

Percentages

GCSE Maths · Worked Solutions

20 questions · 62 marks total

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Section A · Foundation

Questions 1–3 are the most straightforward; they get harder as you go on. Question 10 is the most challenging.

1 [1 mark]

Write 0.35 as a percentage.

1 To change a decimal into a percentage, multiply by 100.

2 $0.35 \times 100 = 35$

Answer: 35%

2 [2 marks]

Work out 20% of 65

1 10% of 65 = $65 \div 10 = 6.5$

2 20% is double 10%: $2 \times 6.5 = 13$

Answer: 13

3 [2 marks]

Write 18 out of 40 as a percentage.

1 Write it as a fraction: $\frac{18}{40}$

2 Multiply by 100: $\frac{18}{40} \times 100 = 18 \times 2.5 = 45$

Answer: 45%

4 [2 marks]

Increase 200 by 12%

1 10% of 200 = 20 and 1% of 200 = 2, so 12% = $20 + 2 + 2 = 24$

2 Increase means add on: $200 + 24 = 224$

3 (Or multiply straight away by 1.12.)

Answer: 224

5

[3 marks]

A jacket costs £70.

In a sale the price is reduced by 30%.

Work out the sale price.

- 1 10% of 70 = 7, so 30% of 70 = 21
- 2 The reduction is £21.
- 3 Sale price = 70 – 21 = £49
- 4 (Or multiply by 0.7 directly: $70 \times 0.7 = 49$.)

Answer: £49

6

[3 marks]

Work out 17.5% of 480 without a calculator.

- 1 Break 17.5% into pieces you can find easily.
- 2 10% of 480 = 48
- 3 5% is half of 10% = 24
- 4 2.5% is half of 5% = 12
- 5 17.5% = 48 + 24 + 12 = 84

Answer: 84

7

[3 marks]

Ben scored 34 out of 50 in a test.

Amy scored 27 out of 40 in a different test.

Who did better? You must show your working.

- 1 Convert both scores to percentages so they can be compared.
- 2 Ben: $\frac{34}{50} \times 100 = 34 \times 2 = 68\%$
- 3 Amy: $\frac{27}{40} \times 100 = 27 \times 2.5 = 67.5\%$
- 4 68% is greater than 67.5%.

Answer: Ben (68% against Amy's 67.5%)

8

[3 marks]

Priya invests £500 for 3 years at 4% **simple** interest per year.

Work out the total amount in her account after 3 years.

- 1 Simple interest means the same amount of interest is earned each year.
- 2 4% of 500 = $0.04 \times 500 = £20$ per year
- 3 Over 3 years the interest is $3 \times 20 = £60$
- 4 Total = 500 + 60 = £560

Answer: £560

9

[4 marks]

A house was bought for £180 000 and later sold for £207 000.

Work out the percentage increase in the value of the house.

1 First find the actual increase: $207\,000 - 180\,000 = £27\,000$

2 Percentage change = $\frac{\text{change}}{\text{original amount}} \times 100$

3 $= \frac{27\,000}{180\,000} \times 100$

4 $\frac{27}{180} = 0.15$

5 $0.15 \times 100 = 15\%$

Answer: 15% increase

10

[4 marks]

A laptop is advertised at £320 plus VAT at 20%.

(a) Work out the total price including VAT.

(b) A voucher takes 15% off the total price. Work out the price after the voucher.

1 (a) $20\% \text{ of } 320 = 0.2 \times 320 = £64$

2 Total = $320 + 64 = £384$

3 (b) Taking 15% off means paying 85%, so multiply by 0.85

4 $384 \times 0.85 = 326.40$

5 The price is £326.40

Answer: (a) £384 (b) £326.40

Section B · Higher

Higher-tier style. Again, questions 1–3 are the gentlest and question 10 is the hardest.

1

[2 marks]

Write

(a) 0.8 as a percentage

(b) $\frac{3}{8}$ as a percentage

1 (a) $0.8 \times 100 = 80\%$

2 (b) $3 \div 8 = 0.375$, and $0.375 \times 100 = 37.5\%$

Answer: (a) 80% (b) 37.5%

2

[2 marks]

Write down the single multiplier you would use for

(a) a 7% decrease

(b) a 3.5% increase

1 (a) A decrease of 7% leaves $100 - 7 = 93\%$, so the multiplier is 0.93

2 (b) An increase of 3.5% gives 103.5%, so the multiplier is 1.035

Answer: (a) 0.93 (b) 1.035

3

[3 marks]

After a 12% discount, a coat costs £52.80

Work out the original price of the coat.

