

Algebraic vocabulary

Algebra is used to represent missing information.

An algebraic x is written using two back-to-back 'c's.

Vocabulary	Examples
A letter can be used to represent any unknown number. This is called a variable .	x or y
A number that multiplies a variable is called a coefficient .	$3x$ or $2y$
A constant is a number that does not change in value.	5 or -8
A term is a single variable or a single constant or variables and constants that have been multiplied together.	a $3b$ 12
An expression is two or more terms joined by an operator (e.g. $+$, $-$, $\times$). In an expression that is a product, the terms that are being multiplied are called factors .	$x - 4 + 3y$ In the expression $7 \times a$, 7 and a are factors.
An equation shows that two expressions are equal (indicated by the $=$ sign).	$7y = 21$
A formula is a variable that is equal to an expression which uses a different variable.	$s = \frac{d}{t}$

In the expression $2x + 11 - 8y$, notice that:

- the **variables** are x and y
- the **coefficients** are 2 and -8
- the **constant** is 11
- the **terms** are $2x$, 11 and $-8y$

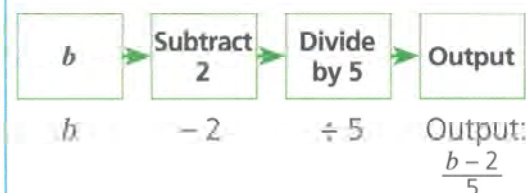
When a variable and a number are multiplied together, the number is always written first. Both $z \times 5$ and $5 \times z$ are written as $5z$.
A product is the result of a multiplication.

Algebraic notation and function machines

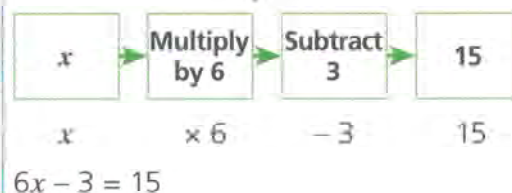
Rules of algebraic notation	Examples
When multiplying in algebra, the $\times$ sign is not written.	$x \times y$ is written as xy $6 \times (t + 1)$ is written as $6(t + 1)$
When dividing in algebra, the division is usually expressed as a fraction.	$x \div y$ is written as $\frac{x}{y}$ $a \div 3$ is written as $\frac{a}{3}$
When multiplying a variable by 1 , the number 1 is not written as the coefficient.	$1 \times w$ is written as w
When multiplying a variable by 0 , the number 0 is not written as the coefficient.	$0 \times w$ is written as 0 , not $0w$
When multiplying a variable by itself, powers are used.	$y \times y$ is written as y^2 $y \times y \times y$ is written as y^3

A **function machine** applies operations to a variable, called the **input**. The result is called the **output**.

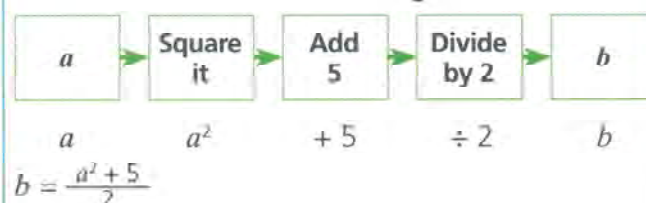
Write the output of the function machine as an **expression**.



Write the instructions in the function machine as an **equation**.



Write the instructions in the function machine as a **formula** linking b and a .



Squaring a variable means to multiply the variable by itself, e.g. " a squared" = a^2

Cubing a variable means to multiply the variable by itself and by itself again, e.g. " a cubed" = a^3

Algebraic vocabulary and notation

Algebraic vocabulary

1 Identify the variables, coefficients, constants and terms in each expression.

- a) $3x + y - 12$ Variables: _____ Coefficients: _____
 Constants: _____ Terms: _____
- b) $-6f + g + 5$ Variables: _____ Coefficients: _____
 Constants: _____ Terms: _____
- c) $10 - de + 4f$ Variables: _____ Coefficients: _____
 Constants: _____ Terms: _____

2 Identify the factors in each expression.

- a) $b \times 12$ _____
- b) $5 \times \frac{1}{n}$ _____

3 Identify whether each of these is an **expression**, an **equation** or a **formula**.

- a) $5a + 4 = 20$ _____
- b) $u = x + 2xy - 4$ _____
- c) $7e + fg - 18$ _____

Algebraic notation and function machines

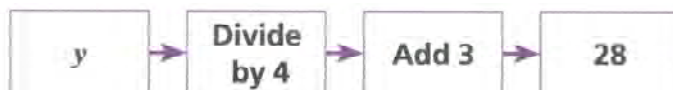
4 Write the expressions algebraically.

- a) $f \times 3$ _____ b) $w \times x \times y$ _____ c) $8 \times (c - d)$ _____
- d) $m \div n$ _____ e) $7 \div a$ _____ f) $b \div 9$ _____
- g) $1 \times d$ _____ h) $h \times 0$ _____ i) $n \times n$ _____

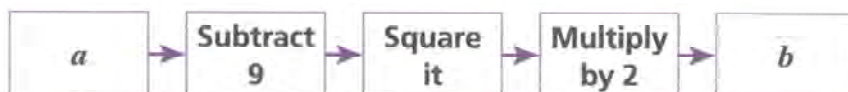
5 a) Write the instructions in the function machine as an **expression**.



b) Write the instructions in the function machine as an **equation**.



c) Write the instructions in the function machine as a **formula** linking b and a .



