Purbrook Junior School

MATHS
KNOWLEDGE ORGANISORS
YEAR 5

Number and Place Value — Knowledge Organiser

Key Vocabulary

- millions
- thousands
- hundreds
- tens
- ones
- zero
- place value
- greater than
- less than
- order
- round
- rounded
- negative number
- partition
- digit
- interval
- sequence
- linear sequence

Compare and Order

equals	greater than	less than
26 + 38 = 8 × 8	23 873 > 8256	901 198 < 1 091 098
Both calculations have the value 64.	The number on the left has 2 ten thousands and the number on the right has 0 ten thousands.	The number on the right has 1 million and the number on the left has 0 millions.

smallest | 898 | 6735 | 6835 | 7019 | 9002 | 11 235 | greatest

Negative Numbers

Counting in Powers of 10

Counting in 10s

365	375	385	395	405	415

The tens increase until 9 tens becomes one more hundred and 0 tens.

Counting in 100s

2841	2941	3041	3141	3241	3341

The hundreds increase until 9 hundreds becomes one more thousand and 0 hundreds.

Counting in 10 000s

276 109	286 109	296 109	306 109

The ten thousands increase until 9 ten thousands become one more hundred thousand and 0 ten thousands.

Counting in 100 000s

2 972 151	3 072 151	3 172 151	3 272 151

The hundred thousands increase until 9 hundred thousands becomes one more million and 0 hundred thousands.

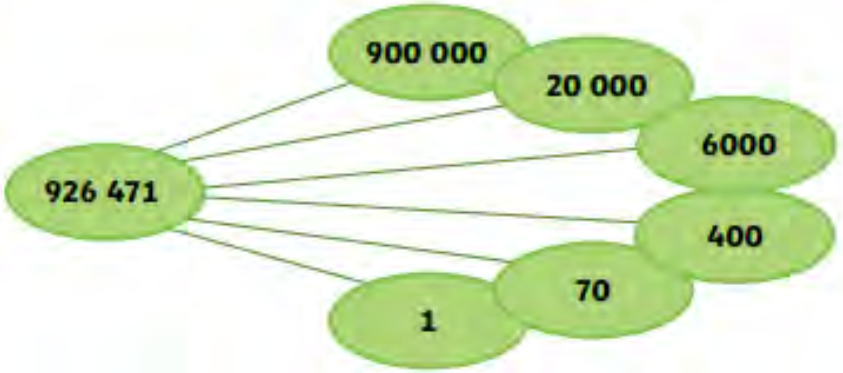
Number and Place Value — Knowledge Organiser

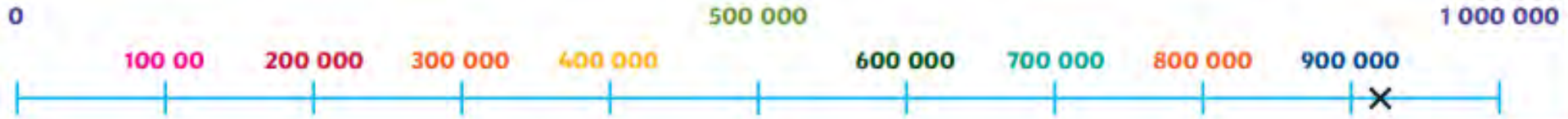
Numbers to One Million

926 471

Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
9	2	6	4	7	1

nine hundred and twenty-six thousand, four hundred and seventy-one





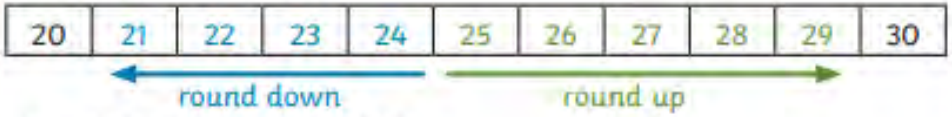
Roman Numerals

	I = 1	II = 2	III = 3	
IV = 4	V = 5	VI = 6	VII = 7	VIII = 8
IX = 9	X = 10	XI = 11	XX = 20	XXX = 30
XL = 40	L = 50	LX = 60	LXX = 70	LXXX = 80
XC = 90	C = 100	CL = 150	CC = 200	CCC = 300
CD = 400	D = 500	DC = 600	DCC = 700	DCCC = 800
CM = 900	M = 1000	MC = 1100	MD = 1500	MM = 2000

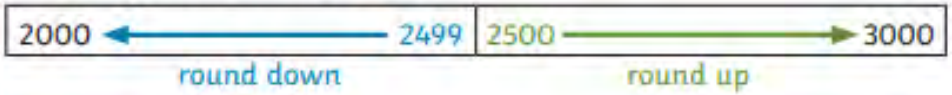
CCXLVIII = 248 DCCLXXXIV = 784 MMXIX = 2019

Rounding

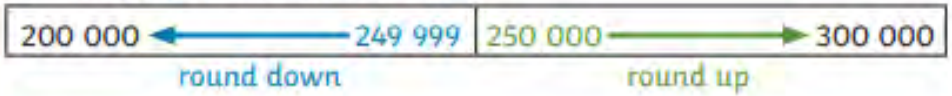
Rounding to the nearest 10



Rounding to the nearest 1000



Rounding to the nearest 100 000



Addition and Subtraction — Knowledge Organiser

Key Vocabulary

- Add
- Total
- Make
- Plus
- Sum
- More
- Altogether
- Difference
- Subtract
- Less
- Minus
- Take away
- Column addition
- Column subtraction
- Estimate
- Inverse operation
- Number facts
- Place value
- Complex

