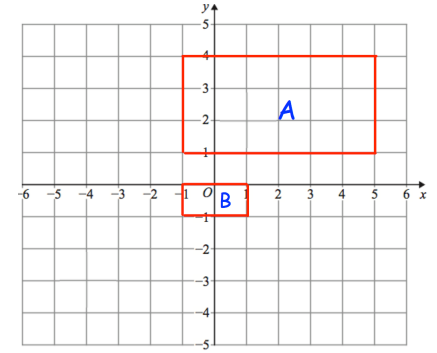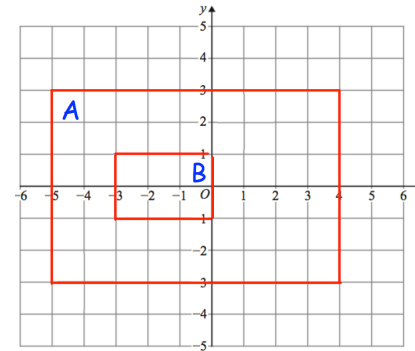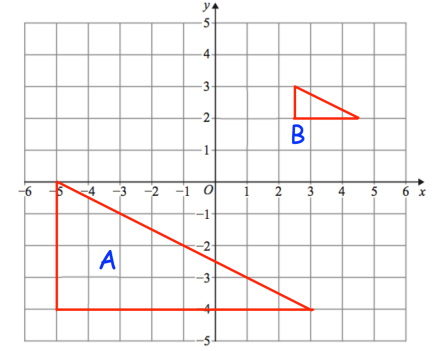
Click here

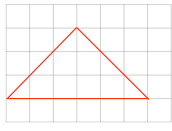Question 1:   Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)

Enlarge by scale factor -3

(b)

Enlarge by scale factor -2

(c)
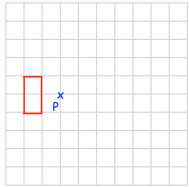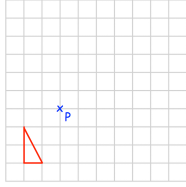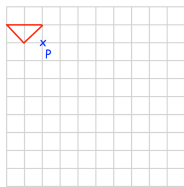
Enlarge by scale factor -4

(d)

Enlarge by scale factor -2

(e)

Enlarge by scale factor -2

(f)
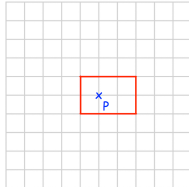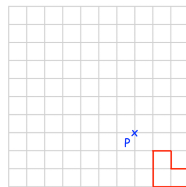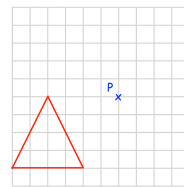
Enlarge by scale factor $-\frac{1}{2}$

Question 2:   Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)

Enlarge by scale factor -3

(b)
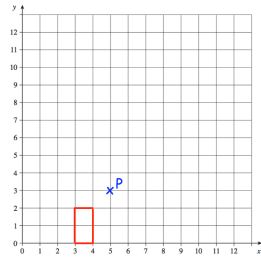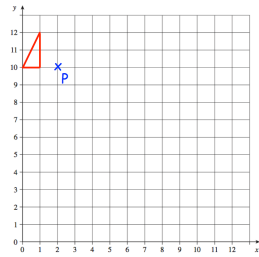
Enlarge by scale factor -4

(c)

Enlarge by scale factor -2

(d)
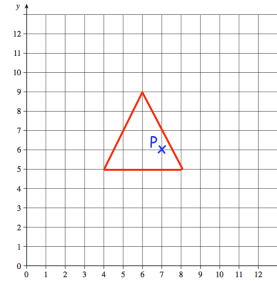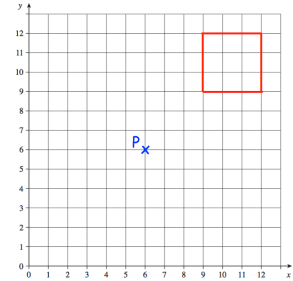
Enlarge by scale factor $-\frac{1}{3}$

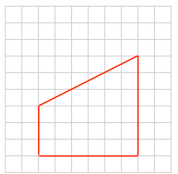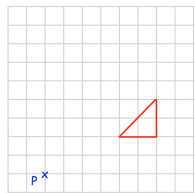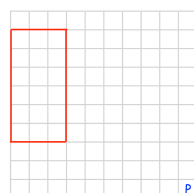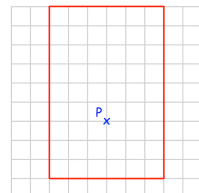Question 3:   Enlarge each shape by the scale factor given
The coordinates for each centre of enlargement are given.

(a)
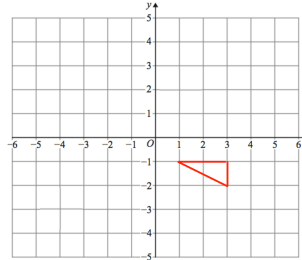
Enlarge by scale factor -2 using
(0, 0) as the centre of enlargement

(b)
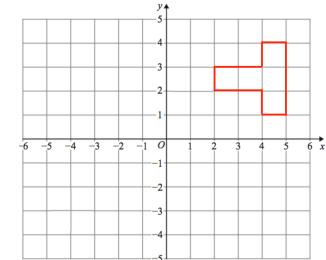
Enlarge by scale factor -2 using
(2, 2) as the centre of enlargement

(c)
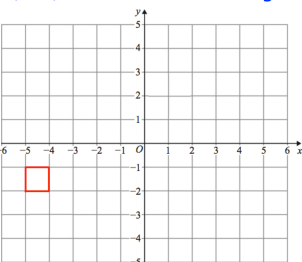
Enlarge by scale factor -4 using
(-3, -1) as the centre of enlargement

(d)
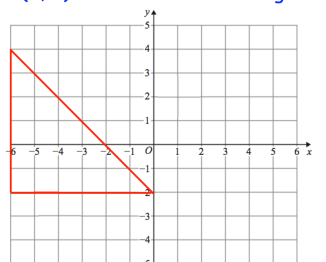
Enlarge by scale factor $-\frac{1}{2}$ using
(0, -2) as the centre of enlargement

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Templates

Question 4: Describe fully the single transformation that takes shape A to shape B.

(a)

(b)

(c)

(d)

Question 1(a)

(c)

Answers

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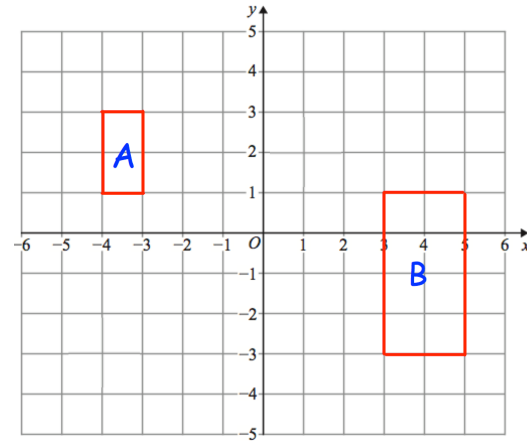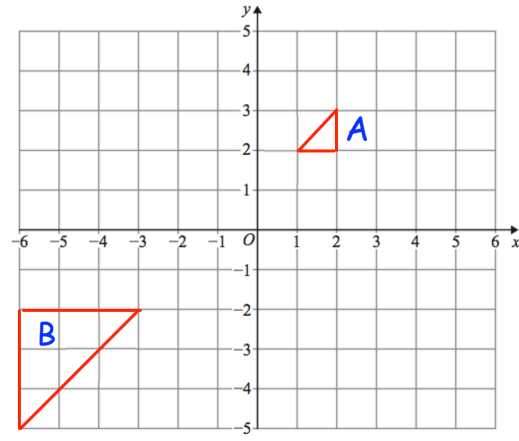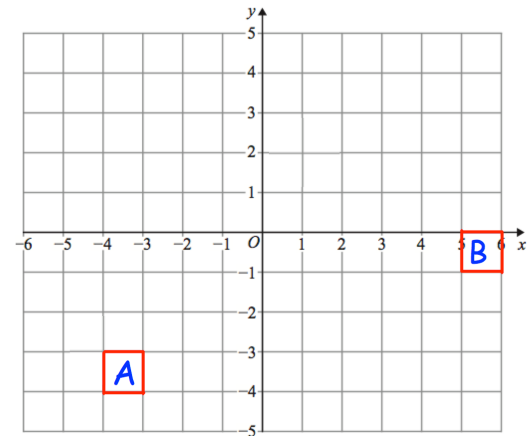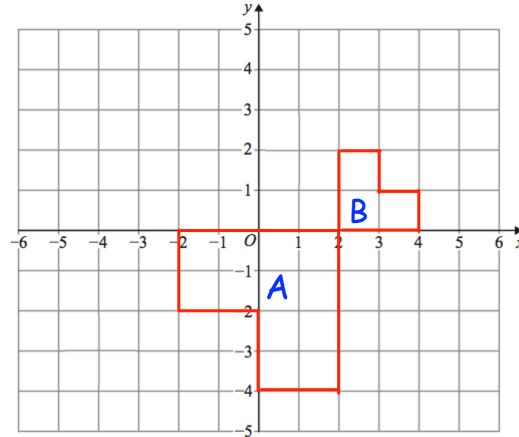
Fluency Practice

pair off the similar triangles and state the scale factor

Intelligent Practice – Find the length of every missing side

Triangles not drawn to scale

1.

80° 8cm
70°
4cm

80°
6cm
70°
8cm

2.

80° 8cm
70°
4cm

70°
6cm
80°
8cm

3.

80° 8cm
70°
4cm

70°
6cm
80°
4cm

4.

80° 8cm
70°
4cm

70°
6cm
3cm
30°

Intelligent Practice

5.

80° 8cm
70°
4cm

90°
6cm
30°
4cm

6.

8cm 60°
90°
4cm

90°
6cm
30°
3cm

7.

8cm
4cm

6cm
2cm

8.

8cm
4cm

6cm
2cm

9.

4cm
6cm
12cm

10.

4cm
6cm
12cm
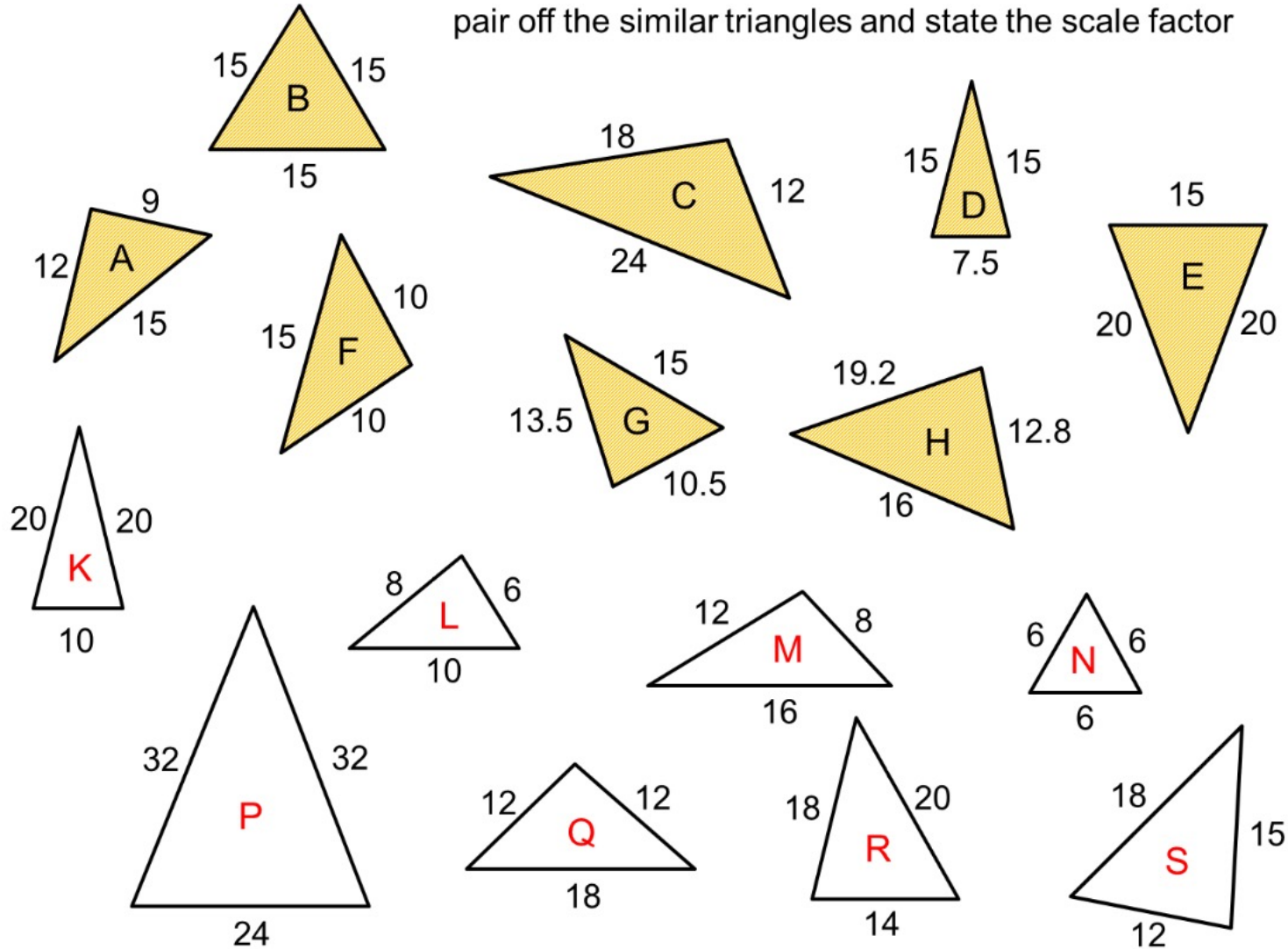
Intelligent Practice

Intelligent Practice – Find the length of every missing side

Triangles not drawn to scale

1.