Area of a square, rectangle and triangle

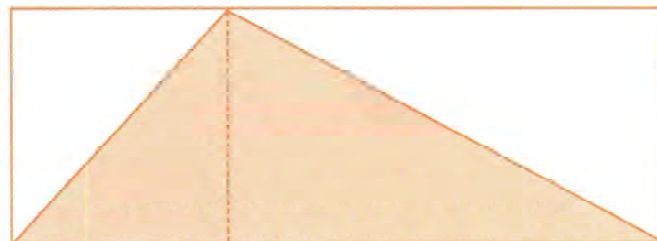
Area of a **square** or a **rectangle** = length $\times$ width

Area is a **two-dimensional** measure, so is measured in, for example, cm^2 , not cm or cm^3

Area of a **triangle** = $\frac{1}{2} \times \text{base} \times \text{perpendicular height}$

The **perpendicular height** of a triangle is the height that meets the base at 90° , not the slanted height.

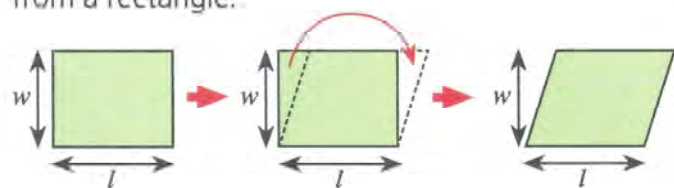
Each part of the triangle is half of the smaller rectangle in which it sits and so the whole triangle is half the area of the large rectangle.



Area of a parallelogram and trapezium

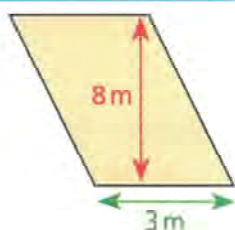
Area of a **parallelogram** = length $\times$ width
= base $\times$ perpendicular height

The area of a parallelogram is the same as the area of a rectangle since you can form a parallelogram from a rectangle.



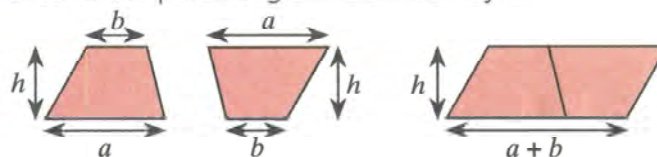
Find the area of the parallelogram.

$$\text{Area} = 3 \times 8 = 24 \text{ m}^2$$

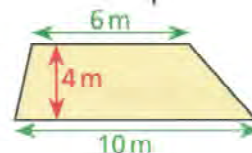


Area of a **trapezium** = $\frac{(a+b)}{2} h$

To derive this formula, join two trapezia to form a parallelogram. The area for a parallelogram is length $\times$ width. The length is given by $a + b$ and the width by h . To find the area of one trapezium, the area of the parallelogram is divided by 2.



Find the area of the trapezium.



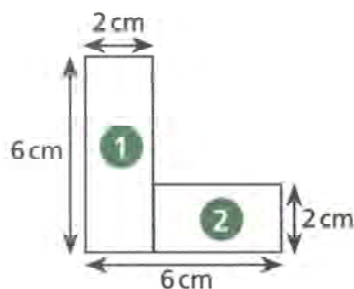
$$\text{Area} = \frac{(a+b)}{2} h = \frac{(6+10)}{2} \times 4 = 8 \times 4 = 32 \text{ m}^2$$

Area of composite shapes

A **composite shape** (or compound shape) is a shape made up of two or more simple shapes.

Split up the composite shape into simple shapes and number them. Then find the area of both shapes and add them together.

What is the area of this composite shape?



$$\text{Area of rectangle 1} = 6 \times 2 = 12 \text{ cm}^2$$

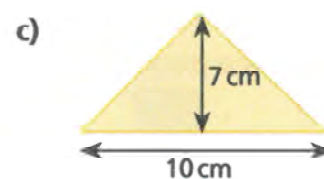
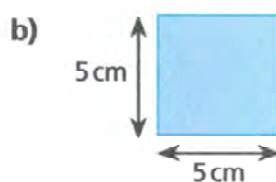
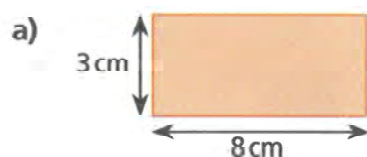
$$\text{Length of rectangle 2 is 4 cm because } 6 - 2 = 4$$

$$\text{Area of rectangle 2} = 4 \times 2 = 8 \text{ cm}^2$$

$$\begin{aligned} \text{Total area of composite shape} &= 12 \text{ cm}^2 + 8 \text{ cm}^2 \\ &= 20 \text{ cm}^2 \end{aligned}$$

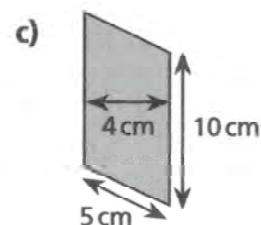
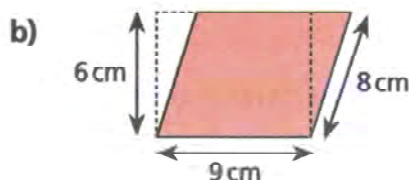
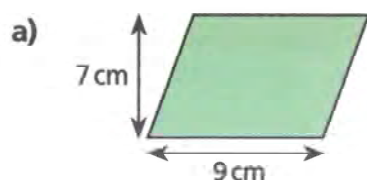
Area of a square, rectangle and triangle

