



eClassroom

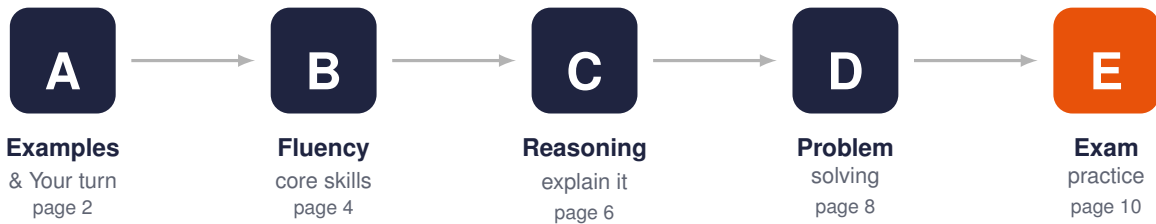
GCSE MATHEMATICS • NUMBER

Percentages

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator for B7, B11 and Sections D and E only

Free Percentages worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: find a percentage of an amount • write one number as a percentage of another • use multipliers to increase, decrease and find the original amount • *Higher*: undo a chain of changes, combine percentages of different groups, and reason with $x\%$.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER The same skills where Higher papers use them: chains of changes worked backwards, combining groups, and percentages with algebra. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	33	15	23	19
Higher marks	9	13	15	16
My score				

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A**Worked examples & Your turn**

Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION*Everyone starts here***Worked example A1**

Work out 35% of 60

Build the percentage from 10% and 5%.

$$10\% \text{ of } 60 = 6 \quad \text{so} \quad 30\% = 18 \quad 5\% = 3$$

Add the parts.

$$18 + 3 = 21$$

21

Your turn A1

Work out 45% of 80

Worked example A2: using a multiplier

Increase 450 by 8%

An 8% increase means 108% of the original. As a decimal this is 1.08

$$450 \times 1.08 = 486$$

486

Your turn A2

Decrease 650 by 6%

Worked example A3: finding the original amount

The price of a coat is increased by 25%. The new price is £150

Work out the original price.

The new price is 125% of the original.

$$\text{original} \times 1.25 = 150$$

Divide by the multiplier to go backwards.

$$150 \div 1.25 = 120$$

£120

Your turn A3

The price of a phone is reduced by 30%. The new price is £91

Work out the original price.



HIGHER*Higher strategies: these are new ways of thinking, not longer sums***Worked example A4: undoing a chain of changes**

A price is increased by 20%. In a sale the new price is reduced by 25%. The sale price is £135

Work out the original price.

Combine the multipliers into one.

$$1.2 \times 0.75 = 0.9$$

original $\times 0.9 = 135$, so divide.

$$135 \div 0.9 = 150$$

£150

Your turn A4

The value of a bike falls by 10% and then rises by 30%. It is now worth £585

Work out its original value.

Worked example A5: combining percentages of different groups

60% of the members of a gym are adults. 30% of the adults and 45% of the children wear glasses.

What percentage of all the members wear glasses?

Each group's share of the whole is (size of group) $\times$ (rate in group).

Adults: $0.6 \times 0.3 = 0.18$

Children: $0.4 \times 0.45 = 0.18$

Add the shares.

36%

Your turn A5

35% of the students in a sixth form are in Year 13. The rest are in Year 12. 80% of Year 13 and 60% of Year 12 passed a driving theory test.

What percentage of all the students passed?

Worked example A6: percentages with algebra

A value is increased by $x\%$, then increased by $x\%$ again. Overall it has increased by 21%.

Find x .

Write the multiplier using x and square it.

$$\left(1 + \frac{x}{100}\right)^2 = 1.21$$

Square root both sides.

$$1 + \frac{x}{100} = 1.1$$

$x = 10$

Your turn A6

A value is decreased by $x\%$, then decreased by $x\%$ again. It is now 49% of its original value.

Find x .



B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer? No calculator except B7 and B11.

