

Percentage Change and Multipliers

Solutions

For AQA GCSE Mathematics (8300) • 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)

Circle the multiplier for a decrease of 7%

Options: 0.07, 0.7, 0.93, 1.07

A decrease of 7% leaves $100 - 7 = 93\%$

$93\% = 0.93$

Answer: 0.93

2 (3 marks)

Write down the single multiplier for

(a) an increase of 4%

An increase of 4% gives $100 + 4 = 104\%$

$104\% = 1.04$

Answer: 1.04

(b) a decrease of 12.5%

A decrease of 12.5% leaves $100 - 12.5 = 87.5\%$

$87.5\% = 0.875$

Answer: 0.875

(c) an increase of 150%

An increase of 150% gives $100 + 150 = 250\%$

$250\% = 2.5$

Answer: 2.5

Tip: The increase is added on to the 100% you start with. 1.5 is a common wrong answer.

3 (3 marks)

Work out the percentage increase from 60 to 195

Increase = $195 - 60 = 135$

Percentage increase = $\frac{\text{increase}}{\text{original}} \times 100$

$\frac{135}{60} \times 100 = 225\%$

(Or with a multiplier: $195 \div 60 = 3.25$, and $3.25 - 1 = 2.25$, which is 225%.)

Answer: 225%

Marks: 1 mark for 135 or $195 \div 60 = 3.25$. 1 mark for $\frac{135}{60} \times 100$ or $3.25 - 1$. 1 mark for 225.

4 (2 marks)

The value of a house increased from £240 000 to £273 600

Work out the percentage increase.

Multiplier = new value $\div$ original value

$273\,600 \div 240\,000 = 1.14$

1.14 means 114% of the original value.

$$114\% - 100\% = 14\% \text{ increase}$$

Answer: 14%

Marks: 1 mark for $273\,600 \div 240\,000$ (or $33\,600 \div 240\,000$). 1 mark for 14.

5 (2 marks)

After a 15% increase, a bike costs £402.50

Work out the price before the increase.

After a 15% increase, the price is 115% of the original.

So original price $\times 1.15 = 402.50$

Original price = $402.50 \div 1.15 = £350$

Check: $350 \times 1.15 = 402.50$ ✓

Answer: £350

Tip: Do not take 15% off £402.50. The 15% was of the **original** price, so divide by 1.15.

Marks: 1 mark for $402.50 \div 1.15$. 1 mark for £350.

6 (3 marks)

Dev's weekly pay goes up by $\frac{1}{12}$

His new weekly pay is £533

Work out his weekly pay before the increase.

The pay went up by $\frac{1}{12}$, so the new pay is $1 + \frac{1}{12} = \frac{13}{12}$ of the old pay.

$\frac{13}{12}$ of the old pay = £533

$\frac{1}{12}$ of the old pay = $533 \div 13 = £41$

Old pay = $41 \times 12 = £492$

Check: $\frac{1}{12}$ of £492 is £41, and $492 + 41 = 533$ ✓

Answer: £492

Tip: Do not work out $\frac{1}{12}$ of £533 and subtract it. The increase was $\frac{1}{12}$ of the **old** pay, so £533 is $\frac{13}{12}$ of the old pay.

Marks: 1 mark for $\frac{13}{12}$. 1 mark for $533 \div \frac{13}{12}$ (or $533 \div 13 \times 12$). 1 mark for £492.

7 (2 marks)

The population of a town increases by 3% in one year and by 5% the next year.
Work out the overall percentage increase.

Multiplier for a 3% increase: 1.03

Multiplier for a 5% increase: 1.05

Overall multiplier: $1.03 \times 1.05 = 1.0815$

1.0815 means 108.15%, which is an increase of 8.15%.

Answer: 8.15%

Tip: Do not just add the percentages to get 8%. The 5% is of the new, bigger population, so multiply the multipliers.

Marks: 1 mark for 1.03×1.05 . 1 mark for 8.15.

8 (1 mark)

A number is increased by 25%

The answer is then decreased by 20%

Circle the overall effect on the number.

Options: a 5% increase, no overall change, a 5% decrease, a 45% increase

Increase by 25%: multiplier 1.25

Decrease by 20%: multiplier 0.8

Overall: $1.25 \times 0.8 = 1$

Multiplying by 1 leaves the number the same.

Check with 100: $100 \rightarrow 125 \rightarrow 125 - 25 = 100$

Answer: no overall change

Tip: Do not just do $25 - 20 = 5$. Multiply the multipliers: the 20% decrease is of the bigger, increased number.