1 Find the areas of the following shapes.

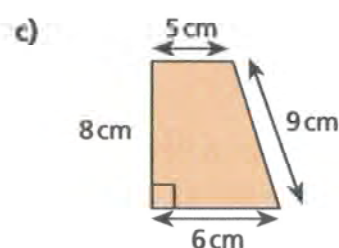
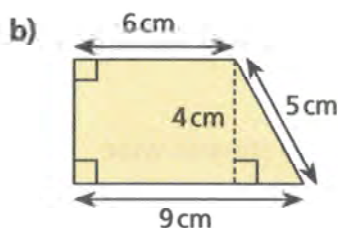
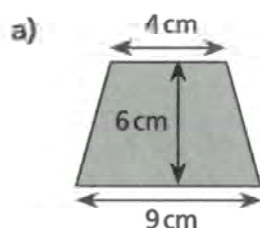


Area of a parallelogram and trapezium

2 Find the areas of the following parallelograms.

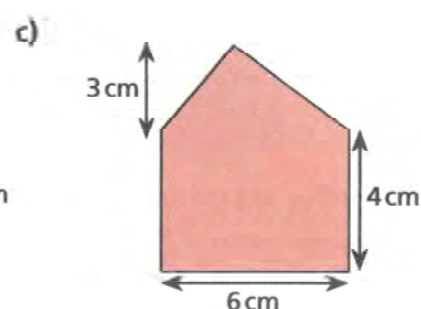
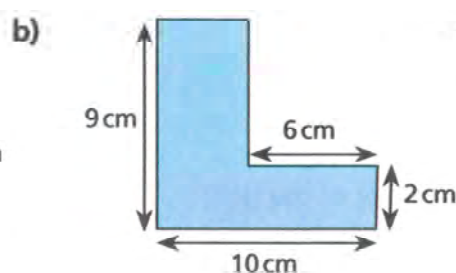
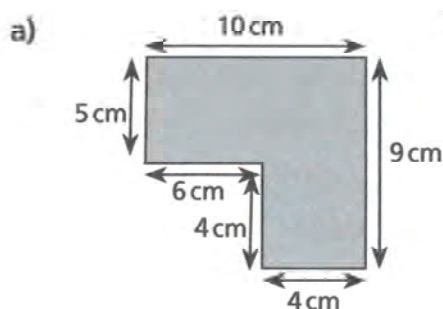


3 Find the areas of the following trapeziums.



Area of composite shapes

4 Find the areas of the following composite shapes.

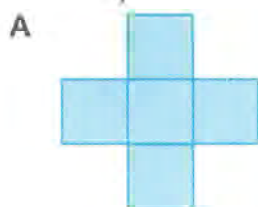


Perimeter

Shape A and shape B are each made from five identical squares.

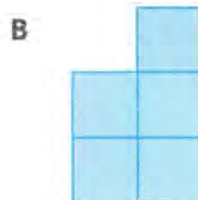
The **perimeter** of shape A is 60 cm.

Work out the perimeter of shape B.



Shape A has 12 sides.

The length of one side = $60 \div 12 = 5$ cm



Shape B has 10 sides that are each 5 cm in length.

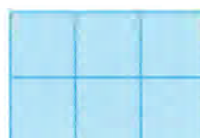
Total perimeter of shape B = $10 \times 5 = 50$ cm

Perimeter and area

The diagram shows a square with a perimeter of 8 cm.



Six of these squares fit together to make a rectangle.



What is the **area** of the rectangle? Give the correct unit with your answer.

Since the perimeter of one square = 8 cm, to find the length of one side of the square, you should divide the perimeter by the number of sides.

$$8 \div 4 = 2 \text{ cm}$$

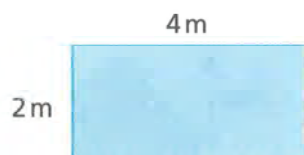
The rectangle is three squares long and two squares wide.

Total length of the rectangle is $2 \text{ cm} + 2 \text{ cm} + 2 \text{ cm} = 6 \text{ cm}$

Total width of the rectangle is $2 \text{ cm} + 2 \text{ cm} = 4 \text{ cm}$

$$\begin{aligned} \text{Area of a rectangle} &= \text{length} \times \text{width} \\ &= 6 \text{ cm} \times 4 \text{ cm} = 24 \text{ cm}^2 \end{aligned}$$

A farmer is building a new rectangular pen for her sheep. It is 4 m long and 2 m wide. It costs £5 for 1 m of fencing and £4 for hay which covers 1 m^2 . How much does the farmer need to spend in total?



It can help to draw a diagram to help visualise a problem.

The fence will go around the perimeter of the pen.

$$\text{Perimeter} = 4 \text{ m} + 2 \text{ m} + 4 \text{ m} + 2 \text{ m} = 12 \text{ m}$$

$$\begin{aligned} \times 12 \quad 1 \text{ m} &= \text{£}5 \\ 12 \text{ m} &= \text{£}60 \end{aligned}$$

It will cost £60 to build the fence around the pen.

