Year 7
Mathematics
Unit 6 – Student

Name: _____

Class: _____

Contents

1 Sets and Venns

1.1 Sets

A set is a collection of numbers, or letters, or symbols, or objects, etc., which are related in some way.

The items in a set are called '**members**' or '**elements**'

Curly brackets (often called 'braces') are usually used when listing or describing sets – this helps to distinguish sets from lists of unrelated items.

The elements within a set are usually described in words or listed

Examples:

Description in words	**List of elements**
{even numbers less than 11}	{2, 4, 6, 8, 10}
{the first five prime numbers}	{2, 3, 5, 7, 11}
{multiples of three between 10 and 20}	{12, 15, 18}
{factors of 27 which are even}	{ }

More examples of sets:

Description in words	**List of elements**
{quadrilaterals with four equal length sides}	{square, rhombus}
{vowels}	{a, e, i, o, u}
{letters in the word 'banana'}	{a, b, n}
{yellow fruit}	{grapefruit, banana, lemon, …}

Notes:

Elements are only ever included once – as shown with {letters in the word 'banana'} = {a, b, n}

{yellow fruits} is an imprecise description and the list of elements contains only examples.

Worked Example

List the following sets:

a) {factors of 15}

b) {the first four square numbers}

c) {letters in the word LONDON}

d) {possible outcomes when an ordinary coin is thrown}

Fluency Practice

A1 List {vowels}	**A2** List {the first six consonants}	**A3** List {vowels in the word 'NUMBER'}	**A4** List {consonants in the word 'MATHS'}
B1 List {vowels in the word 'ALGEBRA'}	**B2** List {consonants in the word 'SETS'}	**B3** List {letters in the word 'ISOSCELES'}	**B4** List {vowels in 'SQUARE ROOT'}
C1 List {days of the week}	**C2** List {seasons in the year}	**C3** List {colours in the rainbow}	**C4** List {countries in the United Kingdom}
D1 List {first three months of the year}	**D2** List {months of the year with four letters}	**D3** List {months of the year beginning with 'A'}	**D4** List {days of the week which contain an 'E'}
E1 Describe the following set: {spring, summer}	**E2** Describe the following set: {square, rhombus}	**E3** Describe the following set: {north, east, south, west}	**E4** Describe the following set: {orange, yellow, indigo, violet}

1.2 Multiple Sets

When we have more than one set, capital letters are usually used to represent them.

Examples:

Description in words	**List of elements**
A = {prime numbers between 10 and 20}	A = {11, 13, 17, 19}
B = {factors of 24}	B = {1, 2, 3, 4, 6, 8, 12, 24}
C = {vowels}	C = {a, e, i, o, u}

Note that it is often convenient to use letters that are in some way connected to the description of the set.

e.g. P = {prime numbers between 10 and 20}, F = {factors of 24} and V = {vowels}

Universal Set

The Universal set is the set of all elements under consideration.

Elements that can be in other sets are restricted to those within the Universal set. For example, if the Universal set was {integers less than 10}, then {prime numbers} would be limited to {2, 3, 5, 7}.

Likewise if the Universal set was {even numbers}, then {factors of 18} would be {2, 6, 18}

Notation

In Britain the special symbol '$\mathcal{E}$' is used to represent the Universal set but in some countries, such as America, the letter 'U' is used.

Thus we could write

$\mathcal{E}$ = {integers less than 10} or $\mathcal{E}$ = {prime numbers}

Worked Example

a) U = {odd numbers less than 15}
A = {prime numbers}
B = {multiples of 3}
List:
i) A
ii) B

b) U = {first 10 letters of the alphabet}
X = {vowels}
Y = {letters in the word 'ENGLISH'}
List:
i) X
ii) Y

c) U = {factors of 24}
P = {prime numbers}
E = {even numbers}
O = {odd numbers}
List:
i) P
ii) E
iii) O

A1 List {the first six multiples of 3}	**A2** List {prime numbers less than 10}	**A3** List {all the factors of 12}	**A4** List {even numbers between 3 and 11}
B1 Describe the set: {1, 2, 3, 4, 5}	**B2** Describe the set: {1, 3, 5, 7, 9}	**B3** Describe the set: {1, 2, 3, 6, 9, 18}	**B4** Describe the set: {11, 13, 17, 19}
C1 A = {positive integers less than 5} List set A	**C2** B = {negative integers more than 6} List set B	**C3** C = {integers between 4 and 9} List set C	**C4** D = {integers between –3 and 4} List set D
D1 M = {the first five multiples of 6} List set M	**D2** F = {all the factors of 20} List set F	**D3** P = {the first six prime numbers} List set P	**D4** S = {square numbers less than 20} List set S
E1 A = {factors of 20} B = {1, 2, 5, 10, 20} Are the sets A and B the same?	**E2** C = {first five multiples of 7} D = {7, 14, 21, 27, 35} Are the sets C and D the same?	**E3** E = {prime numbers less than 20} F = {the first nine prime numbers} Are the sets E and F the same?	**E4** G = {numbers on a dice} H = {positive integers less than 7} Are the sets G and H the same?

Fluency Practice

Describe these sets in words.

(a) {4, 8, 12, 16, 20, 24, 28}

(b) {1, 4, 9, 16, 25}

(c) {Europe, Asia, Africa,…}

(d) {1, 2, 3, 4, 6, 12}

List the elements of the sets:

(a) Multiples of 7 less than 30

(b) Months of the year

(c) Factors of 25

$A = \{factors\ of\ 6\}$

$B = \{prime\ numbers\ less\ than\ 20\}$

$C = \{integers\ from\ 1\ to\ 10\}$

(a) List the elements of A

(b) List the elements of B

(c) List the elements of C

1.3 Venns

Starter

How could we categorise (group) these animals?

List 5 ways in your book.

Starter



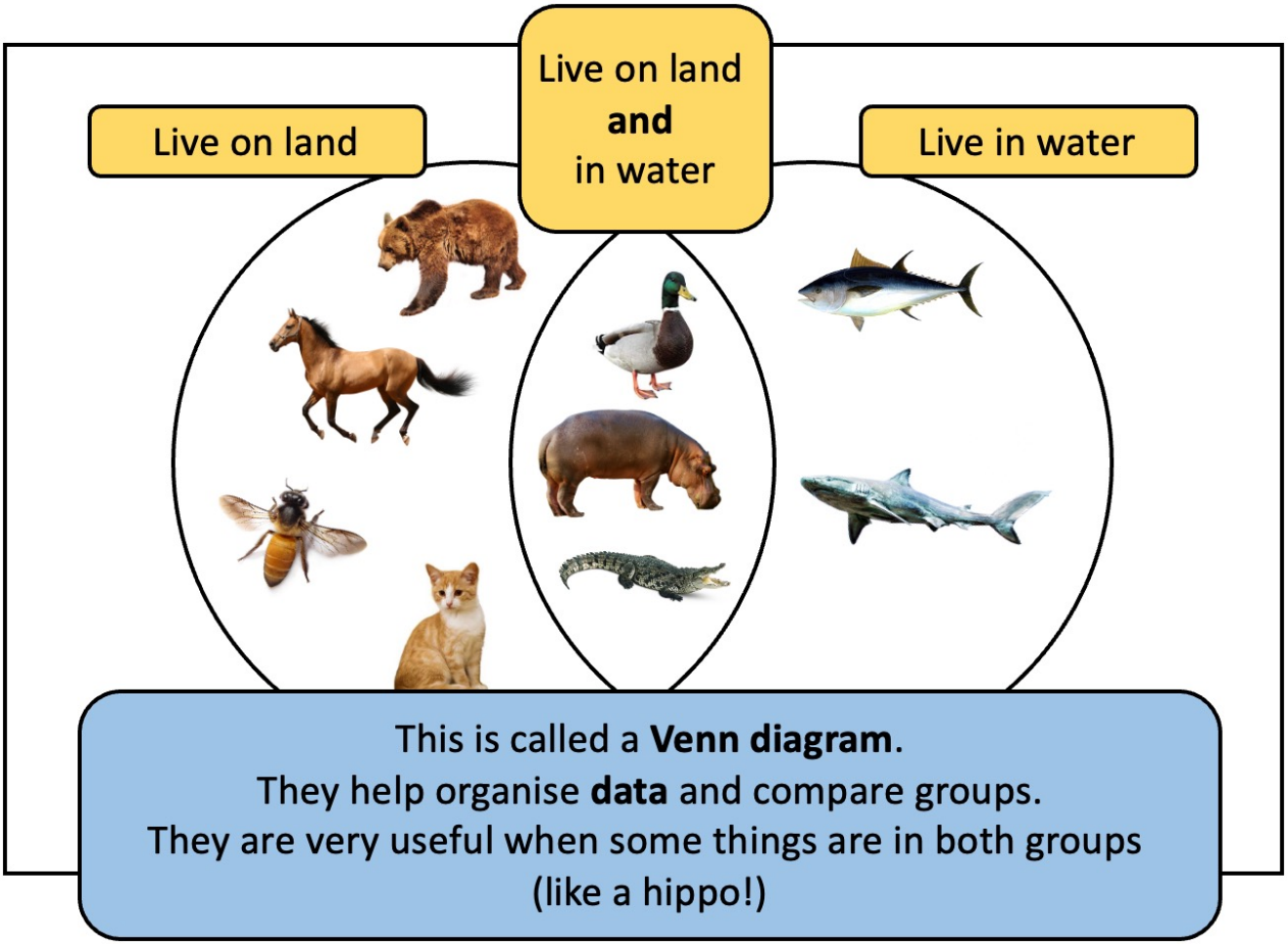

Live on land


Live in water

Which group would these animals go into?



1.4 Venn Diagrams

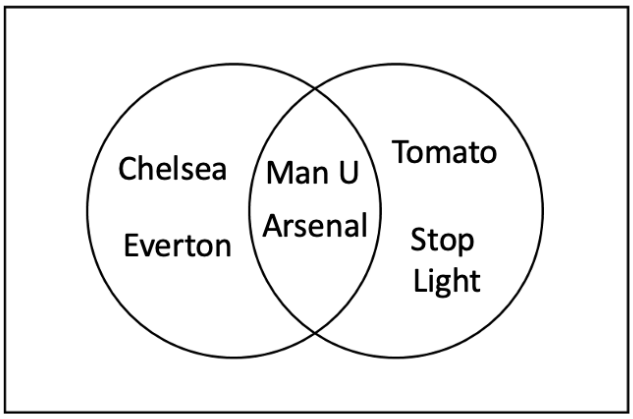


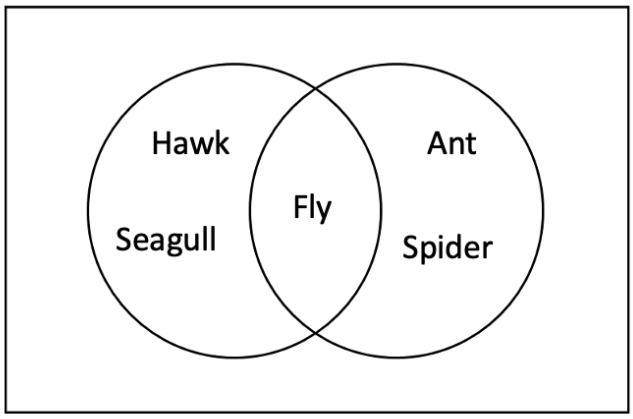
A Venn diagram ('created' by John Venn)
is a pictorial view of the relationships between sets.

