ORGANISE

3 Algebraic vocabulary and notation

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. +, −, ×). 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 × 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**.

b → Subtract 2 → Divide by 5 → Output

b -2 $\div 5$ Output: $\frac{b-2}{5}$

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

x → Multiply by 6 → Subtract 3 → 15

x $\times 6$ -3 15

$6x - 3 = 15$

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

a → Square it → Add 5 → Divide by 2 → b

a a^2 $+5$ $\div 2$ b

$b = \frac{a^2 + 5}{2}$

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

RETRIEVE 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**.

d → **Multiply by 6** → **Add 1** → **Output** ....

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

y → **Divide by 4** → **Add 3** → **28** ....

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

a → **Subtract 9** → **Square it** → **Multiply by 2** → b ....

ORGANISE

3 Algebraic expressions

Substitution

To **substitute** in an expression means to replace a variable with a number to evaluate the expression.

Use brackets when substituting to make sure you obey the order of operations.

a) **Evaluate a^3 when $a = 4$**

$a^3 = a \times a \times a$

$= 4 \times 4 \times 4 = 64$

So $a^3 = 64$

b) **Evaluate $2x + 4$ when $x = 6$**

$2x + 4 = (2 \times x) + 4$

$= (2 \times 6) + 4 = 12 + 4 = 16$

So $2x + 4 = 16$

Evaluate $5x + 3y$ when $x = 2$ and $y = 7$

$5x + 3y = (5 \times x) + (3 \times y)$

$= (5 \times 2) + (3 \times 7)$

$= 10 + 21 = 31$

So $5x + 3y = 31$

Which set of variables satisfy $a + 13 = b$?

$\boxed{a = 8, b = 22}$ or $\boxed{a = 7, b = 20}$

$8 + 13 = b$

$8 + 13 = 22$ ✘

$7 + 13 = b$

$7 + 13 = 20$ ✔

So $a = 7$ and $b = 20$

Forming algebraic expressions and equations

Algebraic expressions and equations can be formed from statements and shapes.

Use algebra to show the relationships.

a) **Two different numbers add to 10.**

$x + y = 10$

These are two different numbers so they are represented by two different variables.

b) **Two numbers are added together to make a third number.**

$a + b = c$

Two different numbers form a third number, so use three different variables.

c) **Two of the same number are added together to make another number.**

$n + n = m$ or $n + n = 2n$

Numbers that are the same are represented using the same variable. The result is a different number so is represented by a different variable.

Form an algebraic equation to represent the following statement:

I am thinking of a number. I add 4 to my number and multiply by 5. I get 30.

The variable y can represent the unknown number.

"*I add 4 to my number*": $y + 4$

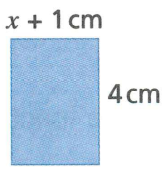
"*and multiply by 5*": $5(y + 4)$

Remember to use brackets when multiplying an expression by a number.

"*I get 30*": $5(y + 4) = 30$

So $5(y + 4) = 30$

Form an expression for the area of a rectangle with these side lengths.



Area of a rectangle

$= \text{length} \times \text{width}$

$= 4 \times (x + 1)$

$= 4(x + 1)\,\text{cm}^2$

Interpreting algebraic expressions

Break down each part of the expression to interpret it algebraically.

$x + 5$ means 'increase x by 5' or '5 more than x'.

$7 + y$ means 'increase 7 by y' or 'y more than 7'.

$q - 3$ means 'decrease q by 3' or '3 less than q'.

$3 - q$ means 'decrease 3 by q' or 'q less than 3'.

$p \times 5 = 5p$ means '5 times as much as p'.

$5 \times p = 5p$ means 'p times as much as 5'.

$s \div 3$ means 'divide s by 3' or 'one third of s'.

$3 \div s$ means 'divide 3 by s' or 'an s^{th} of 3'.

RETRIEVE 3

Algebraic expressions

Substitution

1 Evaluate:

a) $7s$ when $s = 2$ ....

b) t^2 when $t = 6$ ....

c) u^3 when $u = 5$ ....

d) $6v - 2$ when $v = 8$ ....

e) $8v - 3y$ when $v = 2$ and $y = 4$ ....

2 Determine which set of variables satisfy the equation $y - 16 = z$

$y = 9,\ z = -7$ or $y = -20,\ z = -4$ ....

Forming algebraic expressions and equations

3 Use algebra to represent each of these relationships.

a) Two different numbers add to 20 ....

b) The difference between two numbers is 3 ....

c) Three identical numbers are multiplied together to make another number ....