Addition

Place Value Grid: 3274 + 5601 = 8875

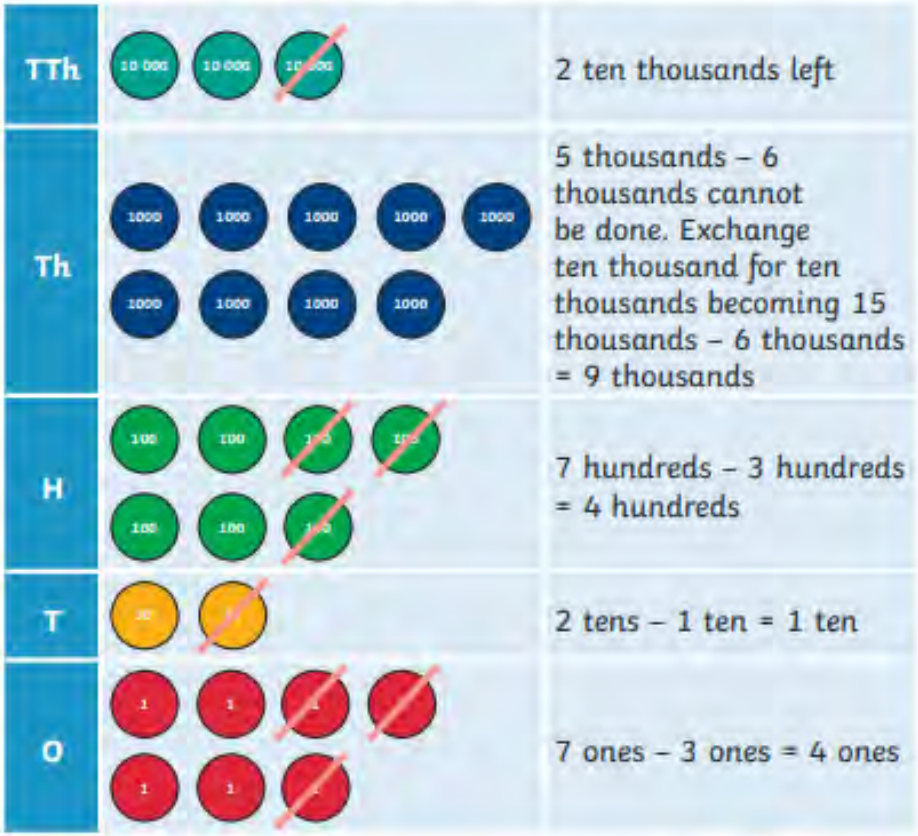
Column Method

Starting with the ones, add each column in turn. Regroup tens, hundreds, thousands, ten thousands and/or as required.

```
 45864
+23497
 69361
 111
```

Subtraction

Place Value Grid: 35 727 – 6313 = 29 414



Column Method

Starting with the ones, subtract each column in turn. Exchange tens, hundreds, thousands and/or ten thousands as required.

```
  6 13 1
 35742
-  3476
 32266
```

Addition and Subtraction

Knowledge Organiser

Estimate and Approximate

Rounding to Estimate

41 635 + 7386 = 49 021

Round to ten:

41 630 + 7380 = 49 010

41 630 + 7390 = 49 020

41 640 + 7390 = 49 030

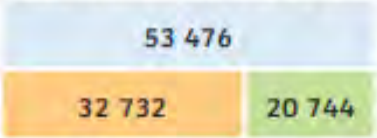
Rounding is not as accurate when both numbers are rounded up. A better estimate comes from "rounding" one down and one up.

Estimating on a Number Line

The arrow is about $\frac{3}{4}$ of the way across the line so it is 40 000.

Inverse Operations

Use the inverse to check:



To check 53 476 – 32 732 = 20 744 use 32 732 + 20 744 = 53 476

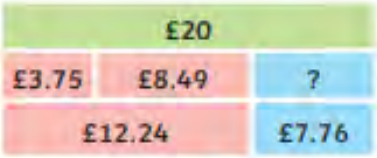
Start with a number, subtract 409 and double. I end with 6264. To find the starting number use the inverse: halve, then add 409. Half of 6264 = 3132. 3132 + 409 = 3541. The starting number was 3541.

Multistep Problems

Using a Bar Model

The sum of two numbers is 25 567.
The difference is 1875.

Subtract 1875 from 25 567 = 23 692.
Halve 23 692 to find smaller number = 11 846.
Add 1875 to find larger number = 13 721.



£20 is used to buy 2 books costing £3.75 and £8.49.

How much change is given?

£3.75 + £8.49 = £12.24

£20.00 - £12.24 = £7.76

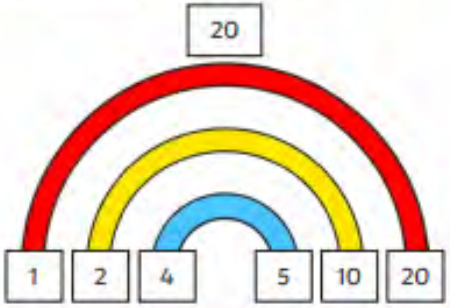
Multiplication and Division — Knowledge Organiser

Key Vocabulary

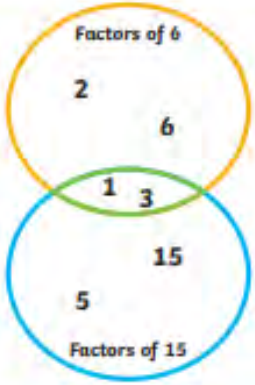
- multiply
- groups of
- lots of
- times
- divide
- share
- remainder
- factor
- multiple
- product

Factors

A factor is a number that divides into another number exactly, without leaving a remainder.



A common factor is a factor of 2 or more numbers.



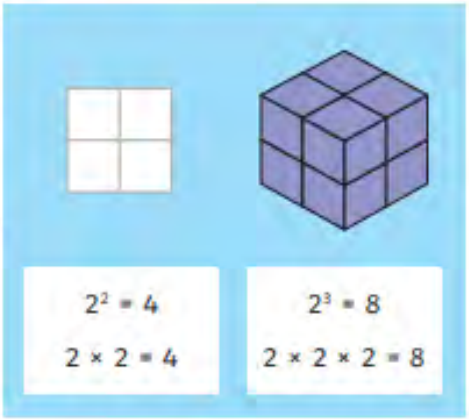
The factors of 20 are 1, 2, 4, 5, 10 and 20.

The factor pairs are:
1 and 20
2 and 10
4 and 5

Prime Numbers

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Squared² and Cubed³ Numbers

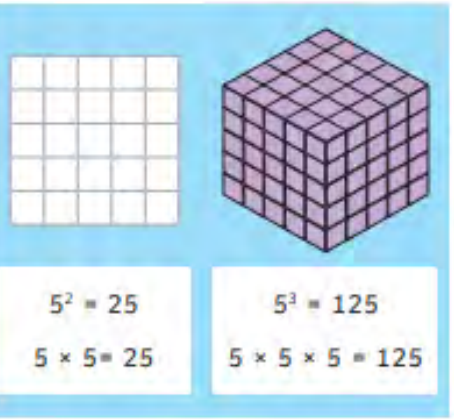


$2^2 = 4$

$2 \times 2 = 4$

$2^3 = 8$

$2 \times 2 \times 2 = 8$



$5^2 = 25$

$5 \times 5 = 25$

$5^3 = 125$

$5 \times 5 \times 5 = 125$

Related Calculations

$8 \times 9 = 72$

$80 \times 9 = 720$

$9 \times 8 = 72$

$90 \times 8 = 720$

$72 \div 9 = 8$

$720 \div 9 = 80$

$72 \div 8 = 9$

$720 \div 8 = 90$

Multiplication and Division

Knowledge Organiser

Short Multiplication

Revision

$2543 \times 7 = 17\,801$

	2	5	4	3
×				7
1	**7**	**8**	**0**	**1**
1	3	3	(2)	

Remember to move any regrouped digits into the next column. After the next multiplication, add the regrouped number to the answer.

