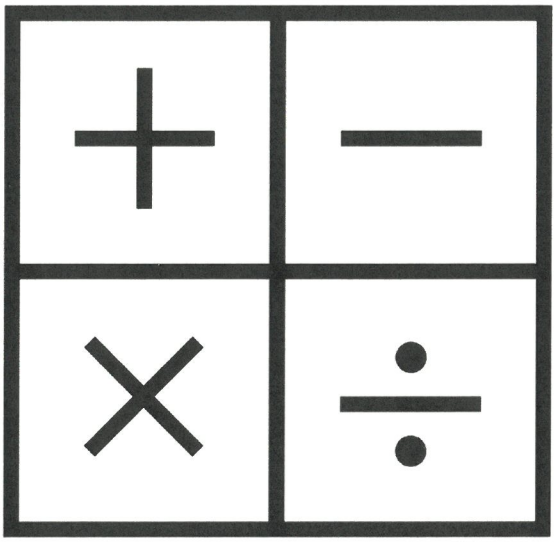
Mathematics
Transition to Year 11

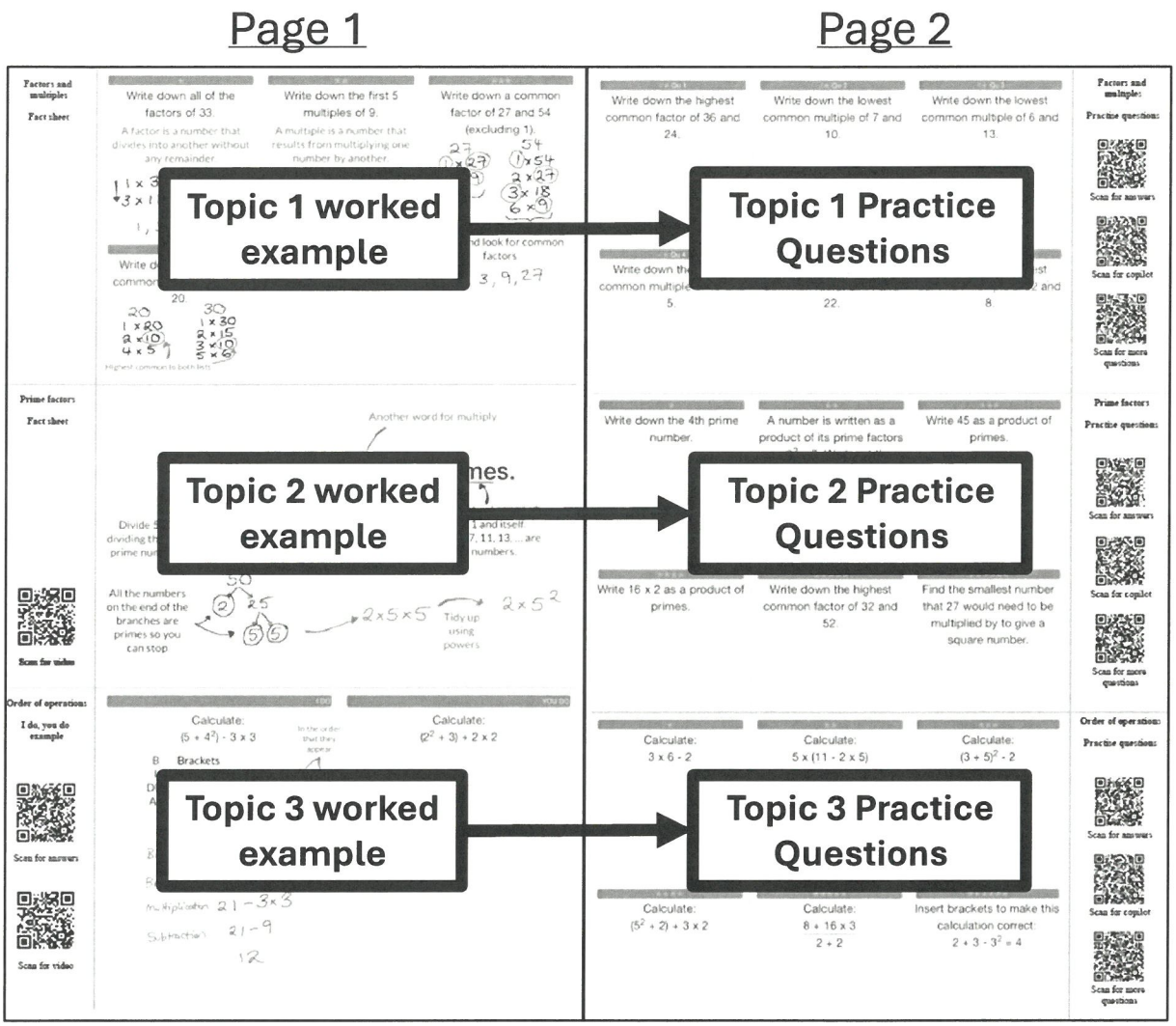
Foundation



Name: _____

How to use this booklet

Work across each row of a double page.



Remember to use the solutions to mark your work.

Factors and multiples

Fact sheet

★

Write down all of the factors of 33.

A factor is a number that divides into another without any remainder.

1×33
3×11

It is a good idea to write down all multiplication pairs

1, 3, 11, 33

★★

Write down the first 5 multiples of 9.

A multiple is a number that results from multiplying one number by another.

1×9, 2×9, 3×9, 4×9, 5×9

9, 18, 27, 36, 45

★★★

Write down a common factor of 27 and 54 (excluding 1).

27: 1×27, 3×9

54: 1×54, 2×27, 3×18, 6×9

Write down all multiplication pairs and look for common factors

1, 3, 9, 27

★★★★

Write down the highest common factor of 30 and 20.

20: 1×20, 2×10, 4×5

30: 1×30, 2×15, 3×10, 5×6

Highest common to both lists

Prime factors

Fact sheet

Another word for multiply

Write 50 as a product of primes.

Divide 50 by a prime number and keep dividing the resulting factors until you have prime numbers on the end of each branch.

A number that has only 2 factors, 1 and itself. E.g. 2, 3, 5, 7, 11, 13, ... are prime numbers.

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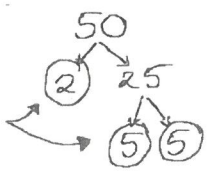
All the numbers on the end of the branches are primes so you can stop



$2\times5\times5$ → Tidy up using powers → 2×5^2

Order of operations

I do, you do example

I DO

Calculate:

$(5 + 4^2) - 3 \times 3$

In the order that they appear

B	Brackets
I	Indices
DM	Division and multiplication
AS	Addition and subtraction

Apply BIDMAS to answer the brackets first

Brackets $(5 + 4^2) - 3 \times 3$

Brackets $(5 + 16) - 3 \times 3$

Multiplication $21 - 3 \times 3$

Subtraction $21 - 9$

12

Scan for answers

Scan for video

YOU DO

Calculate:

$(2^2 + 3) + 2 \times 2$

★ Qu 1

Write down the highest common factor of 36 and 24.

★★ Qu 2

Write down the lowest common multiple of 7 and 10.

★★ Qu 3

Write down the lowest common multiple of 6 and 13.

★★ Qu 4

Write down the lowest common multiple of 18 and 5.

