Red/ Purple Class

Addition and Subtraction: Stage 5

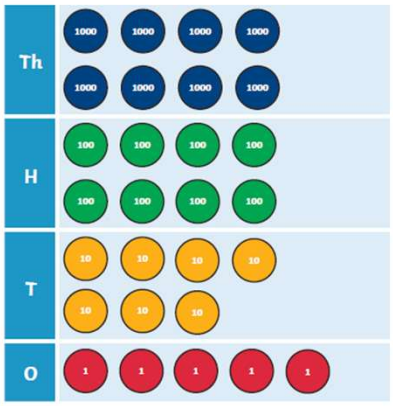
Addition and Subtraction — Knowledge Organiser

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



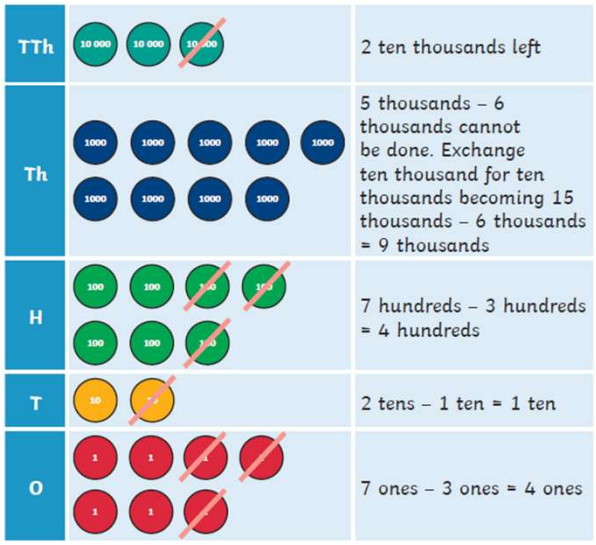
Column Method

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

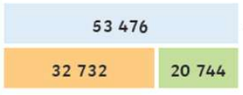
Rounding is not as accurate when both numbers are rounded up. A better estimate comes from "rounding" one down and one up.

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

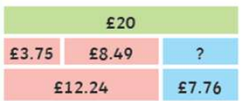
Start with a number, subtract 409 and double. I end with 6264. To find the starting number use the inverse: halve, then add 409. Half of 6264 = 3132. 3132 + 409 = 3541. The starting number was 3541.

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: Stage 5

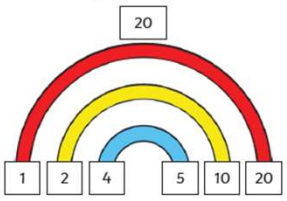
Multiplication and Division — Knowledge Organiser

Key Vocabulary

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

Factors

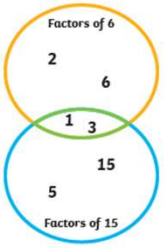
A factor is a number that divides into another number exactly, without leaving a remainder.



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

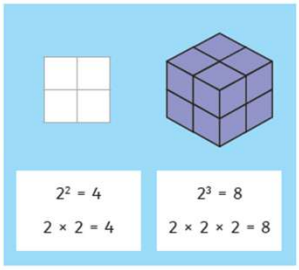
A common factor is a factor of 2 or more numbers.



Prime Numbers

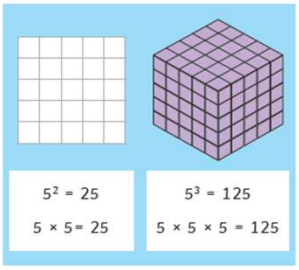
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

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

$2543 \times 7 = 17\,801$

	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.

Four Operations: Stage 6

Four Operations — Knowledge Organiser

Key Vocabulary

- Add
- Total
- Make
- Plus
- Sum
- More
- Altogether
- Difference
- Leave
- Subtract
- Difference between
- Less
- Minus
- Take away
- Mentally, Orally
- Column Addition
- Column Subtraction
- Estimate
- Inverse operation
- Solve problems
- Number facts
- Place Value
- Complex

Add and Subtract Whole Numbers

Column Method

	4	5	8	6	4
+	2	3	4	9	7
	6	9	3	6	1
		1	1	1	

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

	3	5	$^{6}\not{7}$	$^{13}\not{4}$	$^{1}\not{2}$
-		3	4	7	6
	3	2	2	6	6

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

Multiply up to 4-digit by 2-digit

1	$\not{3}$	$\not{2}$	
	1	5	4
×		2	6
	9	2	4
3	0	8	0
4	0	0	4
1	1		

Start with the ones.