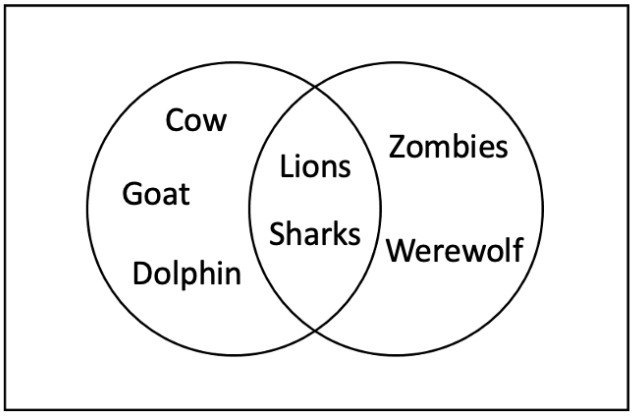
A rectangle is drawn to represent the Universal set, and one or more ovals to represent the other sets.

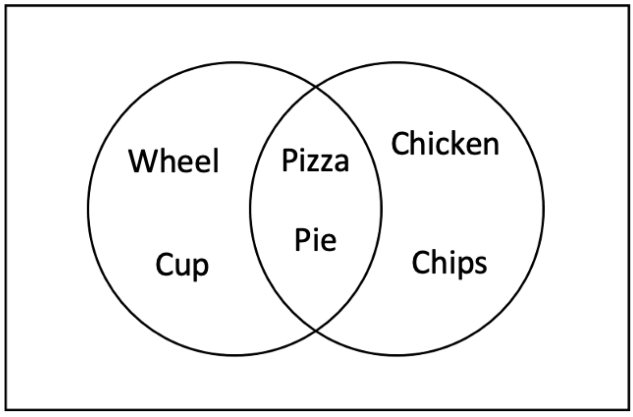
Venn Diagrams

What are the different groups in these Venn diagrams?









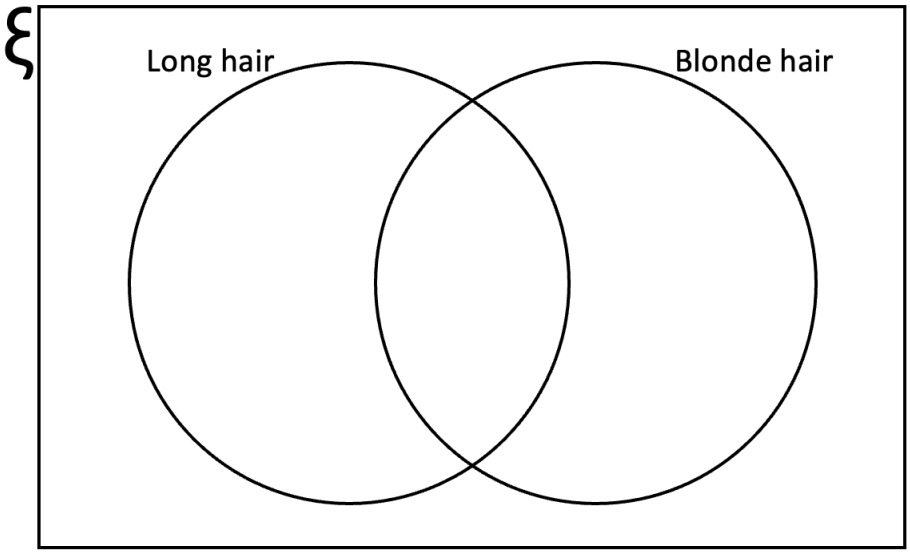
Worked Example

Complete the Venn Diagram:

4 students were picked from Year 7

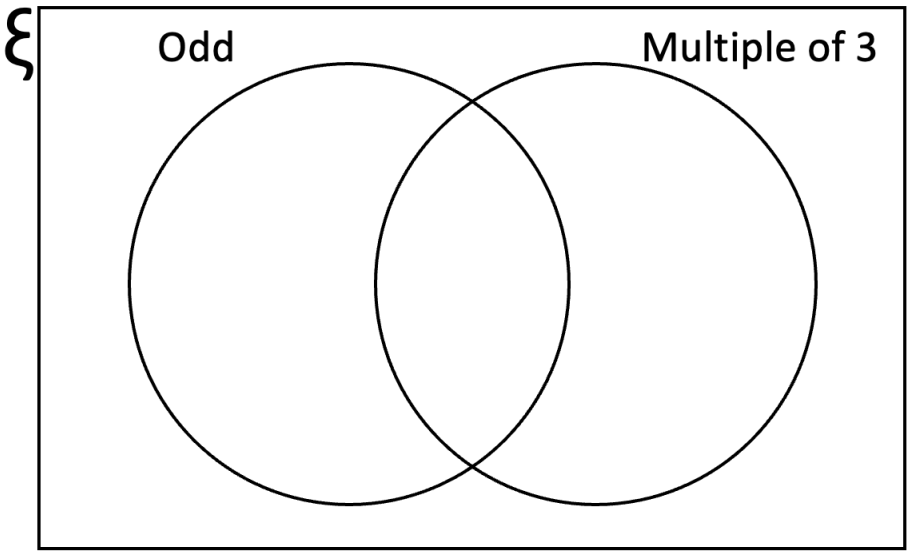
ξ =

Anna Tom Mary Jack Beth



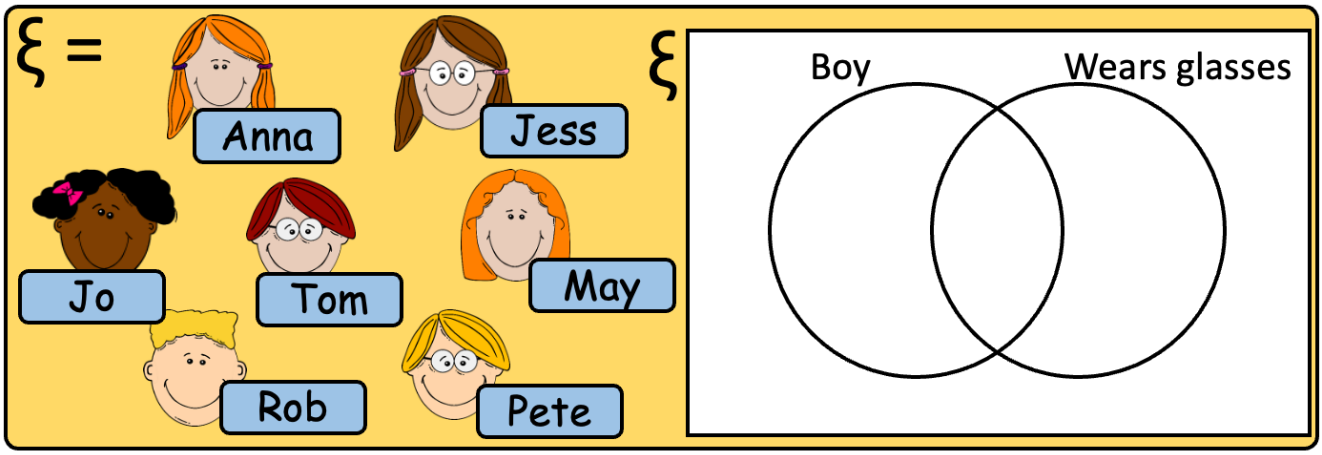
We want to sort the numbers 1 to 10.

ξ = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

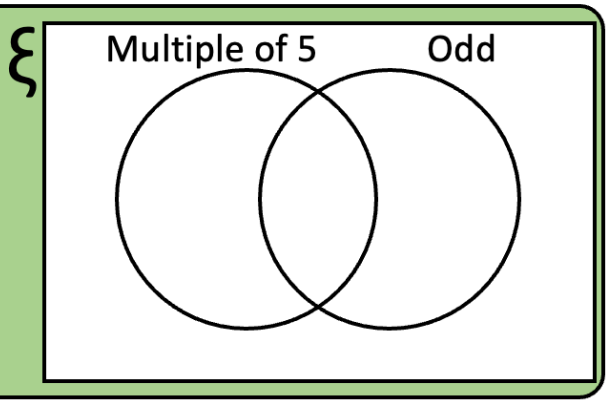


Your Turn

Complete the Venn Diagram:



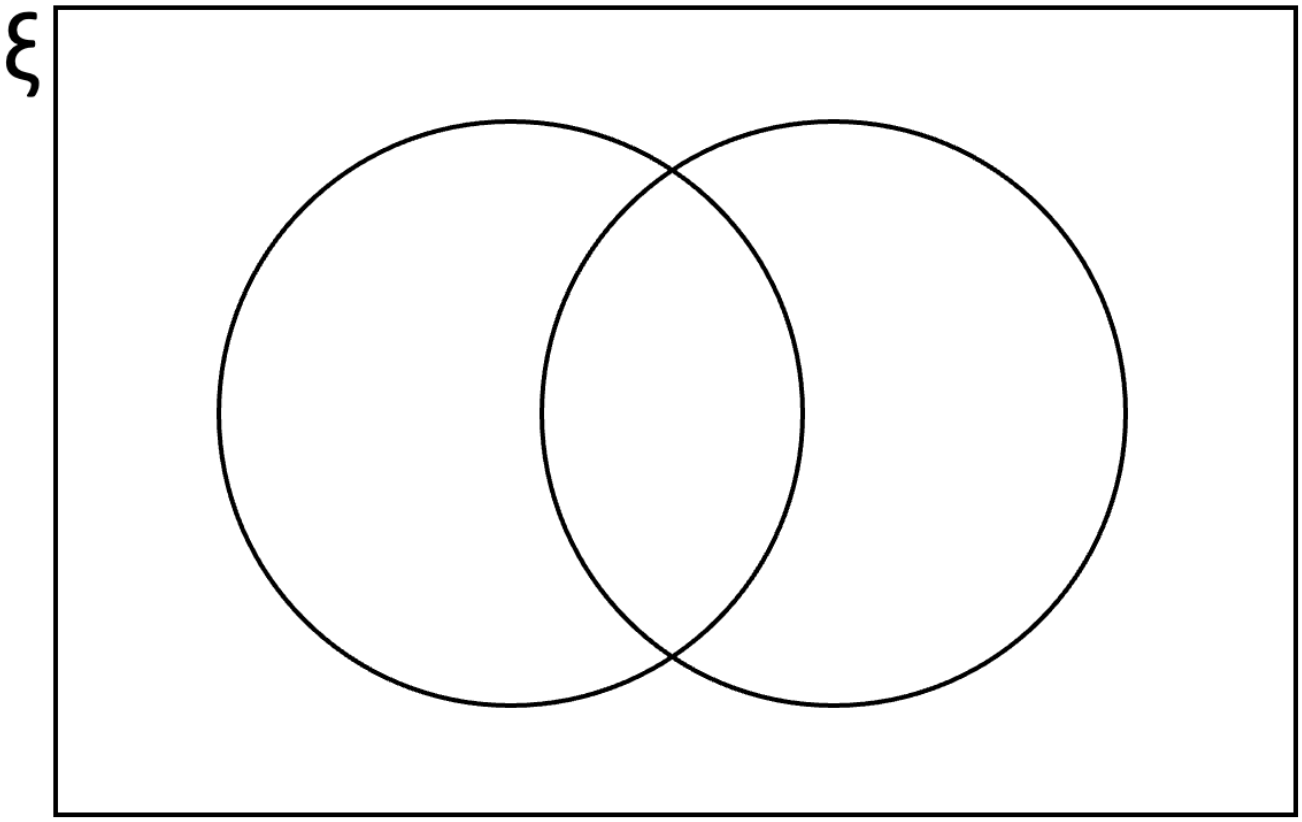
ξ = 3, 4, 5, 7, 10, 12, 13, 15, 20, 24, 25