The hay will need to cover the area inside the rectangular pen.

$$\text{Area} = 4 \times 2 = 8 \text{ m}^2$$

$$\begin{aligned} \times 8 \quad 1 \text{ m}^2 &= \text{£}4 \\ 8 \text{ m}^2 &= \text{£}32 \end{aligned}$$

The total amount that the farmer will need to spend for the fence and the hay is $\text{£}60 + \text{£}32 = \text{£}92$

Solving perimeter and area problems

Perimeter

- 1 A rectangular field measuring 7 m by 2 m needs to be fenced. The fence comes in 1 m sections.

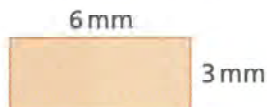
a) How many sections are needed to fence the whole rectangular field? _____

b) The fence costs £10 per section.

What is the total cost of fencing the field? _____

Perimeter and area

- 2 The diagram shows a rectangle.



Three of the rectangles are joined together to make this composite shape.



a) Work out the perimeter of the composite shape. _____

b) Work out the area of the composite shape. _____

- 3 This is a right-angled triangular tile.



How many tiles can fit into the 6 cm by 6 cm square? _____

- 4 A square-shaped sign measuring 9 m by 9 m needs painting. A tin of paint which covers 3 m^2 costs £5.

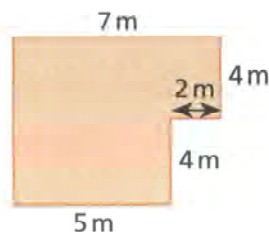
a) What is the area of the sign? _____

b) How many tins of paint will be needed to paint the sign? _____

c) How much would it cost to paint the sign? _____

- 5 The diagram shows a garden.

A gardener wants to grow new grass in the garden.



Each bag of grass seed covers 2 m^2 .

a) How many bags of grass seed does the gardener need? _____

b) Each bag of grass seed costs £5.

How much will it cost the gardener to buy all the grass seed that is needed? _____

- 6 A room is to be covered in carpet tiles. The room measures 4 m by 2 m. Each carpet tile measures 25 cm by 4 cm. Each tile costs £2.

a) Work out the area of the room, giving your answer in cm^2 . _____

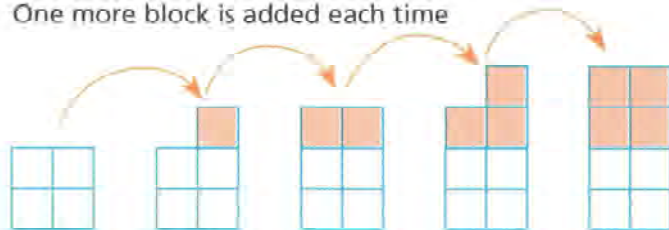
b) How many carpet tiles will be needed to cover the room? _____

c) What is the cost of tiling the room? _____

What is a sequence?

A **sequence** is a pattern of numbers or images appearing in a special order. The numbers in a sequence are called **terms**. An ellipsis (...) at the end of the sequence shows that it continues.

One more block is added each time



In an **arithmetic sequence** (also called a **linear sequence**), the terms increase or decrease by the same value (the **common difference**) each time.

1, 3, 5, 7, 9, ... is an arithmetic sequence in which each term increases by 2.

25, 20, 15, 10, 5, ... is an arithmetic sequence in which each term decreases by 5.

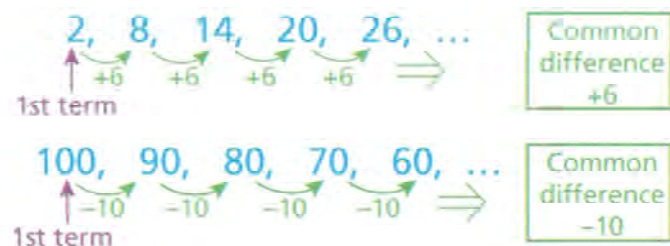
In a **geometric sequence**, each term is multiplied or divided to get the next term. The number the terms are multiplied or divided by is called the **common ratio**.

2, 4, 8, 16, 32, ... is a geometric sequence in which each term is multiplied by 2 to get the next term.

If a sequence is arithmetic, it is increasing or decreasing by a constant value.

Describing and generating arithmetic sequences

An arithmetic sequence can be described in words or by giving the **first term** and the common difference, or **term-to-term rule**.



To **generate a sequence** means to write down the terms. You need the first term and the relationship between the terms (the term-to-term rule).

The first term of a sequence is 15 and the value of each term is 4 less than the previous term. Generate the first five terms.

1st term is 15

2nd term is $15 - 4 = 11$

3rd term is $11 - 4 = 7$

4th term is $7 - 4 = 3$

5th term is $3 - 4 = -1$

The sequence is 15, 11, 7, 3, -1, ...

This is an arithmetic sequence as each term is decreasing by the same value.

Describing and generating other sequences

A **geometric sequence** can be described by stating the first term and the number each term is multiplied (or divided) by to get the next term.

The sequence 1, 4, 16, 64, ... starts with 1 and each term is multiplied by 4 to create the next term.

Some sequences are neither arithmetic nor geometric. In the **Fibonacci sequence**, the previous two terms are added together to create the next term. The first eight terms in the sequence are:

1, 1, 2, 3, 5, 8, 13, 21

$1 + 1 = 2$, $1 + 2 = 3$,
 $2 + 3 = 5$, $3 + 5 = 8$, etc.

The first term of a sequence is 100 and each term is half the previous term. Write the first five terms.