Long Multiplication

$2543 \times 67 = 170\,381$

		2	5	4	3
	×			6	7
	1 (1)	7 (3)	8 (3)	0 (2)	1
1 (1)	5 (3)	2 (2)	5 (1)	8	(0)
1	**7**	**0**	**3**	**8**	**1**
	1	1			

Before multiplying by the number in the tens column, remember to use zero as a placeholder because the 6 in 67 is 6 tens (60).

Division

$136 \div 4 = 34$

		3	4	
4	1	3	6	
−	1	2	0	→ 30 × 4
		1	6	
	−	1	6	→ 4 × 4
			0	

Short Division

		3	8
4	1	1 5	3 2

15 ÷ 4 = 3 remainder 3

Remember to regroup any remainders and move them into the next column.

		4	5	5	r	3
5	2	2	2 7	2 8		

28 ÷ 5 = 5 remainder 3

If your calculation has a remainder, remember to record it in the answer using the letter r.

Decimals

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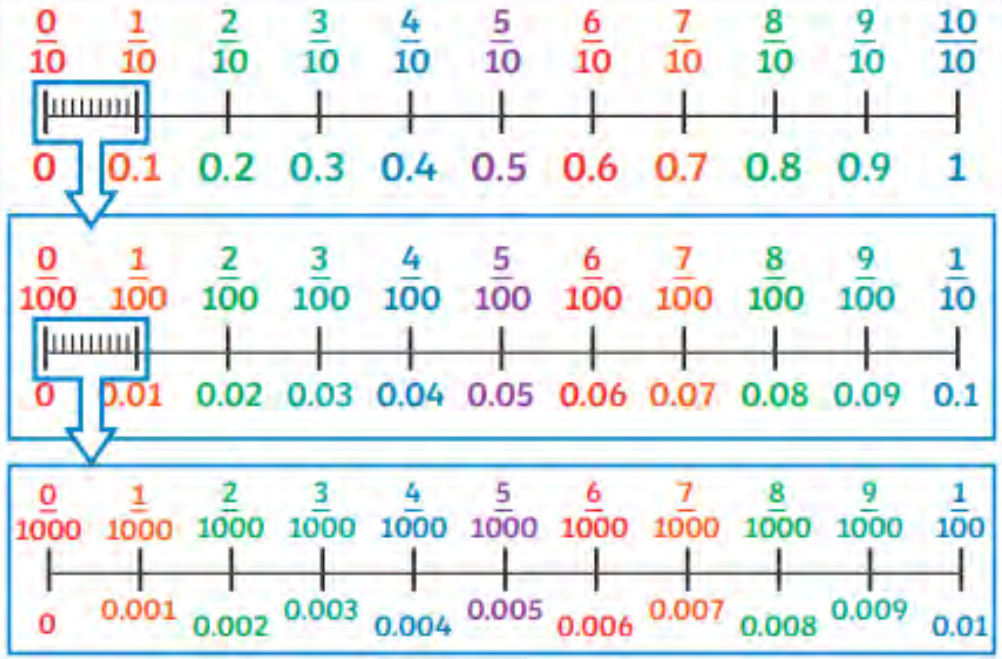
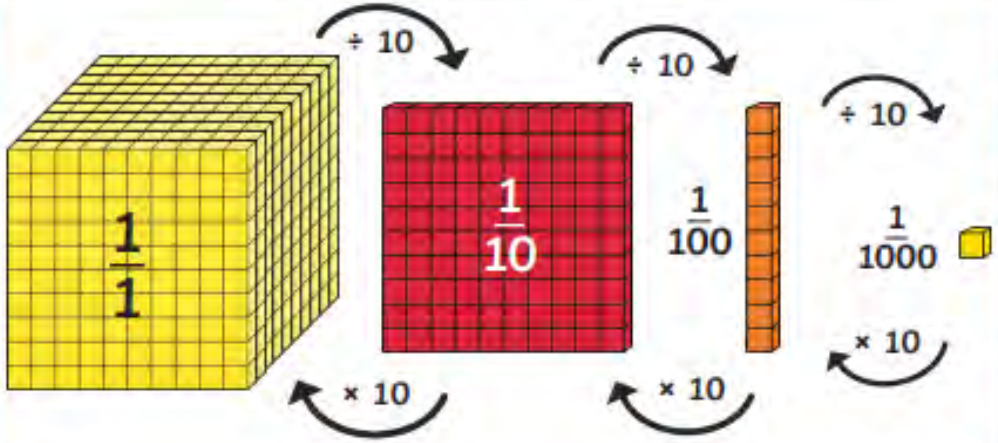
Key Vocabulary

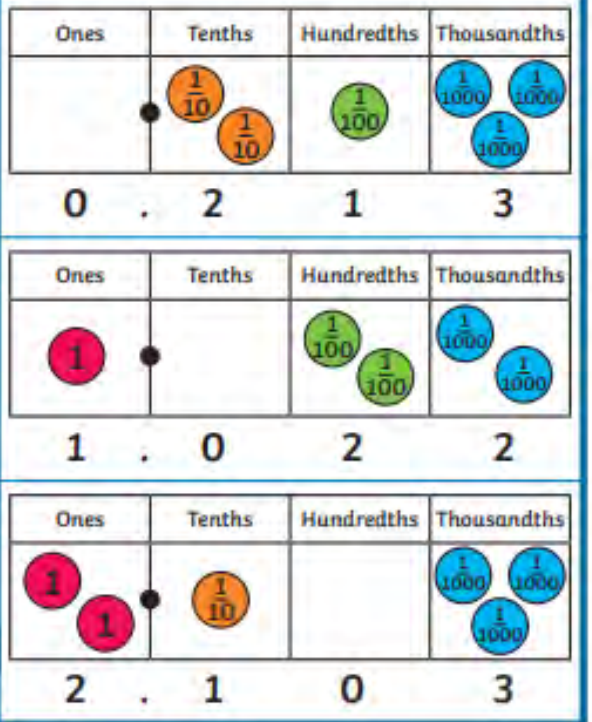
- tenths
- hundredths
- decimal tenths
- decimal hundredths
- decimal equivalents
- part-whole model
- rounding
- decimal point
- place value

Tenths, Hundredths and Thousandths





Order and Compare Numbers with Three Decimal Places



Decimal Numbers as Fractions

$$0.71 = \frac{71}{100} = \frac{7}{10} + \frac{1}{100}$$

$$0.37 = \frac{37}{100} = \frac{3}{10} + \frac{7}{100}$$

Decimals

Knowledge Organiser

Multiplying and Dividing by 10, 100 and 1000

Tens	Ones	Tenths	Hundredths	Thousandths
3	8			
	3	8		
3	8			

÷ 10 (3 8 → 3 8)

× 10 (3 8 → 3 8)

Tens	Ones	Tenths	Hundredths	Thousandths
3	8			
	0	3	8	
3	8			

÷ 100 (3 8 → 0 3 8)

× 100 (0 3 8 → 3 8)

Tens	Ones	Tenths	Hundredths	Thousandths
3	8			
	0	0	3	8
3	8			

÷ 1000 (3 8 → 0 0 3 8)

× 1000 (0 0 3 8 → 3 8)

Adding and Subtracting Decimals

0.8 + 0.001 = 0.801

1.031 - 0.23 = 0.801

0.4005 + 0.4005 = 0.801

Rounding Decimals

1 ← 1.1 1.2 1.3 1.4 | 1.5 1.6 1.7 1.8 1.9 → 2

If the tenths digit is 1, 2, 3 or 4, we round down to the nearest whole number.