★★ Qu 5

Write down the highest common factor of 44 and 22.

★★ Qu 6

Write down the lowest common multiple of 22 and 8.

Factors and multiples

Practise questions

Scan for answers

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Scan for more questions

★

Write down the 4th prime number.

★★

A number is written as a product of its prime factors as $2^3 \times 7$. Work out the number.

★★★

Write 45 as a product of primes.

★★★★

Write 16 x 2 as a product of primes.

★★★★★

Write down the highest common factor of 32 and 52.

★★★★★★

Find the smallest number that 27 would need to be multiplied by to give a square number.

Prime factors

Practise questions

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Scan for more questions

★

Calculate:

$3 \times 6 - 2$

★★

Calculate:

$5 \times (11 - 2 \times 5)$

★★★

Calculate:

$(3 + 5)^2 - 2$

★★★★

Calculate:

$(5^2 + 2) + 3 \times 2$

★★★★★

Calculate:

$$\frac{8 + 16 \times 3}{2 + 2}$$

★★★★★★

Insert brackets to make this calculation correct:

$2 + 3 - 3^2 = 4$

Order of operations

Practise questions

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Scan for more questions

Equivalent fractions

I do, you do example

Scan for answers

Scan for video

I DO

Simplify the following fraction:

$\frac{12}{20}$ — Look for the highest common factor of 12 and 20

÷4

$\frac{3}{5}$ — Both the numerator and denominator were divided by the highest common factor

Key notes:

The highest common factor is the highest number that goes into 2 or more numbers without a remainder.

Both the numerator and denominator are divided by the common factor to keep the fraction equivalent (equal).

YOU DO

Simplify the following fraction:

$\frac{24}{44}$

Add or subtract fractions

I do, you do example

Scan for answers

Scan for video

I DO

Calculate:

$\frac{7}{8} - \frac{5}{9}$ — 72 is the lowest common multiple of 8 and 9

To add or subtract fractions, we must first have common denominators

Turn both fractions into equivalent fractions with 72 as the denominator

$\frac{7}{8} - \frac{5}{9}$ ×9 ×8

$\frac{63}{72} - \frac{40}{72}$

Operate with the numerators:

$\frac{63-40}{72} = \frac{23}{72}$

Always check to see if the answer can be simplified

YOU DO

Calculate:

$\frac{4}{7} + \frac{3}{8}$

Write one number as a fraction of another

I do, you do example

Scan for answers

I DO

Express 78p as a fraction of £8.
Give your answer in its simplest form.

Before writing one number as a fraction of another, ensure the units are the same.

£8 = 800p

x 100

$\frac{78}{800}$ — The numerator is the number to be expressed as a fraction of another

÷2

$\frac{39}{400}$ — Simplify

YOU DO

Express 42p as a fraction of £4.
Give your answer in its simplest form.

2★ Qu 1

Simplify the following fraction:

$\frac{20}{28}$

2★ Qu 2

Simplify the following fraction:

$\frac{35}{55}$

2★ Qu 3

Simplify the following fraction:

$\frac{10}{26}$

2★ Qu 4

Simplify the following fraction:

$\frac{24}{42}$

2★ Qu 5

Simplify the following fraction:

$\frac{20}{130}$

2★ Qu 6

Simplify the following fraction:

$\frac{54}{78}$

Equivalent fractions

Practise questions

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Scan for more questions

★

Calculate:

$\frac{6}{7} - \frac{2}{7}$

★★

Calculate:

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

★★★

Calculate:

$\frac{1}{3} + \frac{5}{6} - \frac{1}{2}$

★★★★

Calculate:

$6\frac{2}{3} - 3\frac{2}{7}$

★★★★★

Calculate:

$\frac{d}{a} + \frac{g}{h}$

Not available at the chosen tier

Add or subtract fractions

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

★

Write the number of squares shaded as a fraction of the total

Give your answer in its simplest form.

★★

Write 24 as a fraction of 75.

Give your answer in its simplest form.

★★★

In a test out of 75 marks, Nat got 50 marks wrong. Write the number of marks that she got right as a fraction of the total.

Give your answer in its simplest form.

Write one number as a fraction of another

Practise questions

Scan for answers

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★★★★

Express 48cm as a fraction of 11m.

Give your answer in its simplest form.

★★★★★

In a bag of 54 counters, 13 are green, 23 are pink and the remainder are yellow. Work out the fraction of counters that are yellow.

Give your answer in its simplest form.

★★★★★★

The fraction below is equivalent to the fraction of shaded squares. Find the value of b.

$\frac{b}{30}$

Fraction of an amount (part ii)

I do, you do example

Scan for answers

Scan for video

I DO

Find $\frac{3}{4}$ of 44

To find a fraction of an amount, divide the number by the denominator and multiply by the numerator.

$44 \div 4 \times 3$

$= 11 \times 3$

$= 33$

YOU DO

Find $\frac{3}{10}$ of 30

Multiply or divide fractions

I do, you do example

Scan for answers

Scan for video

I DO

Calculate:

$\frac{7}{9} \div \frac{7}{8}$

Keep, change, flip

Find the reciprocal of the second fraction

$\frac{7}{9} \times \frac{8}{7}$

Whenever you multiply fractions, multiply the numerators together and multiply the denominators

Note: common factor of 7

$\frac{7 \times 8}{9 \times 7} = \frac{56}{63}$

Simplify where possible

$= \frac{8}{9}$

YOU DO

Calculate:

$\frac{4}{9} \times \frac{3}{8}$

FDP conversion

I do, you do example

Scan for answers

I DO

Order the following numbers from smallest to largest:

$\frac{47}{50}$, 0.39, 28%

To order or compare numbers, they first need to be the same number type:

Convert to an equivalent fraction over 100 then divide the numerator by 100, or, numerator ÷ denominator

Fractions ⇄ Decimals ⇄ Percentages

Read the place value

× 100

÷ 100

$47/50 = \frac{94}{100} = 0.94$, 0.39, $28 \div 100 = 0.28$

0.28, 0.39, 0.94 → Reorder the originals → 28%, 0.39, $\frac{47}{50}$

YOU DO

Order the following numbers from smallest to largest:

$\frac{183}{1000}$, 0.68, 24%

★

Find $\frac{1}{5}$ of 70

★★

Find $\frac{10}{11}$ of 121

★★★

Find $2\frac{2}{3}$ of 24

★★★★

Decrease 33 by $\frac{6}{11}$

★★★★★

Ruth had £120, from this:

$\frac{1}{5}$ was spent on food,

$\frac{3}{8}$ on rent and bills.

How much does Ruth have left?

★★★★★★

What number is $\frac{5}{12}$ of the way between 38 and 65?

Fraction of an amount (part ii)

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

★

Fill in the missing blanks:

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

★★

Calculate:

$9 \div \frac{4}{5}$

★★★

Calculate:

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

★★★★

Calculate:

$\frac{5}{7} \times \frac{5}{6} \div \frac{3}{4}$

★★★★★

Calculate:

$5\frac{7}{8} \div 3\frac{4}{7}$

Not available at the chosen tier

Multiply or divide fractions

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

3★ Qu 1

Are the following equal?

0.3 and $\frac{43}{50}$

3★ Qu 2

Are the following equal?