1st term is 100

2nd term is $100 \div 2 = 50$

3rd term is $50 \div 2 = 25$

4th term is $25 \div 2 = 12.5$

5th term is $12.5 \div 2 = 6.25$

The sequence is 100, 50, 25, 12.5, 6.25, ...

This is a geometric sequence as each term is being divided by 2.

Any sequence can be written if you know how it starts and the relationship between the terms.

What is a sequence?

1 Identify whether the following sequences are **arithmetic** or **geometric**. Circle your answers.

- | | | |
|-------------------------|------------|-----------|
| a) 2, 10, 50, 250, 1250 | Arithmetic | Geometric |
| b) 6, 1, -4, -9, -14 | Arithmetic | Geometric |
| c) 2, 4, 6, 8, 10 | Arithmetic | Geometric |
| d) 16, 8, 4, 2, 1 | Arithmetic | Geometric |

Describing and generating arithmetic sequences

2 Describe each sequence by stating the first term and the common difference.

- a) 7, 12, 17, 22, 27, ...
- _____

- b) 11, 7, 3, -1, -5, ...
- _____

3 Write down the first five terms of each sequence.

- a) First term 77, common difference -7
- _____

- b) First term -6, common difference +3
- _____

Describing and generating other sequences

4 Describe each geometric sequence by stating the first term and the relationship between the terms.

- a) 3, 9, 27, 81, 243, ...
- _____

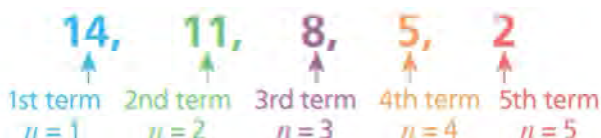
- b) 54, 18, 6, 2, $\frac{2}{3}$, ...
- _____

5 Write down the first five terms of a sequence with first term -1, multiplying each term by 3.

2 n^{th} term rules

Generating sequences from n^{th} term rules

The n^{th} term rule (or **position-to-term rule**) describes a sequence and can be used to find any term, n , given its position in the sequence.



The n^{th} term rule for an arithmetic sequence will always be some number multiplied by n , plus (or minus) another number. The number multiplied by n is the common difference.

$$n^{\text{th}} \text{ term} = \boxed{}n + \boxed{}$$

common difference a constant

To use the n^{th} term rule, substitute the term number into the formula and find the value of the term.

If given the rule, you can generate any sequence by substituting the term numbers (or positions) into the n^{th} term rule.

To write the first five terms of an arithmetic sequence with the n^{th} term rule $3n + 4$, substitute the values $n = 1, 2, 3, 4$ and 5 into the rule.

1st term: $n = 1$	$(3 \times 1) + 4 = 7$
2nd term: $n = 2$	$(3 \times 2) + 4 = 10$
3rd term: $n = 3$	$(3 \times 3) + 4 = 13$
4th term: $n = 4$	$(3 \times 4) + 4 = 16$
5th term: $n = 5$	$(3 \times 5) + 4 = 19$

The sequence is 7, 10, 13, 16, 19, ...

The n^{th} term rule can be used to find any term of the sequence.

100th term: $n = 100$ $(3 \times 100) + 4 = 304$

Find the 1st, 2nd, 3rd and 20th terms of the sequence with n^{th} term rule $n^2 + 2n$

1st term: $n = 1$	$1^2 + (2 \times 1) = 3$
2nd term: $n = 2$	$2^2 + (2 \times 2) = 8$
3rd term: $n = 3$	$3^2 + (2 \times 3) = 15$
20th term: $n = 20$	$20^2 + (2 \times 20) = 440$

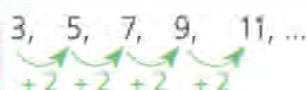
Writing n^{th} term rules for arithmetic sequences

Follow these steps to find the n^{th} term rule of an arithmetic sequence:

1. Find the common difference.
2. Write the common difference as the coefficient of n .
3. Substitute $n = 1$ into the expression from step 2 and find the constant. What needs to be added or subtracted to get the first term? Check by substituting another term.
4. Write the n^{th} term rule using the common difference and the constant.

Find the n^{th} term rule of the sequence 3, 5, 7, 9, 11, ...

First find the common difference.



The common difference is +2.

Then write the common difference as the coefficient of n .

The coefficient of n is +2 so write $2n$.

Substitute $n = 1$.

When $n = 1$, $2n$ is $2 \times 1 = 2$

To get the first term of 3, add 1.

When $n = 2$, $2n$ is $2 \times 2 = 4$

To get the second term of 5, add 1.

The constant is +1.

Finally, write the n^{th} term rule using the common difference and the constant.

$$n^{\text{th}} \text{ term} = 2n + 1$$

Common difference The constant

Generating sequences from n^{th} term rules

- 1 Find the 1st, 2nd, 3rd and 10th terms of these sequences from the n^{th} term rules.

a) $4n + 9$

b) $2n - 5$

- 2 Find the 1st, 2nd, 3rd and 10th terms of these sequences from the n^{th} term rules.

a) $n^2 + 5$

b) $n^3 - 1$

Writing n^{th} term rules for arithmetic sequences

- 3 Find the n^{th} term rule for these arithmetic sequences.