154 × 6 = 924

154 × 20 = 3080

3080 + 924 = 4004

Order of Operations

B	Brackets	10 × (4 + 2) = 10 × 6 = 60
O	Order	5 + 2^2 = 5 + 4 = 9
D	Division	10 + 6 ÷ 2 = 10 + 3 = 13
M	Multiplication	10 - 4 × 2 = 10 - 8 = 2
A	Addition	10 × 4 + 7 = 40 + 7 = 47
S	Subtraction	10 ÷ 2 - 3 = 5 - 3 = 2

Four Operations — Knowledge Organiser

Short Division

Start from the left.

		4	4	0	5
12	5	$^{5}2$	$^{4}8$	6	$^{6}0$

5 ÷ 12 = 0 r5

52 ÷ 12 = 4 r4

48 ÷ 12 = 4

6 ÷ 12 = 0 r6

Long Division

		1	2	0	r	3
14	1	6	8	3		
	1	4	0	0		
		2	8	3		
		2	8	0		
				3		

Common Factors

Factors of 48

1	2	3	4	6	8	12	16	24	48

Factors of 30

1	2	3	5	6	10	15	30

Common factors: 1, 2, 3, 6

Common Multiples

Multiples of 3

3	...	18	21	24	...	39	42

Multiples of 7

7	14	21	28	35	42

Common multiples: 21, 42...

Primes

A prime number has only 1 and itself as factors: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 33, 37, 41, 43

A composite number has factors other than 1 and itself.

Squares and Cubes

Square numbers result from a number being multiplied by itself (e.g. 5 × 5 = 25):

1, 4, 9, 16, 25, 36, 49, 64, 81, 100

Cube numbers result from a number being multiplied by itself twice (2 × 2 × 2 = 8):

1, 8, 27, 64, 125

Mental Calculations and Estimation

Order of calculations:

50 × 34 × 2 = 50 × 2 × 34 = 100 × 34 = 3400

Money: £8.99 + £3.49 = £12.48

Use £9 + £3.50 = £12.50 and subtract 2p

Estimate on a number line

Subdivide line to estimate: **17**

Reason from Known Facts

90 ÷ 10 = 9 **so 90 ÷ 20 = 4.5 and 90 ÷ 5 = 18**

16 × 9 = 144 **so 1.6 × 9 = 14.4**

4352 ÷ 17 = 256
so 256 × 18 = 4352 + 256 = 4608

3786 + 2850 = 6636
so 4786 + 2850 = 7636
and 2786 + 3850 = 6636
and 8636 – 3786 = 4850

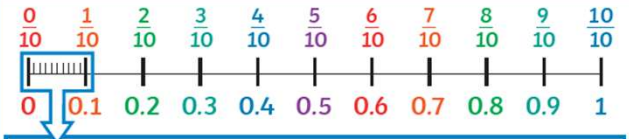
Decimals: Stage 5

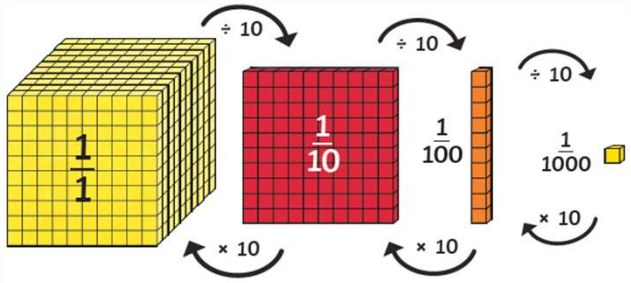
Decimals — Knowledge Organiser

Key Vocabulary

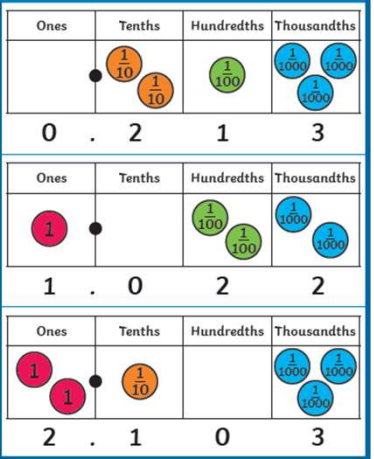
- tenths
- hundredths
- decimal tenths
- decimal hundredths
- decimal equivalents
- part-whole model
- rounding
- decimal point
- place value

