Red/ Purple Class

Addition and Subtraction: Stage 5

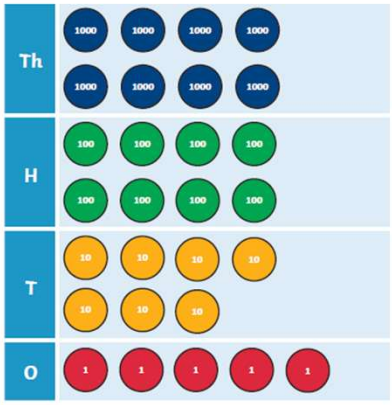
Addition and Subtraction — Knowledge Organiser

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



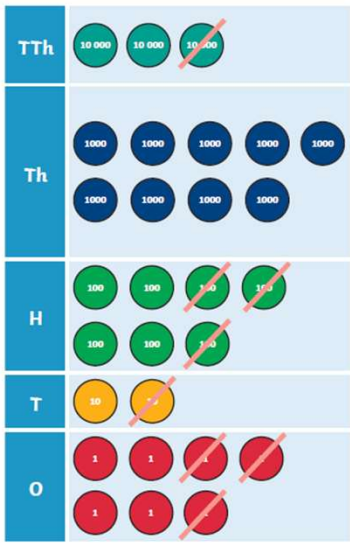
Column Method

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



2 ten thousands left

5 thousands – 6 thousands cannot be done. Exchange ten thousand for ten thousands becoming 15 thousands – 6 thousands = 9 thousands

7 hundreds – 3 hundreds = 4 hundreds

2 tens – 1 ten = 1 ten

7 ones – 3 ones = 4 ones

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

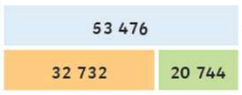
Rounding is not as accurate when both numbers are rounded up. A better estimate comes from "rounding" one down and one up.

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

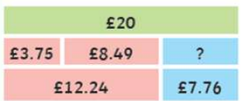
Start with a number, subtract 409 and double. I end with 6264. To find the starting number use the inverse: halve, then add 409. Half of 6264 = 3132. 3132 + 409 = 3541. The starting number was 3541.

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

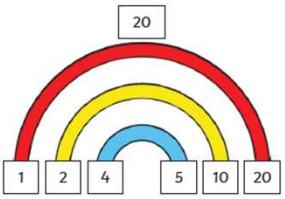
Multiplication and Division — Knowledge Organiser

Key Vocabulary

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

Factors

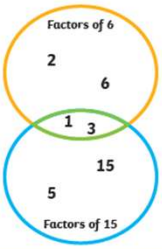
A factor is a number that divides into another number exactly, without leaving a remainder.



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

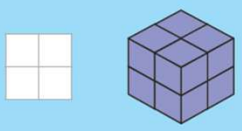
A common factor is a factor of 2 or more numbers.



Prime Numbers

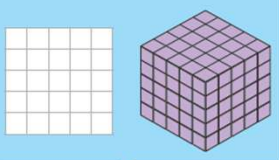
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

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

$8 \times 9 = 72$ $80 \times 9 = 720$	$9 \times 8 = 72$ $90 \times 8 = 720$
$72 \div 9 = 8$ $720 \div 9 = 80$	$72 \div 8 = 9$ $720 \div 8 = 90$

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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	7	8	0	1
	1	3	3	2	
1	5	2	5	8	0
1	3	2	1		
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	15	32

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	27	28		

28 ÷ 5 = 5 remainder 3

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

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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

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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	~~7~~ 6	~~4~~ 13	~~2~~ 12
-		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	~~3~~	~~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		

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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

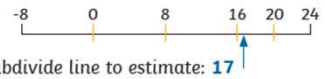
Order of calculations:

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

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

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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.