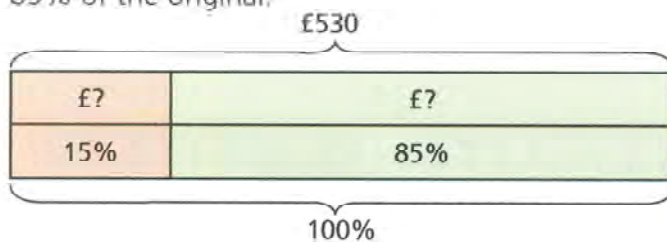
a) 1, 5, 9, 13, 17, ...

b) 22, 17, 12, 7, 2, ...

Percentage decrease

Prices may be reduced by a certain percentage; this is an example of **percentage decrease**.

This bar model represents a £530 TV decreased in price by 15%. £530 is 100% of the original cost. The price is reduced by 15%, so the sale price is 85% of the original.



To find the new price, either find 15% of the original price and subtract it from the original price, or find 85% of the original price.

To find the new price, use one of these methods:

Convert 15% to a decimal:
 $15\% = 15 \div 100 = 0.15$

Find the amount of the decrease:
 $£530 \times 0.15 = £79.50$

Find the new price:
 $£530 - £79.50 = £450.50$

Find the percentage the sale price is of the original price:
 $100\% - 15\% = 85\%$

Convert 85% to a decimal:
 $85\% = 85 \div 100 = 0.85$

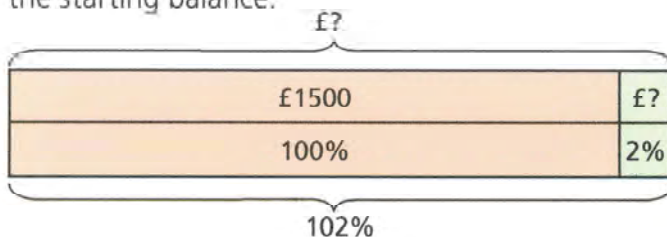
Find the new price:
 $£530 \times 0.85 = £450.50$

To find the new value after a percentage decrease, multiply the original value by the percent remaining after the decrease (100% - percentage decrease).

Percentage increase

Prices may rise by a certain percentage; this is called **percentage increase**. Interest in a bank account is also an example of percentage increase. The bank pays interest based on a percentage of the balance. When this interest is paid at the end of the year, it is called **simple interest**.

This bar model shows the interest earned on a £1500 bank account. The new balance is 2% more than at the start. So the new balance is 102% of the starting balance.



To find the new balance, use one of these methods:

Convert 2% to a decimal:
 $2\% = 2 \div 100 = 0.02$

Find the amount of interest earned:
 $£1500 \times 0.02 = £30$

Add to the original balance to find the new balance:
 $£1500 + £30 = £1530$

Find the percentage the new balance is of the original balance:
 $100\% + 2\% = 102\%$

Convert 102% to a decimal:
 $102\% = 102 \div 100 = 1.02$

Find the new balance:
 $£1500 \times 1.02 = £1530$

To find the new value after a percentage increase, multiply the original value by (100% + the percentage increase).

Finding the percentage change

The percentage by which a value has increased or decreased is the **percentage change**. It is the same as asking what percentage one number is of another.

$$\% \text{ change} = \frac{\text{amount of increase or decrease}}{\text{original value}} \times 100$$

The price of a video game has been reduced by £5. The original price was £40.

$$\% \text{ change} = \frac{\text{amount of increase or decrease}}{\text{original value}} \times 100$$

$$\% \text{ decrease} = \frac{5}{40} \times 100 = 12.5\%$$

The price has decreased by 12.5%

Find the percentage increase in the amount of shampoo in the bottle.

Amount of increase:

$$420 \text{ ml} - 400 \text{ ml} = 20 \text{ ml}$$

$$\% \text{ change} = \frac{\text{amount of increase or decrease}}{\text{original value}} \times 100$$

$$\% \text{ increase} = \frac{20}{400} \times 100 = 5\%$$

The amount of shampoo has increased by 5%



Percentage changes

Percentage decrease

- 1 A furniture shop is having a sale. The original prices are shown.

Calculate the new price of each item.

a)



b)



Percentage increase

- 2 A manufacturer is increasing the amounts in its food packages.

a) Increase the amount of cereal by 8%



b) Increase the amount of porridge by 20%

Finding the percentage change

- 3 An electronics store is having a sale on TVs.

Calculate the percentage change of each of these discounts given the original prices indicated. Give your answers to the nearest percent.

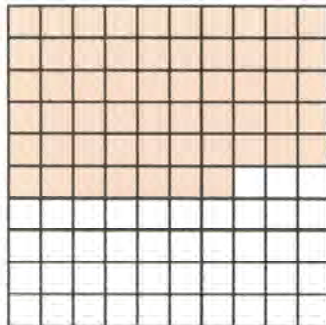
a) A TV originally costs £2500 and is being discounted by £300.

b) A TV originally costs £1700 and is now £1350.

Fractions, decimals and percentages

Percent means 'out of 100'. Percentages, fractions and decimals are all ways to represent part of a whole, so percentages can also be written as equivalent fractions and decimals.

57 out of 100 squares (57%) are shaded



Write the amount of cake that has been eaten as a fraction, a decimal and a percentage.