4 Using n as the variable, form an algebraic expression from each statement.

a) Three times Leo's age ....

b) Nine years older than Fatima ....

c) Six years younger than Amira ....

5 Use algebra to represent each statement.

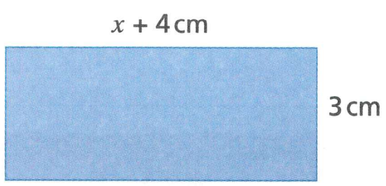
a) *I am thinking of a number.*

I multiply my number by 4 and subtract 1. ....

b) *I am thinking of a number.*

I add 6 to my number, and divide by 4. I get 20. ....

6 Form an expression for the area of a rectangle with these side lengths.



....

Interpreting algebraic expressions

7 Draw lines to join each expression to the correct interpretation.

$3b$	$b \div 2$	$2 - b$	$b + 3$
3 more than b	Decrease 2 by b	3 times as much as b	Half of b

Simplifying expressions

Collecting like terms involving integers

An algebraic expression can contain several different variables within the same expression. Terms with the **same variables** to the **same power** are called **like terms**.

An expression consisting of only like terms can be expressed as a single term.

The sign in front of each term shows whether it is negative or positive.

a) Simplify the expression $c + c + c + c$

$4c$

Repeated addition can be expressed using multiplication. $4 \times c$ is written as $4c$.

b) Simplify the expression $c + c + c - c$

$c + c + c - c$

Adding three lots of c makes $3c$.

Subtracting one c leaves $2c$

$= 2c$

c) Simplify the expression $4r + 3t + 2r + t$

$4r + 3t + 2r + t$

$= 6r + 4t$

$4r$ and $2r$ are like terms because they have the same variable, r, to the same power (r can be written as r^1).

d) Simplify the expression

$-5c + 9 + 8d - 3c + 2d + 1$

$-5c$ and $-3c$ are like terms that can be simplified. $8d$ and $2d$ are also like terms that can be simplified.

$-5c + 9 + 8d - 3c + 2d + 1$

9 and 1 are like terms (they are both constants).

$= -8c + 10d + 10$

The unlike terms cannot be simplified further and are kept separate in the answer.

e) Simplify the expression $3xy + 2xy$

$3xy$ and $2xy$ are like terms because they contain the same variables to the same power, x and y.

$5xy$

f) Simplify the expression $3ef + 3eg$

You can't simplify this expression because the terms are not like. ef is not the same as eg.

Collecting like terms involving indices

a) Simplify the expression $7a^3 - a^3$

$6a^3$

$7a^3$ and $-a^3$ are like terms because they have the same variable, a, to the same power, 3.

b) Simplify the expression $4b^2 - b^3 + b^2 - b^3$

$4b^2 - b^3 + b^2 - b^3$

$= 5b^2 - 2b^3$

$4b^2$ and b^2 are like terms because they have the same variable, b, to the same power, 2.

$-b^3$ and $-b^3$ are like terms because they have the same variable, b, to the same power, 3.

Collecting like terms involving fractions

Coefficients and constants that are fractions should be treated in the same way as shown above.

Simplify the expression $\frac{1}{7}z - \frac{5}{7} + \frac{3}{7}z$

$\frac{1}{7}z - \frac{5}{7} + \frac{3}{7}z$

$\frac{1}{7}z$ and $\frac{3}{7}z$ are like terms because they have the same variable, z, to the same power, 1.

$= \frac{4}{7}z - \frac{5}{7}$

$-\frac{5}{7}$ is not like the term $\frac{1}{7}z$ because it is not being multiplied by the variable, z, so it is left separate.

Simplifying expressions

Collecting like terms involving integers

1 Simplify the expressions.

a) $x + x + x$

b) $y + y - y$

2 Simplify the expressions.

a) $6c + 3d + c + 2d$

b) $9e - 7f - 2e + 3f$

3 Simplify the expressions.

a) $s - 6t + 3 - 2s + t - 2$

b) $5 - 2x - 6 + 2y$

4 Write the expressions in their simplest form.

a) $6xy - xy$

b) $2wz + wx$

Collecting like terms involving indices

5 Simplify the expressions.

a) $5t^2 + 4t^2$

b) $2w^3 + w^4 - w^3 + 9w^4$

Collecting like terms involving fractions

6 Simplify the expression.

$\frac{3}{5}y - \frac{4}{5}y$

ORGANISE 3

Expanding two or more binomials

The distributive law

The **distributive law** says that the **product** of two numbers multiplied together is the same as the sum of the product of those numbers split into groups, or **partitioned**.