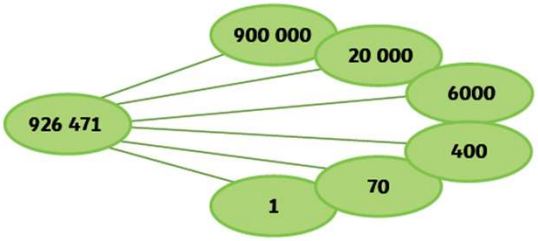
Number and Place Value — Knowledge Organiser

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

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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

Number and Place Value: Stage 6

Number and Place Value — Knowledge Organiser

Key Vocabulary

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

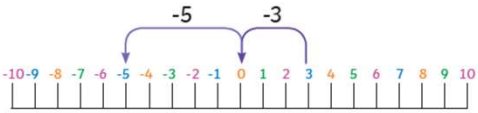
Compare and Order

equals	greater than	less than
26 + 38 = 8 × 8	223 873 > 98 256	901 198 < 1 091 098
Both calculations have the value 64.	The number on the left has 2 hundred thousands and the number on the right has 0 hundred thousands.	The number on the right has 1 million and the number on the left has 0 millions.

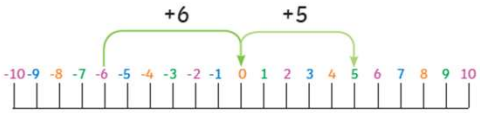
smallest | 81 782 | 127 352 | 127 835 | 137 019 | 200 002 | greatest

Negative Numbers

3 - 8 = -5



-6 + 11 = 5



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Number and Place Value — Knowledge Organiser

Numbers to Ten Million

3 926 471

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
3	9	2	6	4	7	1

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

3 926 471	
3 926 000	471

Round Any Number

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

Rounding to the nearest 10 000

20 000 ← 24 999	25 000 → 30 000
round down	round up

Rounding to the nearest 1 000 000

2 000 000 ← 2 499 999	2 500 000 → 3 000 000
round down	round up

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Fractions: Stage 5

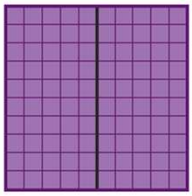
Fractions — Knowledge Organiser

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.



$\frac{1}{2} \xrightarrow{\times 5} \frac{5}{10} \xrightarrow{\times 10} \frac{50}{100}$

$\times 5$ $\times 10$

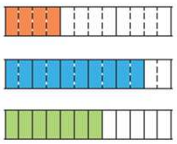
Compare and Order Fractions

We can compare and order fractions by using common denominators.

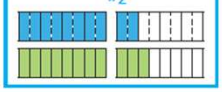
$\frac{1}{3}, \frac{5}{6}, \frac{7}{12}$

$\frac{4}{12}, \frac{10}{12}, \frac{7}{12}$

$\frac{1}{3}, \frac{7}{12}, \frac{5}{6}$



$\frac{11}{8} > \frac{5}{4}$ $\times 2$ $\frac{10}{8}$ $\times 2$



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.

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

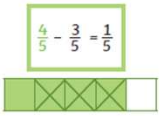
Add the fractions together.

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.

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

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



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

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

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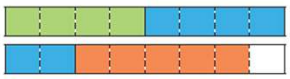
Fractions — Knowledge Organiser

Add Fractions Where the Total is Greater Than 1

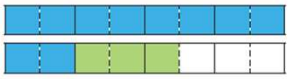
$\frac{1}{2} + \frac{3}{4} + \frac{5}{8} = \frac{4}{8} + \frac{6}{8} + \frac{5}{8} = \frac{15}{8} = 1\frac{7}{8}$



Add Mixed Numbers

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

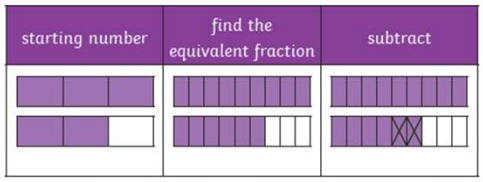
$1\frac{1}{4} + \frac{3}{8} = \frac{5}{4} + \frac{3}{8} = \frac{10}{8} + \frac{3}{8} = \frac{13}{8} = 1\frac{5}{8}$



Subtract from a Mixed Number

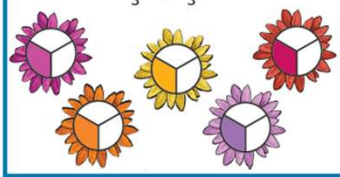
$1\frac{2}{3} - \frac{2}{9} = 1\frac{6}{9} - \frac{2}{9} = 1\frac{4}{9}$

starting number	find the equivalent fraction	subtract



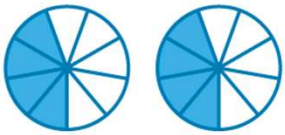
Multiply Unit Fractions by an Integer

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



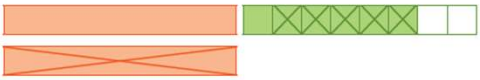
Multiply Non-Unit Fractions by an Integer

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



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.