12mm

4 mm

5 mm

x

2.

x

4 mm

5 mm

20mm

3.

6mm

x

5 mm

10mm

4.

6mm

x

12mm

6mm

Intelligent Practice – Find the length of every missing side

Triangles not drawn to scale

5.

6mm

x

6mm

12mm

6.

8mm

6mm

x

3mm

y

6 cm
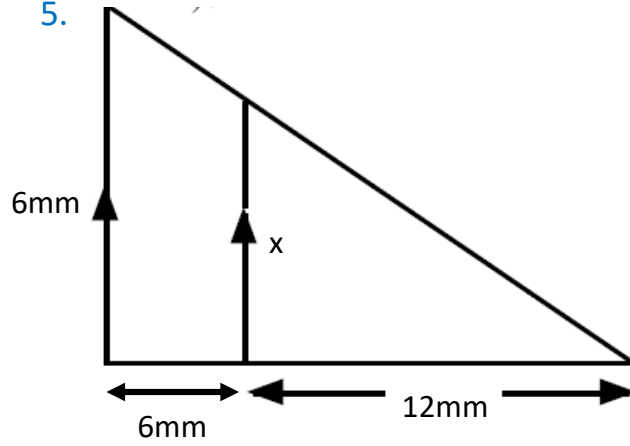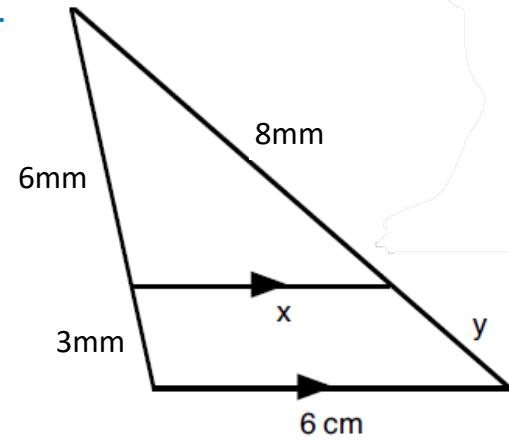
Fluency Practice

Similar Triangles

Q1.
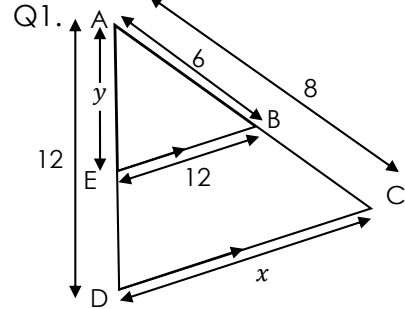
i)   Find the scale factor between triangle ABE and triangle ACD
ii) Find the value of x
iii) Find the value of y

Q2.
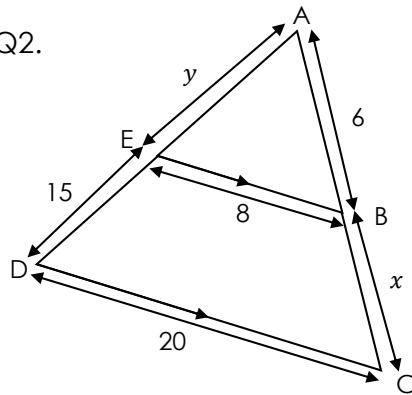
i)   Find the scale factor between ABE and ACD
ii) Find the value of x
iii) Find the value of y

Q3.
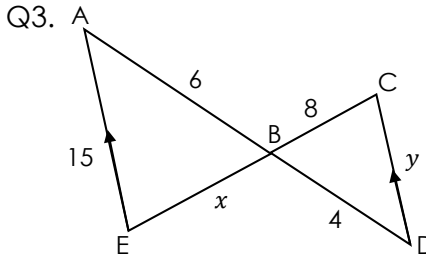
i)   How can you tell that ABE and BCD are mathematically similar?
ii) Find the value of x
iii) Find the value of y

Q4
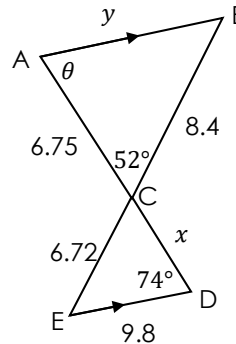
i)   Find the value of x
ii) Find the value of y
iii) Find the size of angle θ

Q5.
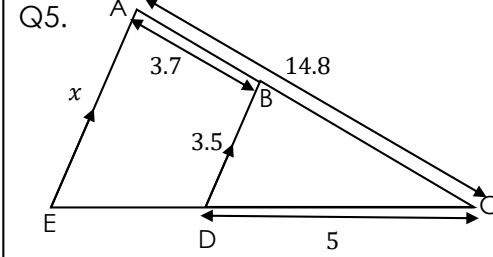
i)   Find the value of x
ii) Hence, find the perimeter of trapezium ABDE

Q6. Find the value of x
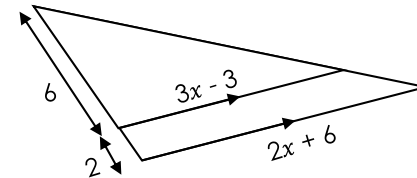
Q7. [non-calculator] Given that $\tan(x) = \tan(y)$, find the area of triangle ABC.
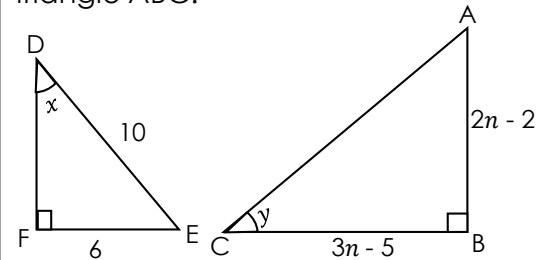
Fluency Practice

Exam Questions around Similar shapes

Question 1
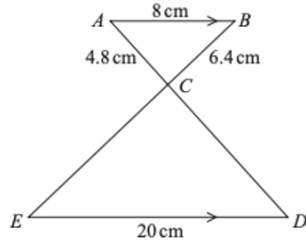
Diagram **NOT** accurately drawn

AB is parallel to ED.
ACD and BCE are straight lines.
$AB = 8$cm $AC = 4.8$cm $BC = 6.4$cm $ED = 20$ cm
Work out the length of BE.

.... cm **(3 marks)**

Question 2

The diagram shows five points joined with four straight lines. BC and AD are parallel. BCE and ADE are isosceles triangles.
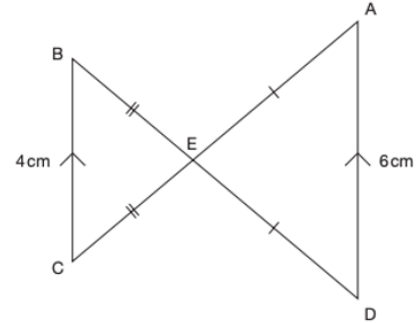
Not drawn accurately

The total length of the four straight lines is 40cm.
What is the length of EA?

.... cm

Question 3

The diagram represents a metal frame.

Diagram **NOT** accurately drawn

The frame is made from four metal bars, AB, AC, BC and BD.
Angle ABC = angle ADB = 90°
$AB = 5$m
$BC = 3$ m
Work out the total length of the four metal bars of the frame.
Give your answer correct to 3 significant figures.

.... m **(5 marks)**

Question 4

The diagram shows a square inside a triangle. DEF is a straight line.
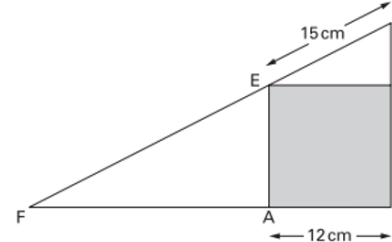
Not drawn accurately

The side length of square $ABCE$ is 12 cm.
The length of DE is 15 cm.
Find the length of EF.

$EF = $ .... cm

(3 marks)

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Extension

similarity questions

(1)   BC is parallel to DE

(a) the length DE

(b) the perimeter of the triangle ADE

30 m   40 m

15 m   46 m

A B C D E
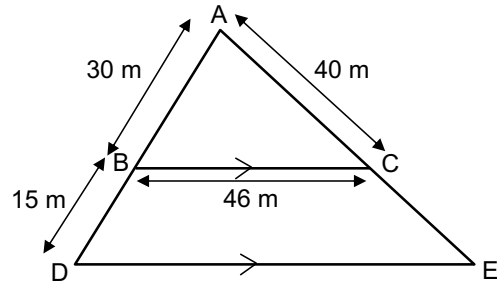
(3)

the quadrilaterals are similar

10 cm   12 cm

6 cm   c

d   18 cm
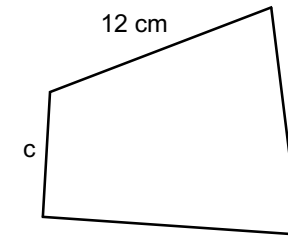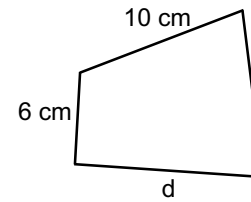
find 'c' and 'd'

(2)   the triangles are similar

4 cm

10 cm

b

a

10 cm

5 cm
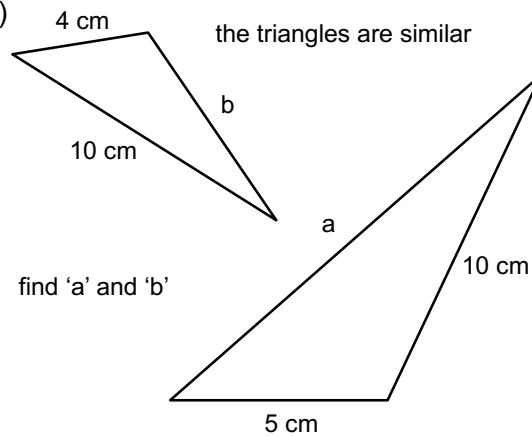
find 'a' and 'b'

(4)

the triangles are similar

10 cm   16 cm

4 cm   g

40°   F

6 cm   e
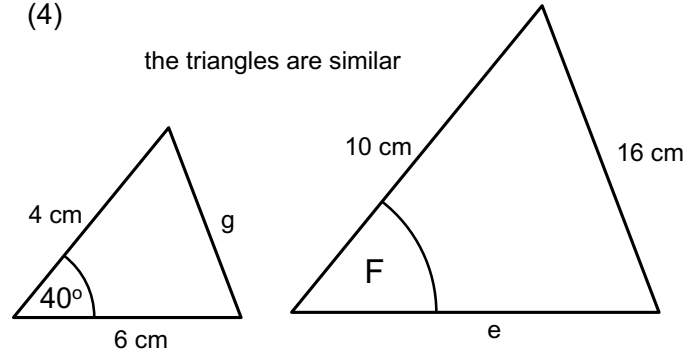
find 'e' and 'F' and 'g'

Extension

similar triangle questions

(1)

28 m   A   34 m   (a) the length DE

14 m   B   38 m   C   (b) the length CE

D   E

(2)

2 m   10 m

D   B   A

15 m   12 m

C

(a) the length DE

(b) the length CE

E

(3)