Tenths, Hundredths and Thousandths





Order and Compare Numbers with Three Decimal Places



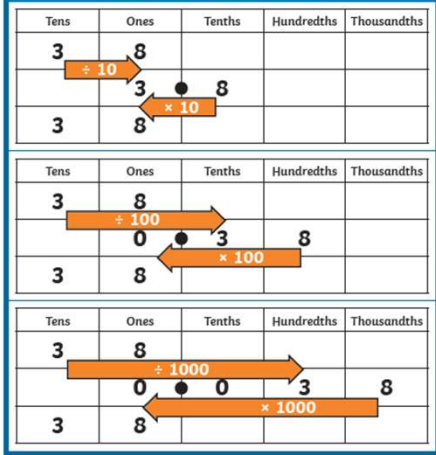
Decimal Numbers as Fractions

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

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

Decimals — Knowledge Organiser

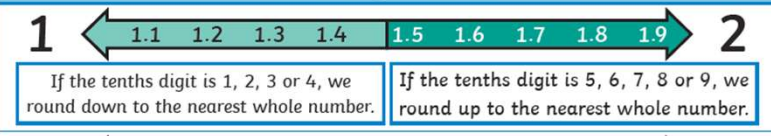
Multiplying and Dividing by 10, 100 and 1000



Adding and Subtracting Decimals

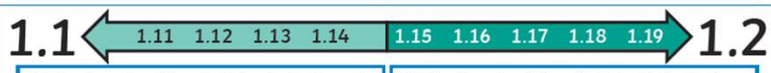
- 0.8 + 0.001 = 0.801
- 1.031 - 0.23 = 0.801
- 0.4005 + 0.4005 = 0.801

Rounding Decimals



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

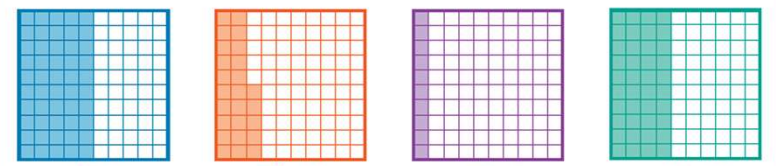
If the tenths digit is 5, 6, 7, 8 or 9, we round up to the nearest whole number.



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.

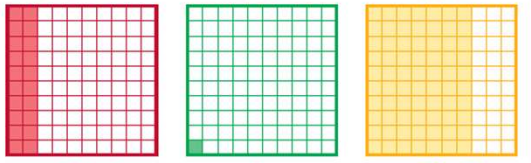
Percentage and Decimal Equivalents



$50\% = \frac{50}{100} = \frac{1}{2} = 0.5$ $25\% = \frac{25}{100} = \frac{1}{4} = 0.25$ $10\% = \frac{10}{100} = \frac{1}{10} = 0.1$ $40\% = \frac{40}{100} = \frac{2}{5} = 0.4$

Crossing the Whole

- 0.82 + 0.63 = 1.45
- 2.531 - 0.6 = 1.931



$20\% = \frac{20}{100} = \frac{1}{5} = 0.2$ $1\% = \frac{1}{100} = 0.01$ $70\% = \frac{70}{100} = \frac{7}{10} = 0.7$

Decimals: Stage 6

Decimals — Knowledge Organiser

Key Vocabulary

- decimal place
- decimal fraction
- recurring decimal
- equivalent fraction
- tenth
- sharing
- partitioning
- exchanging
- rounding to 3d.p.
- hundredth
- thousandth
- equal to
- remainder
- grouping

Place Value

Tens	Ones	.	tenths	hundredths	thousandths
	1 1 1	.	0.1 0.1 0.1 0.1	0.01 0.01	0.001 0.001 0.001 0.001 0.001 0.001

$3 + \frac{4}{10} + \frac{2}{100} + \frac{6}{1000}$ ← 3.426 → $3 + 0.4 + 0.02 + 0.006$

1	2	3	4	5	6	7	8	9
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009

Fractions to Decimals

$\frac{7}{20} = \frac{35}{100}$ or 0.35 (×5)

$\frac{7}{25} = \frac{28}{100}$ or 0.28 (×4)

$\frac{7}{50} = \frac{14}{100}$ or 0.14 (×2)

$\frac{8}{200} = \frac{4}{100}$ or 0.04 (÷2)