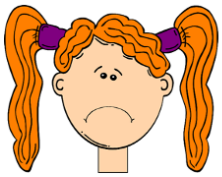
Activity

Classmates in a Venn Diagram

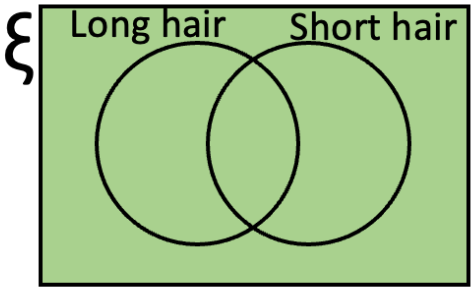
Possible Categories: blonde hair, curly hair, straight hair, short hair, female, male, has a sister, has a brother, wears glasses, right-handed, left-handed, pet dog, pet cat, plays football, loves maths…

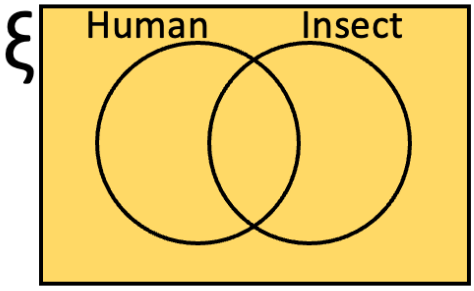


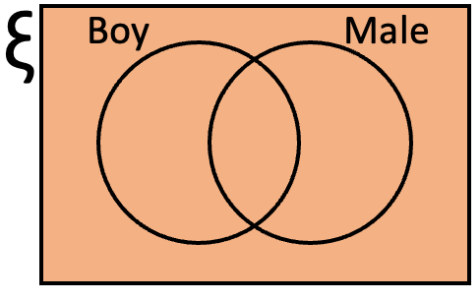
Mistakes

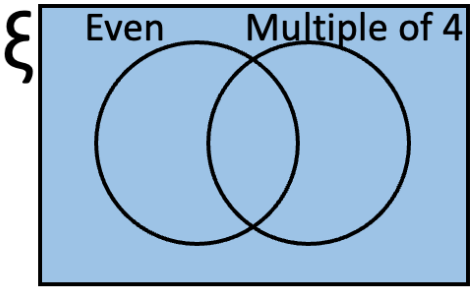


What's wrong with these Venn Diagrams?









Fluency Practice

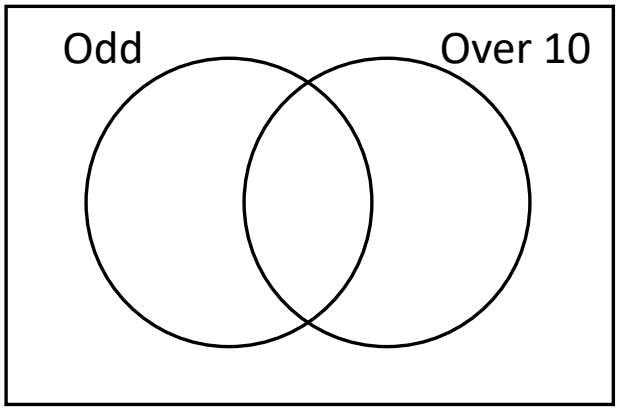
Venn Diagrams

1

Complete each Venn Diagram

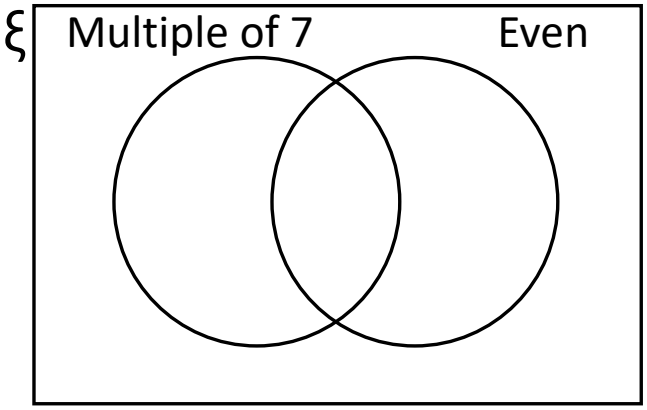
A) ξ =

1	2	3
7	8	9
11	12	13
16	17	18



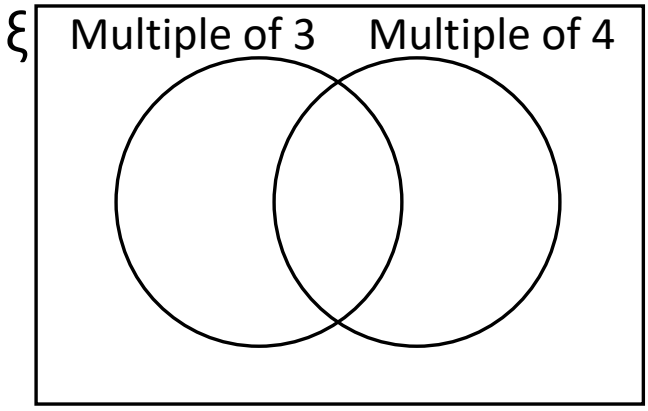
B) ξ =

34	14	15	28
21	70	20	13
1	25	7	16
6	35	18	41



C) ξ = Numbers from 1 to 25

What fraction of the numbers are not a multiple of 3 or 4?



Fluency Practice

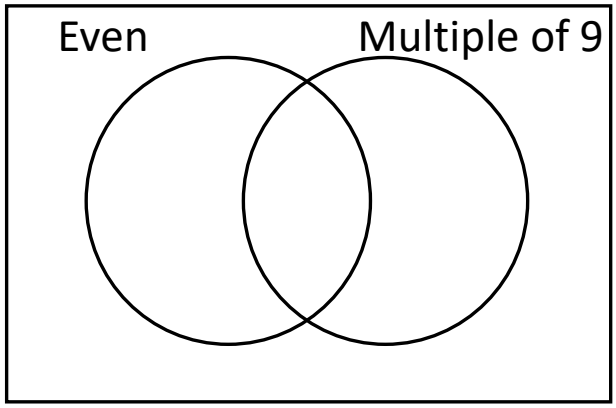
Venn Diagrams

2

Complete each Venn Diagram

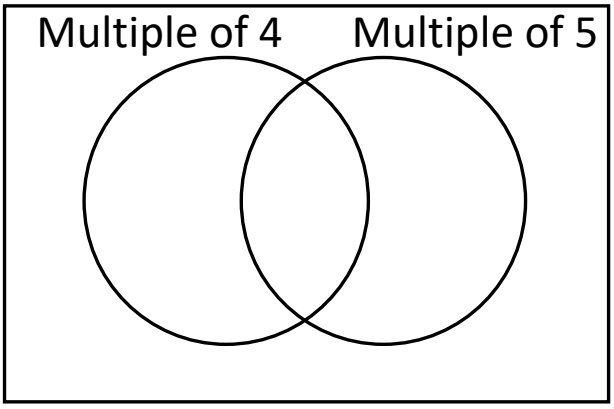
A) ξ =

44	90	45	88
54	27	6	26
91	16	71	9
18	13	24	33



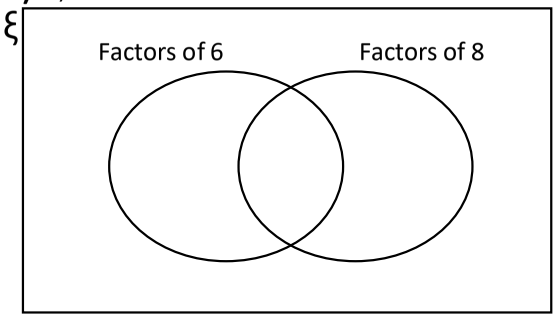
B) ξ = Even numbers from 10 to 40

What fraction of the numbers are multiple of 4 and 5?