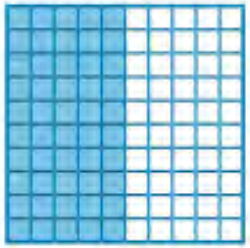
If the tenths digit is 5, 6, 7, 8 or 9, we round up to the nearest whole number.

1.1 ← 1.11 1.12 1.13 1.14 | 1.15 1.16 1.17 1.18 1.19 → 1.2

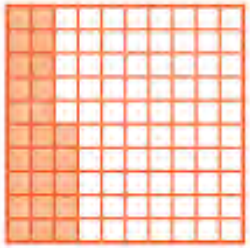
If the hundredths digit is 1, 2, 3 or 4, we round down to the nearest tenth.

If the hundredths digit is 5, 6, 7, 8 or 9, we round up to the nearest tenth.

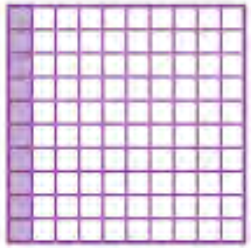
Percentage and Decimal Equivalents



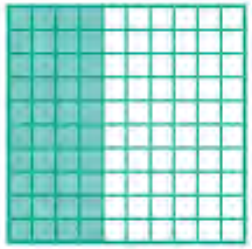
$50\% = \frac{50}{100} = \frac{1}{2} = 0.5$



$25\% = \frac{25}{100} = \frac{1}{4} = 0.25$



$10\% = \frac{10}{100} = \frac{1}{10} = 0.1$

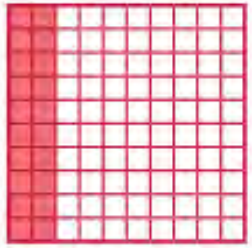


$40\% = \frac{40}{100} = \frac{2}{5} = 0.4$

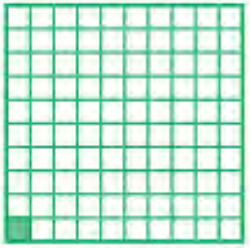
Crossing the Whole

0.82 + 0.63 = 1.45

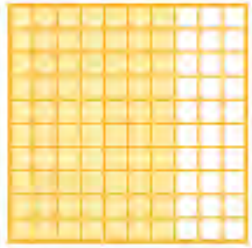
2.531 - 0.6 = 1.931



$20\% = \frac{20}{100} = \frac{1}{5} = 0.2$



$1\% = \frac{1}{100} = 0.01$



$70\% = \frac{70}{100} = \frac{7}{10} = 0.7$

Fractions — Knowledge Organiser

Key Vocabulary

- numerator
- denominator
- unit fraction
- non-unit fraction
- whole
- equivalent
- mixed number
- improper fraction
- simplest form
- multiple
- common denominator
- common numerator

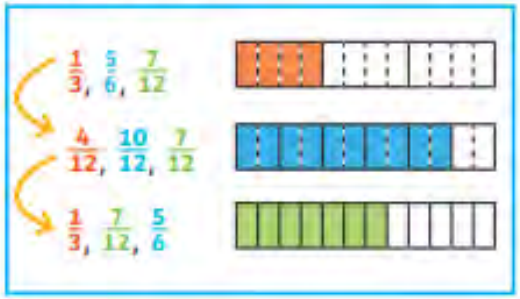
Equivalent Fractions

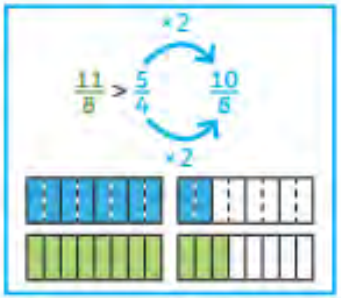
To find equivalent fractions, we multiply or divide the numerator and denominator by the same number.

$\frac{1}{2} = \frac{5}{10} = \frac{50}{100}$ (×5, ×10; ×5, ×10)

Compare and Order Fractions

We can compare and order fractions by using common denominators.





Mixed Numbers

Mixed numbers contain a whole number and a fraction.

whole → $2\frac{1}{4}$ ← fraction

Improper Fractions

An improper fraction has a numerator which is greater than or equal to the denominator.

$\frac{5}{3}$

Convert an Improper Fraction to a Mixed Number

$\frac{9}{4}$

$9 \div 4 = 2r1$ → $2\frac{1}{4}$

Divide the numerator by the denominator.

This shows you the whole number and the fraction.

Convert a Mixed Number to an Improper Fraction

Multiply the whole by the denominator to make an improper fraction.

$2\frac{5}{6} = \frac{12}{6} + \frac{5}{6} = \frac{17}{6}$

Add the fractions together.

Adding and Subtracting Fractions

To add or subtract fractions with denominators that are multiples of the same number, we must change one fraction to have the same denominator.

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

$\frac{4}{5} - \frac{3}{5} = \frac{1}{5}$

$\frac{1}{4} + \frac{3}{8} = \frac{2}{8} + \frac{3}{8} = \frac{5}{8}$

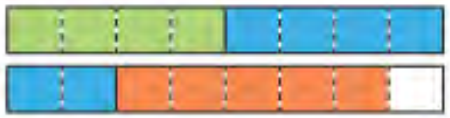
$\frac{5}{6} - \frac{2}{3} = \frac{5}{6} - \frac{4}{6} = \frac{1}{6}$

Fractions

Knowledge Organiser

Add Fractions Where the Total is Greater Than 1

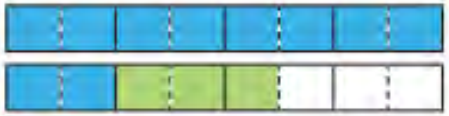
$\frac{1}{2} + \frac{3}{4} + \frac{5}{8} = \frac{4}{8} + \frac{6}{8} + \frac{5}{8} = \frac{15}{8} = 1\frac{7}{8}$



Add Mixed Numbers

$1\frac{1}{4} + \frac{3}{8} = 1\frac{2}{8} + \frac{3}{8} = 1 + \frac{5}{8} = 1\frac{5}{8}$