20 m

a

17.5 m   2.5 m

b   10 m

(4)

w

k   15 m

21 m

18 m

30 m
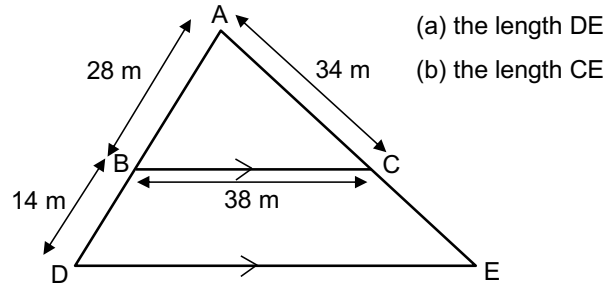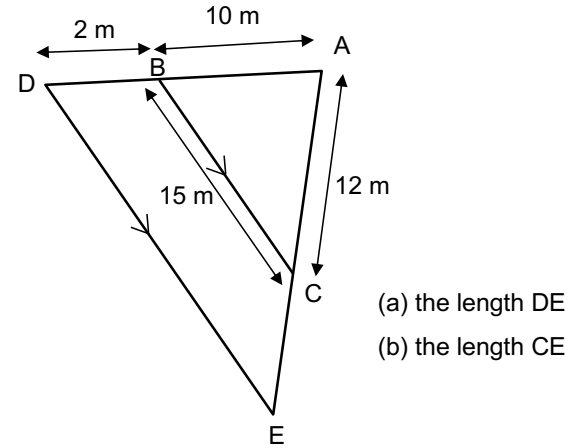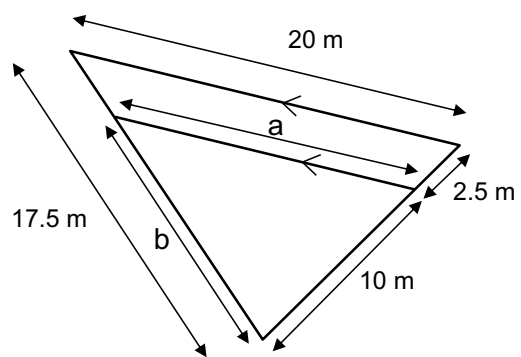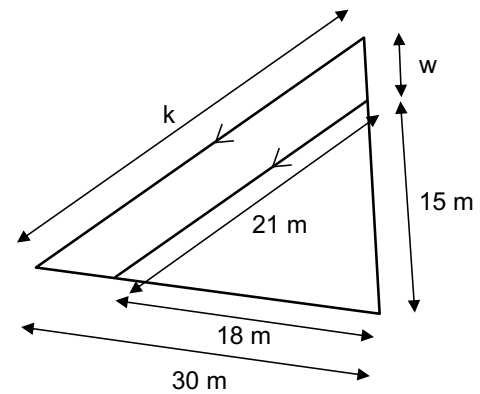
Extension

similar triangles

(6)
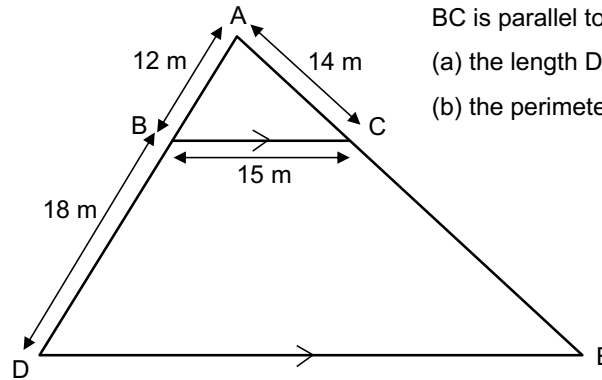
BC is parallel to DE, find:

(a) the length DE

(b) the perimeter of the triangle ADE

(7) BC is parallel to DE

(a) the length CE

(b) the length BC
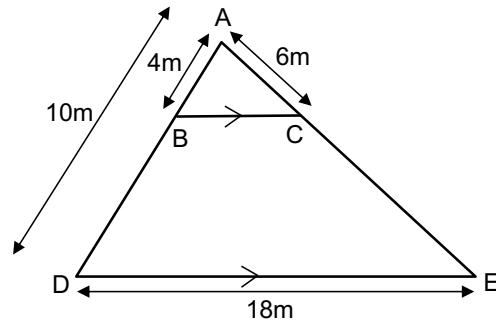
Fluency Practice
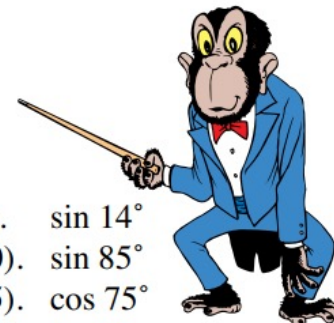
C. Find the value of the following to 3 d.p..

1). $\sin 10°$ 2). $\cos 45°$ 3). $\tan 45°$ 4). $\tan 62°$ 5). $\sin 14°$
6). $\sin 69°$ 7). $\tan 14°$ 8). $\cos 32°$ 9). $\cos 5°$ 10). $\sin 85°$
11). $\tan 68°$ 12). $\sin 55°$ 13). $\tan 4°$ 14). $\sin 15°$ 15). $\cos 75°$
16). $\sin 90°$ 17). $\cos 90°$ 18). $\cos 12°$ 19). $\tan 78°$ 20). $\tan 9°$

D. Calculate the following to 2 d.p..

1). $5 \tan 45°$ 2). $4 \sin 30°$ 3). $8 \cos 60°$ 4). $6 \sin 43°$ 5). $9 \cos 18°$
6). $15 \tan 83°$ 7). $14 \cos 25°$ 8). $24 \cos 72°$ 9). $31 \sin 45°$ 10). $20 \cos 34°$
11). $5 \cos 60°$ 12). $56 \sin 15°$ 13). $30 \tan 45°$ 14). $19 \sin 82°$ 15). $14 \tan 45°$
16). $17 \tan 60°$ 17). $8 \cos 0°$ 18). $45 \tan 28°$ 19). $61 \sin 90°$ 20). $28 \tan 50°$

E. Calculate the following to 2 d.p..

1). $\dfrac{6}{\sin 34°}$ 2). $\dfrac{12}{\cos 83°}$ 3). $\dfrac{4}{\tan 16°}$ 4). $\dfrac{23}{\tan 45°}$ 5). $\dfrac{31}{\sin 30°}$

6). $\dfrac{38}{\cos 18°}$ 7). $\dfrac{48}{\tan 80°}$ 8). $\dfrac{8}{\sin 54°}$ 9). $\dfrac{18}{\sin 15°}$ 10). $\dfrac{5}{\cos 51°}$

11). $\dfrac{25}{\tan 52°}$ 12). $\dfrac{62}{\cos 71°}$ 13). $\dfrac{82}{\sin 68°}$ 14). $\dfrac{16}{\cos 8°}$ 15). $\dfrac{2}{\sin 12°}$

16). $\dfrac{6}{\sin 75°}$ 17). $\dfrac{18}{\tan 45°}$ 18). $\dfrac{48}{\cos 50°}$ 19). $\dfrac{37}{\tan 12°}$ 20). $\dfrac{52}{\tan 84°}$

Intelligent Practice

Find 'x'. Give your solution to 2 decimal places.

1) $\tan(30) = \dfrac{x}{2}$

2) $\tan(45) = \dfrac{x}{2}$

3) $\sin(45) = \dfrac{x}{2}$

4) $\sin(45) = \dfrac{x}{4}$

5) $\dfrac{x}{4} = \sin(45)$

6) $x \times \sin(45) = 4$

7) $x \times \sin(30) = 4$

8) $x \times \cos(30) = 4$

9) $x \times \cos(30) = 8$

10) $x \times \cos(31) = 8$

Intelligent Practice

Find 'x'. Give your solution to 2 decimal places.

1) $\cos(30) = \dfrac{2}{x}$

2) $\cos(45) = \dfrac{2}{x}$

3) $\sin(45) = \dfrac{2}{x}$

4) $\sin(45) = \dfrac{4}{x}$

5) $\sin(45) = \dfrac{8}{x}$

6) $\tan(45) = \dfrac{8}{x}$

7) $\tan(45) = \dfrac{x}{8}$

8) $\cos(45) = \dfrac{x}{8}$

9) $\cos(45) = \dfrac{8}{x}$

10) $\dfrac{8}{x} = \cos(45)$

Fluency Practice

Q1. Rearrange to make **c** the subject.

    a. $a = \frac{c}{b}$ b. $a = \frac{b}{c}$ c. $5 = \frac{c}{b}$ d. $20 = \frac{b}{c}$

    e. $\sin A = \frac{c}{b}$ f. $sinA = \frac{b}{c}$ g. $sin5 = \frac{c}{b}$ h. $sin20 = \frac{b}{c}$

    i. $cos\ A = \frac{c}{b}$ j. $cos\ 28 = \frac{b}{c}$ k. $tan\ A = \frac{b}{c}$ l. $tan\ A = \frac{10}{c}$

Q2.   Calculate **a** to 2dp.

    a. $sin40 = \frac{a}{6}$ b. $sin31 = \frac{a}{8}$ c. $cos70 = \frac{20}{a}$ d. $cos46 = \frac{12a}{7}$

    e. $tan20 = \frac{a}{27}$ f. $tan58 = \frac{67}{a}$

Q3. Calculate **a** to 3sf.

    a. $sin36 = \frac{a}{9}$ b. $sin71 = \frac{a}{6}$ c. $sin29 = \frac{6}{a}$ d. $sin81 = \frac{75}{a}$ e. $sin205 = \frac{a}{11}$

    f. $cos53 = \frac{29}{a}$ g. $cos101 = \frac{a}{61}$ h. $tan44 = \frac{a}{7}$ i. $tan18 = \frac{50}{c}$

Fluency Practice

A. Name all the sides from the given angle, x°.

1).

2).

3).

4).

5).

6).

7).

8).

9).

10).

11).

12).

13).

14).

15).
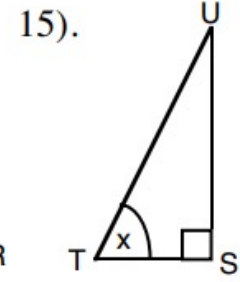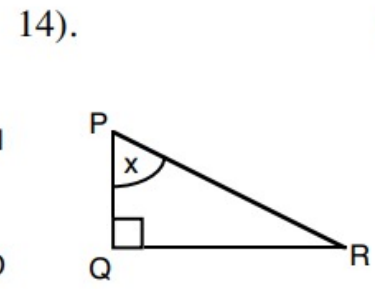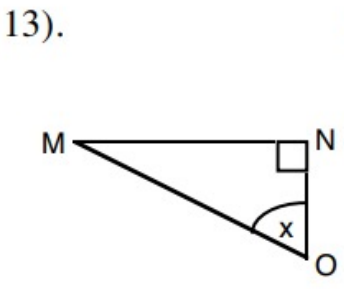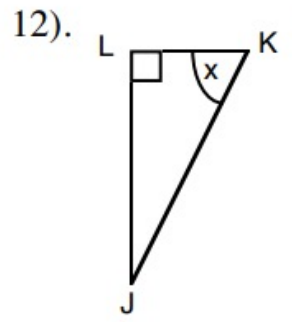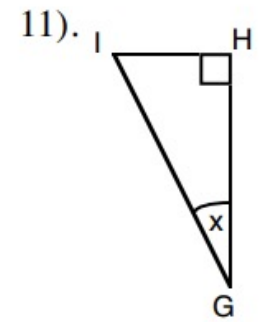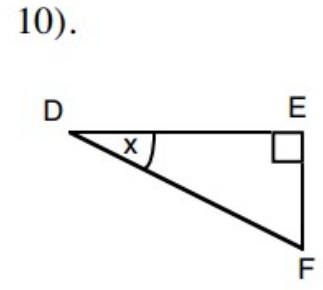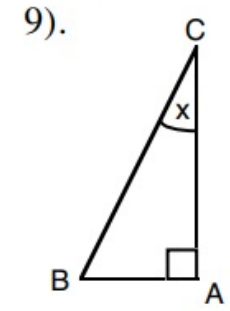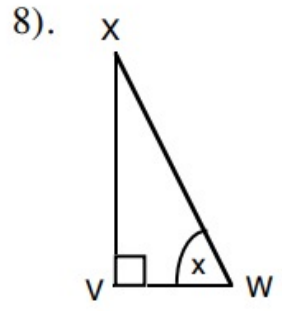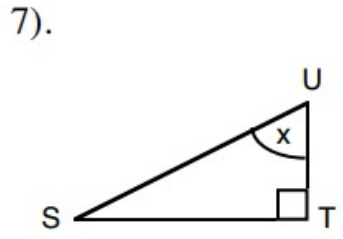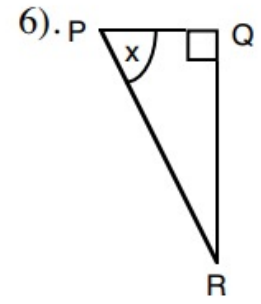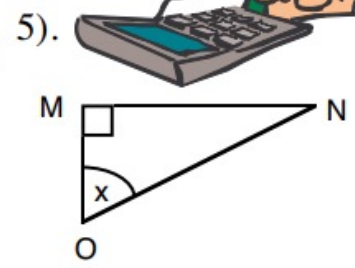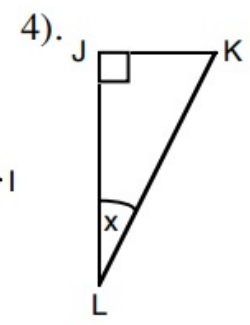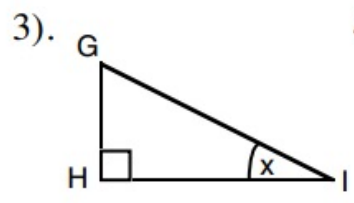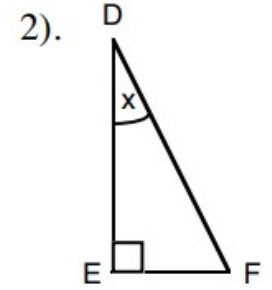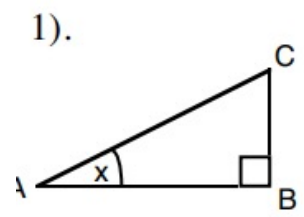
Fluency Practice

B. For each of the following questions look at the information given and the information you have to find. Which of the trigometrical ratios would you use to solve it for x?
Do not try to solve the questions.