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

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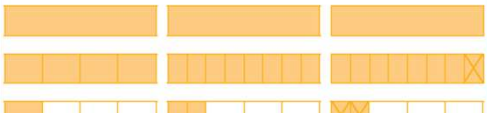
Subtract from a Mixed Number - Breaking the Whole

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



Fractions: Stage 6

Fractions — Knowledge Organiser

Key Vocabulary

- numerator
- denominator
- proper fraction
- improper fraction
- factor
- highest common multiple
- lowest common multiple
- equivalents
- common numerator
- common denominator
- decimal equivalent
- simplify
- simplest form
- mixed number
- whole number
- mixed number

Simplify Fractions

$\frac{9}{12}$

Factors of 9: 1, 3, 9

Factors of 12: 1, 2, 3, 4, 6, 12

$\frac{9}{12} = \frac{3}{4}$ (÷3)

Compare and Order Fractions

Use the Common Denominator

$\frac{3}{5} \square \frac{2}{3}$

Multiples of 5: 5, 10, 15

Multiples of 3: 3, 6, 9, 12, 15

$\frac{3}{5} = \frac{9}{15}$ (×3)

$\frac{9}{15} < \frac{10}{15}$

$\frac{2}{3} = \frac{10}{15}$ (×5)

Use the Common Numerator

$\frac{5}{8} \square \frac{10}{13}$

Multiples of 5: 5, 10, 15

Multiples of 10: 10, 20

$\frac{5}{8} = \frac{10}{16}$ (×2)

$\frac{10}{16} < \frac{10}{13}$

$\frac{10}{13} = \frac{10}{13}$

Fractions — Knowledge Organiser

Adding and Subtracting Proper Fractions

Same Denominators

$\frac{4}{7} + \frac{2}{7} = \frac{6}{7}$

$\frac{8}{11} - \frac{3}{11} = \frac{5}{11}$

Different Denominators

$\frac{2}{7} + \frac{3}{5}$

Multiples of 7: 7, 14, 21, 28, **35**
Multiples of 5: 5, 10, 15, 20, 25, 30, **35**

$\frac{2}{7} = \frac{10}{35}, \frac{3}{5} = \frac{21}{35}$

$\frac{10}{35} + \frac{21}{35} = \frac{31}{35}$

$\frac{9}{10} - \frac{1}{4}$

Multiples of 10: 10, **20**
Multiples of 4: 4, 8, 12, 16, **20**

$\frac{9}{10} = \frac{18}{20}, \frac{1}{4} = \frac{5}{20}$

$\frac{18}{20} - \frac{5}{20} = \frac{13}{20}$

Multiplying Proper Fractions

Multiplying Fractions by Fractions

$\frac{1}{2} \times \frac{1}{3} = \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

Multiplying Fractions by Whole Numbers

$\frac{2}{5} \times 3 \rightarrow 3 = \frac{3}{1}$

$\frac{2}{5} \times \frac{3}{1} = \frac{6}{5} = 1\frac{1}{5}$

Adding and Subtracting Mixed Numbers

Add or subtract the whole numbers and fractions separately.

$2\frac{2}{5} + 1\frac{3}{10}$

$2 + 1 = 3$

$\frac{2}{5} + \frac{3}{10} = \frac{4}{10} + \frac{3}{10} = \frac{7}{10}$

$3 + \frac{7}{10} = 3\frac{7}{10}$

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

$2 - 1 = 1$

$\frac{1}{2} - \frac{1}{4} = \frac{2}{4} - \frac{1}{4} = \frac{1}{4}$

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

Convert the mixed numbers to improper fractions.