$1\frac{1}{4} + \frac{3}{8} = \frac{5}{4} + \frac{3}{8} = \frac{10}{8} + \frac{3}{8} = \frac{13}{8} = 1\frac{5}{8}$



Subtract from a Mixed Number

$1\frac{2}{3} - \frac{2}{9} = 1\frac{6}{9} - \frac{2}{9} = 1\frac{4}{9}$

starting number	find the equivalent fraction	subtract

Multiply Unit Fractions by an Integer

$\frac{1}{3} \times 5 = \frac{5}{3}$

Multiply Non-Unit Fractions by an Integer

$2 \times \frac{4}{9} = \frac{8}{9}$

Subtract Two Mixed Numbers

$2\frac{3}{4} - 1\frac{5}{8} = 1\frac{1}{8}$

$2 - 1 = 1$

$\frac{3}{4} - \frac{5}{8} = \frac{1}{8}$

Multiply Mixed Numbers by Integers

Convert to an improper fraction and multiply the numerator by the integer.

$2\frac{1}{4} \times 2 = \frac{9}{4} \times 2 = \frac{18}{4} = 4\frac{2}{4} = 4\frac{1}{2}$

Use repeated addition.

$2\frac{1}{4} \times 2 = 2\frac{1}{4} + 2\frac{1}{4} = 4\frac{2}{4} = 4\frac{1}{2}$

Subtract from a Mixed Number - Breaking the Whole

$2\frac{1}{4} - \frac{3}{8} = 2\frac{2}{8} - \frac{3}{8} = 1\frac{10}{8} - \frac{3}{8} = 1\frac{7}{8}$

Converting Units

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Key Vocabulary

- mass
- gram
- kilogram
- capacity
- volume
- millilitre
- centilitre
- litre
- millimetre
- centimetre
- kilometre

Converting Mass

1000g = 1kg

$\frac{1}{10}$kg = 0.1kg = 100g

$\frac{1}{4}$kg = 0.25kg = 250g

$\frac{1}{2}$kg = 0.5kg = 500g

$\frac{3}{4}$kg = 0.75kg = 750g

Converting Capacity

1000ml = 1 litre

$\frac{1}{10}$l = 0.1l = 100ml

$\frac{1}{4}$l = 0.25l = 250ml

$\frac{1}{2}$l = 0.5l = 500ml

$\frac{3}{4}$l = 0.75l = 750ml

$\frac{1}{100}$l = 0.01l = 10ml

Converting Length

1000 metres = 1 kilometre

100cm = 1m

10mm = 1cm

$\frac{1}{10}$km = 0.1km = 100m

$\frac{1}{4}$km = 0.25km = 250m

$\frac{1}{2}$km = 0.5km = 500m

$\frac{3}{4}$km = 0.75km = 750m

Converting Units

Knowledge Organiser

Units of Time

Minute

1 minute = 60 seconds

Hour

1 hour = 60 minutes

Day

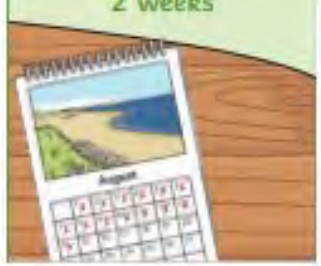
1 day = 24 hours

Week

1 week = 7 days

Fortnight

1 fortnight = 2 weeks



Month

Year

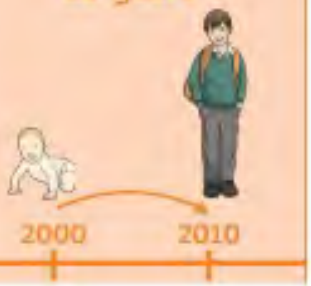
1 year =
12 months =
52 weeks =
365 days

Leap Year

1 leap year =
366 days

Decade

1 decade =
10 years

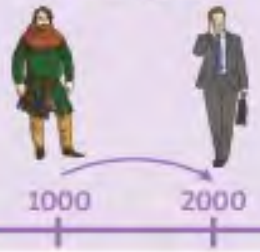


Century

1 century =
100 years

Millennium

1 millennium =
1000 years



Perimeter and Area — Knowledge Organiser

Key Vocabulary

- metre
- kilometre
- perimeter
- length
- width
- rectangle
- rectilinear
- dimensions

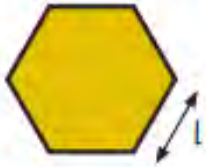
Measure Perimeter

Measure the perimeter of a rectangle:

Measure the length (l) and width (w).

Perimeter = l + w + l + w or (l + w) × 2

Measure the perimeter of regular shapes:



Measure the length (l) and count the number of sides (s) on the shape.

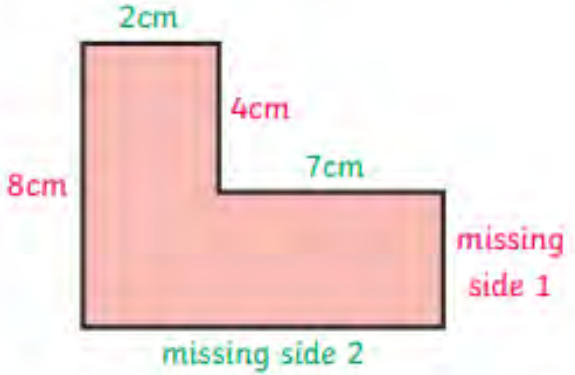
Perimeter = l × s

Measure the perimeter of irregular shapes:

Measure the length of each side and add them together.

Calculate Perimeter

Calculate the missing sides of this rectilinear shape to find the perimeter:



*This shape is not drawn to the dimensions specified.

Missing side 1 + 4cm = 8cm,
so missing side 1 = 4cm.