1).
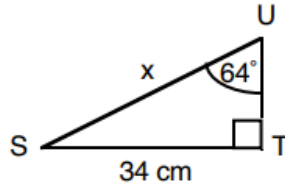
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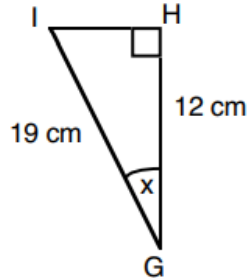
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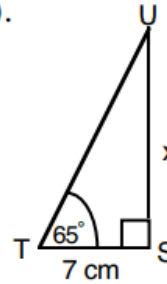
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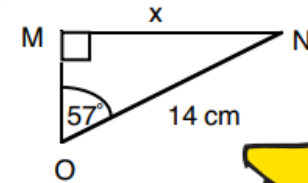
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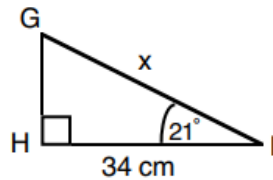
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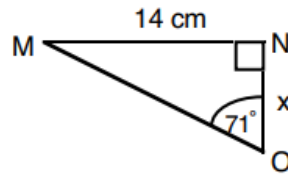
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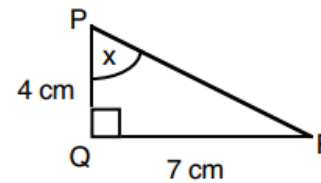
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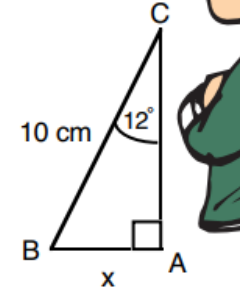
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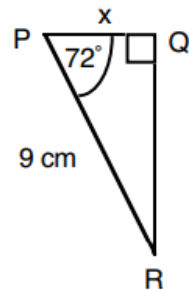
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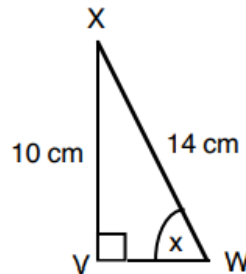
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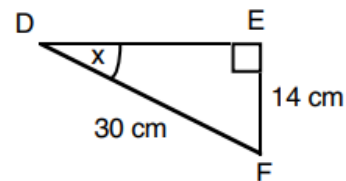
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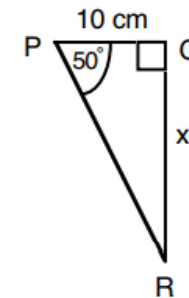
Fluency Practice

F. Find the length of the side marked x, leave all answers to 1 decimal place.
Diagrams not to scale.

1).

12 cm, C, x, 30°, A, B

2).

15 cm, E, D, 72°, x, F

3).

G, 8 cm, 36°, H, x, I

4).

x, J, K, 22 cm, 17°, L

5).

M, N, x, 68°, 18 cm, O

6).

34 cm, P, Q, 72°, x, R

7).

U, 28 cm, 53°, S, x, T

8).

X, 16 cm, V, 47°, W, x

9).

C, 42 cm, 32°, B, x, A

10).

D, 6 cm, E, 29°, x, F

11).

I, H, x, 56 cm, 34°, G

12).

L, K, 58°, x, 45 cm, J

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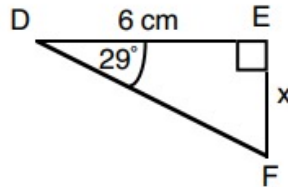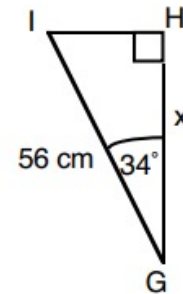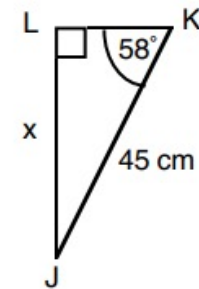
Fluency Practice

A. Find the length of the side marked x, leave all answers to 1 decimal place. Diagrams not to scale.

1).

P, 67°, x, Q, 15 cm, R

2).

M, N, 12 cm, x, 72°, O

3).

U, x, 8 cm, 65°, T, S

4).

W, x, V, 37°, 24 cm, Z

5).

C, x, 18 cm, A, 36°, B

6).

D, x, 32°, E, 38 cm, F

7).

G, 22 cm, H, 18°, I, x

8).

J, K, 22 cm, 17°, x, L, Z

9).

M, 8 cm, N, 64°, x, O

10).

P, x, 68°, Q, 44 cm, R

11).

U, x, 49°, 76 cm, S, T

12).

J, K, z, N, 6 cm, x, V, 57°, W
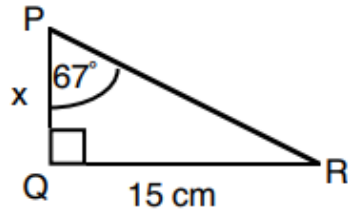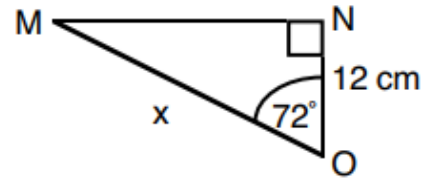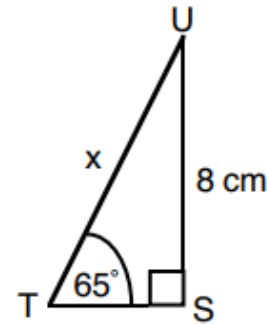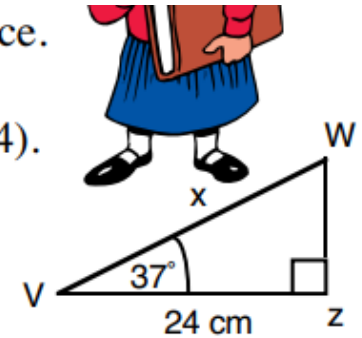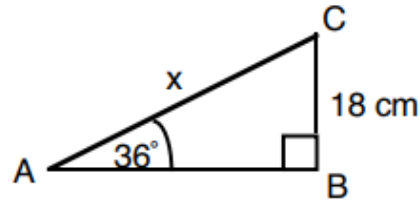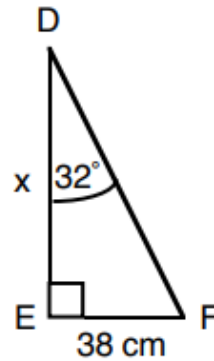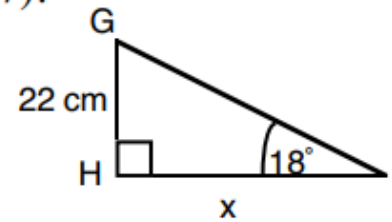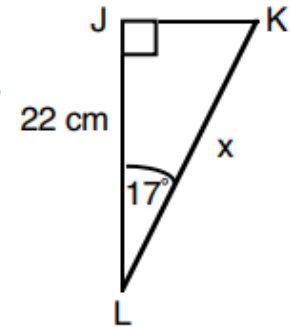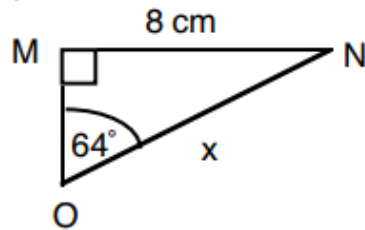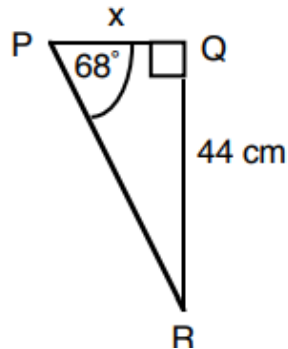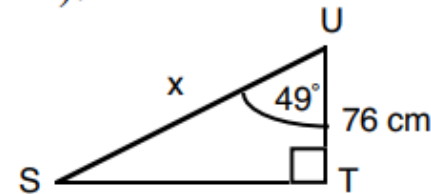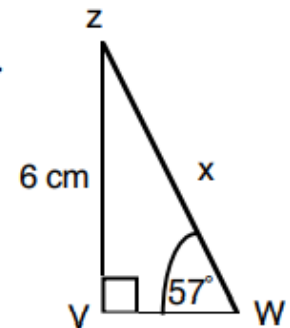
Inverse Functions

Bronze

Find $f^{-1}(x)$:

Q1) $f(x) = \frac{5x+4}{2}$

Q2) $f(x) = \frac{7x+6}{8}$

Q3) $f(x) = \frac{8x+3}{7}$

Q4) $f(x) = \frac{7x+6}{9}$

Q5) $f(x) = 5x - 7$

Q6) $f(x) = \frac{x}{4} + 9$

Q7) $f(x) = \frac{x}{4} - 7$

Q8) $f(x) = \frac{3x+5}{3}$

Silver

Find $f^{-1}(x)$

Q1) $f(x) = \frac{\sqrt{x+8}}{6}$

Q2) $f(x) = (x-7)^3$

Q3) $f(x) = (x+4)^3$

Q4) $f(x) = (x-8)^2$

Q5) $f(x) = (x+4)^2$

Q6) $f(x) = (x+3)^3$

Q7) $f(x) = (x-6)^3$

Q8) $f(x) = (x+5)^2$

Gold

Find $f^{-1}(x)$

Q1) $f(x) = \frac{-7x-1}{-3x-8}$

Q2) $f(x) = \frac{4x+3}{6x+4}$

Q3) $f(x) = \frac{5x-4}{4x-8}$

Q4) $f(x) = \frac{3x+6}{5x+8}$

Q5) $f(x) = \frac{-x+6}{4x+7}$

Q6) $f(x) = \frac{-x-3}{6x+6}$

Q7) $f(x) = \frac{7x-3}{-5x+7}$

Q8) $f(x) = \frac{3x+6}{7x+7}$

Intelligent Practice

Find 'x'. Give your solution to 2 decimal places.

1) $\sin(x) = 0$

2) $\sin(x) = \dfrac{1}{5}$

3) $\sin(x) = \dfrac{2}{5}$

4) $\sin(x) = \dfrac{3}{5}$

5) $\sin(x) = \dfrac{4}{5}$

6) $\sin(x) = 1$

7) $\cos(x) = 0$

8) $\cos(x) = \dfrac{1}{5}$

9) $\cos(x) = \dfrac{2}{5}$

10) $\cos(x) = \dfrac{3}{5}$

11) $\cos(x) = \dfrac{4}{5}$

12) $\cos(x) = 1$

Fluency Practice

C). Find the angles marked x.

1).

2).

3).

4).

5).

6).

7).

8).

9).

10).

11).

12).

13).

14).

15).