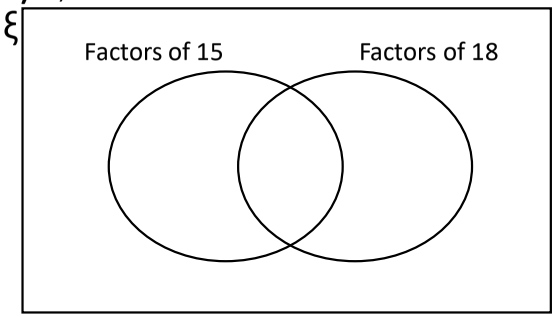


Venn Diagrams for Factors

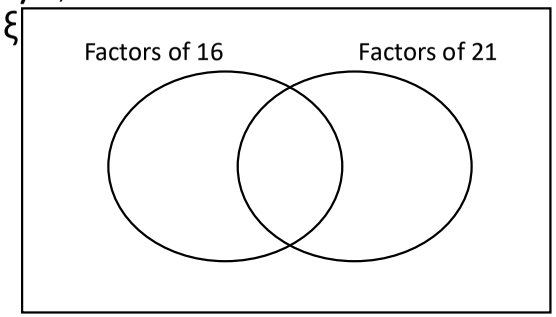
A) ξ = Factors of 24



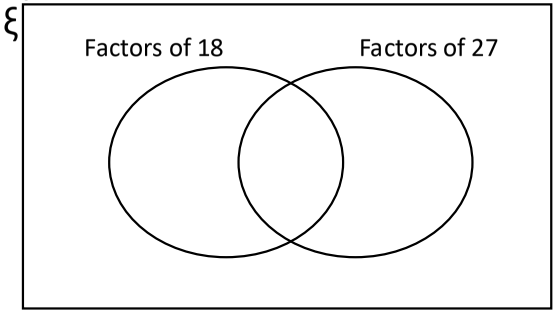
B) ξ = Factors of 36



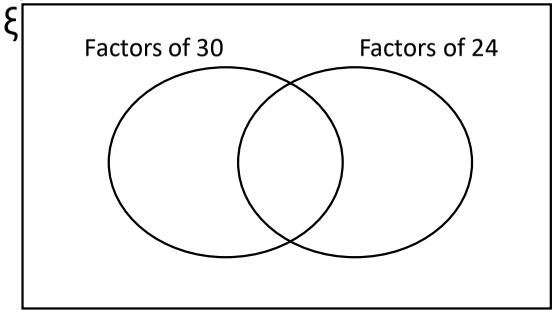
C) ξ = Factors of 28



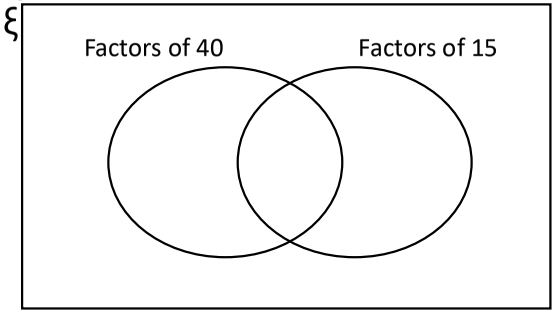
D) ξ = Factors of 54



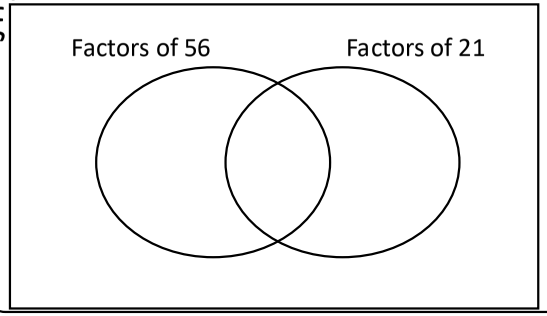
E) ξ = Factors of 60



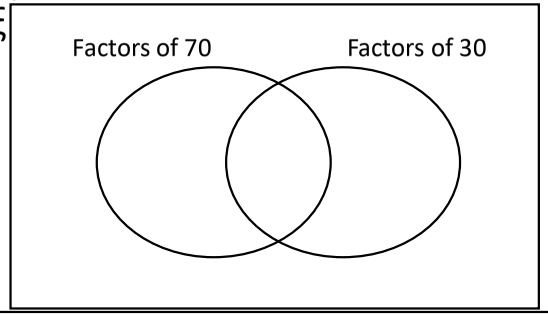
F) ξ = Factors of 90



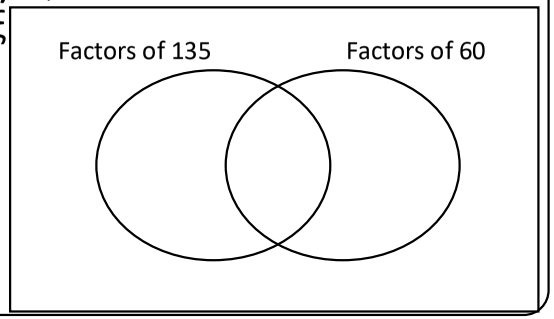
G) ξ = Factors of 42



H) ξ = Factors of 140



I) ξ = Factors of 180



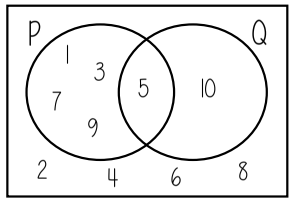
1.5 Review and Problem Solving

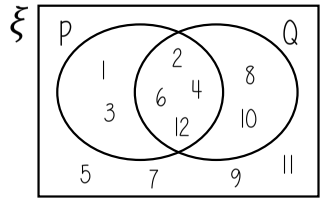
Worked Example	Your Turn
Represent as a Venn diagram: $\xi = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ $A = \{0, 1, 3, 5, 8\}$ $B = \{2, 5, 8, 9\}$	Represent as a Venn diagram: $\xi = \{2, 3, 4, 5, 7, 11, 13, 17, 19\}$ $A = \{2, 3, 5, 11, 13\}$ $B = \{5, 7, 13, 17, 19\}$

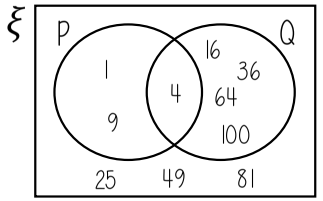
Worked Example	Your Turn
Represent as a Venn diagram: ξ =Positive integers between 1 and 10 inclusive $A = \{$Prime numbers$\}$ $B = \{$Even numbers$\}$	Represent as a Venn diagram: $\xi =$ Integers between 0 and 5 inclusive $A = \{$Prime numbers$\}$ $B = \{$Odd numbers$\}$

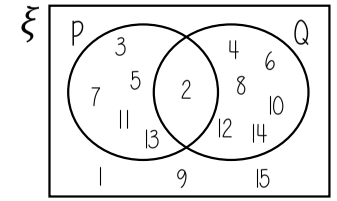
Worked Example	Your Turn
$\xi = \{Days\ of\ the\ week\}$ $A = \{Tuesday, Thursday\}$ B = $\{Days\ starting\ with\ S\ or\ T\}$ Draw a Venn diagram to represent this information.	$\xi = \{Months\ of\ the\ year\}$ $A = \{Months\ starting\ with\ A\}$ B = $\{Months\ with\ six\ letters\}$ Draw a Venn diagram to represent this information.

1. For each Venn diagram, describe the sets: ξ, P and Q

a. 

b. 

c. 

d. 

2. Given the sets, can you place the members into a Venn diagram

a.
ξ = {10, 11, 12, 13, 14, 15, 16}
P = {12, 14, 16}
Q = {10, 11, 12, 16}

b.
ξ = {integers from 15 to 21, inclusive}
X = {15, 18, 21}
Y = {16, 18, 20}

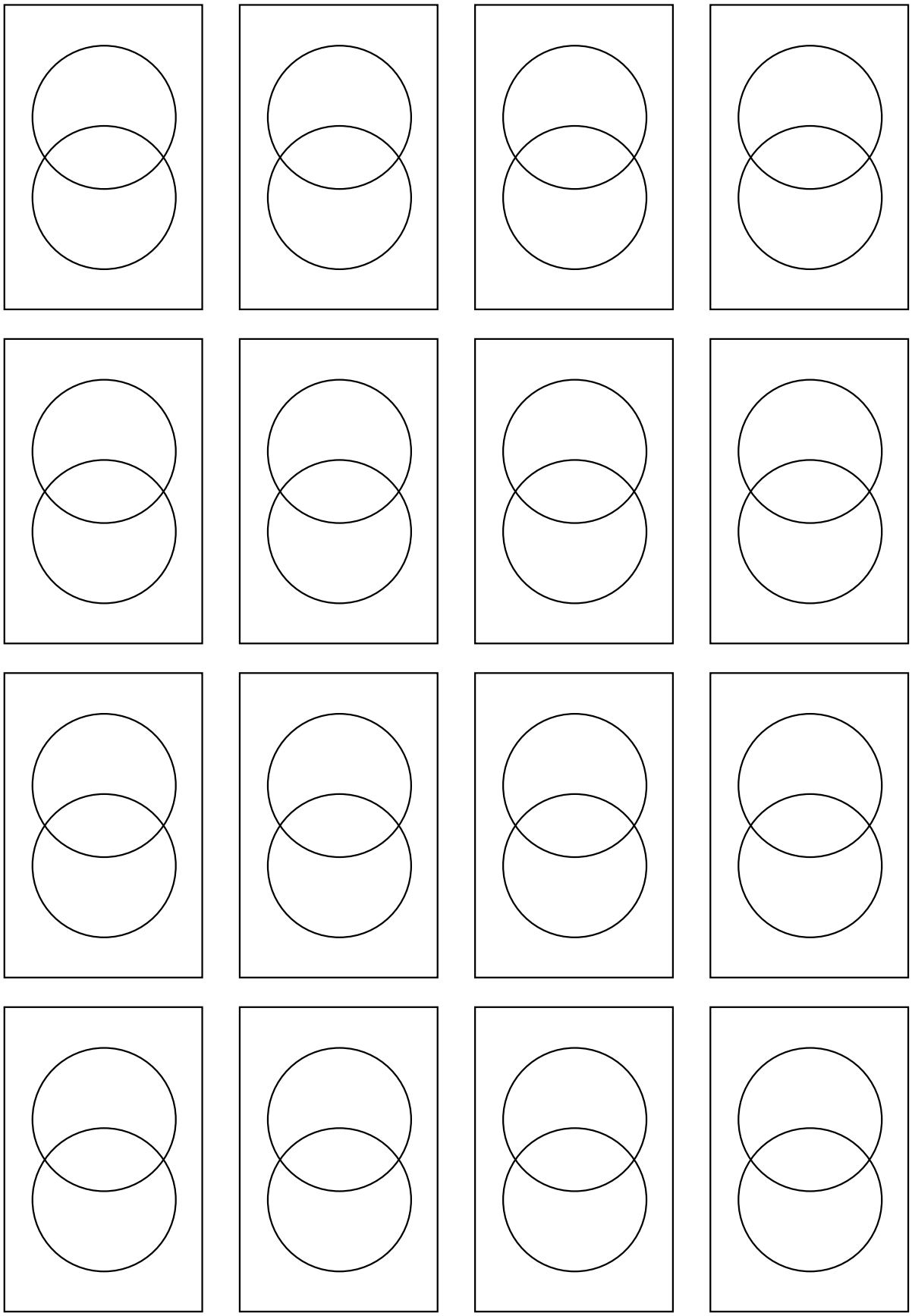
c.
ξ = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
E = {even numbers}
F = {factors of 10}

d.
ξ = {a, b, c, d, e, f, g, h, i, j}
A = {a, e, i}
B = {a, c, e, g, i}

e.
ξ = {integers from 1 to 12, inclusive}
M = {multiples of 2}
N = {numbers less than or equal to 5}

f.
ξ = {C, F, G, H, I, N, S, T, X}
L = {letters with lines of symmetry}
R = {letter with rotational symmetry of order 2}

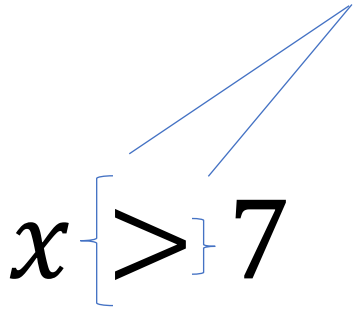
Template



2 Ordering Numbers

2.1 Reading Inequalities

Notice the symbol is taller on the side which is larger.



Inequality	What It Means
$x > 7$	"x is greater than 7" This doesn't include 7 Examples: $7.2, 10$
$x \geq 7$	"x is greater than or equal to 7" or "x is at least 7" This does include 7 Examples: $7, 8, 100.5$
$x < 10$	"x is less than 10" Examples: $-3, 4, 9.2$
$x \leq 8$	"x is less than or equal to 8" or "x is at most 8" Examples: $8, -3, 4, 7.2$

Worked Example	Your Turn
Write an inequality in between the two numbers: 4 5	Write an inequality in between the two numbers: 4.1 4.05

Fluency Practice

Write an inequality or equality in between the two numbers:

1) $9 \quad 5$

2) $3 \quad 3.5$

3) $3.55 \quad 3.5$

4) $3.09 \quad 3.091$

5) $4.44 \quad 4.04$

6) $0.5 \quad \frac{1}{2}$

7) $0.89 \quad 0.98$

8) $0.99 \quad 1.01$

9) $3.101 \quad 3.099$

10) $\frac{1}{4} \quad 0.26$

11) $\frac{1}{4} \quad \frac{3}{8}$

12) $0.1 \quad 0.1001$

13) $-3 \quad -4$

14) $-3.2 \quad -3.3$

15) $-11 \quad -10.9$

16) $0.33 \quad \frac{1}{3}$

True or False

Are the following inequalities true or false?

- $3 < 4$

In words: “3 is less than 4”. This is true: 3 is a smaller value than 4.

- $-5 > 1$

In words: “-5 is greater than 1”. This is not true: -5 is not the larger value.

- $5 \leq 5$

In words: “5 is less than or equal to 5”. This is true: the left can either be less than **or equal to** the right. 5 is equal to 5!

Fluency Practice

Decide if the following statements are true or false for the values given.