Missing side 2 = 2cm + 7cm = 9cm

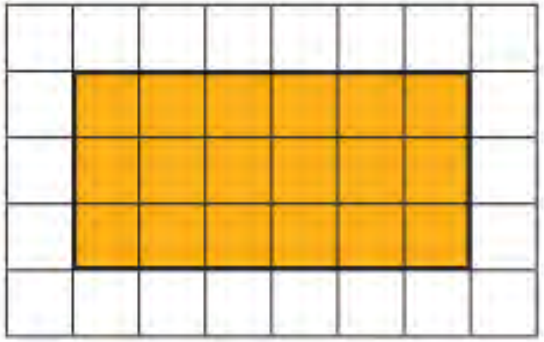
Perimeter = sum of all sides =
2cm + 4cm + 7cm + 4cm + 9cm + 8cm = 34cm

Length and Perimeter

Knowledge Organiser

Area of Rectangles

The area of a rectangle on a grid:

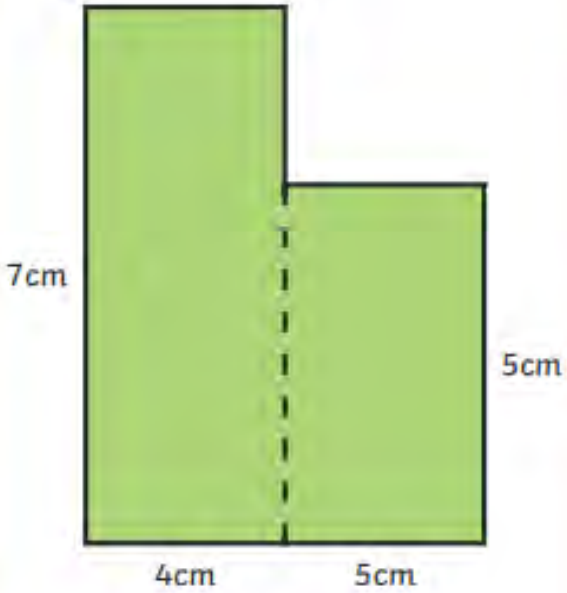


Multiply the length × width
= 6 × 3 = 18 squares.

The area of a rectangle = length (l) × width (w).

Area of Compound Shapes

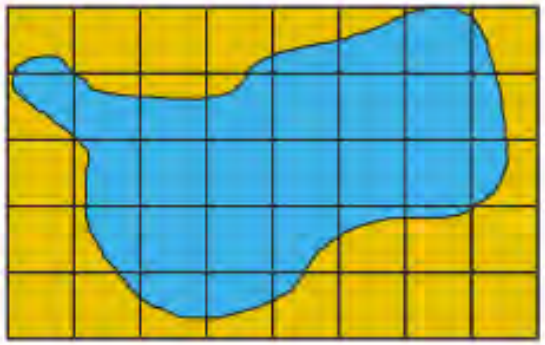
To find the area of a compound shape, divide the shape into rectangles with known dimensions:



Area = 7cm × 4cm + 5cm × 5cm
= 28cm² + 25cm²
= 53cm²

Area of Irregular Shapes

To find the area of an irregular shape, find the number of whole squares and part squares.



Whole squares = 10
Part squares = 22

Estimate of area = whole squares + half part squares

= 10cm² + 11cm² = 21cm²

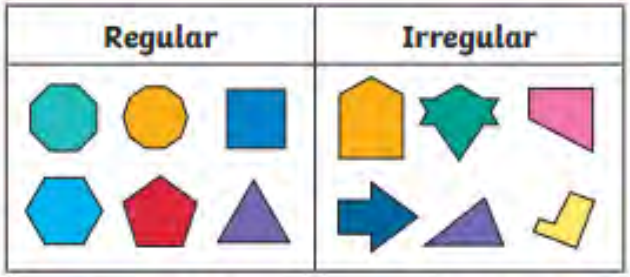
*There are other ways to estimate the area of irregular shapes.

Properties of Shape — Knowledge Organiser

Key Vocabulary

- angle
- right angle
- acute
- obtuse
- reflex
- protractor
- horizontal
- vertical
- parallel
- perpendicular
- polygon
- regular
- irregular
- two-dimensional
- three-dimensional
- flat face
- curved surface
- edge
- curved edge
- vertex
- apex

Regular and Irregular Polygons



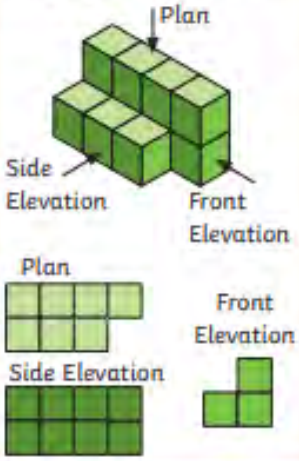
A polygon is any two-dimensional shape formed with straight lines.

In a regular polygon, all the sides and angles are equal.

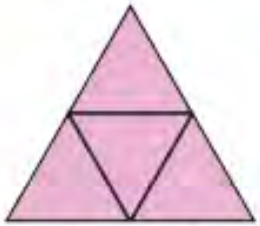
In an irregular polygon, the sides and angles are not equal.

Representations

Cube models can be drawn as 2D representations using different elevations.



A shape net is a 2D drawing of an unfolded 3D shape. When you are drawing or reasoning about shape nets, think carefully about where the edges of the faces meet.



Shape net of a tetrahedron.

Properties of 3D Shapes

Name	Surfaces		Edges		Vertices	Picture
	Flat	Curved	Flat	Curved		
sphere	0	1	0	0	0	
cube	6	0	12	0	8	
cuboid	6	0	12	0	8	
cone	1	1	0	1	0	
cylinder	2	1	0	2	0	
square-based pyramid	5	0	8	0	5	
tetrahedron	4	0	6	0	4	
triangular prism	5	0	9	0	6	
pentagonal prism	7	0	15	0	10	
hexagonal prism	8	0	18	0	12	
octagonal prism	10	0	24	0	16	
octahedron	8	0	12	0	6	

A cone has an apex. This is because a vertex is the point where two straight edges meet and a cone has no straight edges.

Properties of Shape — Knowledge Organiser

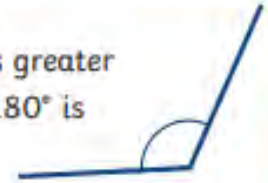
Identifying Angles

Acute Angles

Any angle that measures less than 90° is called an **acute** angle.

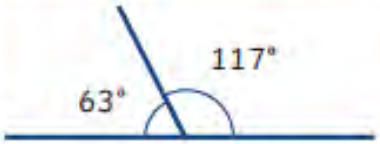
Obtuse Angles

Any angle that measures greater than 90° and less than 180° is called an **obtuse** angle.

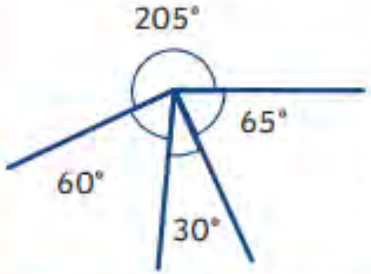


Reflex Angles

Any angle that measures greater than 180° is called a **reflex** angle.