9 (1 mark)

The price of a concert ticket goes up from £40 to £100

Priya says, "This is a 150% increase."

Owen says, "This is a 250% increase."

Who is correct? Tick a box.

Give a reason for your answer.

Increase = $100 - 40 = £60$

Percentage increase = $\frac{60}{40} \times 100 = 150\%$

Owen has worked out $\frac{100}{40} \times 100 = 250\%$

That shows the new price is 250% **of** the old price, which is an increase of $250 - 100 = 150\%$.

Answer: Priya: the increase is £60, and $\frac{60}{40} \times 100 = 150\%$

Tip: Percentage increase uses the **change** (£60), not the new amount (£100).

10 (2 marks)

A theatre increases all its ticket prices by 20%

Later, it reduces the new prices so that they go back to the original prices.

Work out the percentage reduction needed.

Give your answer to 1 decimal place.

After the increase, a price is 1.2× the original.

To get back, multiply by $\frac{1}{1.2} = 0.8333 \dots$

0.8333... is 83.33... % of the new price.

$$\text{Reduction} = 100 - 83.33 \dots = 16.66 \dots \%$$

Check with £100: £120 back to £100 is a £20 cut, and $\frac{20}{120} \times 100 = 16.7\%$

Answer: 16.7%

Tip: The answer is not 20%. The reduction is a percentage of the new, higher price, so a smaller percentage is needed.

Marks: 1 mark for $\frac{1}{1.2}$ or $\frac{20}{120}$ (e.g. using a price of £100). 1 mark for 16.7.

11 (3 marks)

In a sale, prices are reduced by 30%

A coat costs £84 in the sale.

Jo says the original price was $84 \times 1.3 = £109.20$

Explain her mistake and work out the correct original price.

Jo's mistake: the 30% was taken off the **original** price, not the sale price.

So £84 is $100 - 30 = 70\%$ of the original price.

Original price = $84 \div 0.7 = £120$

Check: 30% of £120 is £36, and $120 - 36 = 84$ ✓

Answer: £120

Marks: 1 mark for a correct explanation. 1 mark for $84 \div 0.7$. 1 mark for £120.

12 (3 marks)

A , B and C are numbers.

Here is some information about B and C .

B is $\frac{5}{2}$ of A

C is A increased by 75%

Work out C as a fraction of B .

B is $\frac{5}{2}$ of A : $B = \frac{5}{2}A$

C is A increased by 75%: $C = 1.75A = \frac{7}{4}A$

$$\frac{C}{B} = \frac{7}{4} \div \frac{5}{2} = \frac{7}{4} \times \frac{2}{5} = \frac{14}{20} = \frac{7}{10}$$

Or choose $A = 4$: then $B = 10$ and $C = 7$, so $\frac{C}{B} = \frac{7}{10}$

Answer: $\frac{7}{10}$

Tip: A increased by 75% is $1.75A$, not $0.75A$. Choosing a value for A is a good way to check.

Marks: 1 mark for $C = 1.75A$ or $\frac{7}{4}A$. 1 mark for $\frac{7}{4} \div \frac{5}{2}$ (or using a value for A , e.g. $A = 4$ gives $B = 10$ and $C = 7$). 1 mark for $\frac{7}{10}$.

13 (4 marks)

Last year a café's total takings were £40 000

35% of these takings came from cold drinks.

The rest came from hot drinks.

This year

takings from cold drinks went up by 20%

takings from hot drinks went down by 8%

Work out the percentage change in the café's total takings.

Is it an increase or a decrease?

Last year, cold drinks: $0.35 \times 40\,000 = £14\,000$

Last year, hot drinks: $40\,000 - 14\,000 = £26\,000$

This year, cold drinks: $14\,000 \times 1.2 = £16\,800$

This year, hot drinks: $26\,000 \times 0.92 = £23\,920$

This year's total: $16\,800 + 23\,920 = £40\,720$

Change: $40\,720 - 40\,000 = £720$ (an increase)

$$\text{Percentage change} = \frac{720}{40\,000} \times 100 = 1.8\%$$

Answer: 1.8% increase

Tip: You cannot just do $20\% - 8\% = 12\%$. The two parts are different sizes, so find this year's total and compare it with last year's total.

Marks: 1 mark for £14 000 and £26 000. 1 mark for £16 800 or £23 920. 1 mark for £40 720 (or a change of £720). 1 mark for 1.8% increase.