1) $n = 7$				
a) $n > 8$	b) $n < 8$	c) $n \geq 8$	d) $n < 3$	e) $n \leq 7$
2) $n = 0.5$				
a) $n > 0$	b) $n < 0.55$	c) $n \geq 0.05$	d) $n < -1$	e) $n \leq 1$
3) $n = -3$				
a) $n > -4$	b) $n < -2$	c) $n \geq 0$	d) $n < -3.5$	e) $n \leq -2.9$
4) $n = \frac{1}{3}$				
a) $n > \frac{2}{6}$	b) $n < \frac{1}{4}$	c) $n \geq \frac{5}{12}$	d) $n < \frac{5}{12}$	e) $n \leq \frac{1}{2}$

2.2 Review and Problem Solving

Fluency Practice

Question 1: Write out the following with either an < or > symbol

(a) 8 ☐ 6 (b) 2 ☐ 3 (c) 7 ☐ 10 (d) 5 ☐ 0

(e) 4 ☐ −1 (f) −4 ☐ 6 (g) 9 ☐ 9.4 (h) 0 ☐ −1

Question 2: Write down an inequality for each of the following

(a) x is greater than 8

(b) x is less than 3

(c) x is less than or equal to 1

(d) x is greater than or equal to 0

(e) x is less than 7

(f) x is greater than or equal to −2

(g) x is less than or equal to −10

(h) x is greater than 5

Question 3: Write down the meaning of these inequalities

(a) $x > 6$ (b) $x < 2$ (c) $x \geq 1$ (d) $x \leq 4$

(e) $x \geq 0$ (f) $x \leq -4$ (g) $x < -2$ (h) $x > 20$

(i) $x < y$ (j) $a \geq b$ (k) $c > 5$ (l) $y \leq 100$

Fluency Practice

Question 3: Place the correct sign, < or >, between the following pairs of numbers

(a) 3 ☐ 1 (b) 2 ☐ 7 (c) 10 ☐ 11

(d) 8 ☐ 5 (e) 33 ☐ 25 (f) 28 ☐ 21

(g) 102 ☐ 99 (h) 110 ☐ 113

Question 4: Place the correct sign, < or >, between the following pairs of numbers

(a) -3 ☐ 2 (b) 4 ☐ -1 (c) -5 ☐ 3

(d) -3 ☐ -1 (e) -19 ☐ 15 (f) -20 ☐ -30

(g) -8 ☐ -11 (h) -12 ☐ -9

Question 3: Place the correct sign, < or > between the following pairs of decimals

(a) 6.3 ☐ 6.7 (b) 0.8 ☐ 0.5 (c) 2.2 ☐ 2.15

(d) 8.21 ☐ 8.9 (e) 9.099 ☐ 9.0971 (f) 1.205 ☐ 1.23

Fluency Practice

Write the correct inequality symbol in each circle

$\sqrt{16}+9$ ◯ $\sqrt{16+9}$

$\sqrt{160}$ ◯ 12

15 ◯ $\sqrt{200}$

15 ◯ $\sqrt{250}$

$\sqrt{20}$ ◯ 5

$\sqrt{25}+\sqrt{5}$ ◯ $\sqrt{30}$

$\sqrt{15}+16$ ◯ $\sqrt{16}+16$

$\sqrt{15}+17$ ◯ $\sqrt{16}+16$

$\sqrt{15}-3$ ◯ $\sqrt{16}-3$

$\sqrt{15}-3$ ◯ $\sqrt{16}-4$

3 Metric Units

The commonly used metric units of length include:

- kilometres (km)
- metres (m)
- centimetres (cm)
- millimetres (mm)

The commonly used metric units of mass include:

- gram (g)
- kilogram (kg)
- tonne (t)
- milligram (mg)

The commonly used metric units of capacity include:

- litre (l)
- millilitre (ml)
- cubic centimetre (cc)

https://www.youtube.com/watch?v=7bUVjJWA6Vw&t=1s&ab_channel=TED-Ed

Fill in the blanks with the appropriate metric units:

A box of corn flakes weighs 750 _____ , and is 35 _____ tall.

A tin of baked beans weighs 415 _____ , and is 120 _____ high.

Tower bridge in London is 0.244 _____ long, and each tower is 61 _____ high.

A pound coin has a diameter of 22.5 _____ and weighs 9.5 _____ .

A football pitch is normally 100 _____ long, and the goalposts are 7.3 _____ apart.

A dairy cow weighs 580 _____ , and is 147 _____ tall at the shoulder.
The average cow produces around 30 _____ of milk a day, or 11 _____ a year.

The iphone 5 weighs 112 _____ , and is 8 _____ thick.

A sheet of A4 paper is 297 _____ long, and weighs 5 _____ .

The Lord of the Rings DVD box-set weighs 0.5 _____ , and has a volume of 2800 _____ .

A single bed measures 91 _____ wide and 1.9 _____ long.

Choose from the common metric units:	*Remember:*
Length: millimetres, centimetres, metres, kilometres	1 cubic centimetre (1 millilitre) of water weighs 1 gram.
Mass: grams, kilograms, tonnes	1 cubic metre (1000 litres) of water weighs 1 tonne.
Capacity: millilitres, litres	*Most common liquids are mostly water, so will be very similar.*

3.1 Conversions

Unit of measurement	Useful conversions	Examples – what would usually be measured in these units?
Distance		
Millimetres (mm)		
Centimetres (cm)		
Metres (m)		
Kilometres (km)		
Weight		
Grams (g)		
Kilograms (kg)		
Tonnes (T)		
Capacity		
Millilitres (ml)		
Litres (l)		

Worked Example	Your Turn
Convert 3.54 kilometres into: a) metres b) centimetres c) millimetres	Convert 5.3 kilometres into: a) metres b) centimetres c) millimetres

Worked Example	Your Turn
Convert 3.54 metres into: a) kilometres b) centimetres c) millimetres	Convert 5.3 metres into: a) kilometres b) centimetres c) millimetres

Worked Example	Your Turn
Convert 3.54 centimetres into: a) kilometres b) metres c) millimetres	Convert 5.3 centimetres into: a) kilometres b) metres c) millimetres

Worked Example	Your Turn
Convert 3.54 millimetres into: a) kilometres b) metres c) centimetres	Convert 5.3 millimetres into: a) kilometres b) metres c) centimetres

Fluency Practice

Question 1: Convert the following lengths into centimetres (cm)

(a) 4 m (b) 9 m (c) 12 m (d) 59 m

(e) 750 m (f) 105 m (g) 2.5 m (h) 8.2 m

(i) 1.53 m (j) 0.6 m (k) 0.38 m (l) 0.03 m

Question 2: Convert the following lengths into metres (m)

(a) 300 cm (b) 700 cm (c) 900 cm (d) 1400 cm

(e) 250 cm (f) 740 cm (g) 1000 cm (h) 348 cm

(i) 80 cm (j) 70 cm (k) 53 cm (l) 2 cm

Question 3: Convert the following lengths into centimetres (cm)

(a) 60 mm (b) 30 mm (c) 65 mm (d) 87 mm

(e) 280 mm (f) 812 mm (g) 2030 mm (h) 9000 mm

(i) 7 mm (j) 4 mm (k) 1.3 mm (l) 0.6 mm

Question 4: Convert the following lengths into millimetres (mm)

(a) 2 cm (b) 6 cm (c) 4.5 cm (d) 9.2 cm

(e) 13 cm (f) 78 cm (g) 124 cm (h) 520 cm

(i) 0.5 cm (j) 0.2 cm (k) 0.8 cm (l) 0.16 cm

Question 5: Convert the following lengths into metres (m)

(a) 4 km (b) 9 km (c) 13 km (d) 28 km

(e) 125 km (f) 300 km (g) 7000 km (h) 7200 km

(i) 0.5 km (j) 0.8 km (k) 1.2 km (l) 2.6 km

(m) 0.07 km (n) 0.02 km (o) 0.006 km (p) 1.008 km

Question 6: Convert the following lengths into kilometres (km)

(a) 6000 m (b) 2000 m (c) 5500 m (d) 6400 m

(e) 800 m (f) 600 m (g) 450 m (h) 125 m

(i) 70 m (j) 90 m (k) 35 m (l) 4 m

(m) 90000 m (n) 40000 m (o) 340000 m (p) 90530 m

Question 7: Convert the following lengths

(a) 2 m into mm (b) 8 m into mm (c) 6500 mm into m

(d) 9000 mm into m (e) 48000 cm into km (f) 9250000 cm into km

(g) 780 mm into m (h) 4km into cm (i) 1km into mm

(j) 25000000 mm into km (k) 0.5 km into cm (l) 0.023km into mm

Worked Example	Your Turn
Convert 3.54 kilograms into: a) grams b) milligrams c) tonnes	Convert 5.3 kilograms into: a) grams b) milligrams c) tonnes

Worked Example	Your Turn
Convert 3.54 grams into: a) kilograms b) milligrams c) tonnes	Convert 5.3 grams into: a) kilograms b) milligrams c) tonnes

Worked Example	Your Turn
Convert 3.54 milligrams into: a) kilograms b) grams c) tonnes	Convert 5.3 milligrams into: a) kilograms b) grams c) tonnes

Worked Example	Your Turn
Convert 3.54 tonnes into: a) kilograms b) grams c) milligrams	Convert 5.3 tonnes into: a) kilograms b) grams c) milligrams

Fluency Practice

Question 8: Convert the following into grams

(a) 2 kg (b) 7 kg (c) 19 kg (d) 20 kg

(e) 1.5 kg (f) 2.4 kg (g) 4.7 kg (h) 0.5 kg

(i) 0.8 kg (j) 0.16 kg (k) 0.03 kg (l) 0.008 kg

Question 9: Convert the following into kilograms

(a) 7000 g (b) 3000 g (c) 12000 g (d) 40000 g

(e) 3945 g (f) 600 g (g) 850 g (h) 735 g

(i) 60 g (j) 75 g (k) 2 g (l) 78.1 g

Question 10: Convert the following into kilograms

(a) 5 tonnes (b) 8 tonnes (c) 15 tonnes (d) 0.6 tonnes

(e) 1.6 tonnes (f) 9.25 tonnes (g) 0.3 tonnes (h) 0.06 tonnes

Worked Example	Your Turn
Convert 3.54 litres into: a) millilitres b) centilitres c) cubic centimetres	Convert 5.3 litres into: a) millilitres b) centilitres c) cubic centimetres

Worked Example	Your Turn
Convert 3.54 centilitres into: a) millilitres b) litres c) cubic centimetres	Convert 5.3 centilitres into: a) millilitres b) litres c) cubic centimetres

Worked Example	Your Turn
Convert 3.54 millilitres into: a) litres b) centilitres c) cubic centimetres	Convert 5.3 millilitres into: a) litres b) centilitres c) cubic centimetres

Worked Example	Your Turn
Convert 3.54 cubic centimetres into: a) litres b) centilitres c) millilitres	Convert 5.3 cubic centimetres into: a) litres b) centilitres c) millilitres

Fluency Practice

Question 11: Convert the following into millilitres

(a) 2 litres (b) 6 litres (c) 24 litres (d) 1.8 litres

(e) 0.6 litres (f) 0.125 litres (g) 0.07 litres (h) 2.05 litres

Question 12: Convert the following into litres

(a) 8000 ml (b) 3000 ml (c) 76000 ml (d) 750 ml

(e) 540 ml (f) 121 ml (g) 88 ml (h) 1035 ml

3.2 Review and Problem Solving

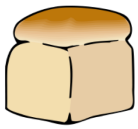
Fluency Practice

Question 1: Jack is 1.36 metres tall.
His friend Ian is 5 centimetres taller than Jack.
What height is Ian? Give your answer in metres.

Question 2: Mary runs 600m every day.
Work out how far Mary runs in one week.
Give your answer in kilometres.

Question 3: Karl is baking a loaf of bread and needs 0.8 kg of flour
He has 72 grams of flour.
How much more flour does Karl need?
Give your answer in grams.

