Percentages

Percentage change

Example

Express £6 as a percentage of £40

$\frac{6}{40} \times 100 = 15\%$

Example

Bert buys a car for £1500 and sells it for £1800. What is Bert's percentage gain?

Bert has gained £1800 - £1500 = **£300** we need to find this as a percentage of the original value:

$\frac{300}{1500} \times 100 = 20\%$

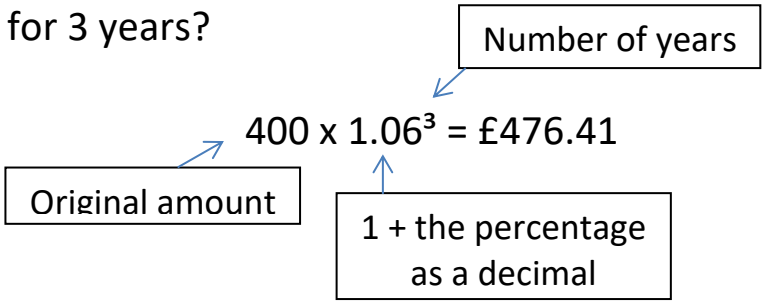
Percentage gain / loss = $\frac{\text{difference}}{\text{original}} \times 100$

1. The population of a village increased from 234 to 275 during one year. Find the percentage increase.	2. When a beaker of sand is dried in a hot oven its mass reduces from 1.2kg to 870g. Find the percentage reduction in its mass.
3. A battery was tested and found to power a camera for 12 hours before it needed recharging. An improved version of the battery powered the camera for an extra 30 minutes. Find the percentage increase in the life of the batteries.	4. The average cost of a local telephone call dropped by 8p to 27p. Find the percentage reduction in the average cost of a local call.

Compound interest

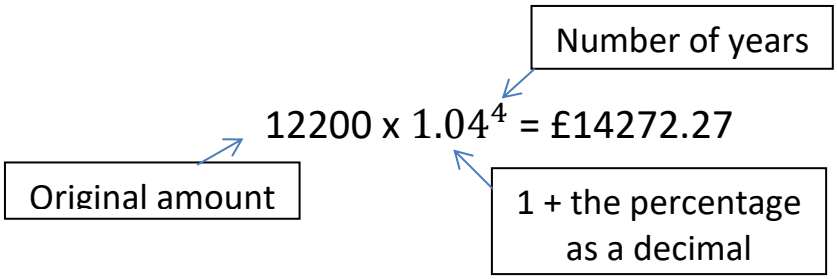
Example

A bank pays 6% compound interest per year. How much will I have in my bank if I invested £400 for 3 years?



Example

A company offers 4% pay increase for each year that they stay with the firm. Gareth started work on a salary of £12200. What salary will he be on after 4 years?



1. Jane invests £1,200 in a bank account which earns interest at the rate of 6% per annum. Find the value of a) the investment after 5 years b) the interest earned.	2. Craig puts £240 into a savings account. Each year the savings earn interest at 6% of the amount in the account at the start of the year. What will his savings be worth after 3 years? Give your answer to the nearest penny.

3. Each year a car loses value by 11% of its value at the start of the year. If it was worth £8000 when it was new, what will it be worth after 2 years?

4. A population of bacteria is estimated to increase by 12% every 24 hours. The population was 2000 at midnight on Friday. What was the population (to the nearest whole number) by midnight the following Wednesday?

5. Ambrose invested £3500 in a six-year bond that added 5% to the amount each year for the first three years and 7.5% each year for the next three years. What is the amount in the bond, to the nearest penny after six years?

Reverse percentages

Example

Tina's pay is increased by 5% to £315. What was Tina's pay before the increase?

We've added 5% to her original pay.
100% + 5% = 105%

105% = £315
÷105 ÷105
1% = £3
x 100 x 100
100% = £300

Example

The price of a refrigerator is decrease by 12% in a sale. The new price is £220. What was the original price before the reduction?