0.77 and $\frac{77}{100}$

3★ Qu 3

Are the following equal?

51% and $\frac{9}{20}$

3★ Qu 4

Are the following equal?

0.15 and $\frac{73}{500}$

Not available at the chosen tier

Not available at the chosen tier

FDP conversion

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

Order numbers

I do, you do example

Scan for answers

I DO

Order the following from smallest to largest:

0.038, 0.094, 0.41, 0.076, 8.4, 0.16

First thing to do is write each of the numbers in a place value grid:

	u.	t	h	th	
(6)	0.	0	3	8	Fill in the gaps with 0s if it makes it easier
(4)	0.	0	9	4	
(2)	0.	4	1	0	This is the second largest since it has 0 units like the other numbers but the tenths column contains the larger number
(5)	0.	0	7	6	
(1)	8.	4	0	0	
(3)	0.	1	6	0	This is the largest number since it has the largest units number

Having used the place value columns to order from largest to smallest, reverse the order:

0.038, 0.076, 0.094, 0.16, 0.41, 8.4

YOU DO

Order the following from smallest to largest:

2.4, 0.036, 0.051, 7.4, 0.31, 0.095

Operate with integers (+ and -)

Fact sheet

Scan for video

6★ Qu 1

What is 3 + (-3)?

3+(-3) (-3)+3

Same answer (commutative law)

0

6★ Qu 2

What is 8 - (-8)?

Minus, subtract, take away and difference are just some of the ways of describing subtraction.

This question would be like answering "What's the difference between -8 and 8?"

16

6★ Qu 3

What is 6 - (-1)?

This question would be like answering "What's the difference between -1 and 6?"

7

6★ Qu 4

What is (-5) - (-1)?

This question would be like answering "What's the difference between -1 and -5?"

-4

6★ Qu 5

What is (-5) + (-1)?

Adding -1 onto -5 so making it more negative

-6

6★ Qu 6

What is (-4) + (-6)?

Adding -6 onto -4 so making it more negative

-10

Operate with integers (x and ÷)

Fact sheet

5★ Qu 1

What is 3 x (-1)?

Sign changer

If 3 x 1 = 3

then 3 x -1 = -3

5★ Qu 2

What is 5 x (-9)?

Sign changer

If 5 x 9 = 45

then 5 x -9 = -45

5★ Qu 3

What is (-35) ÷ (-7)?

Sign changer — A second sign changer

If 35 ÷ 7 = 5

then 35 ÷ -7 = -5

then -35 ÷ -7 = 5

5★ Qu 4

What is (-16) ÷ 4?

Sign changer

If 16 ÷ 4 = 4

then -16 ÷ 4 = -4

5★ Qu 5

What is (-7) x 1?

Sign changer

If 7 x 1 = 7

then -7 x 1 = -7

5★ Qu 6

What is (-6) x (-6)?

Sign changer — A second sign changer

If 6 x 6 = 36

then 6 x -6 = -36

then -6 x -6 = 36

★

Order the following from smallest to largest:
55, 25, 41, 62, 54, 76

★★

Order the following from smallest to largest:
57, 96, 30, -4, -93, -13

★★★

Order the following from smallest to largest:
0.49, 0.065, 0.091, 0.087, 0.51, 4.2

★★★★

Order the following from smallest to largest:
$\frac{17}{50}$, 0.78, 19%

★★★★★

Order the following from smallest to largest:
$\frac{13}{20}$, $\frac{71}{100}$, $\frac{3}{50}$, $\frac{8}{25}$

Order numbers

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

6★ Qu 1

What is 1 - (-7)?

6★ Qu 2

What is 5 - (-8)?

6★ Qu 3

What is (-9) + 2?

6★ Qu 4

What is (-4) - 6?

6★ Qu 5

What is (-9) - (-2)?

6★ Qu 6

What is (-1) + (-9)?

Operate with integers (+ and -)

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

5★ Qu 1

What is (-3) x (-3)?

5★ Qu 2

What is (-3) x 5?

5★ Qu 3

What is 1 x (-3)?

5★ Qu 4

What is 40 ÷ (-5)?

5★ Qu 5

What is 2 x (-7)?

5★ Qu 6

What is (-14) ÷ 2?

Operate with integers (x and ÷)

Practise questions

Scan for answers

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Scan for more questions

Column multiplication

I do, you do example

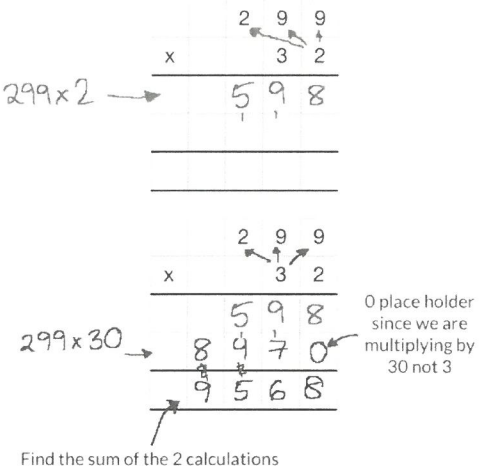
Scan for answers

Scan for video

I DO

Calculate:

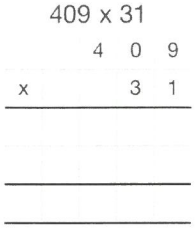
299 x 32



YOU DO

Calculate:

409 x 31



Short division

I do, you do example

Scan for answers

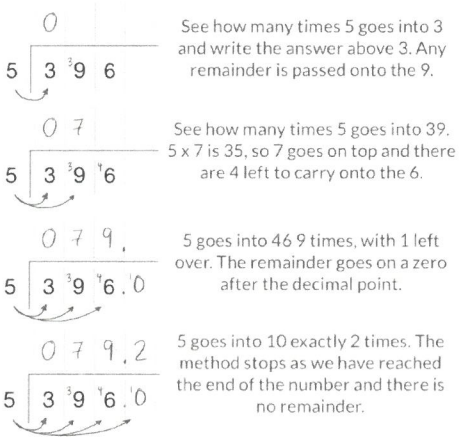
Scan for video

I DO

Calculate:

396 ÷ 5

Place the number you are dividing inside the bus stop and the other on the outside:



YOU DO

Calculate:

147 ÷ 6

Operate with decimals (+ and -)

I do, you do example

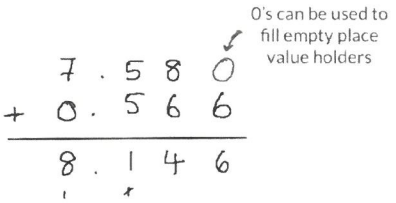
Scan for answers

I DO

Calculate:

7.58 + 0.566

When you add or subtract decimals, you can use the column method. When using the method, ensure the decimals are correctly aligned in their place value columns.