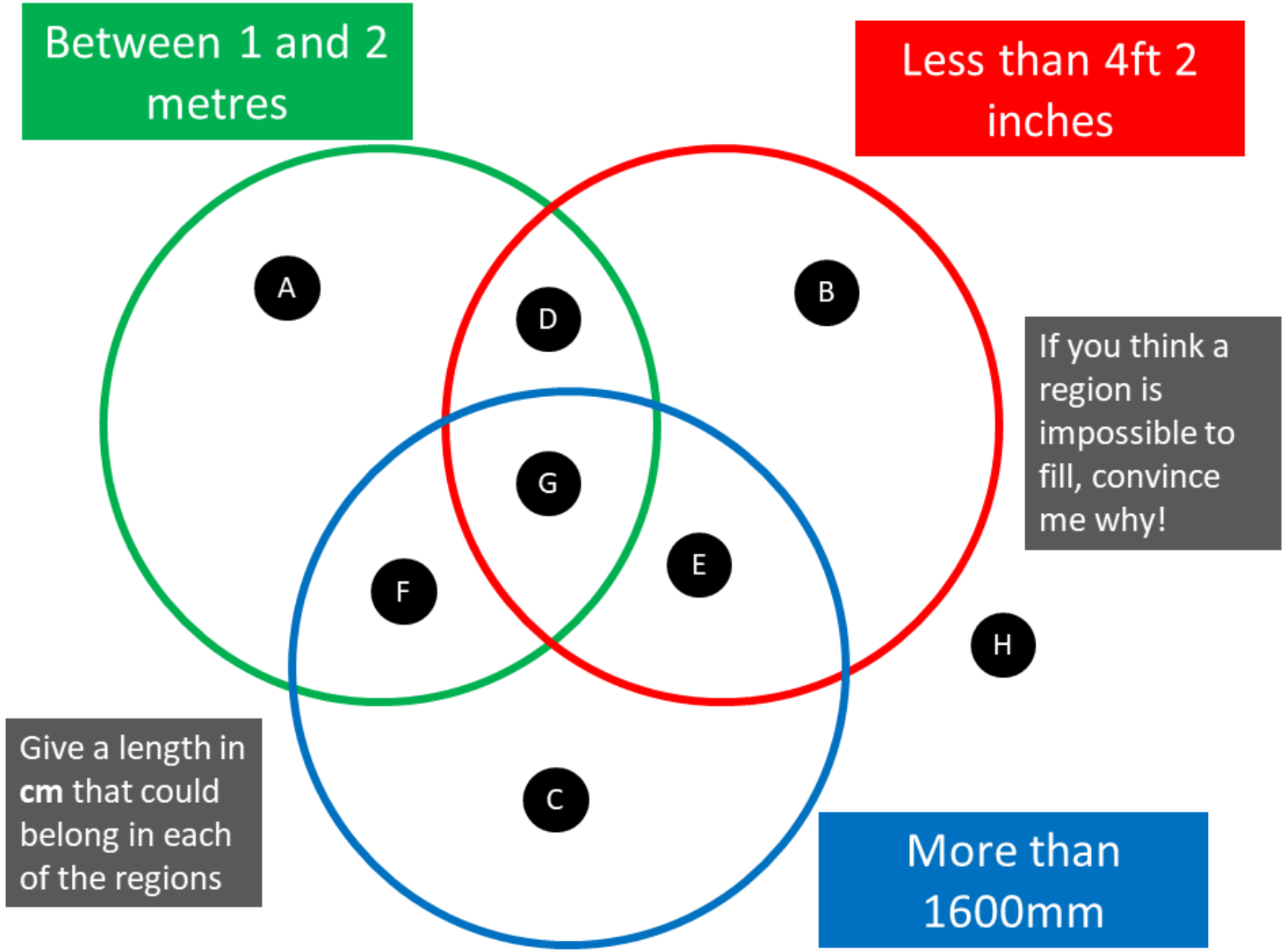
Question 4: James and Jack buy a 3 litre carton of orange juice.
Each boy drinks 650 ml of orange juice.
How much orange juice is left?
Give your answer in litres.



Question 5: Rebecca has two dogs, Lucky and Pepe.
Lucky weighs 5.4 kilograms.
Pepe is 800 grams lighter than Lucky.
Work out how much Pepe weighs.
State your units.

Question 6: A 2p coin has a mass of 7 grams.
Find the total mass of £80 worth of 2p coins.
Give your answer in kilograms.

Maths Venns


Between 1 and 2 metres
Less than 4ft 2 inches
A
D
B
If you think a region is impossible to fill, convince me why!
G
E
F
H
Give a length in **cm** that could belong in each of the regions
C
More than 1600mm

4 Properties of 2D Shapes

4.1 2D Shapes

2-dimensional (2D) shapes have only two dimensions, length and width.

A polygon is a closed 2D shape with straight sides. Polygons are named depending on the number of sides.

Fluency Practice

Question 1: Draw the following shapes

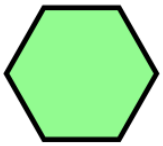
(a) A square (b) A rectangle (c) A circle (d) A triangle

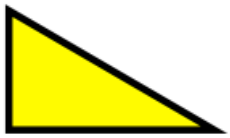
(e) A semi-circle (f) A pentagon (g) An octagon (h) A hexagon

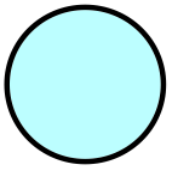
(i) A decagon (j) A heptagon

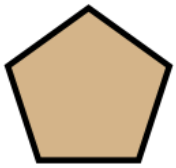
Question 2: Name each of the shapes below

(a) 

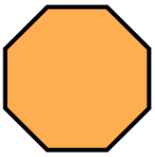
(b) 

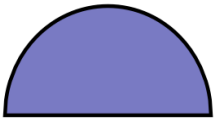
(c) 

(d) 

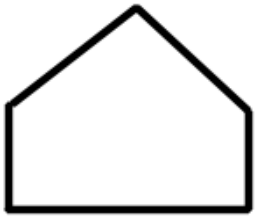
(e) 

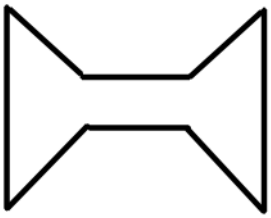
(f) 

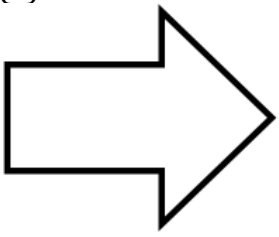
(g) 

(h) 

Question 3: Name each of the polygons below

(a) 

(b) 

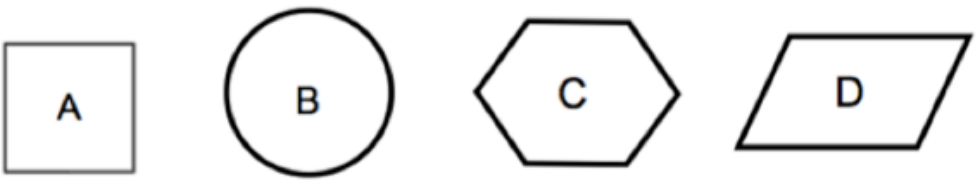
(c) 

Extension

Question 1: Draw 4 different hexagons.

Question 2: Below is a picture of a street.
Write down any 2D shapes you see and what they are in the picture.

Question 3: Can you spot any mistakes below?



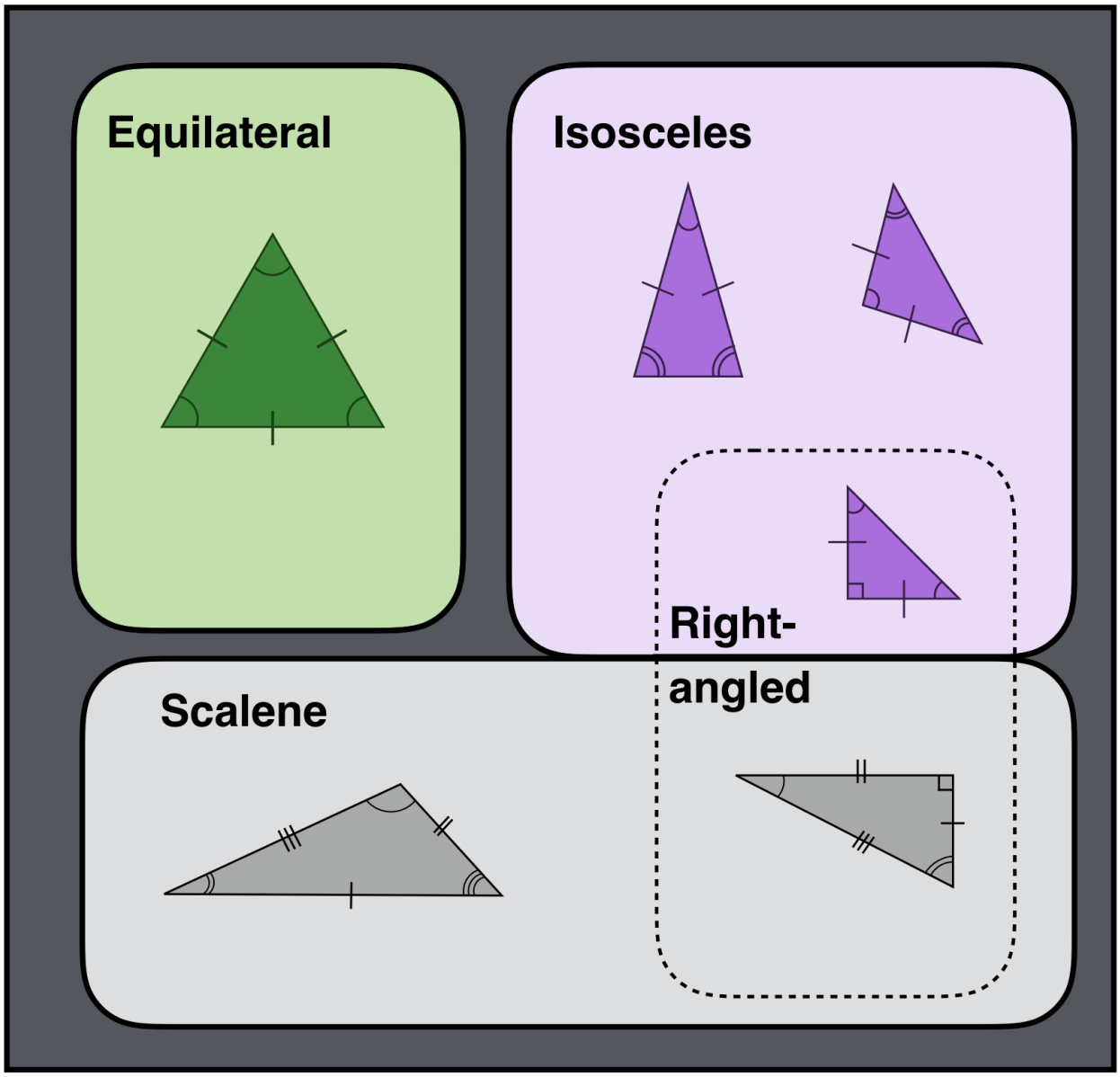
(a) Name shape A — Square (1)

(b) Name shape B — Circle (1)

(c) Name shape C — Pentagon (1)

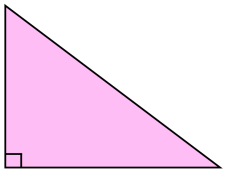
(d) Name shape D — Diamond (1)

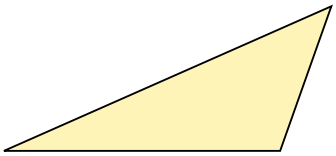
4.2 Triangles

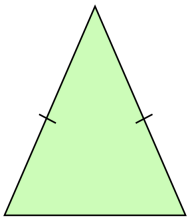


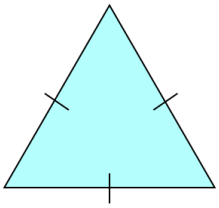
Fluency Practice

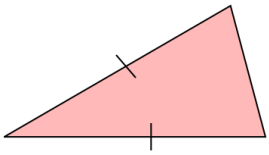
Question 1: Write down what type of triangle each picture shows.

