

Percentage Change and Multipliers

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Higher tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

The yearly rent for an allotment goes up by $P\%$

The new rent can be found using

$$\text{new rent} = 1.035 \times \text{old rent}$$

Write down the value of P .

1.035 means the new rent is 103.5% of the old rent.

So the rent goes up by $103.5 - 100 = 3.5\%$

Answer: 3.5

Tip: P is the **increase**, so it is not 103.5 or 1.035. It is not 35 either: $1.035 = 103.5\%$, not 135%.

2 (2 marks)

A shop buys a jacket for £40 and sells it for £58

Work out the percentage profit.

$$\text{Profit} = 58 - 40 = \text{£}18$$

$$\text{Percentage profit} = \frac{\text{profit}}{\text{cost price}} \times 100$$

$$\frac{18}{40} \times 100 = 45\%$$

Answer: 45%

Marks: 1 mark for $\frac{18}{40} \times 100$ (or $58 \div 40 = 1.45$). 1 mark for 45.

3 (3 marks)

Kwame buys 40 plants for £30

He wants to make a profit of 60% when he sells all 40 plants.

He sells each plant for the same price.

Work out the price he should charge for each plant.

A 60% profit means he wants 160% of what he paid.

Total he wants to take: $30 \times 1.6 = £48$

Price for each plant: $48 \div 40 = £1.20$

Check: $40 \times 1.20 = 48$, profit = $48 - 30 = £18$, and $\frac{18}{30} \times 100 = 60\%$ ✓

Answer: £1.20

Tip: The 60% profit is worked out on what Kwame **paid** (£30). Work out the total he needs first, then share it between the 40 plants.

Marks: 1 mark for 30×1.6 or $30 \times 0.6 = 18$. 1 mark for £48. 1 mark for £1.20.

4 (2 marks)

A gym reduces its monthly fee by 15%

This reduction saves each member £6.30 a month.

Work out the monthly fee after the reduction.

15% of the old fee = £6.30

Old fee = $6.30 \div 0.15 = £42$

New fee = $42 - 6.30 = £35.70$

(Or new fee = $42 \times 0.85 = £35.70$)

Answer: £35.70

Tip: £6.30 is the **saving**, which is 15% of the old fee. Find the old fee first, then take off the saving.

Marks: 1 mark for $6.30 \div 0.15$ (£42). 1 mark for £35.70.

5 (3 marks)

Carys changes her phone tariff.
Her monthly bill goes down by 12%
Her new monthly bill is £22.44
Work out her monthly bill before the change.

The bill went down by 12%, so the new bill is $100 - 12 = 88\%$ of the old bill.

$$\text{Old bill} \times 0.88 = 22.44$$

$$\text{Old bill} = 22.44 \div 0.88 = £25.50$$

$$\text{Check: } 25.50 \times 0.88 = 22.44 \quad \checkmark$$

Answer: £25.50

Tip: Do not add 12% on to £22.44. The 12% was taken off the **old** bill, so divide by 0.88.

Marks: 1 mark for 88% or 0.88. 1 mark for $22.44 \div 0.88$. 1 mark for £25.50.

6 (1 mark)

The value of a car went down by 25% in one year.
At the end of the year the car was worth £9000
Leah wants to find the value of the car at the start of the year.
Here is her working.

25% of 9000 = 2250
 $9000 + 2250 = 11250$
Value at the start = £11250

Leah's answer is wrong.
Explain what Leah has done wrong.

Leah has found 25% of £9000, the value at the **end** of the year.
The 25% decrease was 25% of the value at the **start** of the year.
£9000 is $100 - 25 = 75\%$ of the start value.

Start value = $9000 \div 0.75 = \text{£}12\,000$

Answer: She found 25% of the end value; £9000 is 75% of the start value (start value = £12 000)

7 (2 marks)

A is 25% more than B .

What percentage of A is B ?

A is 25% more than B : $A = 1.25B$

Divide both sides by 1.25: $B = \frac{A}{1.25} = 0.8A$

So B is 80% of A .

Check with $B = 100$: $A = 125$, and $\frac{100}{125} = 0.8$ ✓

Answer: 80%

Tip: The answer is not 75%. The 25% is a percentage of B , but now you are comparing with A , which is bigger.

Marks: 1 mark for $B = \frac{A}{1.25}$ (or using values such as $B = 100$ and $A = 125$). 1 mark for 80.

8 (2 marks)

The number of visitors to a museum in 2023 was 25% more than in 2022.

The number of visitors in 2024 was 20% more than in 2023.

Find the number of visitors in 2022 as a fraction of the number of visitors in 2024.

Multiplier from 2022 to 2023: 1.25

Multiplier from 2023 to 2024: 1.2

From 2022 to 2024: $1.25 \times 1.2 = 1.5$

So visitors in 2024 = $1.5 \times$ visitors in 2022

2022 as a fraction of 2024: $\frac{1}{1.5} = \frac{2}{3}$

(Check with 100 visitors in 2022: $100 \rightarrow 125 \rightarrow 150$, and $\frac{100}{150} = \frac{2}{3}$)

Answer: $\frac{2}{3}$

Marks: 1 mark for 1.25×1.2 (or using a starting value, e.g. $100 \rightarrow 125 \rightarrow 150$). 1 mark for $\frac{2}{3}$.

9 (3 marks)

The normal price of a sofa is £850

Zara buys the sofa in a sale with 30% off the normal price.

Leon buys the same sofa later, after the normal price has gone up by 10%

He uses a voucher for 35% off the new price.

Who paid less for the sofa, Zara or Leon?

You must show how you get your answer.

Zara: 30% off, so the multiplier is 0.7

$$850 \times 0.7 = £595$$

Leon: the price goes up by 10% and then 35% is taken off.

$$850 \times 1.1 = £935$$

$$935 \times 0.65 = £607.75$$

$595 < 607.75$, so Zara paid less.

Answer: Zara (£595 < £607.75)

Tip: Leon's 35% is taken off the **new** price (£935), not off £850.

Marks: 1 mark for £595. 1 mark for £607.75. 1 mark for Zara, with both prices correct.

10 (2 marks)

The value of a painting went up by 40% in one year.

The next year its value went down by 40%

Show that, over the two years, the value of the painting went down by 16%

Increase of 40%: multiplier 1.4

Decrease of 40%: multiplier 0.6

Overall multiplier: $1.4 \times 0.6 = 0.84$

$0.84 = 84\%$ of the starting value.

$100\% - 84\% = 16\%$, so the value went down by 16%.

Answer: Shown

Marks: 1 mark for 1.4×0.6 (or a worked example, e.g. $\pounds 100 \rightarrow \pounds 140 \rightarrow \pounds 84$). 1 mark for a clear conclusion that it is a 16% decrease.

11 (3 marks)

The number of red squirrels in a forest went down by 10% each year for 3 years.

At the end of the 3 years there were 729 red squirrels.

How many red squirrels were there at the start of the 3 years?

Decrease of 10%: multiplier 0.9

For 3 years: $0.9^3 = 0.729$

Start $\times 0.729 = 729$

Start $= 729 \div 0.729 = 1000$

Check: $1000 \rightarrow 900 \rightarrow 810 \rightarrow 729$ ✓

Answer: 1000

Tip: To work backwards, **divide** by the multiplier. Adding 10% back on three times gives the wrong answer (about 970).

Marks: 1 mark for 0.9^3 (or 0.729). 1 mark for $729 \div 0.729$ (or dividing by 0.9 three times). 1 mark for 1000.