16).
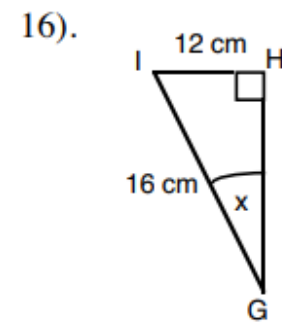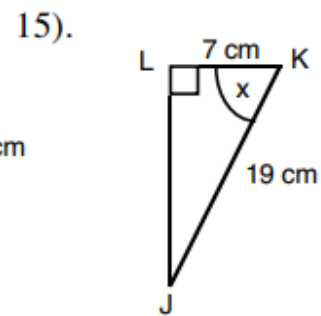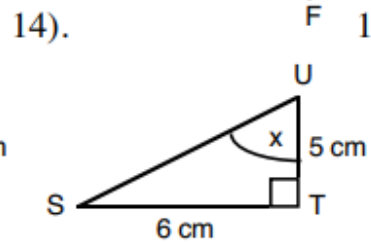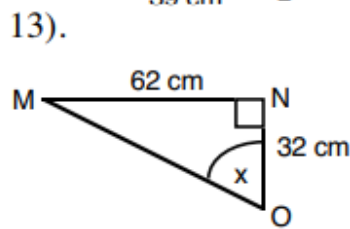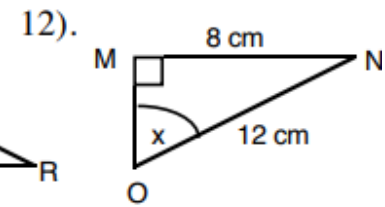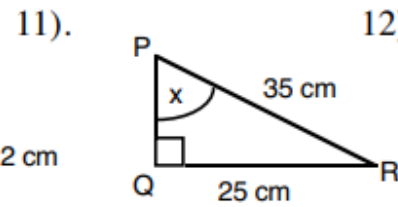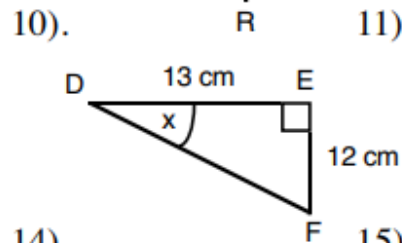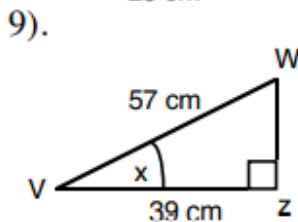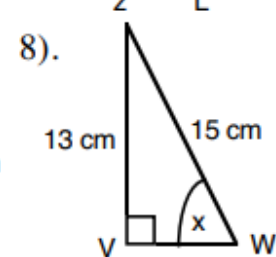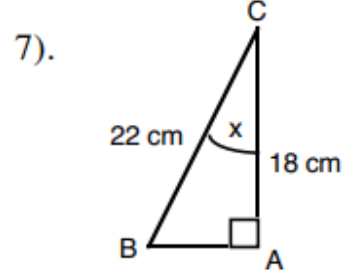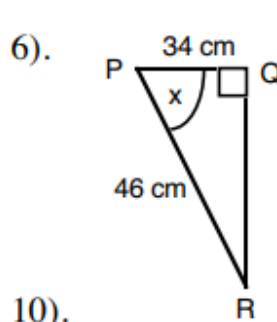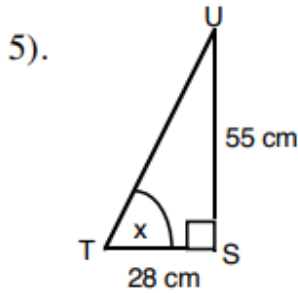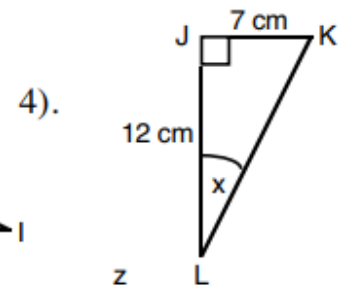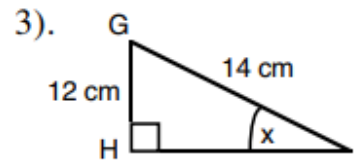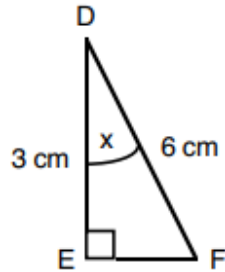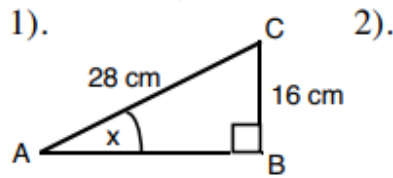
Fluency Practice

D). In the following triangles find **all the missing angles and sides.**

1). 8 cm, 5 cm, S, U, T

2). D, 40°, 6 cm, E, F

3). G, 18 cm, 10 cm, H, I

4). J, K, 24 cm, 17°, L

5). I, H, 12 cm, 25°, G

6). P, 75°, Q, 40 cm, R

7). 32 cm, P, Q, 56 cm, R

8). 4 cm, M, N, 55°, O

9). L, 9 cm, K, 17 cm, J

10). C, 24 cm, 13 cm, A, B

11). D, 12°, E, 18 cm, F

12). Z, 65°, V, 23 cm, W

13). J, C, 32 cm, 28 cm, B, A

14). M, N, 62 cm, 72°, O

15). U, 35 cm, T, S

16). W, 27 cm, 16 cm, V, Z

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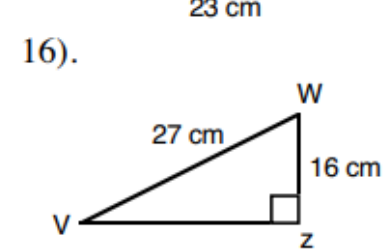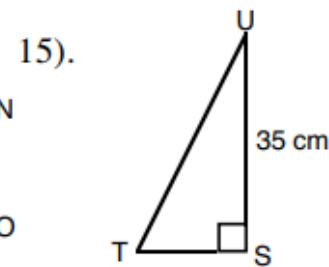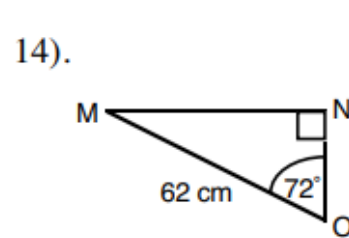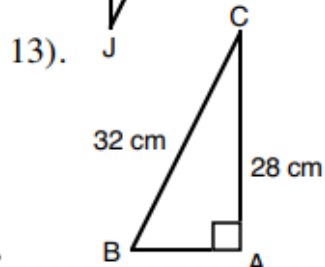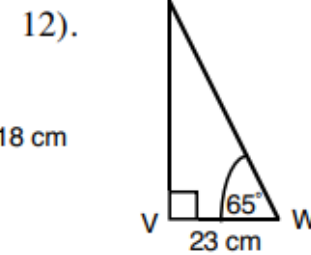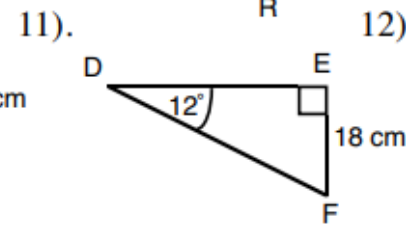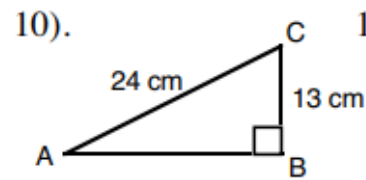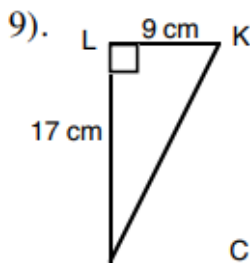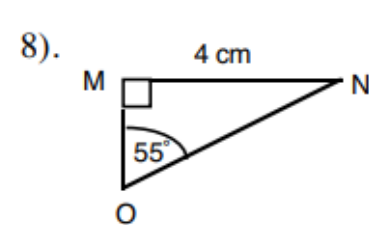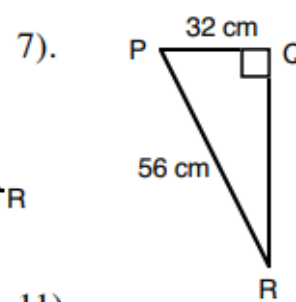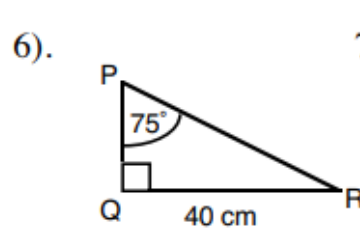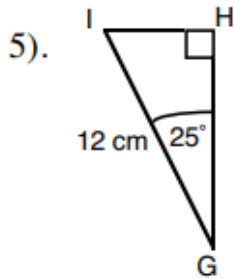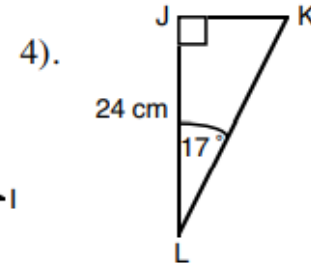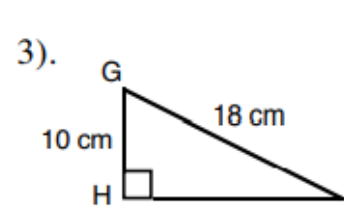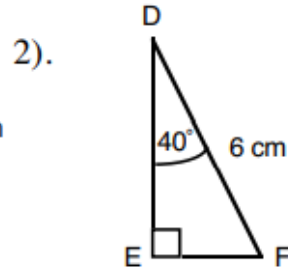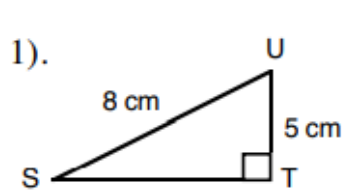
Each calculation has been created from a diagram.
Draw each diagram.

$$x = \frac{9}{\cos(38°)} \qquad x = 9 \times \cos(38°) \qquad y = \frac{9}{\sin(38°)}$$

Thinker: $h = 12 \times \tan(45°) + 6$

Extension

In the table a line of working has been given.

Draw the corresponding triangle that would produce that line of working.

$x = 10sin12°$	$y = \dfrac{16}{cos34°}$	$x = sin^{-1}(\dfrac{5}{6})$
$x = \dfrac{4.3}{tan35°}$	$\theta = cos^{-1}(\dfrac{16}{34})$	$x = \dfrac{10}{sin12°}$
$y = tan^{-1}(\dfrac{10}{9})$	$x = 34cos16°$	$x = tan67° × 6$

Given this …

12

58°

12 sin 32°

32°

12 sin 58°

… complete these:

17 43°

47°

9 55°

26°

31

29° 67

5 sin 36°

One of the angles is 67°

¼ sin ☐

Fluency Practice

A1 Find length *AB*
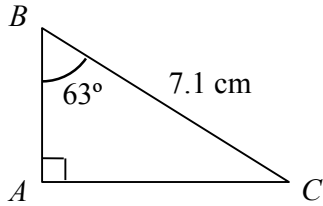
A2 Find length *AB*
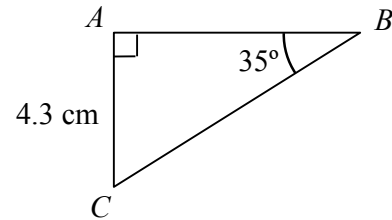
A3 Find angle *BAC*
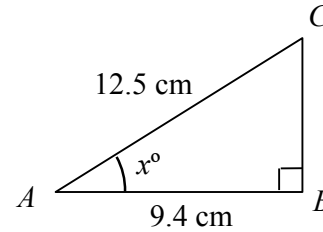
A4 Find length *AC*
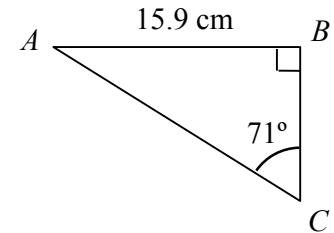
B1 Find angle *ACB*
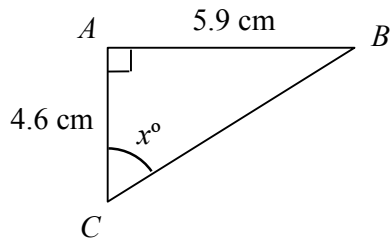
B2 Find length *BC*
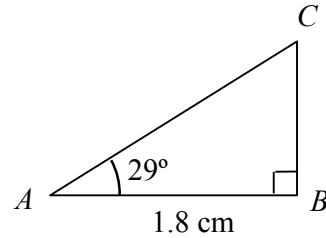
B3 Find length *AC*
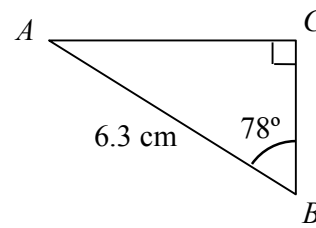
B4 Find angle *ACB*
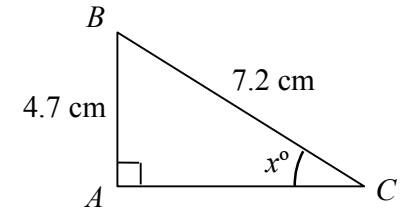
C1 Find length *CD*
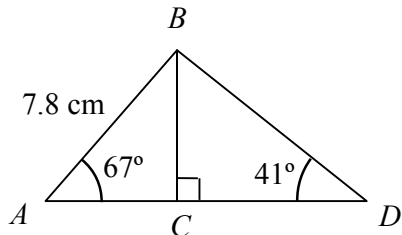
C2 Find angle *CBD*
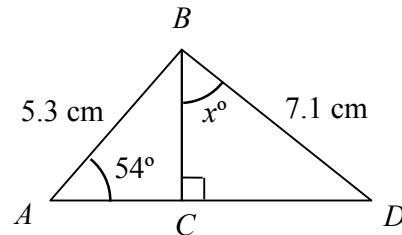
C3 Find angle *BAC*

C4 Find length *CD*

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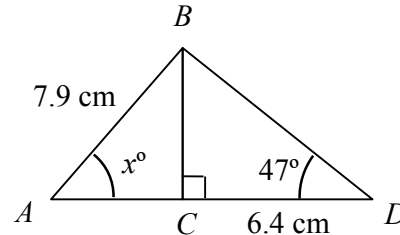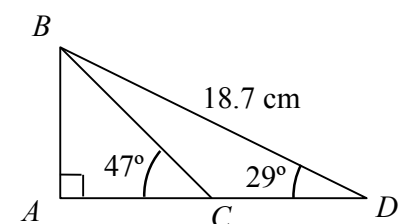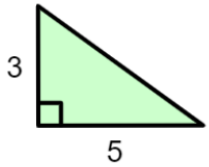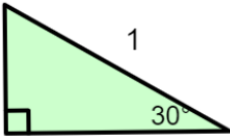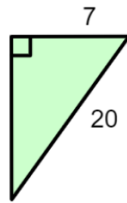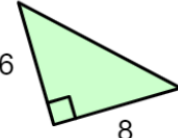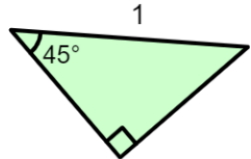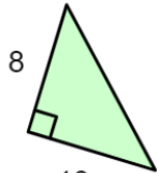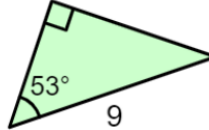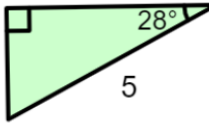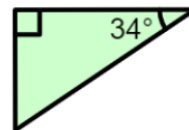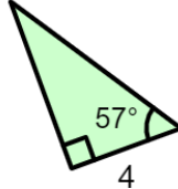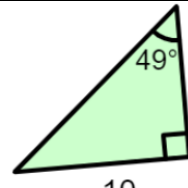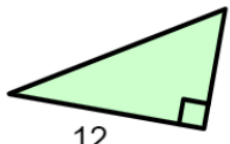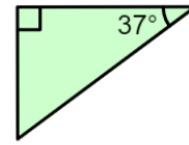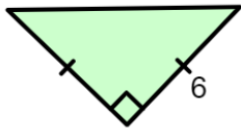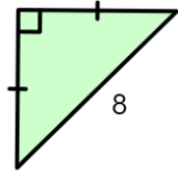
Fluency Practice

PERPLEXING PERIMETERS?