When the denominator is not a factor or multiple of 100

$\frac{7}{8} = 7 \div 8$

	0	.	8	7	5
8	7	.	7 0	6 0	4 0

Dividing Decimals by Integers

8.12 ÷ 4

	2	.	0 3
4	8	.	1 2

6.93 ÷ 3 = 2.31

Ones	.	tenths	hundredths
1 1		0.1 0.1 0.1	0.01
1 1		0.1 0.1 0.1	0.01
1 1		0.1 0.1 0.1	0.01

Decimals — Knowledge Organiser

Multiplying and Dividing by 10, 100 and 1000

Thousands	Hundreds	Tens	Ones	.	tenths	hundredths	thousandths
			2	.	0	8	
		2	0	.	8		
			2	.	0	8	

× 10 ÷ 10

Thousands	Hundreds	Tens	Ones	.	tenths	hundredths	thousandths
		4	3	.	5		
4	3	5	0	.			
		4	3	.	5		

× 100 ÷ 100

Thousands	Hundreds	Tens	Ones	.	tenths	hundredths	thousandths
			1	.	3	5	1
1	3	5	1	.			
			1	.	3	5	1

× 1000 ÷ 1000

Multiplying Decimals by Integers

	3	.	4	5
×				3
1	0	.	3	5
	1		1	

3.21 × 3 = 9.63

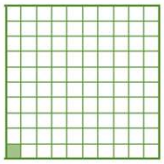
Ones	.	tenths	hundredths
1 1 1		0.1 0.1	0.01
1 1 1		0.1 0.1	0.01
1 1 1		0.1 0.1	0.01

Decimal Numbers as Fractions

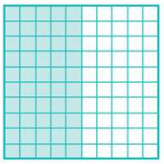
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

$\frac{1}{10}$ $\frac{2}{10}$ $\frac{3}{10}$ $\frac{4}{10}$ $\frac{5}{10}$ $\frac{6}{10}$ $\frac{7}{10}$ $\frac{8}{10}$ $\frac{9}{10}$ 1

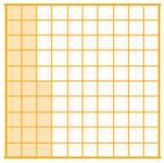
$\frac{1}{5}$ $\frac{2}{5}$ $\frac{1}{2}$ $\frac{3}{5}$ $\frac{4}{5}$



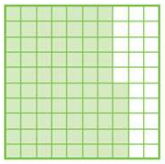
$\frac{1}{100} = 0.01$



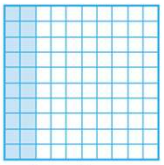
$\frac{50}{100} = \frac{1}{2} = 0.5$



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



$\frac{75}{100} = \frac{3}{4} = 0.75$



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

$\frac{1}{3} = 0.33$ $\frac{1}{8} = 0.125$ $\frac{1}{1000} = 0.001$

Number and Place Value: Stage 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.

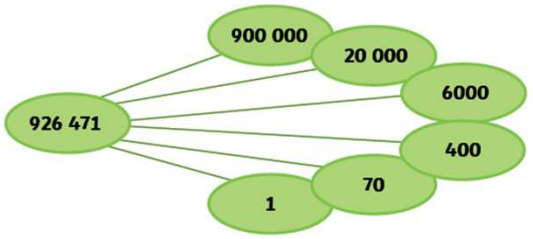
Number and Place Value — Knowledge Organiser