For example, $3(2+3)$ can be shown using an area model. Imagine a rectangle split into two sections. To find the area of the whole rectangle, add up the area of each section.

	2	3
3	$3 \times 2 = 6$	$3 \times 3 = 9$

Whole area $= 6 + 9$
$= 15$

The distributive law can be shown without visual aids by **expanding the bracket**.

$$3(2+3) = (3 \times 2) + (3 \times 3)$$
$$= 6 + 9 = 15$$

Using an area model (the grid method)

The distributive law also applies when there are variables inside or outside the brackets.

Recall the area method for expanding a single bracket.

	$2x$	3
5	$10x$	15
	$5 \times 2x$	5×3

$5(2x+3)$
$= (5 \times 2x) + (5 \times 3)$
$= 10x + 15$

Keep any negative sign with the number when partitioning the brackets.

This model can be extended to finding the **product** of two **binomials** (expressions with two terms):

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

	$2x$	$+3$
x	$2x^2$	$3x$
-4	$-8x$	-12

1. Partition each expression
2. Multiply each expression
3. Simplify:

$2x^2 + 3x - 8x - 12$
$2x^2 - 5x - 12$
$(2x+3)(x-4) = 2x^2 - 5x - 12$

Using the FOIL method

Two brackets can be expanded using a method called FOIL.

First: multiply the first terms of both brackets
Outer: multiply the outer terms of both brackets
Inner: multiply the inner terms of both brackets
Last: multiply the last terms of both brackets

Firsts Lasts
$(a + b)(c + d)$
Outers Inners

Find the product of $(2x+3)(x-4)$

$$(2x+3)(x-4) = (2x \times x) + (2x \times -4) + (3 \times x) + (3 \times -4)$$
$$= 2x^2 \quad -8x \quad +3x \quad -12$$
$$= 2x^2 - 5x - 12$$

Make sure you multiply **every** term in the first bracket by **every** term in the second bracket.

Expanding more than two binomials

Both the area model and FOIL can be extended to multiplying more than two brackets. Expand any two brackets first, simplify, then multiply the new expression by the third bracket.

Find the product of $(2x+3)(x-4)(x-3)$

$(2x+3)(x-4) = 2x^2 - 5x - 12$ — As shown above.

Now multiply $(2x^2 - 5x - 12)(x-3)$ — Multiply the product of the first two brackets by the third bracket.

Area model

	$2x^2$	$-5x$	-12
x	$2x^2 \times x = 2x^3$	$-5x \times x = -5x^2$	$-12 \times x = -12x$
-3	$2x^2 \times -3 = -6x^2$	$-5x \times -3 = 15x$	$-12 \times -3 = 36$

$= 2x^3 - 6x^2 - 5x^2 + 15x - 12x + 36$
$= 2x^3 - 11x^2 + 3x + 36$

FOIL method

$(2x^2 - 5x - 12)(x-3) =$
$(2x^2 \times x) + (2x^2 \times -3) + (-5x \times x) +$
$(-5x \times -3) + (-12 \times x) + (-12 \times -3)$

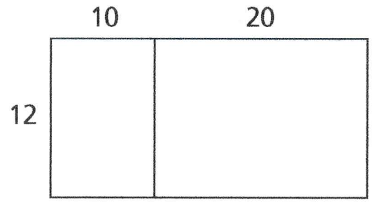
You could first multiply $(x-4)(x-3)$, then multiply by $(2x+3)$, and get the same answer.

RETRIEVE

3 Expanding two or more binomials

The distributive law

1 Find the area of this rectangle using the distributive law.



(........ × ....) + (........ × ....) = ... × ....

.... + ... = ...

Using an area model (the grid method)

2 Use an area model to find the product of:

a) $(x - 4)(4x + 3)$

b) $(2n - 1)(3n - 2)$

....

....

Using the FOIL method

3 Use the FOIL method to find the product of:

a) $(4y + 2)(y - 5)$

b) $(2k + 3)(3k + 5)$

....

....

Expanding more than two binomials

4 Find the product of $(x - 4)(4x + 3)(x - 2)$ using any method. You may wish to use your answer from question 2a) to help you.

....

ORGANISE

2 Multiplication and division

Multiplying and dividing with positive and negative integers

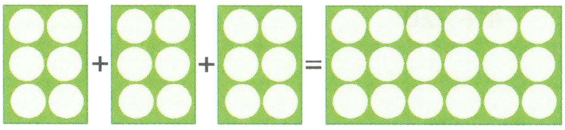
When multiplying or dividing a **positive** number by a **negative** number, the result is **negative**.