Work out the perimeter of each triangle to 2 d.p. Cross of your answers from those on the right as you go.

A	B	C	D
3, 5	1, 30°	7, 20	6, 8

E	F	G	H
1, 45°	8, 10	53°, 9	28°, 5

I	J	K	L
4, 34°	57°, 4	49°, 10	12, 9

M	N	O	P
8, 37°	6	12	8

2.37

2.41

11.76

13.83

17.08

17.50

19.31

20.49

21.60

24

24.05

30.81

31.94

36

40.97

45.73

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Pythagoras, Trigonometry or Angles? Interleaved Practice

These resources have been used as AO1 practice for revision of right-angled triangles, but primarily as interleaved practice with simple figures leading students to making decisions about whether or not we need Pythagoras, trigonometry or angle sums to 180°

Prior knowledge needed:
- Sum of interior angles in a triangle is 180°
- Using Pythagoras' theorem to find hypotenuse and catheti
- Using the three main trigonometric ratios to calculate side lengths and angles
- Basic notation conventions that demonstrate equal length sides

Sheet 1: Mixture of different right-angled triangles with
Sheet 2: Some of the triangles are the same but asking about a different aspect of it to alter the maths applied to find the answer

[All solutions have been provided to 2 decimal places]

Fluency Practice

a — right triangle: 10mm (hypotenuse), 6mm (base)

b — right triangle: 6cm, 50°

c — triangle: 70°, 8m

d — right triangle: 50°

e — right triangle: 35°, 15ft

f — right triangle: 15°

g — right triangle: 2.5ft, 2ft

i — right triangle: 10m, 24m, 25m

j / k — quadrilateral with marked sides: 10mm

m — right triangle: 40°, 12cm

n — right triangle: 6m, 7m

p / q — triangle: 12cm, 13cm, 2cm

r — right triangle: 10m, 15m, 25m

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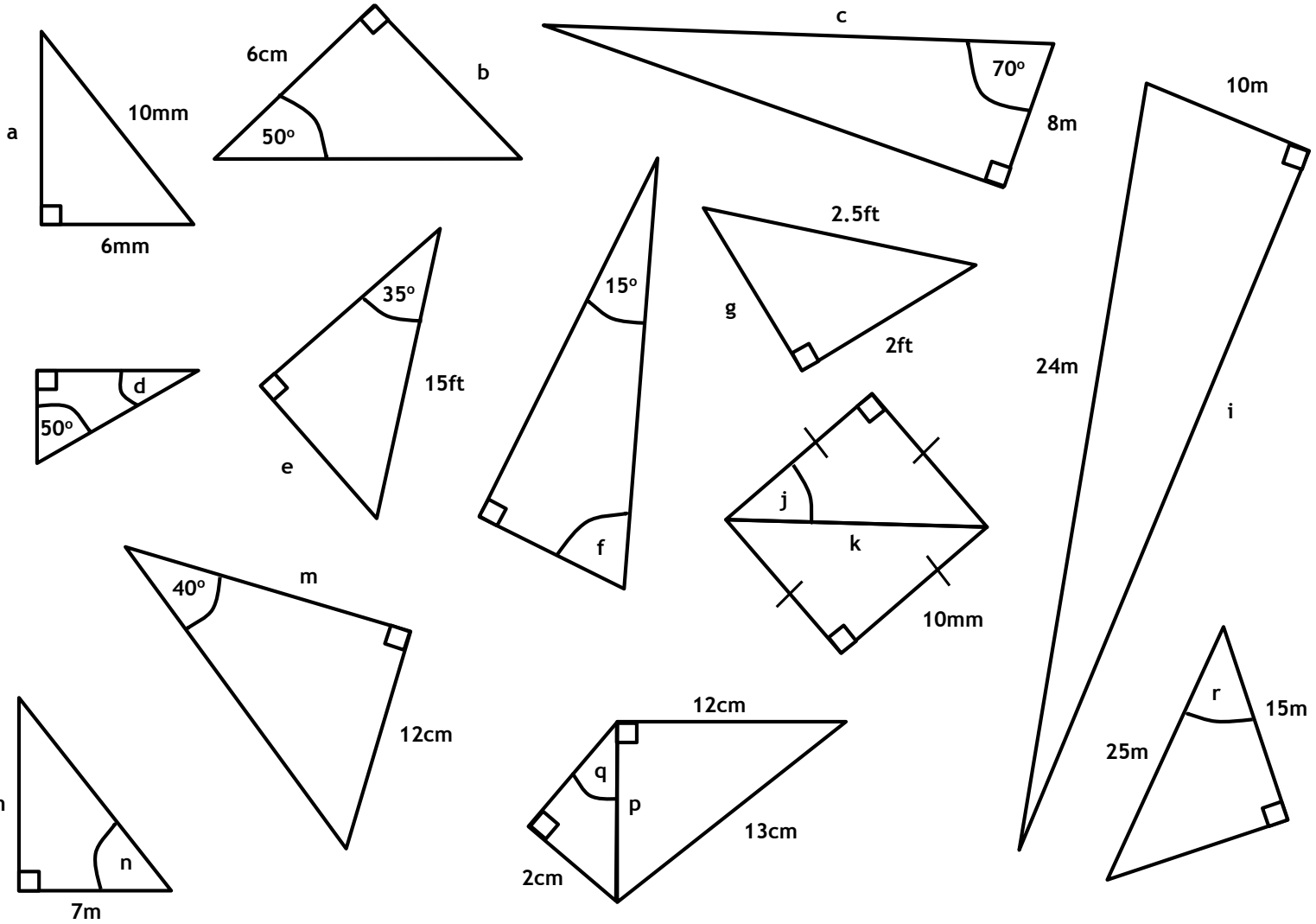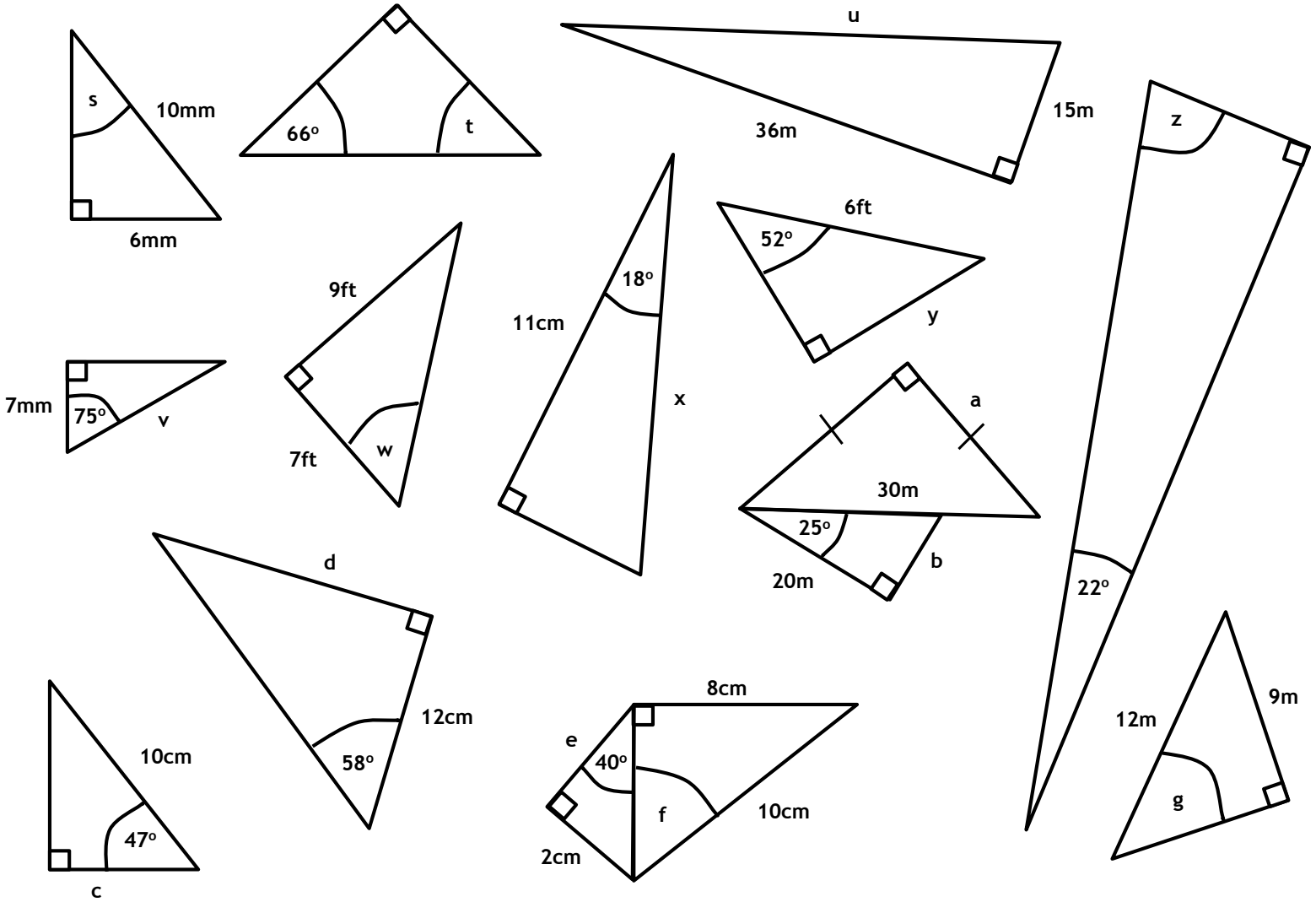
Fluency Practice

Question 1: Convert the times from hours/minutes into hours, without a calculator.
e.g. 1   45 minutes = 0.75 hours
e.g. 2   1 hour 30 minutes = 1.5 hours

(a) 15 minutes   (b) 30 minutes   (c) 45 minutes
(d) 20 minutes   (e) 40 minutes   (f) 2 hours 30 minutes
(g) 1 hour 15 minutes   (h) 3 hours 45 minutes   (i) 2 hours 40 minutes
(j) 5 hours 30 minutes   (k) 7 hours 20 minutes   (l) 4 hours 15 minutes

Question 2: Convert the times from hours/minutes into hours.
            You may use a calculator if needed.

(a) 18 minutes   (b) 54 minutes   (c) 1 hour 3 minutes
(d) 1 hour 36 minutes   (e) 2 hours 48 minutes   (f) 2 hours 33 minutes
(g) 8 hours 51 minutes   (h) 3 hours 21 minutes   (i) 27 minutes

Question 3: Convert the times from hours/minutes into hours.
            Give each answer to 3 decimal places.

(a) 44 minutes   (b) 8 minutes   (c) 1 hour 50 minutes
(d) 2 hours 10 minutes   (e) 4 hours 26 minutes   (f) 3 hours 29 minutes
(g) 5 hours 2 minutes   (h) 2 hours 55 minutes   (i) 59 minutes

Question 4: Convert the times from hours into hours/minutes, without a calculator.

(a) 0.75 hours   (b) 1.25 hours   (c) 5.5 hours
(d) 1.3333... hours   (e) 2.6666... hours   (f) 10.75 hours
(g) 3.25 hours   (h) 0.5 hours   (i) 22.3333... hours

Question 5: Convert the times from hours into hours/minutes.
            You may use a calculator if needed.