3 out of 8 slices have been eaten. That means $\frac{3}{8}$ of the cake has been eaten.

$$\frac{3}{8} = 3 \div 8 \quad 8 \overline{) 3.000} \quad \frac{3}{8} = 0.375$$

$$0.375 \times 100 = 37.5\%$$

Conversion	Method
Decimal to percentage	Multiply by 100, e.g. $0.75 \times 100 = 75\%$
Decimal to fraction	Use the smallest decimal place value as the denominator and digits as the numerator, e.g. $0.75 = \frac{75}{100} = \frac{3}{4}$ $\uparrow$ Hundredths place Divide by 25 to simplify $\frac{75}{100}$
Percentage to decimal	Divide by 100, e.g. $75\% \div 100 = 0.75$
Percentage to fraction	Use 100 as the denominator and the percentage as the numerator, e.g. $75\% = \frac{75}{100}$
Fraction to decimal	Divide the numerator by the denominator, e.g. $\frac{3}{4} = 3 \div 4 \quad 4 \overline{) 3.000} \quad \frac{3}{4} = 0.75$
Fraction to percentage	Convert to a decimal then multiply by 100, e.g. $\frac{3}{4} = 0.75$ $0.75 \times 100 = 75\%$

One number as a percentage of another number

To find what percent one number is of another, divide the first number by the second and multiply by 100.

7 out of 10 beads in a bag are red.

This is $\frac{7}{10}$ as a fraction. As a decimal, $\frac{7}{10} = 0.7$

$0.7 \times 100 = 70\%$, so 70% of the beads are red.

To find what percent 18 is of 12, divide $18 \div 12 = 1.5$, then $1.5 \times 100 = 150\%$. 18 is 150% of 12.

A shirt that originally cost £20 is reduced by £3 in a sale. By what percentage has the price decreased?

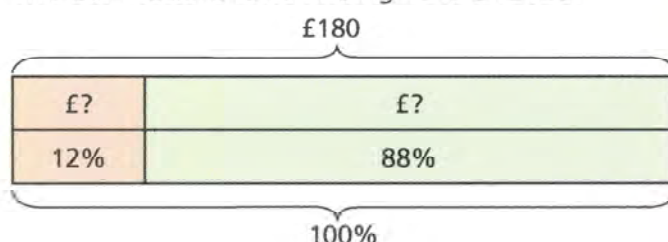
Find what percent £3 is of £20.

$\frac{3}{20} = 3 \div 20 = 0.15$, then $0.15 \times 100 = 15\%$.
The price of the shirt has decreased by 15%.

Finding percentages of a number or an amount

To find a percentage of an amount, convert the percentage to a decimal or fraction and multiply by the amount.

This bar model shows finding 12% of £180.



To find 12% of £180, convert 12% to a decimal or fraction, then multiply by 180. $12\% \text{ of } £180 = £21.60$

To Find 10% of a number, $\times$ by 0.1, or $\div$ by 10.

To Find 5% of a number, halve 10% of the number.

To Find 1% of a number, $\times$ by 0.01, or $\div$ by 100.

Find 17% of 160.

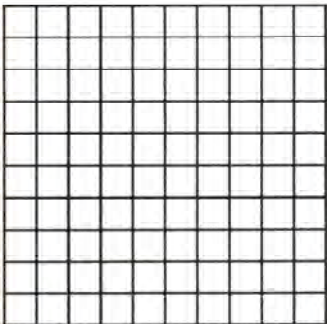
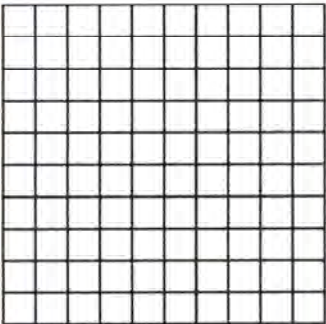
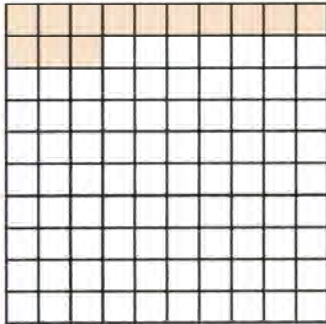
$10\% \text{ of } 160 = 160 \div 10 = 16$
 $5\% \text{ of } 160 = 16 \div 2 = 8$
 $2\% \text{ of } 160 = 1.6 \times 2 = 3.2$

17% of 160 =
 $10\% \text{ of } 160 +$
 $5\% \text{ of } 160 +$
 $2\% \text{ of } 160$

So $17\% \text{ of } 160 = 16 + 8 + 3.2 = 27.2$

Fractions, decimals and percentages

1 Complete the table.

Fraction	$\frac{19}{50}$		
Decimal		0.74	
Percentage			
Diagram			

One number as a percentage of another number

2 Find the percent by which each of these items is discounted. Give your answers to the nearest percent.

a) A shirt is originally £18 and is decreased by £2.

.....

b) A pair of trousers is originally £38 and is decreased by £5.

.....

Finding percentages of a number or an amount

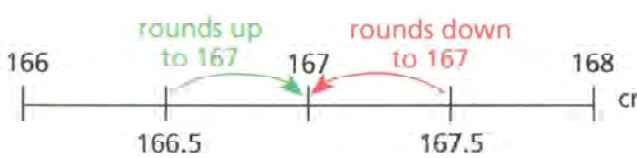
3 A theme park offers a discount of 8% for tickets bought online.
A family of 1 adult and 3 children plan to go to the theme park.

How much will they save by buying their tickets online?

