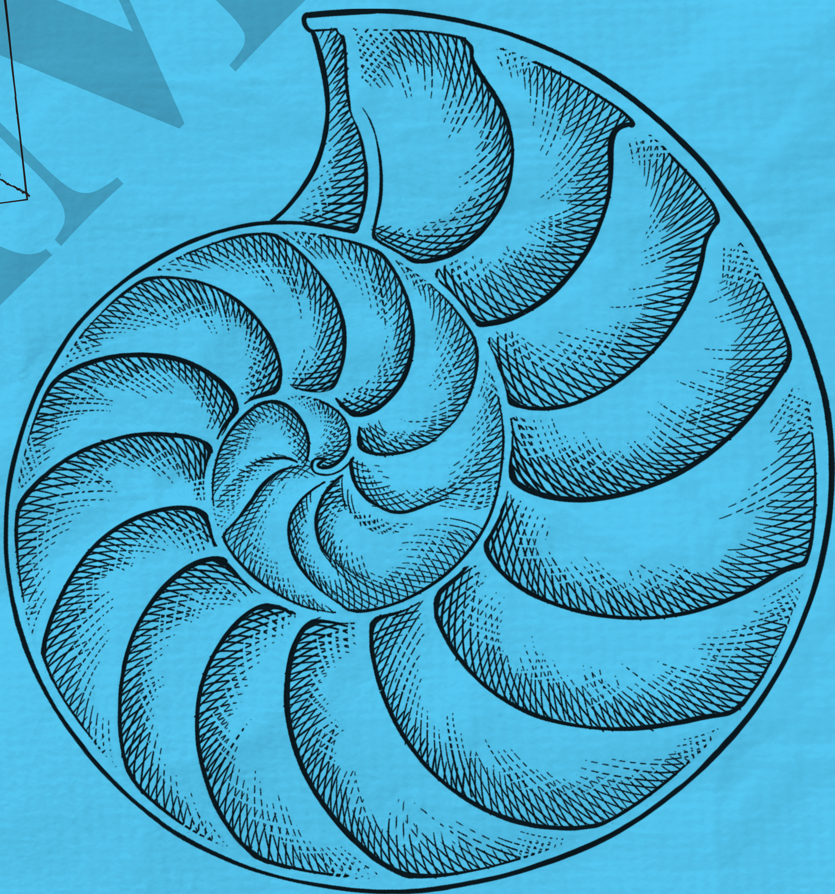
Endorsed for
Pearson Edexcel
Qualifications

PEARSON EDEXCEL INTERNATIONAL GCSE (9–1)
REVISE
Mathematics A
REVISION GUIDE

Higher



Contents

A small bit of small print
Edexcel publishes Sample Assessment Material and the Specification on its website. This is the official content and this book should be used in conjunction with it. The questions in *Now try this* have been written to help you practise every topic in the book. Remember: the real exam questions may not look like this.

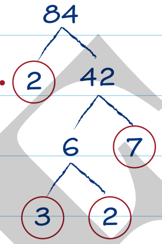
Factors and primes

The **factors** of a number are any numbers that divide into it exactly. A **prime number** has exactly two factors. The prime numbers are 2, 3, 5, 7, 11, 13, 17, 19 and so on.

Prime factors

If a number is a factor of another number **and** it is a prime number then it is called a **prime factor**. You use a factor tree to find prime factors.

Remember to circle the prime factors as you go along. The order doesn't matter.



$84 = 2 \times 2 \times 3 \times 7$ Remember to put in the multiplication signs.

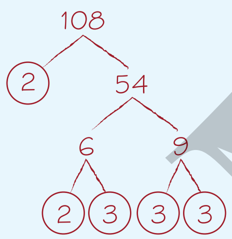
$= 2^2 \times 3 \times 7$ This is called a **product** of **prime factors**.

The highest common factor (HCF) of two numbers is the **highest number** that is a **factor** of both numbers.

The lowest common multiple (LCM) of two numbers is the **lowest number** that is a **multiple** of both numbers.

Worked example

(a) Write 108 as the product of its prime factors. Give your answer in index form. **(3 marks)**



$108 = 2 \times 2 \times 3 \times 3 \times 3 = 2^2 \times 3^3$

Draw a factor tree. Continue until every branch ends with a prime number. This question asks you to write your answer in **index form**. This means you need to use **powers** to say how many times each prime number occurs in the product.

Check it!