When multiplying or dividing a **negative** number by a **negative** number, the result is **positive**.

$5 \times 1 = 5$	$-2 \times 1 = -2$
$5 \times 0 = 0$	$-2 \times 0 = 0$
$5 \times -1 = -5$	$-2 \times -1 = 2$

Multiplication is commutative, so $a \times b = b \times a$.
For example, $4 \times 3 = 12$ and $3 \times 4 = 12$

a) Calculate 6×3



$6 \times 3 = 18$

When multiplying a positive number by a positive number, the result is positive ($+ \times + = +$). 6×3 is the same as adding 3 lots of 6.

b) Calculate -8×3

$-8 \times 3 = -24$ $- \times + = -$

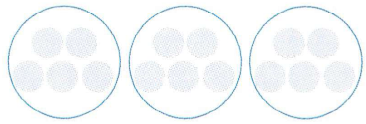
c) Calculate 8×-3

$8 \times -3 = -24$ $+ \times - = -$

d) Calculate -7×-4

$-7 \times -4 = 28$ $- \times - = +$

e) Calculate $15 \div 5$



There are 15 dots with 5 dots in each group.
There are 3 groups of dots.

$15 \div 5 = 3$

f) Calculate $-20 \div 4$

$-20 \div 4 = -5$ $- \div + = -$

g) Calculate $20 \div -4$

$20 \div -4 = -5$ $+ \div - = -$

h) Calculate $-28 \div -7$

$-28 \div -7 = 4$ $- \div - = +$

Multiplying and dividing with decimals

When multiplying a number by another number that is less than 1, the value decreases.

Work out 0.09×0.7

0.09×0.7

$\downarrow \times 100$ $\downarrow \times 10$

$9 \times 7 = 63$

$\downarrow \div 1000$

$= 0.063$

Multiply both numbers so they are whole numbers.

$100 \times 10 = 1000$, so divide 63 by 1000 to get 0.063

A **divisor** is a number that divides another number and may leave a remainder.

A **dividend** is the number that is being divided.

dividend		divisor		quotient
20	$\div$	4	$=$	5

A **quotient** is the result of dividing one number by another.

When dividing with decimals, multiply each number by 10 until the divisor is a whole number.

a) Work out $1.8 \div 0.2$

$1.8 \div 0.2$

$\downarrow \times 10$ $\downarrow \times 10$

$18 \div 2 = 9$

$1.8 \div 0.2 = 9$

2 goes into 18 nine times.

2	2	2	2	2	2	2	2	2

0.2 also goes into 1.8 nine times.

0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

The calculations are equivalent.

b) Work out $1.36 \div 0.4$

$1.36 \div 0.4$

$\downarrow \times 10$ $\downarrow \times 10$

$13.6 \div 4$

$$\begin{array}{r} 0\ 3\ .\ 4 \\ 4\,\overline{)\,\cancel{1}\ {}^{1}3\ .\ {}^{1}6} \end{array}$$

Ensure that the decimal points are lined up.

So, $1.36 \div 0.4 = 3.4$

RETRIEVE

2 Multiplication and division

Multiplying and dividing with positive and negative integers

1 Work out:

a) 7×8 ....

b) 9×6 ....

c) -6×2 ....

d) -5×10 ....

2 Work out:

a) 7×-2 ....

b) 4×-8 ....

c) -2×-3 ....

d) -12×-8 ....

3 Work out:

a) $12 \div 2$ ....

b) $18 \div 9$ ....

c) $-49 \div 7$ ....

d) $-63 \div 7$ ....

4 Work out:

a) $108 \div -12$ ....

b) $30 \div -6$ ....

c) $-90 \div -9$ ....

d) $-56 \div -7$ ....

Multiplying and dividing with decimals

5 Work out:

a) 8×0.3 ....

b) 0.5×0.7 ....

c) 0.03×0.9 ....

d) 32×0.1 ....

e) 0.9×0.6 ....

f) 0.11×0.4 ....

6 Work out:

a) $8 \div 0.4$ ....

b) $12 \div 0.6$ ....

c) $3.2 \div 0.8$ ....

d) $8.8 \div 0.11$ ....

e) $6.4 \div 0.08$ ....

f) $2.14 \div 0.2$ ....