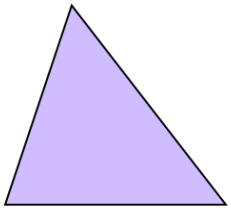
(a) 

(b) 

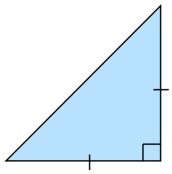
(c) 

(d) 

(e) 

(f) 

Question 2: What type of triangle shown below?



Question 3: Draw a right angle triangle

Question 4: Draw an isosceles triangle

Question 5: Draw a scalene triangle

Question 6: Draw an equilateral triangle

Extension

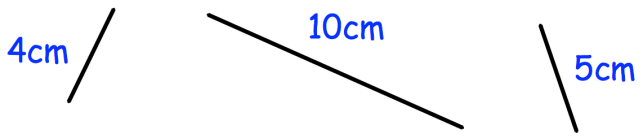
Question 1: Daniel has drawn a triangle with sides of length 5cm, 5cm and 8cm.
What type of triangle has he drawn?

Question 2: Charlotte has drawn a triangle with angles of 60°, 60° and 60°.
What type of triangle has she drawn?

Question 3: Is each statement below True or False?

(a) Scalene triangles have 3 lines of symmetry
(b) Isosceles triangles have 1 line of symmetry
(c) A right angle triangle can have a line symmetry

Question 4: Lily has 3 different wooden sticks.
Explain why she cannot make a triangle using the sticks.



Question 5: Liam says he has drawn a triangle with one acute angle, one right angle and one obtuse angle.

Explain why Liam must be wrong.

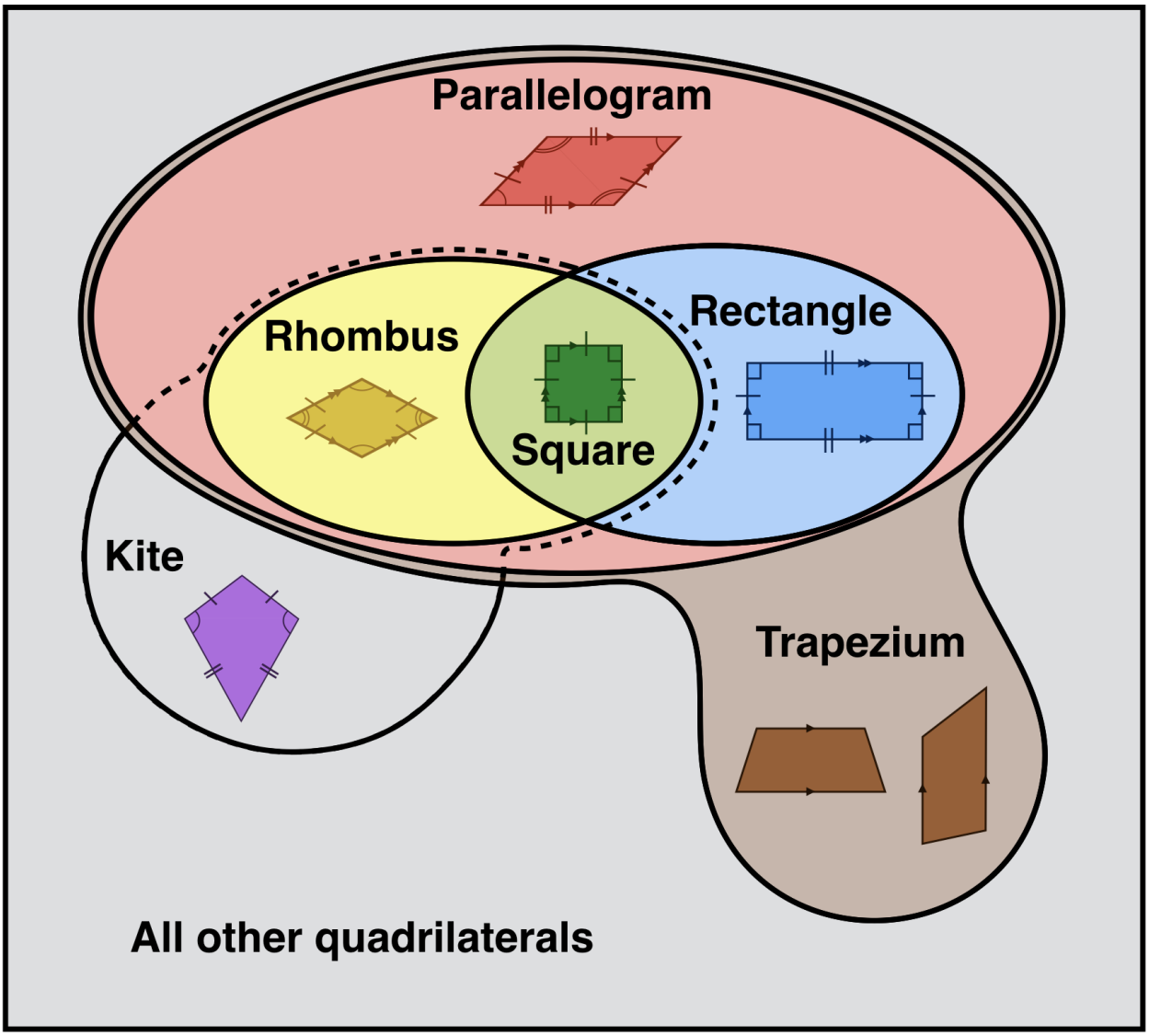
Extension

Triangles. Draw up a table like this (big enough to contain *drawings*):

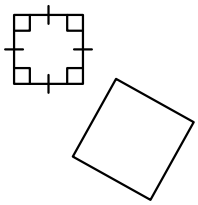
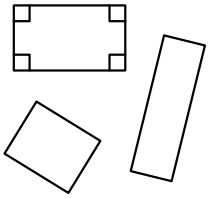
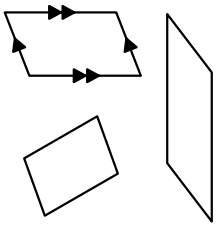
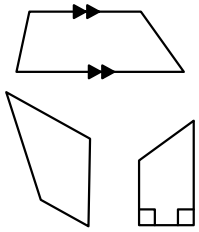
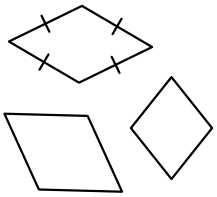
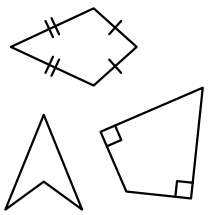
	scalene	**isosceles**	**equilateral**
acute-angled			
obtuse-angled			
right-angled			

For the top left square, if a triangle can be both scalene and acute-angled, draw an example. Put X if it's impossible, and try to say why. Complete the table.

4.3 Quadrilaterals



Quadrilaterals

Name	Examples	Properties	Diagonals
Square			
Rectangle			
Parallelogram			
Trapezium			
Rhombus			
Kite			

Fluency Practice

Question 1: Draw the following quadrilaterals

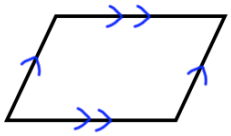
(a) A kite (b) A rectangle (c) A square (d) A parallelogram

(e) A trapezium (f) A rhombus (g) An arrowhead/A delta

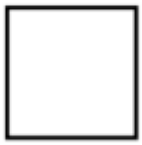
Question 2: Name each of the shapes below

(a)

(b)



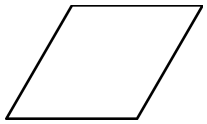
(c)



(d)

(e)

(f)



Question 3: Draw all lines of symmetry on the quadrilaterals you have drawn in Question 1.

Question 4: Write down the order of rotational symmetry that each quadrilateral below has:

(a) A square (b) A rectangle (c) A kite (d) A parallelogram

(e) A trapezium (f) A rhombus

Question 5: Which quadrilaterals have only one pair of equal length sides?

Question 6: Which quadrilaterals have two pairs of equal length sides?

Question 7: Which quadrilaterals have four equal length sides?

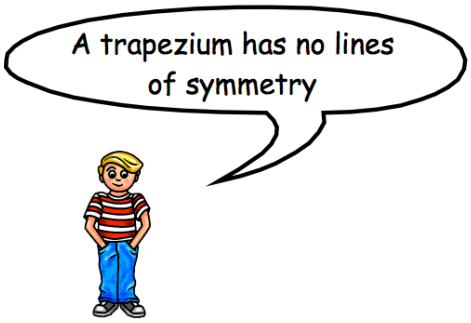
Question 8: Which quadrilaterals have two pairs of parallel sides?

Question 9: Which quadrilaterals have one pair of parallel sides?

Question 10: Which quadrilaterals have diagonals of equal length?

Extension

Question 1: Explain why Martin is incorrect.



Question 2: Can you spot any mistakes?

Below is a rectangle.

Tick the correct boxes for the four statements.

	True	False
A rectangle has four right angles	☑	☐
A rectangle has one pair of parallel lines	☑	☐
A rectangle has four lines of symmetry	☑	☐
A rectangle has rotational symmetry of order 2	☑	☐

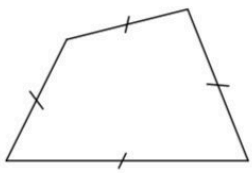
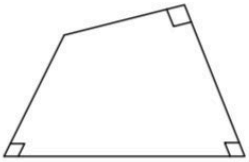
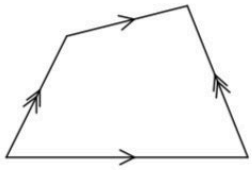
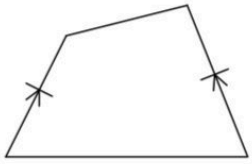
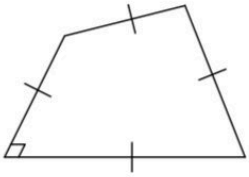
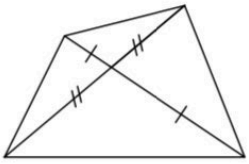
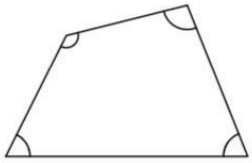
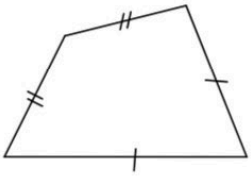
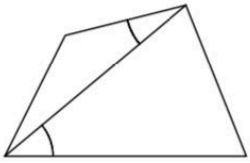
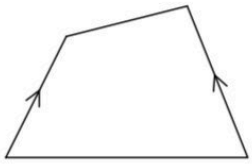
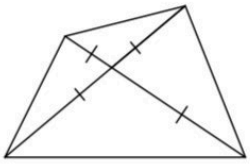
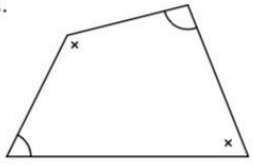
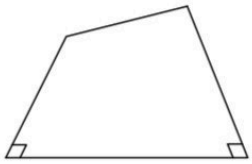
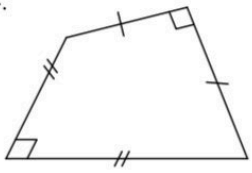
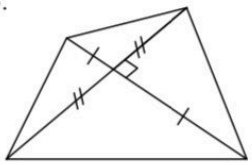
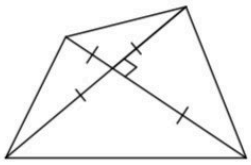
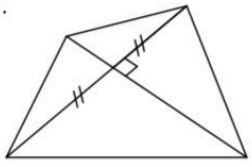
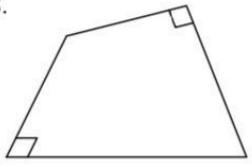
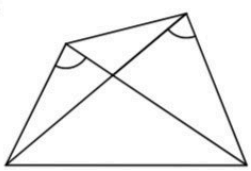
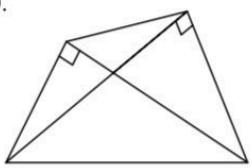
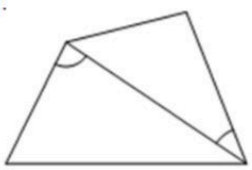
Extension

What Quadrilateral am I?