$2^2 \times 3^3 = 4 \times 27 = 108$ ✓

(b) Work out the highest common factor (HCF) of 108 and 24. **(2 marks)**

$108 = 2 \times 2 \times 3 \times 3 \times 3$

$24 = 2 \times 2 \times 2 \times 3$

HCF is $2 \times 2 \times 3 = 12$

To find the HCF, circle all the prime numbers which are **common** to both products of prime factors. 2 appears twice in both products so you have to circle it twice. Multiply the circled numbers together to find the HCF.

(c) Work out the lowest common multiple (LCM) of 108 and 24. **(2 marks)**

$\text{LCM} = 12 \times 3 \times 3 \times 2 = 216$

To find the LCM multiply the HCF by each unshared prime from part (b).

You can use numbers given in index form directly:
HCF: Choose the **lowest** power of each prime.
LCM: Choose the **highest** power of each prime.

Now try this

1 (a) Express 980 as a product of its prime factors. **(3 marks)**

(b) Find the highest common factor (HCF) of 980 and 56. **(2 marks)**

2 $X = 2 \times 3^5 \times 7^2$ $\quad Y = 3^2 \times 5 \times 7$

(a) Find the highest common factor (HCF) of X and Y. **(2 marks)**

(b) Find the lowest common multiple (LCM) of X and Y. **(2 marks)**

Algebraic expressions

You need to be able to work with algebraic expressions confidently. For a reminder about using the index laws with **numbers** have a look at pages 2 and 3.

1 You can use the **index laws** to simplify algebraic expressions.

$a^m \times a^n = a^{m+n}$

$x^4 \times x^3 = x^{4+3} = x^7$

$\frac{a^m}{a^n} = a^{m-n}$

$m^8 \div m^2 = m^{8-2} = m^6$

$(a^m)^n = a^{mn}$

$(n^2)^4 = n^{2 \times 4} = n^8$

2 You can square or cube a whole expression.

$(4x^3y)^2 = (4)^2 \times (x^3)^2 \times (y)^2$

$= 16x^6y^2$

$16 = (4)^2$

$(x^3)^2 = x^{3 \times 2} = x^6$

You need to square everything inside the brackets.

Remember that if a letter appears on its own then it has the power 1.

3 Algebraic expressions may also contain negative and fractional indices.

$a^{-m} = \frac{1}{a^m}$

$(c^2)^{-3} = c^{2 \times -3} = c^{-6} = \frac{1}{c^6}$

$a^{\frac{1}{n}} = \sqrt[n]{a}$

$(8p^3)^{\frac{1}{3}} = (8)^{\frac{1}{3}} \times (p^3)^{\frac{1}{3}}$

$= \sqrt[3]{8} \times p^{3 \times \frac{1}{3}}$

$= 2p$

One at a time

When you are **multiplying** expressions:

1. Multiply any number parts first.
2. Add the powers of each letter to work out the new power.

$6p^2q \times 3p^3q^2 = 18p^5q^3$

$6 \times 3 = 18$

$p^2 \times p^3 = p^{2+3} = p^5$

$q \times q^2 = q^{1+2} = q^3$

When you are **dividing** expressions:

1. Divide any number parts first.
2. Subtract the powers of each letter to work out the new power.

$12 \div 3 = 4$

$b^3 \div b^2 = b^{3-2} = b$

$\frac{12a^5b^3}{3a^2b^2} = 4a^3b$

$a^5 \div a^2 = a^{5-2} = a^3$

Worked example

Simplify fully

(a) $m^2 + m^2 + m^2 + m^2$ **(1 mark)**

$4m^2$

(b) $(x^3)^3$ **(1 mark)**

x^9

(c) $\frac{4y^2 \times 3y^7}{6y}$ **(2 marks)**

$\frac{4y^2 \times 3y^7}{6y} = \frac{12y^9}{6y} = 2y^8$

(a) This is four lots of m^2, so you write it as $4 \times m^2$ or $4m^2$

(b) Use $(a^m)^n = a^{mn}$

(c) Start by simplifying the top part of the fraction. Do the number part first then the powers. Use $a^m \times a^n = a^{m+n}$

Next divide the expressions. Divide the number part, then divide the indices using $\frac{a^m}{a^n} = a^{m-n}$

Worked solution video

Now try this

1 Simplify $(h^2)^6$ **(1 mark)**

2 Simplify fully

(a) $(2a^5b)^4$ **(2 marks)**

(b) $5x^4y^2 \times 3x^3y^7$ **(2 marks)**

(c) $18d^8g^{10} \div 6d^2g^5$ **(2 marks)**

Aiming higher

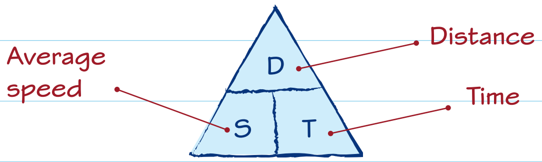
3 (a) Simplify $(16p^{10})^{\frac{1}{2}}$ **(2 marks)**

(b) Simplify $(64x^9y^2)^{-\frac{1}{3}}$ **(2 marks)**

Apply the power outside the brackets to everything inside the brackets.