FOUNDATION*Everyone starts here***B1** Work out**(a)** 10% of 70**(b)** 5% of 70**(c)** 15% of 70**(d)** 115% of 70**[4 marks]****B2** Work out**(a)** 25% of 48**(b)** 2.5% of 48**(c)** 17.5% of 40**(d)** 0.5% of 600**[4 marks]****B3** Write the first number as a percentage of the second.**(a)** 7 out of 20**(b)** 9 out of 25**(c)** 36 out of 80**(d)** 45 out of 40**[4 marks]****B4** Write down the multiplier for each percentage change.**(a)** increase of 15%**(b)** decrease of 8%**(c)** increase of 2.5%**(d)** increase of 120%**[4 marks]****B5** Use a multiplier to work out**(a)** Increase 320 by 15%**(b)** Decrease 320 by 15%**(c)** Increase 84 by 2.5%**(d)** Decrease 1200 by 17.5%**[4 marks]****B6** Work out the percentage change. State whether it is an increase or a decrease.**(a)** from 40 to 50**(b)** from 50 to 40**(c)** from 250 to 210**[3 marks]**

FOUNDATION*continued: calculator, finding the original, combined changes***B7** *(calculator)* Work out**(a)** 23% of 185**(b)** 7.5% of £64**(c)** 38 as a percentage of 95**[3 marks]****B8** Work out the original amount.**(a)** After a 20% increase the amount is 96**(b)** After a 15% decrease the amount is 170**(c)** After a 4% increase the amount is 468**(d)** After a 35% decrease the amount is 78**[4 marks]****B9** Work out the overall percentage change. State whether it is an increase or a decrease.**(a)** +20% then +25%**(b)** -10% then -10%**(c)** +50% then -50%**[3 marks]****HIGHER***Higher tier only***B10** Work out the original amount.**(a)** After +10% then +20% the amount is 264**(b)** After -20% then -50% the amount is 60**(c)** After +25% then -20% the amount is 88**[3 marks]****B11** *(calculator)* **(a)** Increase £2000 by 5% three times. **(b)** Decrease 800 by 10% four times.**(c)** A value increases by 20% each year. After how many whole years has it more than doubled?**[3 marks]****B12** **(a)** Write an expression for p increased by 30%. **(b)** Write an expression for y decreased by $x\%$.**(c)** n increased by 8% is 270. Work out n .**[3 marks]**



Reasoning

Show your working and explain your thinking. A correct answer without a reason does not score full marks. No calculator.

FOUNDATION

Everyone starts here

- C1** Is 30% of 50 the same as 50% of 30?
You **must** show your working. [2 marks]
- C2** Jack says, "To find 5% of a number, divide it by 5."
Explain why Jack is wrong, and work out 5% of 80. [2 marks]
- C3** A jacket costs £200. The price is increased by 10%. Later, the new price is decreased by 10%.
Ben says, "The jacket is back to £200."
Is Ben correct? You **must** show your working. [3 marks]
- C4** In a sale, all prices are reduced by 20%. The sale price of a bag is £40
Kim says, "20% of £40 is £8, so the bag cost £48 before the sale."
Is Kim correct? You **must** show your working. [3 marks]
- C5** Explain why an increase of 20% followed by an increase of 30% is **not** the same as an increase of 50%. [2 marks]
- C6** The price of a laptop **including** 20% VAT is £960
Omar works out 20% of £960 and subtracts it to find the price before VAT.
(a) Explain why Omar's method is wrong. (b) Work out the correct price before VAT. [3 marks]



HIGHER*Higher tier only*

- C7** A number is increased by 25%.
By what percentage must the new number be decreased to get back to the original number? [3 marks]
- C8** y is 60% of x .
Write x as a percentage of y . Give your answer as a mixed number. [3 marks]
- C9** A is 20% more than B . B is 25% less than C .
Show that A is 10% less than C . [3 marks]
- C10** A number is increased by $x\%$. The result is then decreased by $x\%$.
(a) Prove that the final value is always less than the original number.
(b) Write an expression, in terms of x , for the overall percentage decrease. [4 marks]



D**Problem solving**

You decide the method. Read the whole question first, and show every step. You may use a calculator.