- 1 This is a reverse percentage — the £52.80 is *after* the discount.
- 2 The multiplier used was $1 - 0.12 = 0.88$
- 3 So original price $\times 0.88 = 52.80$
- 4 Original price $= 52.80 \div 0.88 = £60$
- 5 Check: $60 \times 0.88 = 52.80$ ✓

Answer: £60

4

[3 marks]

£4000 is invested at 2.5% compound interest per year.

Work out the value of the investment after 3 years, to the nearest penny.

- 1 The multiplier for a 2.5% increase is 1.025
- 2 Value $= 4000 \times 1.025^3$
- 3 $1.025^3 = 1.076890625$
- 4 $4000 \times 1.076890625 = 4307.5625$

Answer: £4307.56

5

[4 marks]

A car is worth £15 000 when new.

It loses 18% of its value in the first year, then 12% of its value in each year after that.

Work out the value of the car after 3 years.

- 1 First year multiplier: $1 - 0.18 = 0.82$
- 2 Later years multiplier: $1 - 0.12 = 0.88$, applied twice.
- 3 Value $= 15\,000 \times 0.82 \times 0.88^2$
- 4 $15\,000 \times 0.82 = 12\,300$
- 5 $12\,300 \times 0.88 = 10\,824$, then $10\,824 \times 0.88 = 9525.12$

Answer: £9525.12

6

[4 marks]

The price of a phone is increased by 20% and then decreased by 20%.

Show that the final price is 4% less than the original price.

- 1 Do not assume the two changes cancel out — the 20% decrease is taken from a bigger amount.
- 2 Multiplier for the increase: 1.2
- 3 Multiplier for the decrease: 0.8
- 4 Overall multiplier $= 1.2 \times 0.8 = 0.96$
- 5 0.96 means the final price is 96% of the original, which is a 4% decrease.
- 6 Check with £100: it rises to £120, then falls by £24 to £96 ✓

Answer: Overall multiplier $1.2 \times 0.8 = 0.96$, so a 4% decrease

7

[4 marks]

£2500 is invested at 4% compound interest per year.

Work out the least number of complete years before the investment is worth more than £3000.

- 1 Each year the amount is multiplied by 1.04
- 2 After 4 years: $2500 \times 1.04^4 = 2500 \times 1.16985856 = £2924.65$ — not enough.
- 3 After 5 years: $2500 \times 1.04^5 = 2500 \times 1.2166529 = £3041.63$ — this is over £3000.
- 4 So it first passes £3000 during the 5th year.

Answer: 5 years

8

[4 marks]

An investment grows by 10% compound interest each year.

After 3 years it is worth £6655.

Work out how much was invested at the start.

- 1 The multiplier each year is 1.1, so over 3 years the total multiplier is 1.1^3
- 2 $1.1^3 = 1.331$
- 3 So starting amount $\times 1.331 = 6655$
- 4 Starting amount = $6655 \div 1.331 = £5000$
- 5 Check: $5000 \rightarrow 5500 \rightarrow 6050 \rightarrow 6655$ ✓

Answer: £5000

9

[4 marks]

In a club, 60% of the members are women.

25% of the women and 40% of the men wear glasses.

What percentage of all the members wear glasses?

- 1 Working with 100 members makes this easier: 60 women and 40 men.
- 2 Women with glasses: 25% of 60 = 15
- 3 Men with glasses: 40% of 40 = 16
- 4 Total with glasses = $15 + 16 = 31$ out of 100

Answer: 31%

A television has a list price of £250.

Shop A takes 20% off, then a further 10% off the reduced price.

Shop B takes 30% off the list price.

(a) Work out the price in each shop.

(b) Which shop is cheaper, and by how much?

(c) Work out the single percentage reduction that Shop A actually gives.

1 (a) Shop A: $250 \times 0.8 = £200$, then $200 \times 0.9 = £180$

2 Shop B: $250 \times 0.7 = £175$

3 (b) Shop B is cheaper by $180 - 175 = £5$

4 (c) Shop A's overall multiplier is $0.8 \times 0.9 = 0.72$

5 0.72 means the customer pays 72% of the list price.

6 So the single reduction is $100 - 72 = 28\%$, not the 30% you might expect from adding 20 and 10.

Answer: (a) A £180, B £175 (b) Shop B, by £5 (c) 28%