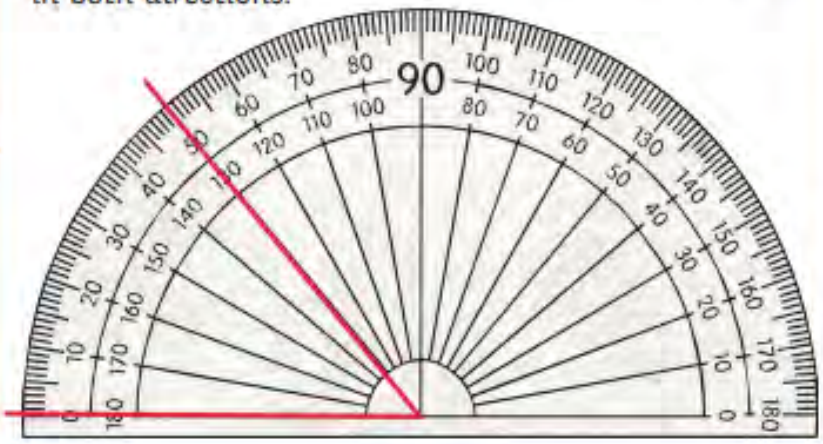
Angles on a straight line always total 180°.



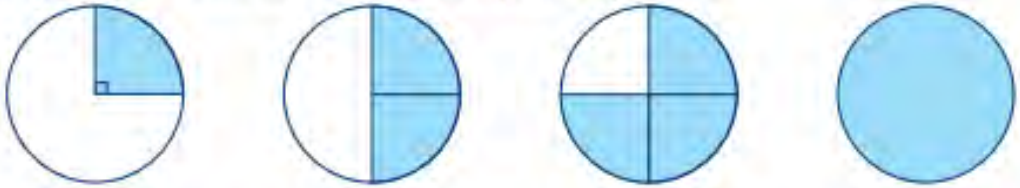
Angles around a point always total 360°.

Measuring and Drawing Angles

To measure angles, we use a protractor. Look carefully at how the numbers on the scale count from 0° to 180° in both directions.

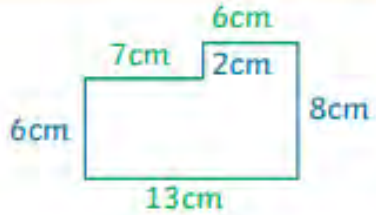


Multiples of 90° can be used as descriptions of a turn.



$\frac{1}{4}$ turn = 90° $\frac{1}{2}$ turn = 180° $\frac{3}{4}$ turn = 270° 1 turn = 360°

Using Properties of Rectangles



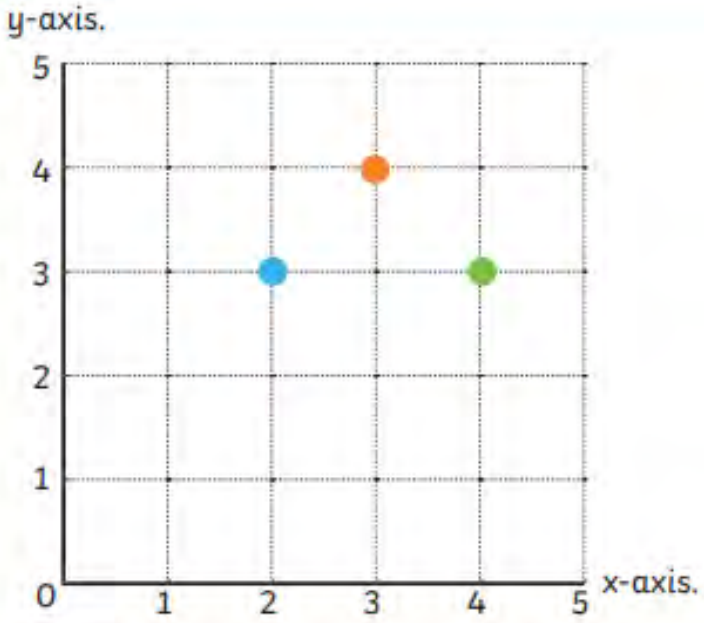
6cm + 2cm = 8cm

7cm + 6cm = 13cm

Position and Direction — Knowledge Organiser

Key Vocabulary

- coordinate
- quadrant
- x-axis
- y-axis
- reflection
- mirror line
- translation
- horizontal
- vertical



Coordinates are a useful way to locate a position on a map or grid.

The numbers across the horizontal line of the grid are on the **x-axis**.

The numbers on the vertical line of the grid are on the **y-axis**.

We always read or write the number on the x-axis before the y-axis.

The x and y position are written in brackets with a comma.

The coordinate of the orange spot is **(3, 4)**.

To help you remember which point to read or write first, simply remember to move 'along the corridor and up the stairs'.

In other words, move on the **x-axis** and then move on the **y-axis**.

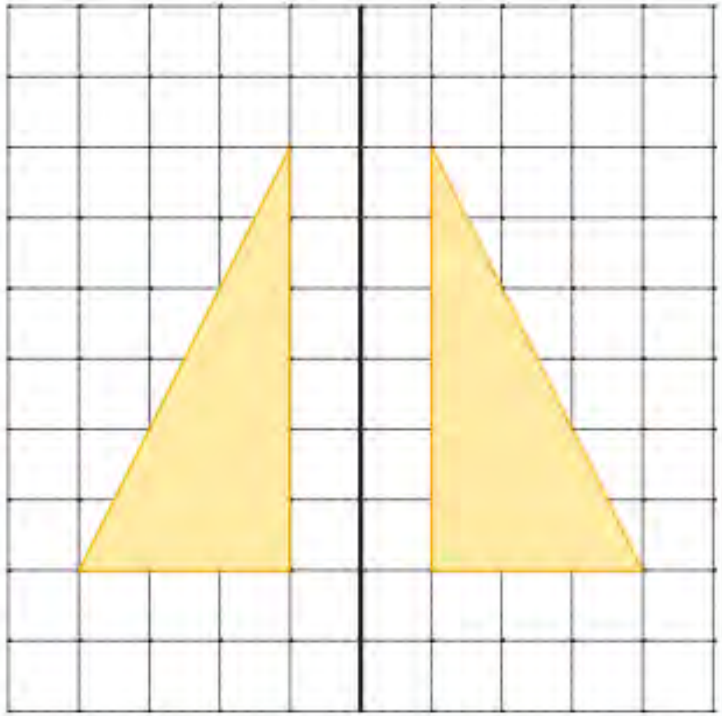
Position and Direction

Knowledge Organiser

Reflection

A shape is reflected when is flipped over a mirror line.