YOU DO

Calculate:

4.87 - 0.475

★

Calculate:

73 x 2

	7	3
x		2

★★

Calculate:

73 x 44

		7	3
x		4	4

★★★

Calculate:

379 x 26

		3	7	9
x			2	6

★★★★

Fill in the missing number:

		1	□	4
x			2	1
		1	4	4
	2	8	8	0
	3	0	2	4

★★★★★

Calculate:

711 x 406

Column multiplication

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

★

Calculate:

42 ÷ 7

★★

Calculate:

225 ÷ 9

9	2	2	5

★★★

Complete the following division calculation:

	0	4	7
2	8	2	

Short division

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

★★★★

Calculate:

354 ÷ 5

★★★★★

Calculate:

341.4 ÷ 12

★★★★★★

Calculate:

177 ÷ 0.6

★

Calculate:

0.4 + 2

★★

Calculate:

8 - 0.4

★★★

Calculate:

0.8 + 0.4

Operate with decimals (+ and -)

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

★★★★

Calculate:

3.5 + 2.4

★★★★★

Calculate:

4.51 + 0.726

★★★★★★

Calculate:

0.853 - 0.01

Operate with decimals (x and ÷)

Fact sheet

★

Calculate:

8.2×10

You can use a normal multiplication method for this or know that when you multiply by 10, the place value of each number increases by 1 space

8.2

82

★★

Calculate:

$6.3 \div 1000$

Place value of 6.3 decreases by 3 spaces

6.3

0.0063

★★★

Calculate:

3.1×6

3.1 x 6 would give the same answer as 31 x 6 ÷ 10

31 × 6 = 186

186 ÷ 10 = 18.6

★★★★

Calculate:

$0.21 \div 0.3$

Convert to an equivalent problem where you divide by an integer

$\frac{0.21}{0.3} = \frac{2.1}{3}$

$= 0.7$

★★★★★

Calculate:

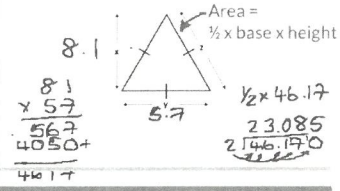
$0.0048 \div 0.008$

$\frac{0.0048}{0.008} = \frac{4.8}{8}$

$= 0.6$

★★★★★★

If x = 8.1cm, y = 5.7cm and z = 8.6cm (to 1dp), calculate the area of:



81 × 57 = 4617

½ × 46.17

46.170 ÷ 2 = 23.085

Money problems

I do, you do example

Scan for answers

I DO

A shop lists for sale:

76p, 56p, £0.84

How much (in £) does it cost to buy 4 and 2?

When adding or subtracting any form of number, it is important to ensure they are measured in the same unit (e.g. £).

Apple : £0.76 Coconut : £0.56

Banana : £0.84

4 × coconut = 4 × 0.56 = £2.24

2 × apple = 2 × 0.76 = £1.52

Total = 2.24 + 1.52 = £3.76

YOU DO

A shop lists for sale:

£0.31, £0.37, 72p

How much (in £) does it cost to buy 3 and 2?

Percentage of an amount

I do, you do example

Scan for answers

Scan for video

I DO

Calculate:

39% of 50

Non-calculator technique

If 100% is 50

÷10 → 10% is 5 ÷2

÷10 → 1% is 0.5

5% is 2.5

39% is 10% × 4 − 1%

So, 5 × 4 − 0.5

19.5

Calculator technique

39% as a decimal

0.39 × 50

19.5

Key note: You can use this technique without a calculator too

YOU DO

Calculate:

73% of 80

Operate with decimals (x and ÷)

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

★

Calculate:
3.4 x 100

★★

Calculate:
2.1 ÷ 1000

★★★

Calculate:
2.6 x 6

★★★★

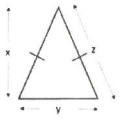
Calculate:
0.49 ÷ 0.7

★★★★★

Calculate:
0.1 x 0.001

★★★★★★

If x = 2.3cm, y = 4.2cm and z = 3.1cm (to 1dp), calculate the area of:



Money problems

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

★

A shop lists items for sale:
🍒 £0.56, 🥑 £0.35, 🍅 £0.19

How much does it cost to buy 1 🍒 and 1 🥑?

★★

A shop lists for sale:
🍎 £0.69, 🍌 £0.43, 🍅 £0.80

How much does it cost to buy 3 🍌 and 3 🍅?

★★★

A shop lists for sale:
🍌 £0.83, 🍅 15p, 🍒 13p

How much (in £) does it cost to buy 5 🍒 and 3 🍅?

★★★★

A shop lists for sale:
🥑 £0.72, 🍒 46p, 🍎 75p

If I buy 2 🍎 and 4 🍒, how much change (in £) do I get from £10?

★★★★★

A shop lists for sale:
🍌 £0.63, 🍒 £0.59, 🍅 41p

What is the maximum number of 🍒 that I can buy with £10?

★★★★★★

A shop lists for sale:
🥑 22p, 🍅 £0.30, 🍒 74p

If I buy 4 🍒 and 4 🥑, what percentage (to 1dp) of the total does the 4 🍒 represent?

Percentage of an amount

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

★

Calculate:
70% of 60

★★

Calculate:
35% of 20

★★★

Calculate:
89% of 70

★★★★

When finding a percentage of an amount on a calculator, explain the following:
20 x 0.53

★★★★★

Calculate:
15.5% of 50

★★★★★★

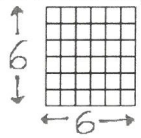
150 students either walk or bus to school. 54% of students walk. 40% of students are boys. 20% of the boys take the bus. How many of the girls walk?

Squares, cubes and roots

Fact sheet

★

How many squares are there in this diagram?



$6 \times 6 = 36$

6 rows of 6 squares

★★

What is 3^2?

3 squared since the power is 2

3^2

The index number or power or exponent

Base number

The power tells you how many times the base number is to be multiplied by itself.

$3 \times 3 = 9$

★★★

What is $\sqrt{25}$?

To take a square root of a number is the inverse operation of squaring a number.

If $5^2 = 25$

therefore

$\sqrt{25} = 5$

★★★★

What is $\sqrt{81} \times 11^2$?

9×121 (11 x 11)

$= 1089$

★★★★★

What is $\sqrt[3]{64}$?

$\sqrt[3]{}$ is the cube root symbol and is the inverse operation of cubing a number.

If $4^3 = 64$ then $\sqrt[3]{64} = 4$

$\sqrt[n]{x}$ is the inverse operation to x^n

★★★★★★

What is $\sqrt[3]{8} + 6^2$?

$= 2 + 36$ (6 x 6)

$= 38$

Names and properties of polygons

Fact sheet

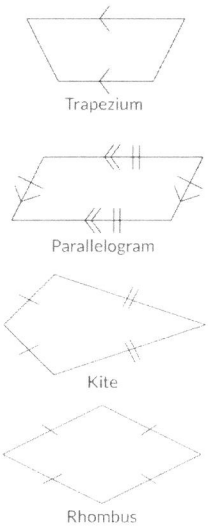
A polygon is a closed straight sided shape.

Polygon family names:
3 sided polygon - Triangle
4 sided polygon - Quadrilateral
5 sided polygon - Pentagon
6 sided polygon - Hexagon
7 sided polygon - Heptagon
8 sided polygon - Octagon
9 sided polygon - Nonagon
10 sided polygon - Decagon

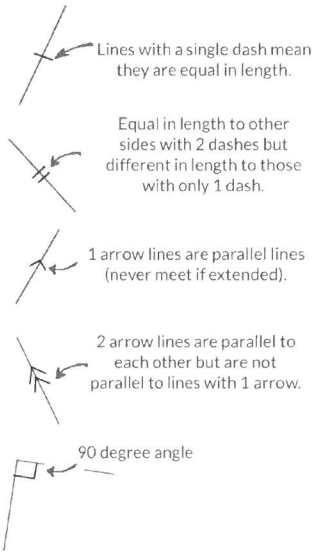
A regular shape is where all sides and all of the angles are equal.