(a) 0.7 hours   (b) 0.1 hours   (c) 0.9 hours
(d) 1.3 hours   (e) 3.6 hours   (f) 6.7 hours
(g) 0.85 hours   (h) 1.15 hours   (i) 3.45 hours

Question 6: Convert the times from hours into hours/minutes.

(a) 0.93333... hours   (b) 0.48333... hours   (c) 1.06666... hours
(d) 2.73333... hours   (e) 3.68333... hours   (f) 2.18333... hours
(g) 8.01666... hours   (h) 4.46666... hours   (i) 1.76666... hours

Fluency Practice

Question 11: Change the following speeds into metres per second.

(a) 360km/h   (b) 18km/h   (c) 36km/h   (d) 72km/h
(e) 10 km/h   (f) 40km/h   (g) 2 km/h   (h) 4.5km/h

Question 12: Change the following speeds into kilometres per hour.

(a) 45m/s   (b) 15m/s   (c) 20m/s   (d) 4m/s
(e) 1m/s   (f) 0.5m/s   (g) 0.2m/s   (h) 300m/s

Question 13: Change these speed into kilometres per hour

(a) 10mph   (b) 40mph   (c) 25 mph   (d) 200mph
(e) 8mph   (f) 2mph   (g) 10.5mph   (h) 24.6mph

Question 14: Change these speed into miles per hour

(a) 32km/h   (b) 48km/h   (c) 24km/h   (d) 800km/h
(e) 16km/h   (f) 0.64km/h   (g) 16000km/h   (h) 2400000km/h

Fluency Practice

Question 1: Calculate the average speeds for each of the following, without using a calculator.

(a) A car travels 60 miles in 2 hours   (b) A lorry travels 120 miles in 3 hours
(c) A cyclist travels 45 miles in 5 hours   (d) A jogger travels 30km in 4 hours
(e) A runner runs 100 metres in 10 seconds   (f) A car travels 195 miles in 3 hours
(g) A helicopter travels 425 miles in 5 hours   (h) A helicopter flies 840 miles in 7 hours
(i) A dog runs 216 metres in 12 seconds   (j) An airplane travels 984 miles in 6 hours
(k) A bird flies 19 miles in 2 hours   (l) A car travels 600km in 8 hours

Question 2: Calculate the average speeds for each of the following, without using a calculator.

(a) A car travels 20 miles in 30 minutes   (b) A lorry travels 32 miles in 30 minutes
(c) A bird flies 17 kilometres in 30 minutes   (d) A man jogs 2 kilometres in 15 minutes.
(e) A helicopter flies 18 miles in 15 minutes   (f) An F1 car travels 32 miles in 15 minutes.
(g) A dog runs 3 kilometres in 10 minutes   (h) A jet travels 23 miles in 6 minutes.
(i) A car travels 12 miles in 20 minutes   (j) A car travels 9 miles in 12 minutes
(k) A motorcycle travels 36 miles in 40 minutes (l) A car travels 27 kilometres in 45 minutes.

Question 3: Calculate the average speeds for each of the following.

(a) A car travels 63 miles in 1 hour 30 minutes
(b) A man runs 15 miles in 2 hours 30 minutes
(c) A helicopter flies 238 miles in 3 hours 30 minutes
(d) A car travels 85.5 miles 2 hours 15 minutes
(e) An airplane flies 315 kilometres in 1 hour 45 minutes
(f) A lorry travels 351 miles in 6 hours 45 minutes
(g) A car drives 154 miles in 2 hours 20 minutes
(h) A helicopter flies 160 kilometres in 1 hour 40 minutes

Question 4: Calculate the average speeds for each of the following.

(a) A man jogs 6 miles in 1 hour 12 minutes
(b) A motorcycle drives 130 miles in 2 hours 36 minutes
(c) A helicopter flies 152 miles in 1 hour 54 minutes
(d) A plane travels 1272 kilometres in 5 hours 18 minutes
(e) A car travels 98 miles in 2 hours 27 minutes
(f) A rocket travels 750 miles in 3 minutes
(g) A car travels 6.4 miles in 7 minutes. Give your answer to 2 decimal places.
(h) A ship sails 105 miles in 4 hours 28 minutes. Give your answer to 2 decimal places.
(i) A plane travels 400 miles in 1 hour 55 minutes. Give your answer to 2 decimal places.
(j) A car drives 500 kilometres in 7 hours 13 minutes. Give your answer to 2 decimal places.

Speed, Distance, Time
Videos 299 on Corbettmaths

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Corbett maths

Question 5:   Calculate how far each of the following travels.

(a) A car travels at a speed of 50mph for 3 hours.
(b) A plane flies at a speed of 230 kilometres per hour for 2 hours.
(c) A lorry drives for 4 hours at a speed of 45 miles per hour.
(d) A man runs at a speed of 8 metres per second for 15 seconds.
(e) A helicopter flies for 8 hours at a speed of 80 miles per hour.
(f) A dog runs at a speed of 15 m/s for 20 seconds.
(g) A car travels at a speed of 48 mph for 3 hours.
(h) A truck travels at a speed of 29 mph for 5 hours.

Question 6:   Calculate the distance travelled by each of the following.

(a) A car drives at a speed of 60mph for 30 minutes.
(b) A taxi travels for 30 minutes at a speed of 28 mph.
(c) A car travels at a speed of 44mph for 15 minutes.
(d) A lorry drives at a speed of 51mph for 20 minutes.
(e) An airplane travels at a speed of 441mph for 20 minutes.
(f) A car drives at a speed of 48mph for 45 minutes.
(g) A helicopter flies at a speed of 72miles per hour for 10 minutes
(h) A bird flies for 40 minutes at a speed of 60 kilometres per hour.

Question 7:   Work out the distance travelled by each of the following.

(a) A car drives at a speed of 40mph for 1 hour 30 minutes
(b) A bird flies at a speed of 32 kilometres per hour for 1 hour 30 minutes
(c) A lorry travels for 2 hours 30 minutes at a speed of 52 mph
(d) A F1 race car drives for 1 hour 15 minutes at a speed of 124 mph
(e) A helicopter flies at a speed of 104 mph for 1 hour 45 minutes
(f) A car drives at a speed of 58 mph for 3 hours 15 minutes
(g) A man runs at 6 mph for 1 hour 24 minutes
(h) A car drives for 2 hours 54 minutes at a speed of 50 mph
(i) A plane flies at a speed of 306 kilometres per hour for 3 hours 20 minutes
(j) A hot air balloon flies at a speed of 18 mph for 1 hour 40 minutes
(k) A bird flies for 4 hours 36 minutes at a speed of 40 kilometres per hour.
(l) A helicopter travels at 98mph for 5 hours 6 minutes.
(m) A car travels at 40 mph for 1 hour 7 minutes. Give your answer to 2 decimal places.
(n) A lorry drives at 65 mph for 2 hours 19 minutes. Give your answer to 2 decimal places.
(o) A car drives at 70 mph for 44 minutes. Give your answer to 2 decimal places.
(p) A car drives at 32 mph for 1 minute. Give your answer to 2 decimal places.

Question 8: Work out the distance travelled by each of the following.

(a) A runner runs at a speed of 8m/s for 2 minutes
(b) A jog runs at a speed of 4m/s for 10 minutes.
(c) A car drives at 60mph for 90 seconds.
(d) A lorry drives at 30 mph for 150 seconds.

Question 9:   Work out how long each of the journeys take.

(a) A car drives 120 miles at a speed of 40 mph.
(b) A lorry drives 250 miles at a speed of 50 mph.
(c) A bird flies 330 kilometres at a speed of 55 kilometres per hour.
(d) An object travels 48 miles at speed of 16 mph.
(e) A man runs 240 metres at a speed of 6m/s
(f) A dog runs 168 metres at a speed of 12m/s
(g) A lorry travels 240 miles at a speed of 60mph.
(h) A helicopter travels 345 miles at speed of 115 mph.
(i) A plane travels at a speed of 250 mph and covers a distance of 2250 miles.

Question 10: Calculate how long each journey lasts.
                    Give each answer in hours and minutes.

(a) A car travels 100 miles at a speed of 40mph.
(b) A lorry travels 90 miles at a speed of 60 mph.
(c) A bus drives at a speed of 48mph and covers a distance of 60 miles.
(d) A helicopter flies 105 kilometres at a speed of 140 km/h
(e) A bird covers a distance of 95 miles at a speed of 20 miles per hour.
(f) A car travels at 50 mph and covers a distance of 110 miles.
(g) A lorry drives a distance of 452.4 kilometres at a speed of 52 km/h.
(h) A bird flies 80 miles at a speed of 15 miles per hour
(i) A ship sails 208 miles a speed of 24 miles per hour
(j) A jet flies at a speed of 480km/h and covers a distance of 2088 kilometres
(k) A racing car drives 256 miles at a speed of 120 mph
(l) A helicopter flies 764 kilometres at a speed of 80 km/h

Question 11: Change the following speeds into metres per second.

| (a) 360km/h | (b) 18km/h | (c) 36km/h | (d) 72km/h |
| (e) 10 km/h | (f) 40km/h | (g) 2 km/h | (h) 4.5km/h |

Question 12: Change the following speeds into kilometres per hour.

| (a) 45m/s | (b) 15m/s | (c) 20m/s | (d) 4m/s |
| (e) 1m/s | (f) 0.5m/s | (g) 0.2m/s | (h) 300m/s |

Question 13: Change these speed into kilometres per hour

| (a) 10mph | (b) 40mph | (c) 25 mph | (d) 200mph |
| (e) 8mph | (f) 2mph | (g) 10.5mph | (h) 24.6mph |

Question 14: Change these speed into miles per hour

| (a) 32km/h | (b) 48km/h | (c) 24km/h | (d) 800km/h |
| (e) 16km/h | (f) 0.64km/h | (g) 16000km/h | (h) 2400000km/h |

1. A bus travels 222 miles in 6 hours.
   What was the average speed of the bus?

2. Thomas drives 130 miles at an average speed of 40 mph.
   How long does the journey take Thomas?

3. A jumbo jet flies at 484 mph for 4 hours 30 minutes.
   How far does the jet travel?

4. Greg and Kevin both travel between two towns that are 90 miles apart.
   Greg drives and it takes him 1 hour 30 minutes.
   Kevin cycles and it takes him 7 hours 30 minutes.
   Work out the difference between their average speeds?

5. Harry catches the train from Belfast to Dublin at 4pm.
   The average speed of the train is 70mph and the distance from Belfast to Dublin is
   105 miles.
   What time does Harry arrive in Dublin?

6. The distance from Sunderland to Wigan is 150 miles.
   Mollie leaves Sunderland in her car at 07:50.
   Her average speed on the journey is 60mph.
   What time does she arrive in Wigan?

7. Jenny drives from Paris to Rochefort, a distance of 483 km
   Her average speed on the journey is 84 km/h.
   She leaves at 9:50pm.
   What time does she arrive in Rochefort?

8. Philip runs at an average speed of 4 m/s.
   How long will it take Philip to complete a 10 kilometre race?
   Give your answer in minutes and seconds.

9. A car travels for 4 hours at an average speed of 45 mph and then 6 hours at an average
   speed of 35 mph.
   (a) Work out the total distance travelled.
   (b) Work out the average speed for the entire journey.

10. David cycles at 20mph for 1¼ hours, then at 16mph for 2 hours and then 12mph for
    45 minutes.
    (a) Work out the total distance travelled.
    (b) Work out the average speed for the entire journey.

11. Mr Jenkins catches the 11:45am bus from London to Glasgow.
    The distance between the two cities is 407 miles.
    The bus travels at an average speed of 55mph.
    What time should he arrive in Glasgow?

12. Michael drives 143 miles from town A to town B in 2 hours 36 minutes.
    He then drives from town B to town C at the same speed and it takes 21 minutes.

    (a) Work out Michael's average speed from town A to town B.
    (b) How far did Michael travel, in total, from town A to town C?

13. The distance from Junction 19 to Junction 20 on a motorway is 14 miles.
    Bethany drove the distance in 15 minutes.
    Max drove the distance at a speed of 52mph.
    Who was faster?

14. The distance from Swindon to a village is 40 miles.
    Vicky drives from the village to Swindon at 60 mph.
    Charlie drives from the village to Swindon at 50mph.
    Work out how much longer the journey takes Charlie.
    Give your answer in minutes.

15. Miss Black completes a journey in 3 stages.
    In stage 1, she drives at a speed of 40km/h for 45 minutes.
    In stage 2, she drives at 60 km/h for 2 hours 9 minutes.
    Altogether, over the 3 stages, Miss Black drives 171.6km in 3 hours 15 minutes
    What is her average speed, in km/h, in stage 3?

16. The speed limit on a road is 40mph.
    A scooter drives 9 miles in 13 minutes.
    Is the scooter breaking the speed limit?

Extension

(1) A Peregrine Falcon flies 14 miles horizontally in 15 minutes.
What is the average speed in miles per hour?