Speed

This is the formula triangle for speed.



Average speed $= \dfrac{\text{total distance travelled}}{\text{total time taken}}$

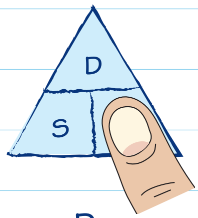
Time $= \dfrac{\text{distance}}{\text{average speed}}$

LEARN IT!

Distance = average speed × time

Using a formula triangle

Cover up the quantity you want to find with your finger.



The position of the other two quantities tells you the formula.

$T = \dfrac{D}{S}$ $S = \dfrac{D}{T}$ $D = S \times T$

Units

The most common units of speed are:

- metres per second: m/s
- kilometres per hour: km/h
- miles per hour: mph.

To convert between measures of speed you need to convert one unit first then the other. Write the new units at each step of your working. To convert 72 km/h into m/s:

72 km/h → 72 × 1000 = 72 000 m/h

72 000 m/h → 72 000 ÷ 3600 = 20 m/s

1 hour = 60 × 60 = 3600 seconds

Minutes and hours

For questions on speed, you need to be able to convert between minutes and hours.

Remember there are 60 minutes in 1 hour.

To convert from minutes to hours you divide by 60.

24 minutes = 0.4 hours $\dfrac{24}{60} = \dfrac{2}{5} = 0.4$

To convert from hours to minutes you multiply by 60.

0.2 hours = 12 minutes 3.2 × 60 = 192

3.2 hours = 3 hours 12 minutes

Worked example

The speed of light in a vacuum is approximately 1.08×10^9 km/h.

Light from the Sun takes approximately 8 minutes and 15 seconds to travel to Earth.

Estimate the distance from the Earth to the Sun. **(3 marks)**

8 mins 15 secs = 8.25 mins $= \dfrac{8.25}{60}$

= 0.1375 hours

D = S × T

$= 1.08 \times 10^9 \times 0.1375$

$= 1.485 \times 10^8$ km

Speed checklist

- Draw formula triangle. ✓
- Make sure units match. ✓
- Give units with answer. ✓

If you're answering questions involving speed, distance and time you must always make sure that the units match. Speed is given in km/h here, so convert the time into hours before calculating.

Now try this

Rosa lives in Durham and works in Newcastle. She takes the train to work every day.

Last Tuesday her train journey to work took 12 minutes, at an average speed of 108 km/h.

Her journey home from work took 15 minutes.

Calculate Rosa's average speed on her journey home. **(3 marks)**

Be careful with the units. You need to convert 12 minutes and 15 minutes into hours before doing your calculations.

Mean, median and mode

You can analyse data by calculating statistics like the **mean**, **median** and **mode**.

Mean

Add up all the values

Divide by the total number of values

Do not round your answer

Median

Write the values in order of size, smallest first

Count the number of values

Odd number of values: The median is the middle value

Even number of values: The median is half-way between the two middle values

Mode

Look for the most common value

One value with highest frequency: This value is the mode

More than one value with highest frequency: These values are all modes

All values have same frequency: There is no mode

Worked example

Kayla has eight numbered cards.

1 2 3 4 5 6 7 8

She removes two cards. The mean value of the remaining cards is 4. Which two cards could Kayla have removed? Give **one** possible answer.

(4 marks)

$6 \times 4 = 24$

$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 = 36$

$36 - 24 = 12$

The removed cards add up to 12 so Kayla could have removed 7 and 5

Check:

$$\frac{1 + 2 + 3 + 4 + 6 + 8}{6} = 4 \checkmark$$

You can work out the sum of the 6 remaining cards using this formula:

Sum of values = mean × number of values

Subtract this sum from the sum of all 8 cards. This tells you the sum of the 2 cards Kayla removed. The removed cards were either 5 and 7 or 8 and 4.

Check it!

Work out the mean of the remaining 6 cards.

Which average works best?

	👍	👎
Mean	Uses all the data	Affected by extreme values
Median	Not affected by extreme values	May not be one of the values
Mode	Suitable for data that can be described in words	Not always near the middle of the data

Now try this

Takeshi scored these marks out of 20 in **six** maths tests.

11 9 5 13 15 12

How many marks must he score in the next test so that his new mean mark and his new median mark are the same as each other? **(3 marks)**

Make sure you check your answer by calculating the new mean and median. Remember that the median is not affected by extreme values.