An irregular shape is where 1 or more of the sides and angles are different.

Quadrilaterals are not just squares and rectangles. There is a variety of quadrilaterals:



Key shape notation to understand:



Basic rules of rounding (inc dp and bounds)

I do, you do example

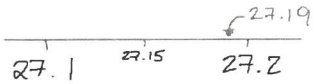
Scan for answers

Scan for video

I DO

Round 27.19 to 1 decimal place.

Rounding to 1 decimal place means we want our answer to have only 1 number after the decimal point.



As can be seen by the number line, 27.19 is closer to 27.2 than 27.1. Any number greater than or equal to 27.15 (the half way mark) would round to 27.2. Anything lower would round to 27.1.

When rounding to 1 decimal place, look at the number in the 2nd decimal place to decide whether we round up or not. 5 or more rounds up, less than 5 rounds down.

YOU DO

Round 24.84 to 1 decimal place.

6★ Qu 1

What is $5^3 - \sqrt{81}$?

6★ Qu 2

What is $4^3 - \sqrt{49}$?

6★ Qu 3

What is $2^3 - \sqrt{144}$?

6★ Qu 4

What is $\sqrt[3]{8} + 5^2$?

6★ Qu 5

What is $2^3 - \sqrt{100}$?

6★ Qu 6

What is $\sqrt[3]{64} + 4^2$?

Squares, cubes and roots

Practise questions

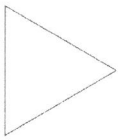
Scan for answers

Scan for copilot

Scan for more questions

★

Name the polygon family that the following shape belongs to:

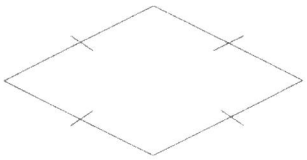


★★

I am a 8 sided shape. All of my sides and all of my angles are equal. What am I called?

★★★

Give the correct Mathematical name for the following shape:



★★★★

I am 4 sided shape. I have 1 pair of parallel sides. I have no right angles. I have only 1 line of symmetry. What shape am I?

Names and properties of polygons

Practise questions

Scan for answers

Scan for copilot

Scan for more questions

4★ Qu 1

Round 99.89 to 1 decimal place.

4★ Qu 2

Round 50.11 to 1 decimal place.

4★ Qu 3

Round 54.81 to 1 decimal place.

5★ Qu 4

Round 7.675 to 2 decimal places.

5★ Qu 5

Round 4.603 to 2 decimal places.

5★ Qu 6

Round 8.538 to 2 decimal places.

Basic rules of rounding (inc dp and bounds)

Practise questions

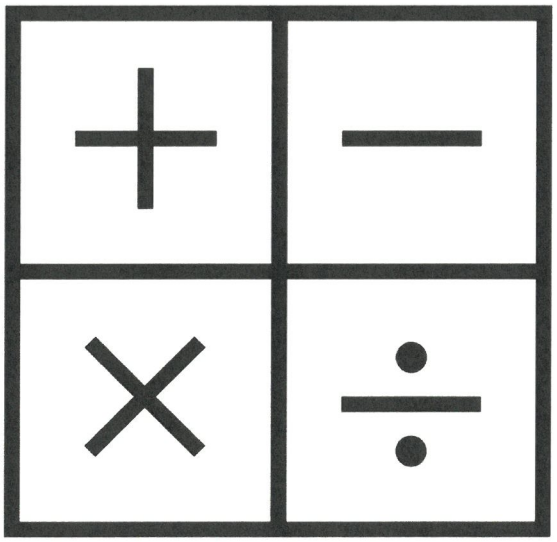
Scan for answers

Scan for copilot

Scan for more questions

Mathematics
Transition to Year 11

Foundation



Solutions

Simplify an expression

I do, you do example

I DO

Simplify the following expression:

$5a - 2f + 2a + 3f$

When you simplify an expression, you need to collect like terms. It is a good idea to identify like terms first:

Take note of the signs too

$5a - 2f + 2a + 3f$

Regroup:

$5a + 2a - 2f + 3f$

$7a + f$

Same as 1f

YOU DO

Simplify the following expression:

$3b + 4a - 2b + 3a$

Regroup:

$3b - 2b + 4a + 3a$

$b + 7a$

Change the subject

I do, you do example

I DO

Make c the subject:

$cb - a = e$

To make c the subject we use inverse operations to isolate c on one side of the equals sign.

$cb - a = e$

$+a \quad +a$

$cb = e + a$

$\div b \quad \div b$

$c = \frac{e+a}{b}$

When something isn't divisible, leave the answer as a fraction

YOU DO

Make e the subject:

$ef + b = a$

$ef + b = a$

$-b \quad -b$

$ef = a - b$

$\div f \quad \div f$

$e = \frac{a-b}{f}$

Solve linear equations (unknown on 1 side, int ans)

I do, you do example

I DO

Solve

$5x + 7 = 27$

To solve the equation, we need to use inverse operations.

Sometimes it helps to consider the story of what is happening to x to know what to do first.

multiply x by 5, add 7 and I get 27

Reverse to solve

Whatever you do to one side of the equals sign, you do to the other to keep it equal

$5x + 7 = 27$

$-7 \quad -7$

$5x = 20$

$\div 5 \quad \div 5$

$x = 4$

Substitute to check: $5 \times 4 + 7 = 27$ ✓

YOU DO

Solve

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

$\times 6 \quad \frac{x+7}{6} = 2 \times 6$

$x + 7 = 12$

$-7 \quad -7$

$x = 5$

Simplify an expression

★

Simplify the following expression:

$c + c + c + c + c + c$

$6c$

★★

Simplify the following expression:

$8c - 4c$

$4c$

★★★

Simplify the following expression:

$4d \times 2$

$8d$

★★★★

Simplify the following expression:

$3c - 2d + 2c + 4d$

$3c + 2c - 2d + 4d$

$5c + 2d$

★★★★★

Simplify the following expression:

$5c^2 + 5c - 3c^2 + 4c$

$5c^2 - 3c^2 + 5c + 4c$

$2c^2 + 9c$

★★★★★★

If $x = 5d + 3$ and $y = 2d - 2$, calculate the perimeter of:

Perimeter $= 2x + 2y$

$P = 2(5d + 3) + 2(2d - 2)$

$P = 10d + 6 + 4d - 4$

$P = 14d + 2$

Change the subject

★

Make c the subject:

$c + e = b$

$-e \quad -e$

$c = b - e$

★★

Make d the subject:

$dc - f = b$

$+f \quad +f$

$dc = b + f$

$\div c \quad \div c$

$d = \frac{b+f}{c}$

★★★

Make c the subject:

$\frac{cb - a}{e} = d$

$\times e \quad \times e$

$cb - a = de$

$+a \quad +a$

$cb = de + a$

$\div b \quad \div b$

$c = \frac{de+a}{b}$

★★★★

Make a the subject:

$\frac{\sqrt{a} - c}{b} = e$

$\times b \quad \times b$

$\sqrt{a} - c = eb$

$+c \quad +c$

$\sqrt{a} = eb + c$

$a = (eb + c)^2$

★★★★★

Make r the subject:

$A = \pi r^2$

$\div \pi \quad \div \pi$

$\frac{A}{\pi} = r^2$

$\sqrt{\frac{A}{\pi}} = r$

★★★★★★

Make c the subject:

$e = ac + 2c$ (factorise)

$e = c(a + 2)$

$\frac{e}{a+2} = c$

Solve linear equations (unknown on 1 side, int ans)

★

Solve

$x + 5 = 6$

$-5 \quad -5$

$x = 1$

★★

Solve

$x \div 5 = 4$

$\times 5 \quad \times 5$

$x = 20$

★★★

Solve

$3x + 8 = 26$

$-8 \quad -8$

$3x = 18$

$\div 3 \quad \div 3$

$x = 6$

★★★★

Solve

$2 - 8x = 18$

$-2 \quad -2$

$-8x = 16$

$\div -8 \quad \div -8$

$x = -2$

★★★★★

Solve

Expand $-4(x - 3) = 32$

$-4x + 12 = 32$

$-12 \quad -12$

$-4x = 20$

$\div -4 \quad \div -4$

$x = -5$

★★★★★★

If a x 50 = b, what is the value of

$\frac{8b}{a}$

$\frac{8(50a)}{a} = \frac{400a}{a} = 400$

Solve linear equations (unknown on 1 side, dec ans)

I do, you do example

I DO

Solve

$$\frac{x - 14}{8} = 0.7$$

A variable is used in place of a number. This number can be of any number type: i) integer, or ii) decimal/fraction. When solving this equation, rearrange the problem like you normally would but have in mind the value of x may be a non integer value.

$(\times 8)$ $\frac{x - 14}{8} = 0.7$ $(\times 8)$

$x - 14 = 5.6$
$+14 \quad +14$

$x = 19.6$

YOU DO

Solve

$10x - 13 = -4$
$+13 \quad +13$

$10x = 9$
$\div 10 \quad \div 10$

$x = 0.9$

Solve linear equations (unknown both sides)

I do, you do example

I DO

Solve

$7x + 3 = -74 - 4x$

The purpose of solving an equation is to find out the value of the unknown, x. A good first step is to get rid of x from one side of the equals sign:

$7x + 3 = -74 - 4x$ ← Remove the smaller number of x's
$+4x \qquad +4x$

Use inverse operations to eliminate terms from one side →

$11x + 3 = -74$
$-3 \quad -3$

$11x = -77$
$\div 11 \quad \div 11$

$x = 7$

YOU DO

Solve

$3 - 8x = -5 - 4x$
$+8x \quad +8x$

$3 = -5 + 4x$
$+5 \quad +5$

$8 = 4x$
$\div 4 \quad \div 4$

$2 = x$

or

$x = 2$

Solve linear equations with brackets

I do, you do example

I DO

Solve:

$-5(x - 3) = 50$

When solving an equation like this, you can remove the bracket in 1 of 2 ways:
i) Expand the brackets.
ii) Divide both sides by the term outside the bracket.
In this example, we will expand the brackets.

$-5(x - 3) = 50$
$\times \quad \times$

$-5x + 15 = 50$ ← Now you can rearrange to find x
$-15 \quad -15$

$-5x = 35$
$\div -5 \quad \div -5$

$x = -7$

YOU DO

Solve:

$3(x + 3) = 33$
$\times \quad \times$

$3x + 9 = 33$
$-9 \quad -9$

$3x = 24$
$\div 3 \quad \div 3$

$x = 8$

Solve linear equations (unknown on 1 side, dec ans)

★

Solve

$x - 0.9 = -1.0$

$+0.9 \quad +0.9$

$x = -0.1$

★★

Solve

$\frac{x}{5} = 0.8$

$\times 5 \quad \times 5$

$x = 4$

★★★

Solve

$\frac{x - 9}{4} = 0.3$

$\times 4 \quad \times 4$

$x - 9 = 1.2$

$+9 \quad +9$

$x = 10.2$

★★★★

Solve

$\frac{11 - x}{6} = 0.2$ $\times 6$ $\times 6$

$11 - x = 1.2$

$-11 \quad -11$

$-x = -9.8$

$x = 9.8$

★★★★★

Solve

$4(x + 12) = 50$

$4x + 48 = 50$

$-48 \quad -48$

$4x = 2$

$\div 4 \quad \div 4$

$x = 0.5$

Solve linear equations (unknown both sides)

★

Solve

$5x = 3x - 12$

$-3x \quad -3x$

$2x = -12$

$\div 2 \quad \div 2$

$x = -6$

★★

Solve

$5x + 2 = 3x + 14$

$-3x \quad -3x$

$2x + 2 = 14$

$-2 \quad -2$

$2x = 12$

$\div 2 \quad \div 2$

$x = 6$

★★★

Solve

$8x + 4 = -8 - 4x$

$+4x \quad +4x$

$12x + 4 = -8$

$-4 \quad -4$

$12x = -12$

$\div 12 \quad \div 12$

$x = -1$

★★★★

Solve x

$10x + 6 = 2(2x - 18)$

$10x + 6 = 4x - 36$

$-4x \quad -4x$

$6x + 6 = -36$

$-6 \quad -6$

$6x = -42$

$\div 6 \quad \div 6$

$x = -7$

★★★★★

x

I think of a number, I times it by 6 and I add 2. The answer is 2 times my number add 38. What was my number?

$6x$ $6x+2$ $2x$ $2x+38$

$6x + 2 = 2x + 38$

$-2x \quad -2x$

$4x + 2 = 38$

$-2 \quad -2$

$4x = 36$

$\div 4 \quad \div 4$

$x = 9$

★★★★★★

Opposite sides of a rectangle are $(8x + 2)$cm and $(26 - 4x)$cm in length. Find the length of 1 side

$8x+2 = 26-4x$

$+4x \quad +4x$

$12x + 2 = 26$

$-2 \quad -2$

$12x = 24$

$\div 12 \quad \div 12$

$x = 2$

So 1 side is

$8x(2) + 2$

$16 + 2$

18

Solve linear equations with brackets

★

Solve:

$4(x + 5) = 32$

$4x + 20 = 32$

$4x = 12$

$x = 3$

★★

Solve:

$-6(2x - 7) + 7(x - 4) = 9$

$-12x + 42 + 7x - 28 = 9$

$-5x + 14 = 9$

$-5x = -5$

$x = 1$

★★★

Solve:

$18x + 6 = 3(3x + 8)$

$18x + 6 = 9x + 24$

$9x + 6 = 24$

$9x = 18$

$x = 2$

★★★★

Solve:

$\frac{1}{3}(8 - 4x) = -6 - 2x$

$8 - 4x = -18 - 6x$

$8 + 2x = -18$

$2x = -26$

$x = -13$

★★★★★

Solve:

$2(2x + 5) + 7(7x + 2)$

$= 3(3x + 8)$

$4x + 10 + 49x + 14 = 9x + 24$

$53x + 24 = 9x + 24$

$44x + 24 = 24$

$44x = 0$

$x = 0$

★★★★★★

Solve:

$3(2x + 2(5x + 9)) = 6(4x + 5)$

$3(2x + 10x + 18) = 24x + 30$

$3(12x + 18) = 24x + 30$

$36x + 54 = 24x + 30$

$12x + 54 = 30$

$12x = -24$

$x = -2$

Expand over a single bracket

I do, you do example

I DO

Expand

$3(x + 5)$

Method 1 The claw

$3x \times x + 3 \times 5$

$3x + 15$

Method 2 The grid

x	x	+5
3	3x	+15

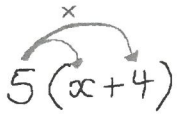
$3x + 15$

Key point: Every term on the inside of the brackets is multiplied by the term on the outside.