$2\frac{2}{5} + 1\frac{3}{10}$

$2\frac{2}{5} = \frac{12}{5}$ $\quad 1\frac{3}{10} = \frac{13}{10}$

$\frac{12}{5} + \frac{13}{10} = \frac{24}{10} + \frac{13}{10} = \frac{37}{10}$

$\frac{37}{10} = 3\frac{7}{10}$

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

$2\frac{1}{2} = \frac{5}{2}$ $\quad 1\frac{1}{4} = \frac{5}{4}$

$\frac{5}{2} - \frac{5}{4} = \frac{10}{4} - \frac{5}{4} = \frac{5}{4}$

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

Dividing Fractions by Whole Numbers

$\frac{2}{5} \div 2 = \frac{1}{5}$

Multiplication and division are the inverse of one another so:

÷ 2 is the same as × $\frac{1}{2}$

$\frac{2}{5} \times \frac{1}{2} = \frac{2}{10}$

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Properties of Shape: Stage 5

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

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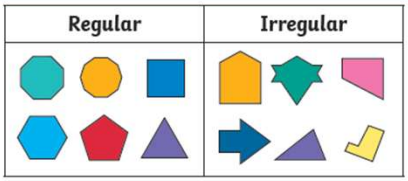
Regular and Irregular Polygons



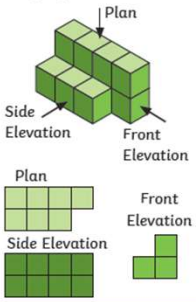
A polygon is any two-dimensional shape formed with straight lines.

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

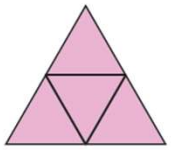
In an irregular polygon, the sides and angles are not equal.

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		
cube	6	0	12	0	8	
cuboid	6	0	12	0	8	
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	

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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.

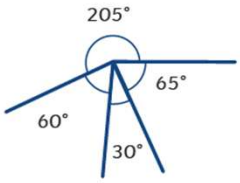
Obtuse Angles

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

Reflex Angles

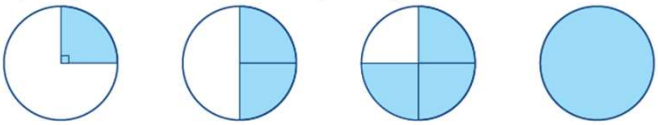
Any angle that measures greater than 180° is called a **reflex** angle.

Angles on a straight line always total 180°.



Angles around a point always total 360°.

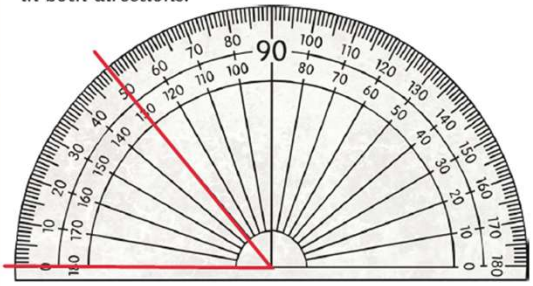
Multiples of 90° can be used as descriptions of a turn.



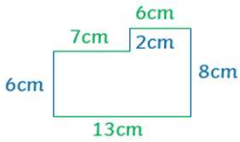
$\frac{1}{4}$ turn – 90° $\frac{1}{2}$ turn – 180° $\frac{3}{4}$ turn – 270° 1 turn – 360°

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.



Using Properties of Rectangles



6cm + 2cm = 8cm

7cm + 6cm = 13cm

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Properties of Shape: Stage 6

Properties of Shapes — 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
- vertices
- apex
- radius
- diameter
- circumference

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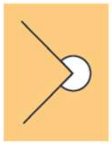
Angle Types

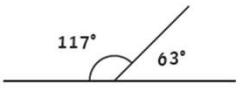
Acute Angles
Any angle that measures less than 90° is called an **acute** angle.

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

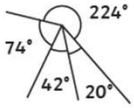


Reflex Angles
Any angle that measures greater than 180° is called a **reflex** angle.