ORGANISE 1

Estimating calculations by rounding and limits of accuracy

Estimating calculations, including in real-life situations

Estimating is rounding **before** doing the calculation rather than after.

Imagine you are at an ice cream van and want to make sure you have enough cash for your order. Instead of adding up each item's exact price, you can round and estimate instead.

For two ice lollies, you could round each to £3, then 2 × £3 = £6. This is an **overestimate** – it is more than the actual price.

You will often need to estimate to the nearest power of 10 (e.g. 10, 100, or 1000), to 1 s.f., or to the nearest measurement.

$\frac{(21.7 \times 11.5) + 9.8}{10.1} = ?$

a) **Estimate the answer to the calculation by rounding each number to 1 s.f.**

21.7 is 20 to 1 s.f.	11.5 is 10 to 1 s.f.
9.8 is 10 to 1 s.f.	10.1 is 10 to 1 s.f.

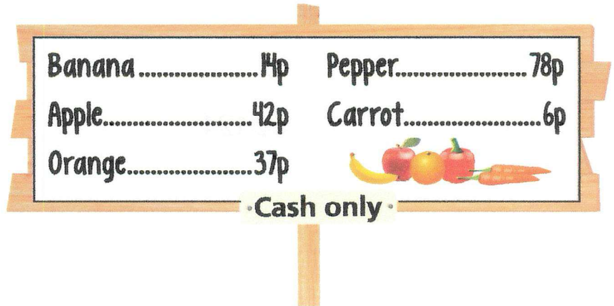
$\frac{(21.7 \times 11.5) + 9.8}{10.1} \approx \frac{(20 \times 10) + 10}{10} \approx \frac{210}{10} = 21$

b) **Calculate the actual answer.**

$\frac{(21.7 \times 11.5) + 9.8}{10.1} = 25.68$ to 2 d.p.

c) **Is the estimate an overestimate or an underestimate?**

It is an underestimate as 21 is less than 25.68



a) **Kian wants to buy 3 apples, 2 bananas and 4 carrots. By rounding to the nearest 5p, estimate the total.**

42p apple rounded to the nearest 5p is 40p.
14p banana rounded to the nearest 5p is 15p.
6p carrot rounded to the nearest 5p is 5p.

(40p × 3) + (15p × 2) + (5p × 4)

= 120p + 30p + 20p = 170p = £1.70

b) **Find the actual total.**

(42p × 3) + (14p × 2) + (6p × 4)

= 126p + 28p + 24p = 178p = £1.78

c) **Is the estimate an overestimate or an underestimate?**

It is an underestimate.

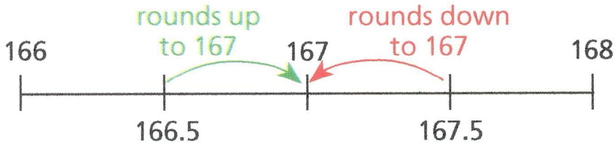
It is less than the actual value as the prices of the apples and carrots have been rounded down by more than the bananas have been rounded up.

Accuracy

Nothing can be measured exactly. It is measured to a certain degree of accuracy. Even if the degree of accuracy is very small, it is not an exact measurement.

The degree of accuracy can be inferred by the way the measurement is written. For example, a measurement of 167 cm was recorded to the nearest cm while a measurement of 1.2 cm was recorded to the nearest tenth of a cm, or mm.

A measurement can also be expressed using **error intervals** to show the possible values it could be. A table measured as 167 cm won't be **exactly** 167 cm.



Numbers greater than 166.5 round to 167.

166.5 also rounds to 167, so use an 'or equal to' symbol, ⩽. This is the **lower bound**, i.e. 166.5 is the absolute smallest the actual measurement could be in order to be rounded to 167.

Numbers less than 167.5 also round to 167.

However, 167.5 itself rounds to 168, so use a strictly 'less than' symbol, <. This is the **upper bound**, as it means all numbers **up to** 167.5.

To write the bounds in error interval notation:

166.5 cm ⩽ length of table < 167.5 cm

A quick way to find the bounds is to divide the degree of accuracy by 2. Then subtract that from the measurement to find the lower bound and add it to the measurement to find the upper bound.

RETRIEVE 1

Estimating calculations by rounding and limits of accuracy

Estimating calculations, including in real-life situations

1 Estimate the answer to the calculation by rounding to the given amount. Before calculating, decide whether rounding will give an overestimate or an underestimate. Give your estimate as a fraction if appropriate.

$$108.3 \div 6.24 =$$

a) **i)** Estimate the calculation by rounding to 1 significant figure. ....

ii) Will this be an overestimate or an underestimate? ....

b) **i)** Estimate the calculation by rounding to the nearest integer. ....

ii) Will this be an overestimate or an underestimate? ....

c) Use a calculator to find the actual value of the calculation. ....