YOU DO

Expand

$5(x + 4)$



$5 \times x + 5 \times 4$

$5x + 20$

Expand 2 or more binomials

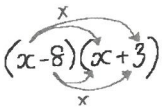
I do, you do example

I DO

Expand

$(x - 8)(x + 3)$

Method 1 The claw



Method 2 The grid

x	x	+3
x	x^2	+3x
-8	-8x	-24

$x^2 + 3x - 8x - 24$

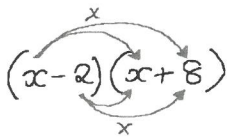
Simplify

$x^2 - 5x - 24$

YOU DO

Expand

$(x - 2)(x + 8)$



$x^2 + 8x - 2x - 16$

Simplify

$x^2 + 6x - 16$

Factorise a simple expression

I do, you do example

I DO

Factorise

$8x^2 - 24x$

Seek the highest common factor of:

$8x^2$ and $-24x$

8 is the HCF of 8 and -24

x is the HCF of x and x^2

The HCF of $8x^2$ and $-24x$ is $8x$

$8x^2 - 24x \equiv 8x(a + b)$

$8x \times a$ must give $8x^2$ so a is x

$8x \times b$ must give $-24x$ so b is -3

$8x^2 - 24x \equiv 8x(x - 3)$

YOU DO

Factorise

$7x^2 + 28x$

The HCF of $7x^2$ and $28x$ is $7x$.

$7x^2 + 28x \equiv 7x(a + b)$

$7x^2 + 28x \equiv 7x(x + 4)$

Expand over a single bracket

★

Expand

$4(x + 3)$

$4(x+3)$

$= 4 \times x + 4 \times 3$

$= 4x + 12$

★★

Expand

$8(3x - 2)$

$8(3x-2)$

$= 8 \times 3x + 8 \times -2$

$= 24x - 16$

★★★

Expand

$-7(6x - 7)$

$-7(6x-7)$

$= -7 \times 6x - 7 \times -7$

$= -42x + 49$

★★★★

Expand

$5x(4x - 9)$

$5x(4x-9)$

$= 5x \times 4x + 5x \times -9$

$= 20x^2 - 45x$

★★★★★

Expand and simplify

$7x(6x + 8) + 6x(8x + 4)$

$7x(6x+8) + 6x(8x+4)$

$= 7x \times 6x + 7x \times 8$

$+ 6x \times 8x + 6x \times 4$ (simplify)

$= 42x^2 + 56x + 48x^2 + 24x$

$= 90x^2 + 80x$

★★★★★★

Here is an identity:

$a(8x + 20) \equiv 56x + 5b$

Find a and b.

$8a\,x + 20a$

$56\,x + 5b$

$8a = 56$

$a = 7$

if $a = 7$, $20a = 140$

so $5b = 140$

$b = 28$

Expand 2 or more binomials

★

Expand

$(x + 4)(x + 4)$

$x^2+4x+4x+16$

$x^2+8x+16$

★★

Expand

$(x - 2)(x - 3)$

$x^2-3x-2x+6$

x^2-5x+6

★★★

Expand

$(x + 4)(x - 4)$

$x^2-4x+4x-16$

x^2-16

★★★★

Expand

$(4x + 8)(8x + 3)$

$32x^2+12x+64x+24$

$32x^2+76x+24$

★★★★★

Expand

$(3x^2 + 3)(5x^3 + 7)$

$15x^5+21x^2+15x^3+21$

$15x^5+15x^3+21x^2+21$

★★★★★★

Expand

$(x + 8)(x + 8)(x + 7)$

$(x^2+8x+8x+64)(x+7)$

$(x^2+16x+64)(x+7)$

$x^3+7x^2+16x^2+112x+64x+448$

$x^3+23x^2+176x+448$

Factorise a simple expression

★

Factorise

$7x + 49$

$7(x+7)$

★★

Factorise

$5x^2 + 25x$

$5x(x+5)$

★★★

Can $10x + 5$ be factorised?

Yes since both $10x$ and 5 have a HCF of 5.

$10x+5 \equiv 5(2x+1)$

★★★★

A rectangle has an area of $15x + 5$. By fully factorising, give possible dimensions of the rectangle.

5 and $3x+1$

★★★★★

Fully factorise

$4(x + 4) + 4x + 16$

factorise

$4(x+4)+4(x+4)$

$(4+4)(x+4)$

$8(x+4)$

Factorise a quadratic expression

I do, you do example

I DO

Factorise

$3x^2 + 10x + 8$

a → 3, c → 8, b → 10

To factorise, you want 2 numbers that multiply together to give ac but add together to give b.

$ac = 3 \times 8 = 24$ (4 × 6) $\quad b = 10$ (4 + 6)

Rewrite the problem with b separated into $4x$ and $6x$:

Factorise each half → $3x^2 + 6x + 4x + 8$ (Must be the same)

$3x(x+2) + 4(x+2)$

Fully factorise

$(3x+4)(x+2)$

YOU DO

Factorise

$2x^2 + 15x + 25$

$ac = 2 \times 25 = 50$ (5 × 10) $\quad b = 15$ (5 + 10)

$2x^2 + 10x + 5x + 25$

$2x(x+5) + 5(x+5)$

$(2x+5)(x+5)$

Solve a quadratic by factorising

I do, you do example

I DO

Solve the following quadratic by factorising:

$x^2 - 10x + 25 = 0$

The quadratic is in the form $ax^2 + bx + c$

To factorise a quadratic, think of 2 numbers that multiply to give ac and add to give b:

$ac = 1 \times 25 = 25 \quad b = -10$

So -5 and -5 (Split b in the quadratic into these 2 numbers)

Factorise each side of the green line

$x^2 - 5x - 5x + 25 = 0$

$x(x-5) - 5(x-5) = 0$ (Common bracket)

$(x-5)(x-5) = 0$

If the product of the 2 brackets is 0, it means 1 or both must equal 0 too:

$x - 5 = 0 \Rightarrow x = 5 \quad x - 5 = 0 \Rightarrow x = 5$

YOU DO

Solve the following quadratic by factorising:

$x^2 - 9x + 14 = 0$

$a = 1 \quad b = -9 \quad c = 14$

$ac = 1 \times 14 = 14 \quad b = -9$

So -7 and -2

$x^2 - 2x - 7x + 14 = 0$

$x(x-2) - 7(x-2) = 0$

$(x-7)(x-2) = 0$

$x - 7 = 0 \Rightarrow x = 7 \quad x - 2 = 0 \Rightarrow x = 2$

Substitute into expressions/formula

I do, you do example

I DO

If a = -8 and b = 4, find the value of

7a + 2b

Substitution in Maths is the act of replacing a letter with a number.