(2) When it is diving the Peregrine Falcon goes much faster, at 4.5 miles in 1 minute.
How fast is this in miles per hour?

(3) A Cheetah runs at an average speed of 72 mph for 20 minutes.
How far did it travel?

(4) A Mako Shark takes 10 minutes to travel 10 miles.
What is the average speed?

(5) A Sea Horse travels at 0.01 mph.
How long (in days and hours) will it take to travel a mile?

(6) A Sailfish, the fastest fish, travels 22.73 miles in 20 minutes.
How fast does it travel in mph?

(7) A snail works hard to travel 0.01 miles in 1 minute.
How fast does it go in mph?

(8) Sound travels at nearly 1200 mph.
How far does it travel in 5 minutes?

(9) A jet aircraft travels 36.5 miles every minute.
How fast is this in mph?

(10) A car runs at an average speed of 42 mph on a fairly built up motorway.
How far will it go at this speed in 1 hour 10 minutes?

speed 1

Extension

speed 2

Shrewsbury in Shropshire
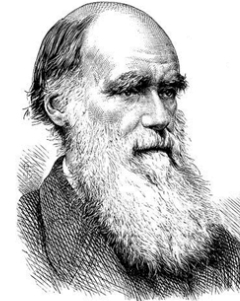
(1) How far is Stoke on Trent away if an escaped horse, travelling at an average speed of 13 mph takes 3 hours to get there?

(2) How far is it to London if it takes 3 hours at an average speed of 54 mph?

(3) A runner goes to Chester, 40 miles away, at an average speed of 8 mph.
How long does it take them?

(4) How long does it take a cyclist riding at an average speed of 12mph to travel to Aberystwyth, 72 miles away?

(5) How long does it take to travel to Telford, 15 miles away at an average speed of 45 mph?

(6) How long does it take to get to Hereford, 54 miles away at an average speed of 36 mph?

(7) How long does it take to get to Wolverhampton, 32 miles away, travelling at an average speed of 48 miles per hour?

(8) What is the average speed of a truck that goes to Birmingham, 48 miles away, in 1hr 30 mins?

(9) What is the average speed of a lorry which travels to Gloucester, 80 miles away, in 2.5 hours?

(10) A very old car takes 3hours 18 mins to get to Liverpool, 66 miles away. What is the average speed of the car? How long would it take at this speed to get to Manchester, 74 miles away?

Extension

speed 3

speed = distance ÷ time

1.6 km/h = 1 mph
1 km/h = 0.62 mph
1 km/min = 37.2 mph
50 km/h = 31 mph

m/sec × 60 = m/min
m/min × 60 = m/hr
m/hr ÷ 1000 = km/hr
km/hr × 0.62 = mph

use a calculator to work out the speeds, in mph, of the world records for:

(1) Women's 2000m of 325.36 seconds.
(2) Men's 100m of 9.58 seconds.
(3) Men's 100 metres freestyle swimming competition of 46.91 seconds.
(4) Women's 100 metre Breaststroke competition of 64.45 seconds.
(5) Men's 20,000m walk of 4645.6 seconds.
(6) Women's 100 metres hurdles of 12.21 seconds.
(7) Men's 200 metres butterfly of 111.51 seconds.
(8) Men's 10,000 metres of 26 minutes and 17.53 seconds.
(9) Men's 50km walk of 3 hours, 34 mins and 14 seconds.
(10) Women's 20km walk of 1 hour, 2 mins and 36 seconds.

Question 1:   Work out the density of each of the following.
             State the units of each answer.

(a)   A piece of wood has a mass of 7g and a volume of 10cm^3

(b)   A rod of aluminium has a mass of 575.4g and a volume of 210cm^3

(c)   A piece of nickel has a mass of 3.48kg and a volume of 400cm^3

(d)   An iron statue with volume of 0.05m^3 and a mass of 394kg

(e)   2.1m^3 of oil with a mass of 1775kg

Question 2:   Work out the mass of each of the following.
             State the units of each answer.

(a)   A statue with a volume of 120cm^3 made from ceramic which has a density of 2g/cm^3.

(b)   A rod with a volume of 50cm^3 made from copper which has a density of 8.9g/cm^3.

(c)   A block with a volume of 1.8m^3 made from silver which has a density of 10490kg/m^3

(d)   A statue with a volume of 3m^3 made from zinc which as a density of 7.14g/cm^3

(e)   2800cm^3 of butter which has a density of 911kg/m^3

Question 3:   Work out the volume of each of the following.
             State the units of each answer.

(a)   A 50g piece of wood which has a density of 0.4g/cm^3

(b)   A 770g block made of brass which has a density of 8.67g/cm^3

(c)   A 4kg sheet of glass which has a density of 2.42g/cm^3

(d)   80kg of rye which has a density of 720kg/m^3

(e)   5 tonnes of gold which has a density of 19300kg/m^3

Question 1:   A cube of ice has side length of 5cm.
              The mass of the cube of ice is 114.5g.

              Find the density of ice.
              Give your answer in g/cm^3

Question 2:   Shown is a solid cylinder made from carbon.
              The density of carbon is 1.95g/cm
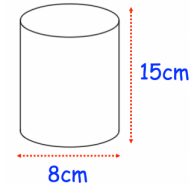
              Find the mass of the cylinder.

15cm

8cm

Question 3:   The mass of 4m^3 of silver is 41960kg.
              The density of gold is 19300kg/m^3.

              Calculate the difference in mass between 5m^3 of silver and 5m^3 of gold.

Question 4:   Beverley is building a toy boat.
              If wood has a density under 1g/cm^3, it will float.
              She has a choice of three different pieces of wood.

              Piece 1:   volume = 400cm^3 and   mass = 450g.

              Piece 2:   volume = 0.02m^3 and   mass = 8kg

              Piece 3:   volume = 1000cm^3 and   mass = 1.03kg

              Which piece of wood is the most suitable?

Question 5:   Material A has a density of 4.5g/cm^3.
              Material B has a density of 14g/cm^3.

              5kg of Material A and 200g of Material B form Material C.

              Work out the density of Material C.

12cm

Could these two cuboids be made of the same material?

2cm

1cm

6cm

4cm

2cm

3cm
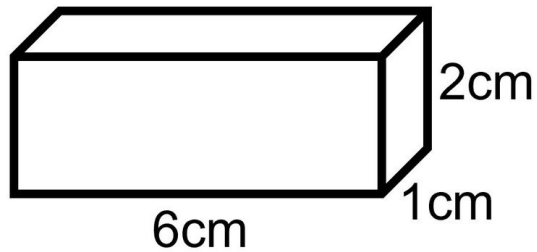
Mass = 60 g
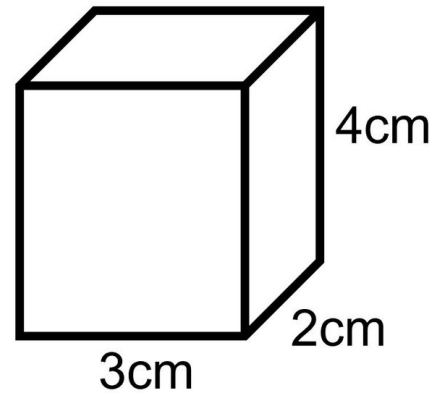
Mass = 120 g

Maths Venns

Volume > 600 cm^3

Density < 1g/cm^3

A

D

B

G

F

E

C

H
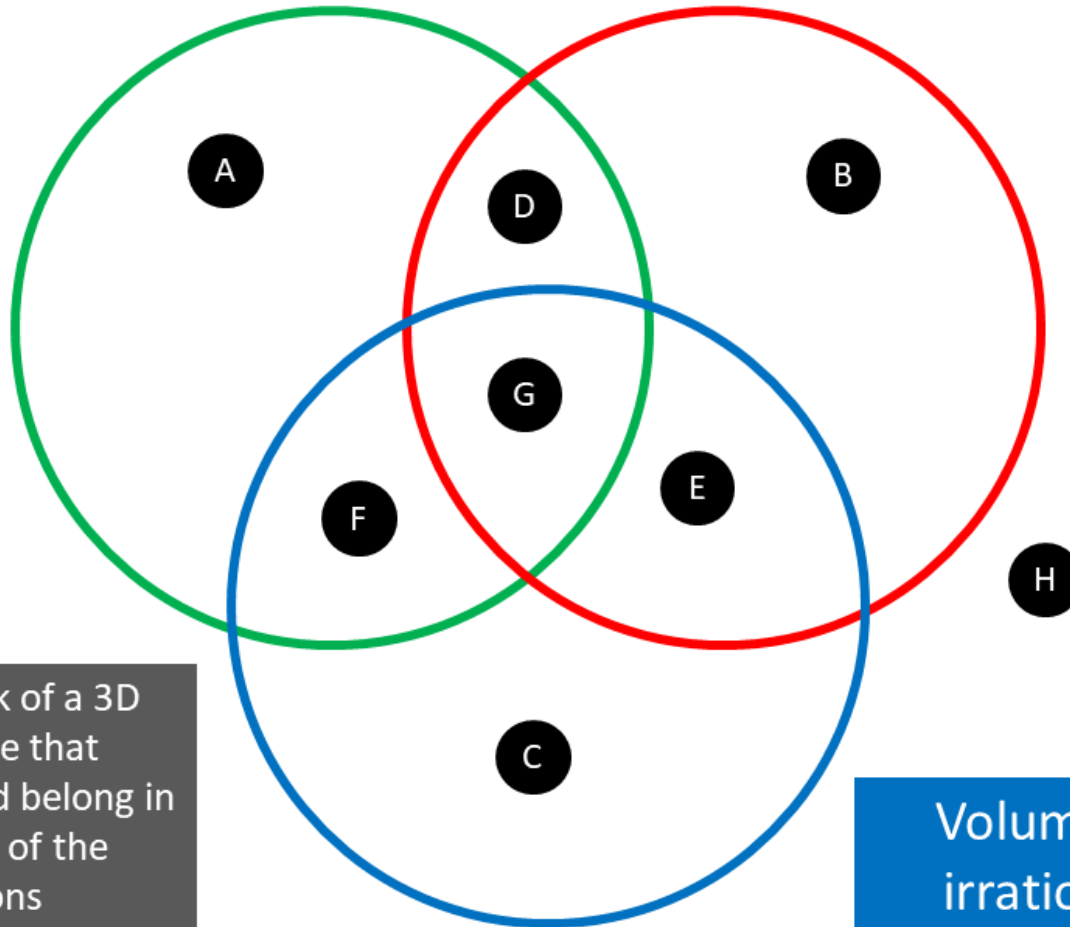
If you think a region is impossible to fill, convince me why!

Think of a 3D shape that could belong in each of the regions

Volume is irrational

Question 1:   Work out the pressure for each of the following.
              Give suitable units for each answer.

(a)   A box is placed on a table and exerts a force of 250N on an area of 20cm²

(b)   An object is placed on the ground and exerts a force of 3000N on an area of 4m²

(c)   An object is placed on the ground and exerts a force of 54N on an area of 0.5cm²

(d)   A box is placed on a table and exerts a force of 124 newtons on an area of 10.5cm²

(e)   An object is placed on the ground and exerts a force of 25958N on an area of 1.4m²

Question 2:   Work out the force for each of the following.
              In each case a box has been placed on the floor.

(a)   The area of contact is 16cm² and the pressure exerted is 10N/cm²

(b)   The area of contact is 1.5m² and the pressure exerted is 5000N/m²

(c)   The area of contact is 660cm² and the pressure exerted is 8.2N/cm²

(d)   The area of contact is 0.2m² and the pressure exerted is 1.2N/cm²

(e)   The area of contact is 500cm² and the pressure exerted is 450000N/m²

Question 3:   Work out the area of contact for each of the following.
              In each case an object has been placed on the floor.
              Give suitable units for each answer.

(a)   The object exerts a force of 420N on the floor and the pressure on the floor is 20N/cm²

(b)   The object exerts a force of 8590N on the floor and the pressure on the floor is 900N/m²

(c)   The object exerts a force of 30N on the floor and the pressure on the floor is 600N/m²

(d)   The object exerts a force of 3945N on the floor and the pressure on the floor is 200N/cm²

Question 1: Find the pressure exerted by a force of 180 newtons on an area of 50cm².
Give your answer in newtons/m²

Question 2: A cylinder is placed on a table.
The cylinder has a weight of 400N and has a diameter of 10cm.

Work out the pressure on the table in newtons/cm²

Question 3: Two cubes are placed on a table.
One cube has a side length of 4cm and the other cube has a cube length of 10cm.

The weight of the smaller cube is 50N and the weight of the large cube is 250N

Which cube exerts a greater pressure on the table?

Question 4: A microwave is placed on a worktop.

The area of the microwave in contact with the table is 600cm².
The pressure of the microwave is 2450 Newtons/m².

Work out the force exerted by the microwave on the worktop.

Question 5: The pressure of a tyre is 32 pounds per square inch.

Given   1 pound = 0.4536 kilograms
             1 inch = 2.54 centimetres

Work out the pressure in grams per square centimetre.