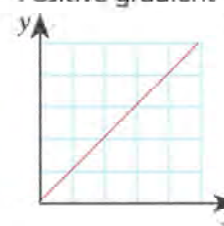
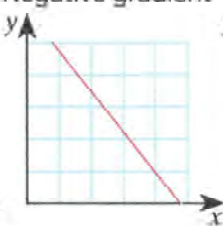
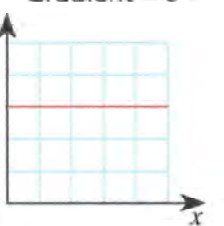
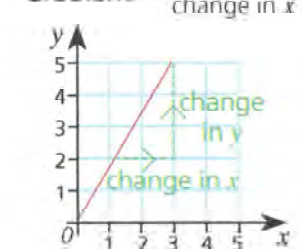


Key facts and vocabulary

Number

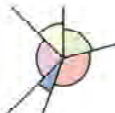
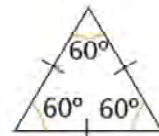
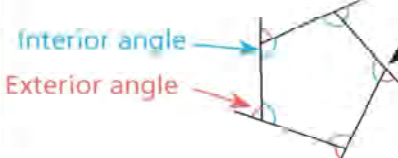
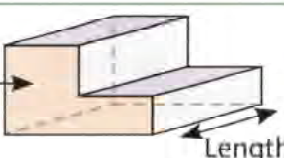
Error interval	The true value can be up to half a unit either side of the measurement  $166.5 \leq \text{length} < 167.5 \text{ cm}$
Percentage change	Percentage change = $\frac{\text{amount of increase or decrease}}{\text{original value}} \times 100$ Repeated percentage change: New value = original value $\times$ multiplier^x (where x is the number of changes)
Percentage increase and decrease	To increase a value by 20%, multiply by the multiplier $\frac{100 + 20}{100} = \frac{120}{100} = 1.2$ To decrease a value by 30%, multiply by the multiplier $\frac{100 - 30}{100} = \frac{70}{100} = 0.7$ To find the original value, use the multiplier and inverse operations
Rounding to significant figures	4852 rounded to 1 s.f. is 5000 0.00649 rounded to 1 s.f. is 0.006 4852 rounded to 2 s.f. is 4900 0.00649 rounded to 2 s.f. is 0.0065

Algebra

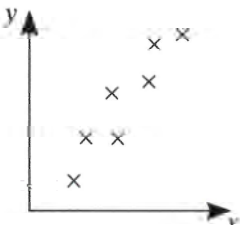
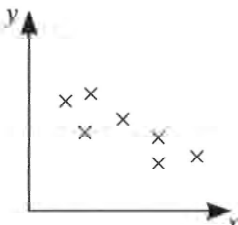
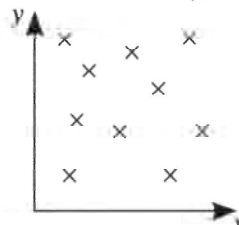
Arithmetic sequence	Terms go up or down by the same amount (common difference) each time 2, 5, 8, 11, 14, ... Common difference +3 5, 3, 1, -1, -3, ... Common difference -2
Direct proportion	As one quantity increases, the other quantity increases at the same rate, e.g. when x doubles, y doubles $y = kx$ k is a constant (a number that does not change)
Equation of a straight line	$y = mx + c$ where m is the gradient and c is the y-intercept
Expand	Multiply every term inside the bracket by the term outside the bracket $3(x + 4) = 3x + 12$ $5(2y - 1) = 10y - 5$
Geometric sequence	Each term is multiplied or divided by the same number to get the next term 2, 4, 8, 16, 32, ... Each term is multiplied by 2 1000, 100, 10, 1, 0.1, ... Each term is divided by 10
Gradient	Measure of the steepness of a line Positive gradient  Negative gradient  Gradient = 0  Gradient = $\frac{\text{change in } y}{\text{change in } x}$ 
Inverse proportion	As one quantity increases, the other quantity decreases at the same rate, e.g. when x doubles, y halves $y = \frac{k}{x}$ k is a constant

n^{th} term	Formula involving n that generates the terms in a sequence; substitute $n = 1$ to find the 1st term, $n = 2$ to find the 2nd term, and so on.	Common difference n^{th} term = $2n + 1$ The constant
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Geometry

Angle bisector	Cuts an angle in half			
Angle facts	Angles at a point  Angles at a point add up to 360°	Vertically opposite  Vertically opposite angles are equal	Equilateral triangle  All angles are 60°	Isosceles triangle  Two equal angles at base of equal sides
Angle sum	Angles in: - a triangle sum to 180° - a quadrilateral sum to 360° - an n-sided polygon sum to $(n - 2) \times 180^\circ$			
Angles in parallel lines	 Alternate angles make a 'Z' shape; they are equal	 Corresponding angles make an 'F' shape; they are equal		
Exterior angles	 Interior angle Exterior angle Exterior angle + interior angle = 180° because angles on a straight line add up to 180°			
Perpendicular bisector	Cuts a line in half, at right angles			
Surface area	Total area of all faces of a 3D shape			
Volume of a prism	Volume of prism = area of cross section $\times$ length			
	Cross section  Length			

Statistics

Correlation	Positive (as one variable increases, the other increases)  Negative (as one variable increases, the other decreases)  None (no pattern or relationship) 
Mean	$\frac{\text{Total sum of values}}{\text{Number of values}}$
Median	Middle value when values are in order In a set of n values, the median is the $\frac{n+1}{2}$ th value
Mode	Most common value; the value with highest frequency
Range	Highest value – lowest value