$7a + 2b$

When a letter and number are together, you multiply them

Replace b with 4

$7 \times -8 + 2 \times 4$

$-56 + 8$

-48

YOU DO

If a = 1 and b = -4, find the value of

-3a + 4b

$-3 \times 1 + 4 \times -4$

$-3 + -16$

-19

Factorise a quadratic expression

★

Factorise

$1x^2 + 12x + 32$

$ac = 1 \times 32 = 32 \quad b = 12$

$4 \times 8 \quad 4 + 8$

$x^2 + 4x + 8x + 32$

$x(x+4) + 8(x+4)$

$(x+8)(x+4)$

★★

Factorise

$1x^2 - 5x - 14$

$ac = 1 \times -14 = -14 \quad b = -5$

$-7 \times 2 \quad -7 + 2$

$x^2 + 2x - 7x - 14$

$x(x+2) - 7(x+2)$

$(x-7)(x+2)$

★★★

Factorise

$1x^2 - 7x + 10$

$ac = 1 \times 10 = 10 \quad b = -7$

$-2 \times -5 \quad -2 + -5$

$x^2 - 2x - 5x + 10$

$x(x-2) - 5(x-2)$

$(x-5)(x-2)$

★★★★

Factorise

$x^2 - 36$

Rewrite the problem

$x^2 + 0x - 36$

$ac = 1 \times -36 = -36 \quad b = 0$

$-6 \times 6 \quad -6 + 6$

$x^2 - 6x + 6x - 36$

$x(x-6) + 6(x-6)$

$(x+6)(x-6)$

★★★★★

Factorise

$3x^2 + 16x + 16$

$ac = 3 \times 16 = 48 \quad b = 16$

$4 \times 12 \quad 4 + 12$

$3x^2 + 12x + 4x + 16$

$3x(x+4) + 4(x+4)$

$(3x+4)(x+4)$

★★★★★★

Factorise

$12x^2 + 14x + 4$

$ac = 12 \times 4 = 48 \quad b = 14$

$6 \times 8 \quad 6 + 8$

$12x^2 + 6x + 8x + 4$

$6x(2x+1) + 4(2x+1)$

$(6x+4)(2x+1)$

Solve a quadratic by factorising

★

Solve the following quadratic by factorising:

$x^2 + 10x + 21 = 0$

$ac = 21 \quad b = 10$

$x^2 + 3x + 7x + 21 = 0$

$x(x+3) + 7(x+3) = 0$

$(x+7)(x+3) = 0$

$x+7 = 0 \quad x+3 = 0$

$x = -7 \quad x = -3$

★★

Solve the following quadratic by factorising:

$x^2 - 3x - 18 = 0$

$ac = -18 \quad b = -3$

$x^2 - 6x + 3x - 18 = 0$

$x(x-6) + 3(x-6) = 0$

$(x+3)(x-6) = 0$

$x+3 = 0 \quad x-6 = 0$

$x = -3 \quad x = 6$

★★★

Solve the following quadratic by factorising:

$x^2 - 9x + 20 = 0$

$ac = 20 \quad b = -9$

$x^2 - 5x - 4x + 20 = 0$

$x(x-5) - 4(x-5) = 0$

$(x-4)(x-5) = 0$

$x-4 = 0 \quad x-5 = 0$

$x = 4 \quad x = 5$

★★★★

Solve the following quadratic by factorising:

$x^2 - 64 = 0$

$ac = -64 \quad b = 0$

$x^2 + 8x - 8x - 64 = 0$

$x(x+8) - 8(x+8) = 0$

$(x-8)(x+8) = 0$

$x-8 = 0 \quad x+8 = 0$

$x = 8 \quad x = -8$

★★★★★

Solve the following quadratic by factorising:

$2x^2 - 13x + 15 = 0$

$ac = 30 \quad b = -13$

$2x^2 - 10x - 3x + 15 = 0$

$2x(x-5) - 3(x-5) = 0$

$(2x-3)(x-5) = 0$

$2x-3 = 0 \quad x-5 = 0$

$2x = 3 \Rightarrow x = 1.5 \quad x = 5$

★★★★★★

Solve the following quadratic by factorising:

$10x^2 + 23x + 12 = 0$

$ac = 120 \quad b = 23$

$10x^2 + 15x + 8x + 12 = 0$

$5x(2x+3) + 4(2x+3) = 0$

$(5x+4)(2x+3) = 0$

$5x+4 = 0 \quad 2x+3 = 0$

$5x = -4 \quad 2x = -3$

$x = -0.8 \quad x = -1.5$

Substitute into expressions/formula

★

If n = 4, find the value of 4n

4×4

$= 16$

★★

If n = 2, find the value of 8n + 2

$8 \times 2 + 2$

$= 16 + 2$

$= 18$

★★★

If a = 2 and b = 6, find the value of -4a + 4b

$-4 \times 2 + 4 \times 6$

$= -8 + 24$

$= 16$

★★★★

If a = -9, find the value of $a^2 - 3$

$(-9)^2 - 3$

$= 81 - 3$

$= 78$

★★★★★

A = ½(a + b)h

If a = 2, b = 5 and h = 5, find A to 1dp.

$\frac{1}{2} \times (2+5) \times 5$

$= \frac{1}{2} \times 7 \times 5$

$= \frac{1}{2} \times 35 = 17.5$

★★★★★★

If f(x) = -7x + 4, calculate f(5)

$-7 \times 5 + 4$

$= -35 + 4$

$= -31$

Form expressions and equations

I do, you do example

I DO

I think of a number (n), I subtract 3 and then multiply it by 6. Write an expression, in terms of n, to represent my number.

Statements like these always provide order that we need to preserve when considering BIDMAS.

① I think of a number n

② I subtract 3 $n-3$

③ multiply by 6 $6(n-3)$

(n - 3) is placed in brackets to ensure the subtraction happens before the multiplication.

YOU DO

I think of a number (n), I add 6 and then multiply it by 3. Write an expression, in terms of n, to represent my number.

I think of a number n

I add 6 $n+6$

I multiply by 3 $3(n+6)$

★

Ashton is 5 years older than Liam. If Ashton is y years old, how old is Liam?

$y - 5$

★★

I think of a number (n), I multiply it by 3 and add 2. Write an expression, in terms of n, to represent my number.

$3n + 2$

★★★

I think of a number (n), I add 2 and then divide it by 4. Write an expression, in terms of n, to represent my number.

$\frac{(n+2)}{4}$

or $(n+2) \div 4$

★★★★

Steve is y years old.
Matt is 2 years older than Steve.
Sue is 6 years younger than Steve. Find the sum of their ages.

$y + (y+2) + (y-6) = 3y - 4$

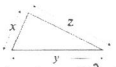
★★★★★

I think of a number (n), I multiply it by 9 and then add 7. If the answer is my original number subtract 17. What is my number?

$9n + 7 = n - 17$
$8n + 7 = -17$
$8n = -24$
$n = -3$

★★★★★★

If $x = n + 6$, $y = n - 8$ and $z = 3n + 4$, write a formula for the perimeter, P, in terms of n.



$(n+6) + (n-8) + (3n+4)$
$= 5n + 2$