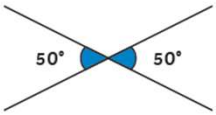
Calculating Angles

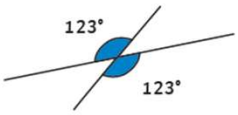


Angles on a straight line always total 180°.

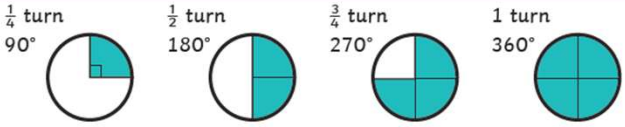


Angles around a point always total 360°.



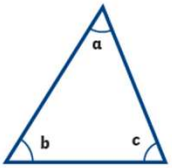


Opposite angles that share a vertex are equal.



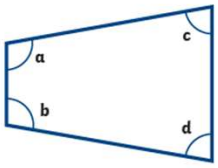
Multiples of 90° can be used as descriptions of a turn.

Angles in a Triangle



a + b + c = 180°

Angles in a Quadrilateral



a + b + c + d = 360°

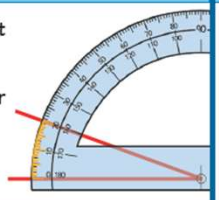
Properties of Shapes — Knowledge Organiser

Using a Protractor

Place the cross or circle at the point of the angle you are measuring.

Read from the zero on the outer scale of your protractor.

Count the degree lines carefully.

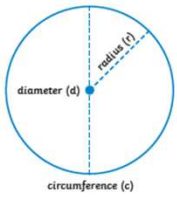


Parts of Circles

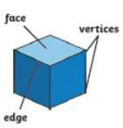
A circle is a 2D shape. The perimeter of a circle is called the **circumference** (c). The distance across the circle, passing through the centre, is called the **diameter** (d).

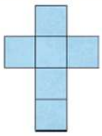
The distance from the centre of the circle to the circumference is called the **radius** (r).

$r \times 2 = d$ $\qquad$ $\frac{d}{2} = r$



Nets of 3D Shapes





A shape net shows which 2D shapes can be folded and joined to make a 3D shape. When you are drawing a net, or solving a problem involving a shape net, think carefully about where the edges of the faces meet.

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Angles in Regular Polygons

As the number of sides of a polygon increases by one, the total of the interior angles increases by 180°. When n = number of sides, this formula can be used to find the size of each angle in a **regular polygon**:

Sum of Interior Angles = (n − 2) × 180°

Each Angle = $\frac{(n - 2) \times 180°}{n}$

Pentagon
n = 5
(5 - 2) × 180° = 540°
540° ÷ 5 = 108°

Hexagon
n = 6
(6 - 2) × 180° = 720°
720° ÷ 6 = 120°

Properties of 3D Shapes

3D shapes have three dimensions – **length**, **width** and **depth**.

A **polyhedron** is a 3D shape with flat faces. Spheres, cylinders and cones are not polyhedrons as they have curved surfaces.

Cube 6 square faces, 12 edges, 8 vertices	**Tetrahedron** 4 triangular faces, 6 edges, 4 vertices	**Sphere** 1 curved surface, 0 edges, 0 vertices
Cuboid 6 faces, 12 edges, 8 vertices	**Octahedron** 8 faces, 12 edges, 6 vertices	**Triangular prism** 5 faces, 9 edges, 6 vertices
Square-based pyramid 5 faces, 8 edges, 5 vertices	**Cone** 1 circular face, 1 curved surface, 1 curved edge, 1 apex	**Cylinder** 2 circular faces, 1 curved surface, 2 curved edges, 0 vertices

Volume: Stage 5

Volume — **Knowledge Organiser**

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

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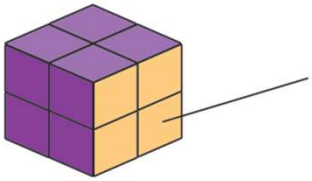
Volume of Cubes and Cuboids

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

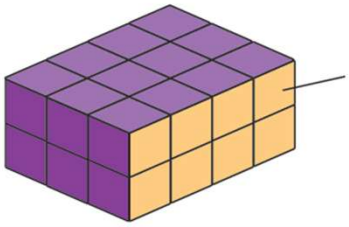
To calculate the volume of cubes and cuboids:

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 $24cm^3$

Perimeter, Area and Volume: Stage 6

Perimeter, Area and Volume — **Knowledge Organiser**

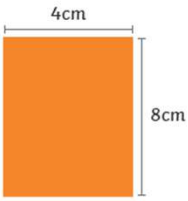
Key Vocabulary

- perimeter
- area
- volume
- cubic units (e.g. cm^3)
- cuboid
- width
- length
- rectangle
- rectilinear
- parallelogram
- perpendicular height

Area of Rectangles

length × width = area of a rectangle

Counting squares:
area = $18cm^2$
Use formula:
6cm × 3cm
area = $18cm^2$

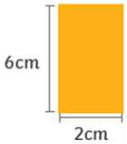


8cm × 4cm area = $32cm^2$

Perimeter of Rectangles

perimeter = length + width + length + width or (length + width) × 2

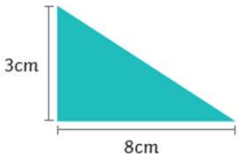
5cm + 4cm + 5cm + 4cm
area = $18cm^2$



(6 + 2) × 2
area = $16cm^2$

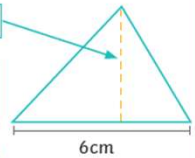
Area of Triangles

base × perpendicular height ÷ 2 = area of a triangle

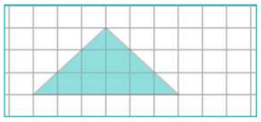


8cm × 3cm ÷ 2
area = $12cm^2$

perpendicular height = 5cm



6cm × 5cm ÷ 2
area = $15cm^2$



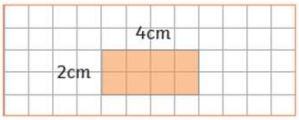
Counting squares:
6 whole squares = $6cm^2$
6 half squares = $3cm^2$
$6cm^2 + 3cm^2 = 9cm^2$
area = $9cm^2$

Using formula:
6cm × 3cm
÷ 2 = $9cm^2$

Perimeter, Area and Volume — **Knowledge Organiser**

Perimeter and Area

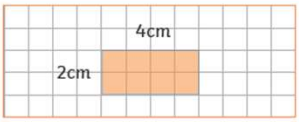
Shapes with the same area can have different perimeters.



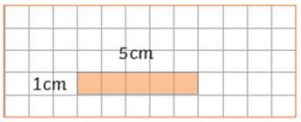
area = $8cm^2$ perimeter = 12cm

area = $8cm^2$ perimeter = 18cm

Shapes with the same perimeter can have different areas.



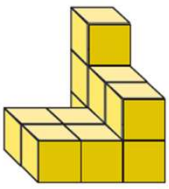
area = $8cm^2$ perimeter = 12cm



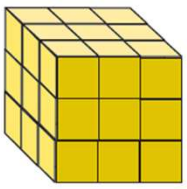
area = $5cm^2$ perimeter = 12cm

Volume - Counting Cubes

= $1cm^3$



$11cm^3$

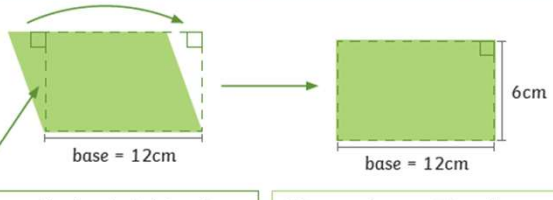


$27cm^3$

Area of Parallelograms

base × perpendicular height = area of a parallelogram

A parallelogram can be transformed into a rectangle.

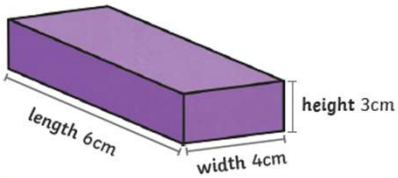


perpendicular height = 6cm

12cm × 6cm = $72cm^2$

Volume of Cuboids

length × width × height = volume of a cuboid



Multiply dimensions in **any** order:
3cm × 6cm × 4cm
volume = $72cm^3$