FOUNDATION*Everyone starts here*

- D1** There are 240 students in Year 10.
45% walk to school, 30% travel by bus and the rest travel by car.
Work out how many students travel by car. [3 marks]
- D2** The same headphones are sold in two shops.
Shop A: normal price £85, with 20% off. Shop B: normal price £90, with 25% off.
Which shop is cheaper, and by how much? [3 marks]
- D3** Nia invests £800 for 4 years. She is paid simple interest at 3% per year.
Work out the total interest Nia is paid. [3 marks]
- D4** Sam buys a bike for £40 and sells it for £52
Work out Sam's percentage profit. [3 marks]
- D5** Asha earns £2400 each month. She gets a pay rise of 5%.
She pays 20% of her new monthly pay in tax.
Work out how much Asha has each month after tax. [4 marks]
- D6** The price of a sofa **including** VAT at 20% is £1140
Work out the price of the sofa before VAT is added. [3 marks]
- D7** In a sale, normal prices are reduced by 15%. The sale price of a bike is £323
(a) Work out the normal price of the bike.
On the last day of the sale, a further 10% is taken off the **sale** price.
(b) Work out the price of the bike on the last day. [4 marks]



HIGHER*Higher tier only*

- D8** 55% of the students in a school are girls.
40% of the girls and 60% of the boys play in a sports team.
Work out the percentage of all the students in the school who play in a sports team. [4 marks]
- D9** Zara buys some shares. Their value rises by 15% in the first year and falls by 20% in the second year.
The shares are then worth £5520
Work out how much Zara paid for the shares. [3 marks]
- D10** A shop buys jackets from a factory.
It adds 60% to the cost price to get the normal selling price.
In a sale, the shop takes 25% off the normal selling price. The shop still makes a profit of £24 on each jacket.
Work out the cost price of a jacket. [4 marks]
- D11** A 400 g block of metal alloy is 35% copper.
Pure copper is melted into the block so that the new block is 48% copper.
Work out the mass of pure copper that is added. You must show algebraic working. [4 marks]



E**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark. You may use a calculator.

FOUNDATION*Foundation and Higher crossover***E1** (a) Work out 35% of 240

.....
(2)

(b) Write 27 out of 60 as a percentage.

..... %
(2)

(Total for Question E1 is 4 marks)

E2 A television costs £360
The price is increased by 15%.
Work out the new price.

£
(Total for Question E2 is 3 marks)



E3 Ella takes a music exam. The table shows the result for different percentages.

Percentage	Result
45% to 59%	Pass
60% to 74%	Merit
75% to 100%	Distinction

Ella scores 57 out of 75

What result does Ella get? You must show your working.

.....
(Total for Question E3 is 3 marks)

E4 Ravi invests £2500 for 3 years in a savings account.
He is paid simple interest at a rate of 2.4% per year.
Work out the total amount in the account at the end of 3 years.

£

(Total for Question E4 is 3 marks)



- E5** In a sale, normal prices are reduced by 20%.
The sale price of a pair of trainers is £76
Work out the normal price.

£

(Total for Question E5 is 3 marks)

- E6** The value of a painting increases by 20% in one year. It then decreases by 15% in the next year.
Work out the overall percentage change in the value of the painting.

.....

(Total for Question E6 is 3 marks)

HIGHER

Higher tier only

- E7** Maya buys and sells mugs. She buys 150 mugs for £4 each.
She sells 60% of the mugs for £6 each. She sells the rest of the mugs for £4.50 each.
Work out Maya's percentage profit.

..... %

(Total for Question E7 is 5 marks)



- E8** Dev, Eli and Fay each have some money.
Dev has 25% more money than Eli. Fay has 40% less money than Eli.
Fay has £84
Work out how much money Dev has.

£

(Total for Question E8 is 3 marks)

- E9** Noah is taking three exam papers. The marks on the three papers are added together.
Paper 1: 52 out of 80 Paper 2: 41 out of 70 Paper 3 is out of 100
Noah needs 65% of the total marks to get a grade 7
Work out the lowest mark Noah needs on Paper 3.

.....
(Total for Question E9 is 4 marks)

- E10** The price of a share is increased by $x\%$. The new price is then decreased by $x\%$.
The final price is 96% of the original price.
Work out the value of x . You must show algebraic working.

$x =$

(Total for Question E10 is 4 marks)

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