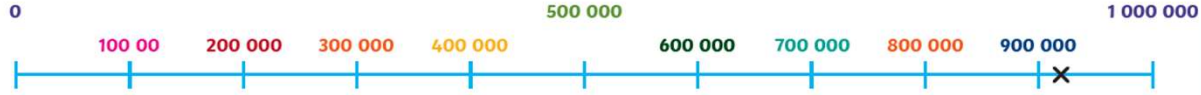
Numbers to One Million

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

20	21	22	23	24	25	26	27	28	29	30

round down | round up

Rounding to the nearest 1000

2000 ← 2499 | 2500 → 3000

round down | round up

Rounding to the nearest 100 000

200 000 ← 249 999 | 250 000 → 300 000

round down | round up

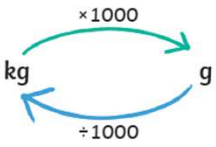
Measurement (mass and time): Stage 5

Converting Units — Knowledge Organiser

Key Vocabulary

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

Converting Mass



1000g = 1kg

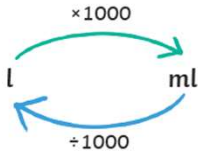
$\frac{1}{10}$kg = 0.1kg = 100g

$\frac{1}{4}$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

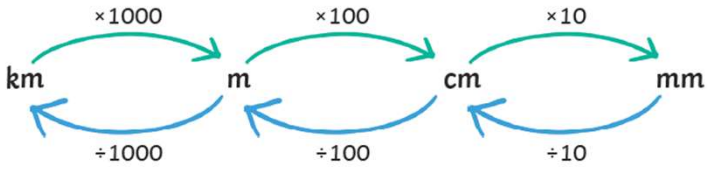
$\frac{1}{4}$l = 0.25l = 250ml

$\frac{1}{2}$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

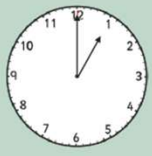
Units of Time

Minute

1 minute = 60 seconds

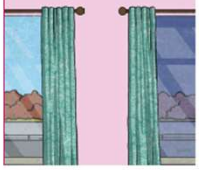
Hour

1 hour = 60 minutes



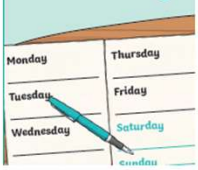
Day

1 day = 24 hours



Week

1 week = 7 days



Fortnight

1 fortnight = 2 weeks

Month

Year

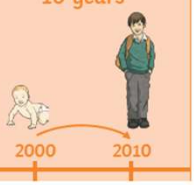
1 year = 12 months = 52 weeks = 365 days

Leap Year

1 leap year = 366 days

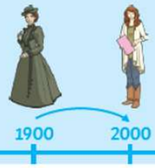
Decade

1 decade = 10 years



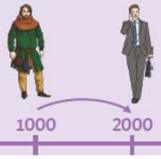
Century

1 century = 100 years



Millennium

1 millennium = 1000 years



Measurement (mass and time): Stage 6

Converting Units — **Knowledge Organiser**

Key Vocabulary

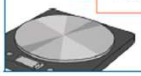
mass
gram
kilogram
capacity
volume
millilitre
litre
millimetre
centimetre
kilometre
foot
inch
ounce
pound
stone
pint
gallon

Converting Mass

1 tonne = 1000kg
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 = 0.75 = 750g

÷ 1000 → kilograms (kg) ← ÷ 1000
grams (g) ← tonnes (t)
× 1000 ← × 1000



Converting Capacity

1000ml = 1l
$\frac{1}{10}$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

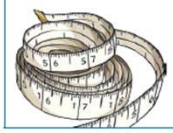
÷ 1000 → litres (l) ← ÷ 1000
millilitre (ml)
× 1000

Converting Length

1000m = 1km
100cm = 1m
10mm = 1cm

$\frac{1}{2}$m = 0.5m = 50cm
$\frac{1}{4}$m = 0.25m = 25cm

$\frac{3}{4}$m = 0.75m = 75cm
$\frac{1}{10}$m = 0.01m = 10cm



÷ 10 → centimetres (cm) ← ÷ 100 → metres (m) ← ÷ 1000 → kilometres (km)
millimetres (mm)
× 10 ← × 100 ← × 1000

Converting Units — **Knowledge Organiser**

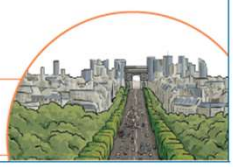
Miles to Kilometres

You might measure the length of a road or the distance between two cities in miles or kilometres.

÷ 5 → × 8 → kilometres (km)
miles (m)
× 5 ← ÷ 8

5 miles ≈ 8 kilometres

≈ means approximately equal to



Time

Minute 1 minute = 60 seconds
Hour 1 hour = 60 minutes
Day 1 day = 24 hours
Week 1 week = 7 days

Year 1 year = 12 months = 52 weeks = 365 days

Imperial Measures

Things that could be measured using imperial units:

- Someone's height in feet and inches
- The mass of a bag of sugar in ounces
- The mass of a sack of potatoes in pounds
- A person's mass in stones
- A carton of milk in pints
- The amount of water in a bath in gallons

1 foot = 12 inches
1 pound = 16 ounces
1 stone = 14 pounds
1 gallon = 8 pints

Metric to Imperial Conversions

metric (new)	imperial (old)
2.5 centimetres	1 inch
1 kilogram	2.2 pounds
4.5 litres	1 gallon

÷ 2.5 → inches ← × 2.5
centimetres

÷ 4.5 → gallons ← × 4.5
litres

÷ 2.2 → pounds ← × 2.2
kilograms