2 Sophia orders two lattes, one hot chocolate and three teas for her friends. The prices are shown.

COFFEE CORNER

Latte	£3.97
Hot chocolate	£2.95
Tea	£3.17
Flavoured syrup	£0.23

a) **i)** Estimate the total cost of Sophia's order by rounding to the nearest integer. ....

ii) Will this be an overestimate or an underestimate? ....

b) Use a calculator to find the actual cost of her order. ....

Accuracy

3 Write these measurements using error interval notation. Each is measured to the nearest unit.

a) The height of a jug measured to be 32 cm ....

b) The volume of milk in a glass measured to be 107 ml ....

c) The distance from London to Boston measured as 5264 km ....

ORGANISE

1 Significant figures

What are significant figures?

The most **significant figure** (s.f.) is the digit with the **highest place value** in a number.

Significant figures are counted left to right from the highest non-zero place value.	A zero in between two other digits is also significant.	For numbers between 0 and 1, count significant figures from the first non-zero digit.
186 has 3 significant figures	307 has 3 significant figures	0.0823 has 3 significant figures

Hundreds	Tens	Ones
1	8	6
1st s.f.	2nd s.f.	3rd s.f.

Hundreds	Tens	Ones
3	0	7
1st s.f.	2nd s.f.	3rd s.f.

Ones	tenths	hundredths	thousandths	ten thousandths
0	• 0	8	2	3
		1st s.f.	2nd s.f.	3rd s.f.

Rounding integers to significant figures

To round a number means to write an approximate value. A rounded number is less accurate, but often simpler to work with.

Round 384 to the nearest hundred.

Look at the hundreds values greater than and less than 384 and decide which value it is closer to.

300 384 400

384 rounded to the nearest hundred is 400.

Remember the rules of rounding. 'Round up' if the digit to the right of the desired place value is greater than or equal to 5.

Rounding to a given number of significant figures means rounding to a certain number of digits rather than to a certain place value or number of decimal places. To round a number to a given number of significant figures, count the number of digits from the highest place value and round to the place value of the desired digit.

a) Round 324 to 1 s.f.

Hundreds	Tens	Ones
3	2	4

The first significant figure is in the hundreds place, so rounding to 1 s.f. means to the nearest hundred.

324 rounded to 1 s.f. is 300

b) Round 4852 to 2 s.f.

Thousands	Hundreds	Tens	Ones
4	8	5	2

The second significant figure is in the hundreds place, so rounding to 2 s.f. means to the nearest hundred.

4852 rounded to 2 s.f. is 4900

c) Round 78 to 3 s.f.

Tens	Ones	tenths
7	8 •	0

The number 78 only has 2 significant figures. To write it to 3 s.f., fill in the third significant figure with a 0.

78 rounded to 3 s.f. is 78.0

Rounding decimal numbers to significant figures

Rounding numbers with decimals is the same as rounding integers. The exception is with numbers between 0 and 1, in which case the first significant figure is the first non-zero digit.

a) Round 0.00649 to 1 s.f.

The first significant figure is in the thousandths place, so rounding to 1 s.f. means to the nearest thousandth.

0.00649 to 1 s.f. is 0.006

b) Round 1.2093 to 3 s.f.

The third significant figure is in the hundredths place, so rounding to 3 s.f. means to the nearest hundredth.

1.2093 to 3 s.f. is 1.21

c) Round 0.5021 to 2 s.f.

The second significant figure is in the hundredths place, so rounding to 2 s.f. means to the nearest hundredth.

0.5021 to 2 s.f. is 0.50

0.5 would only be to 1 s.f.

RETRIEVE

1 Significant figures

What are significant figures?

1 Underline the digit that is the third significant figure in the following numbers.

68 124 9439 70 623

0.00573 0.9406 0.10904

Rounding integers to significant figures

2 Round these numbers to the given number of significant figures.

	1 s.f.	2 s.f.	3 s.f.
57 271			
843 913 759			
83			
1095			
165 878			
2 475 000			

Rounding decimal numbers to significant figures

3 Round these numbers to the given number of significant figures.

	1 s.f.	2 s.f.	3 s.f.
0.23696			
0.059 218			
1.056			
0.008			
9.976			
52.601			