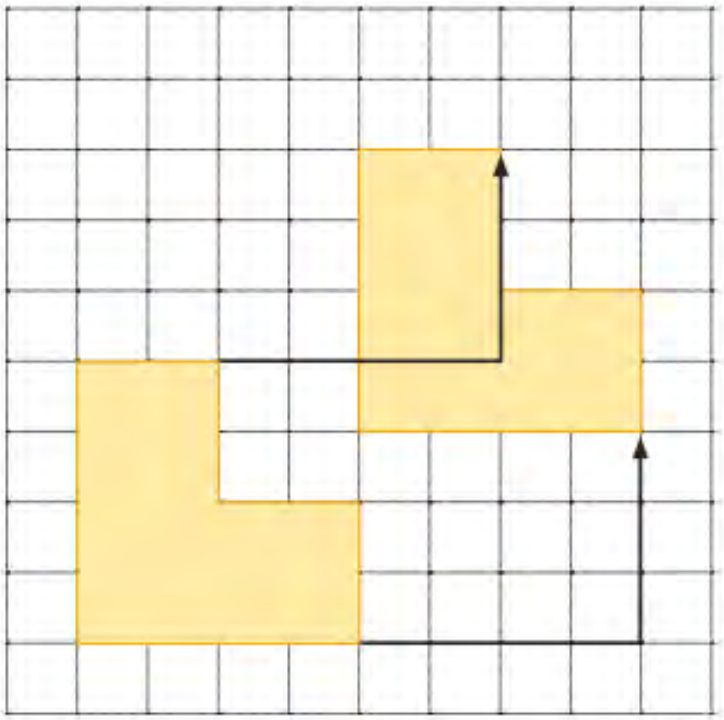
The reflected image is congruent to the original. This means that the measurements of the sides and angles have not changed. Each point of the reflected shape is the same distance from the mirror line as the original shape.



Translation

In maths, translation means moving an object on a grid. The object is moved without changing the size, turning or reflecting it.

When translating an object on a grid, it can move up or down, left or right.



Volume — Knowledge Organiser

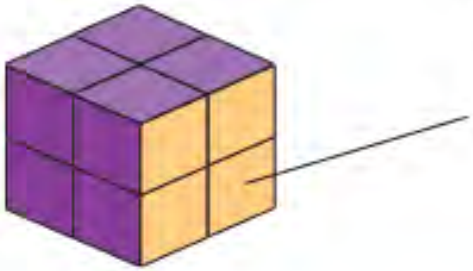
Key Vocabulary
cubed
area
cross-section
prism
cube
cuboid
face
length
height
width
depth

Volume of Cubes and Cuboids

Volume is measured in cubed units. For example, **cm³**, **m³** and **km³**.

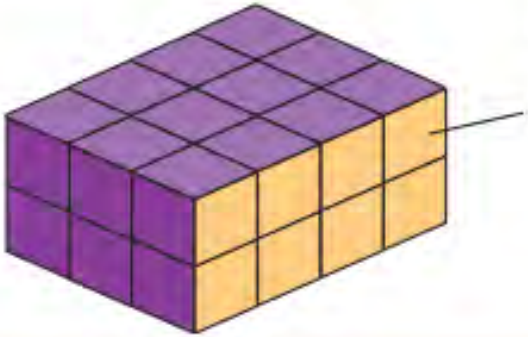
To calculate the volume of cubes and cuboids:

1. Calculate the area of the cross-section (one face).
2. Multiply the area of the cross-section (one face) by its depth.



Area of cross section (face) = 2cm × 2cm = $4cm^2$

$4cm^2$ × 2cm = Volume of $8cm^3$



Area of cross section (face) = 4cm × 2cm = $8cm^2$

$8cm^2$ × 3cm = Volume of $24cm^3$

Statistics

Knowledge Organiser

Key Vocabulary

- axis
- continuous data
- horizontal
- data
- interpret
- label
- line graph
- maximum value
- minimum value
- pattern
- predict
- relationship
- represent
- scale
- survey
- table
- tally
- timetable
- vertical
- x-axis
- y-axis

Reading and Understanding Tables

A table to show ticket prices at a local cinema.

Ticket Type	Weekday Price	Weekend Price
Adult	£6	£7.50
Child	£4	£4.50
Student	£5.50	£6

In order to understand the data presented in a table, you must read the table's title and the headings. Remember to always look at the heading that each piece of information falls under.

Completing Tables

Here is a table showing the favourite drink flavours of some children.

	Boys	Girls	Total
Orange	8		18
Blackcurrant		6	
Total	15		

To find how many boys voted for blackcurrant, look at the total number of boys who voted and subtract the number of votes for orange.

To find how many girls voted for orange, look at the total number of votes for orange and subtract the number of votes from boys.

To find the total number of votes for blackcurrant, the total number of girls or the total number of voters, simply add up the values from the appropriate row or column.

Timetables

Here is a bus timetable:

Bus stop locations	Three different buses		
Mill Road	0726		0842
High Street	0729	0803	
Pitsmoor Road	0759	0833	
Fulwood	0845	0919	0946

The bus starts at this time and location.

The bus does not stop here.

The bus terminates at this time and location.

Statistics

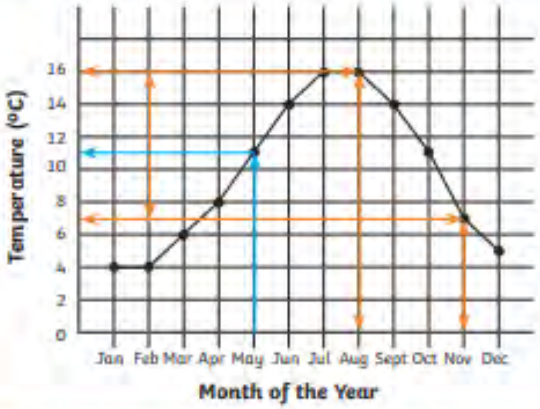
Knowledge Organiser

Read and Interpret Line Graphs

Here is a line graph showing the average temperature for each month.

The y-axis shows temperature in intervals of 2°C on a scale of 0°C to 16°C.

The points show the average temperature for each month.



The x-axis shows the months of the year.

Use Line Graphs to Solve Problems

To find the average temperature in May, follow the arrow up from May and across to the temperature. As this is halfway between 10°C and 12°C, the average temperature in May is 11°C.

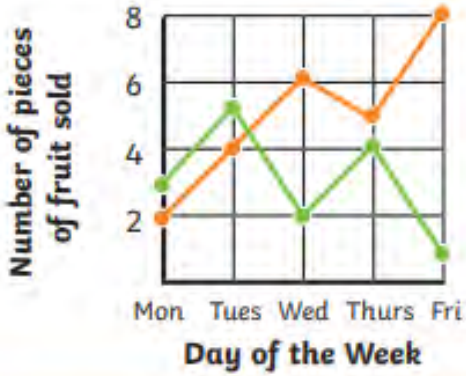
To find the difference between the average temperatures in August and in November, find the temperature for each month and calculate the difference between the two. The shape of the line graph can show how the temperature changed. he average temperature falls 9°C from August to November.

Draw Line Graphs

Here is a table showing the number of different types of fruit sold each day.

	Bananas	Apples
Mon	2	3
Tues	4	5
Wed	6	2
Thurs	5	4
Fri	8	1

This graph can be used to represent the data from the table.



Mark each point for the number of bananas sold each day and join each point with a line.

Mark each point for the number of apples sold each day and join each point with a line.