The following quadrilaterals have not been drawn to scale, but each one has some markings that tell you something about it. If you used the information to construct the quadrilateral, but didn't include any additional features that have not been shown, what is the best name for the quadrilateral?
Here are the choices:

quadrilateral, kite, trapezium, parallelogram, rhombus, rectangle, square

Write the best name for the quadrilateral on each diagram.

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16. 
17. 
18. 
19. 
20. 
21. 

4.4 Review and Problem Solving

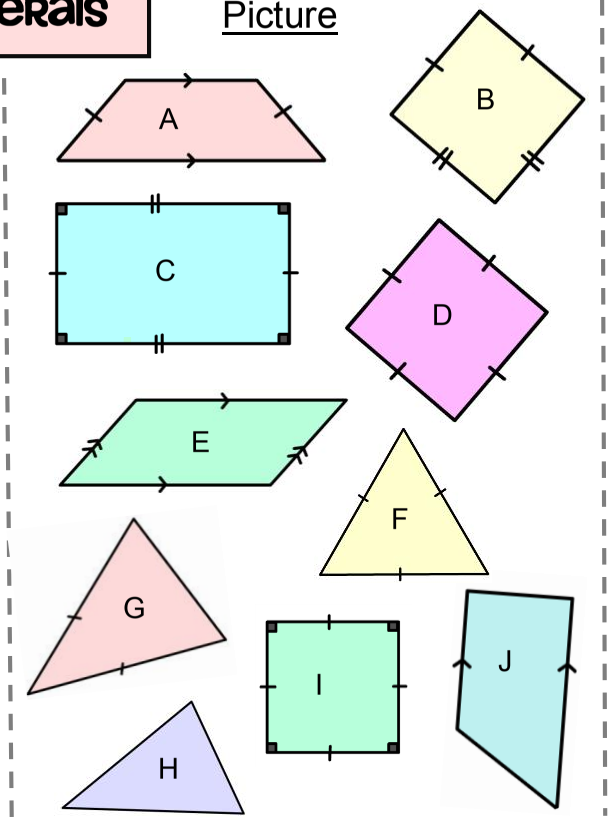
Triangles & Special Quadrilaterals

Can you match these shapes to their descriptions?
Record your answers in the table.

Description

1. A shape with 3 sides and no equal angles.
2. A quadrilateral with four equal angles and four equal sides.
3. A quadrilateral with one pair of parallel sides.
4. A shape with 3 sides and two equal angles.
5. A shape with equal opposite angles.
6. Any quadrilateral with four equal sides.
7. A shape with one pair of parallel sides and two equal sides.
8. A shape with four 90 degree angles but not all sides equal.
9. When you cut this shape in half, you get two isosceles triangles.
10. A shape with 3 equal angles.

Picture



Name

K) Isosceles Triangle

L) Square

M) Kite

N) Trapezium

O) Equilateral Triangle

P) Rectangle

Q) Scalene Triangle

R) Parallelogram

S) Isosceles Trapezium

T) Rhombus

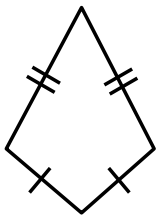
Descrip-tion	1	2	3	4	5	6	7	8	9	10
Picture										
Name										

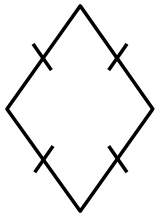
Fluency Practice

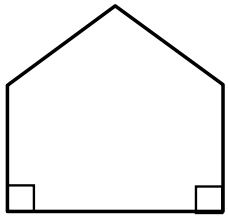
Fluency Practice

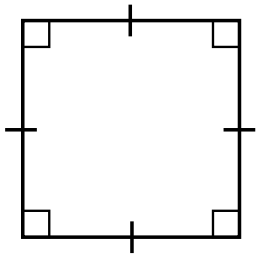
Cut out the nine shape cards and arrange them into a 3×3 grid using the clues below:

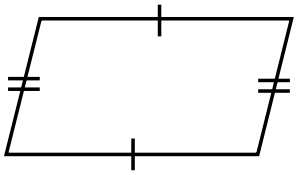
1. The equilateral shapes are all in different columns.
2. Each shape in the middle row has two sets of parallel lines.
3. The shapes in the top two corners each have exactly one line of symmetry.
4. One of the rows contains a total of 10 sides.
5. The square is in a corner below the parallelogram.
6. The shape in the centre has all angles the same, but its diagonals do not intersect at right angles.
7. The shape with two pairs of equal adjacent sides is not in the same column as the square.
8. The shape with the most sides is in the bottom right hand corner.

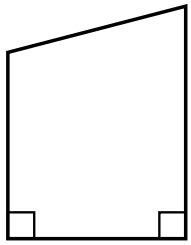


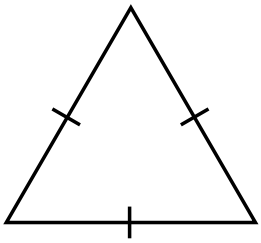


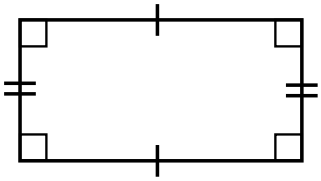


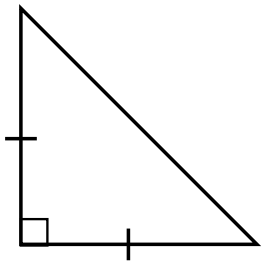












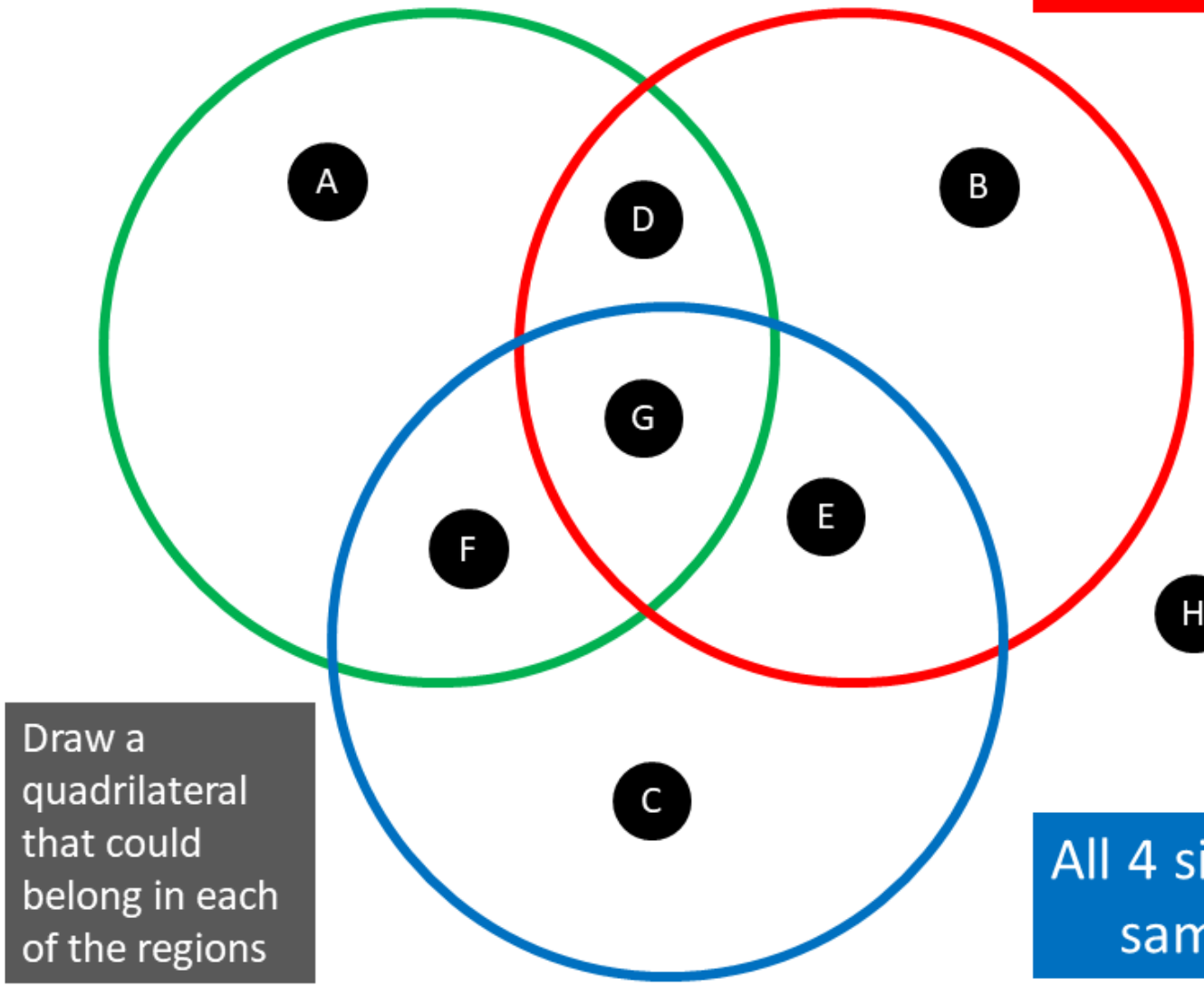
sketch the shape

1) a triangle with a right angle that is isosceles	2) an isosceles triangle with one obtuse angle	3) a parallelogram made up of two isosceles right angled triangles	4) a trapezium made up of a square and an isosceles triangle	5) a hexagon with just one line of symmetry and with five right angles	6) a hexagon with two lines of symmetry and two reflex angles
7) a quadrilateral with perpendicular diagonals and two pairs of equal sides	8) a pentagon with two sides parallel, one reflex angle and one line of symmetry	9) a hexagon made up of four isosceles right angled triangles	10) a quadrilateral with just one line of symmetry which does not pass through any of the vertices (corners)	11) four congruent (identical) kites surrounding a point	12) a quadrilateral with diagonals that bisect each other
13) an octagon with rotational symmetry, order 2 and with six right angles	14) an octagon with (exactly) five right angles	15) a hexagon with one line of symmetry (only) and two right angles	16) a kite that is a trapezium	17) an octagon with four lines of symmetry (only)	18) an octagon with one line of symmetry (only)
19) a hexagon with only rotational symmetry, order 2	20) a quadrilateral with two equal length diagonals and 1 reflex angle	21) a heptagon with only one line of symmetry and four right angles	22) a decagon with only two lines of symmetry	23) a hexagon with only rotational symmetry, order 3	24) a dodecagon with only four lines of symmetry

Fluency Practice

Maths Venns

Diagonals cross at right-angles
If you think a region is impossible to fill, convince me why!
Diagonals are equal length
Exactly one pair of parallel sides
A
B
C
D
E
F
G
H
Draw a quadrilateral that could belong in each of the regions


At least one pair of parallel sides
At least one right-angle
A
D
B
G
E
F
H
C
If you think a region is impossible to fill, convince me why!
Draw a quadrilateral that could belong in each of the regions
All 4 sides are the same length

Maths Venns

Diagonals Are Perpendicular
If you think a region is impossible to fill, convince me why!
Diagonals Are Congruent
Diagonals Bisect Each Other
Think of a quadrilateral that could belong in each of the regions
A
B
C
D
E
F
G
H