We've subtracted 12%
100% - 12% = 88%

88% = £220
÷88 ÷88
1% = £2.50
x 100 x 100
100% = £250

You can check your answer at the end.
12% of £250 is £30,
£250 - £30 = £220

1. A jacket is reduced by 12% to £66 in a sale. Find the original price.

2. A baby's weight increases by 8% over a month from birth to 4.05kg, what wasthe weight at birth?

3. Which product has the greatest original price? Show your working.

A

B

4. The air pressure increases by 1.2% to 1,214.4 mbar. What was the original air pressure?

5. A dress in a sale is reduced by 7% to £60.45. What is the original price?

6. A stereo system is sold for £1,998 and an 11% profit is made. Find the original cost of the stereo.

7. A shop sells a television to a man and makes a 15% profit. The man sells it to another man for £414 at a loss of 10%. Find the original price of the television.

Mixed exam questions

Q1. Franz invests £2500 for 2 years at $3\frac{1}{2}\%$ per annum compound interest.
Work out the value of his investment at the end of 2 years.

£ .....

(Total for question = 3 marks)

Q2. Kristen buys a laptop.
She gets a discount of 20% off the normal price.
Kristen pays £480 for the laptop.
Work out the discount. Give your answer in pounds.

£ .....

(Total for question = 3 marks)

Q3. Claire is making a loaf of bread.
A loaf of bread loses 12% of its weight when it is baked.
Claire wants the baked loaf of bread to weigh 1.1 kg.
Work out the weight of the loaf of bread before it is baked.

..... kg

(Total for question = 3 marks)

Q4. Ria is going to buy a caravan.
The total cost of the caravan is £7000 plus VAT at 20%.
Ria pays a deposit of £3000
She pays the rest of the total cost in 6 equal monthly payments.
Work out the amount of each monthly payment.

£.....

(Total for Question is 4 marks)

Q5. * Railtickets and Cheaptrains are two websites selling train tickets.
Each of the websites adds a credit card charge and a booking fee to the ticket price.

Railtickets

Credit card charge: 2.25% of ticket price

Booking fee: 80 pence

Cheaptrains

Credit card charge: 1.5% of ticket price

Booking fee: £1.90

Nadia wants to buy a train ticket.
The ticket price is £60 on each website.
Nadia will pay by credit card.
Will it be cheaper for Nadia to buy the train ticket from Railtickets or from Cheaptrains?

(Total for Question is 4 marks)

Q6. Bill's weight decreases from 64.8 kg to 59.3 kg.
Calculate the percentage decrease in Bill's weight.
Give your answer correct to 3 significant figures.

(Total for Question is 3 marks)

Q7. * Peter has £20 000 to invest in a savings account for 2 years.
He finds information about two savings accounts.

Bonus Saver
Compound interest
4% for the first year then 1.5% each year

Fixed Rate
Compound interest
2.5% each year

Peter wants to have as much money as possible in his savings account at the end of 2 years.
Which of these savings accounts should he choose?

(Total for question = 4 marks)

Q8.
In a sale normal prices are reduced by 20%.
A washing machine has a sale price of £464
By how much money is the normal price of the washing machine reduced?

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

Q9. Liam invests £6200 for 3 years in a savings account.
He gets 2.5% per annum compound interest.
How much money will Liam have in his savings account at the end of 3 years?

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

Q10. Becky buys a new car for £20 000
The value of this car will depreciate
by 15% at the end of the first year
then by 10% at the end of every year after the first year.
After how many years will the car have a value of less than £15 000?
You must show all your working.

(Total for Question is 4 marks)

Q11. Charlie invests £1200 at 3.5% per annum compound interest.
Work out the value of Charlie's investment after 3 years.

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

Q12. Aminata invested £2500 for *n* years in a savings account.
She was paid 3% per annum compound interest.
At the end of *n* years, Aminata has £2813.77 in the savings account.
Work out the value of *n*.

(Total for Question is 2 marks)

Q13. Martin bought a computer for £1200
At the end of each year the value of the computer is depreciated by 20%.
After how many years will the value of the computer be £491.52?
You must show your working.

(Total for Question is 3 marks)

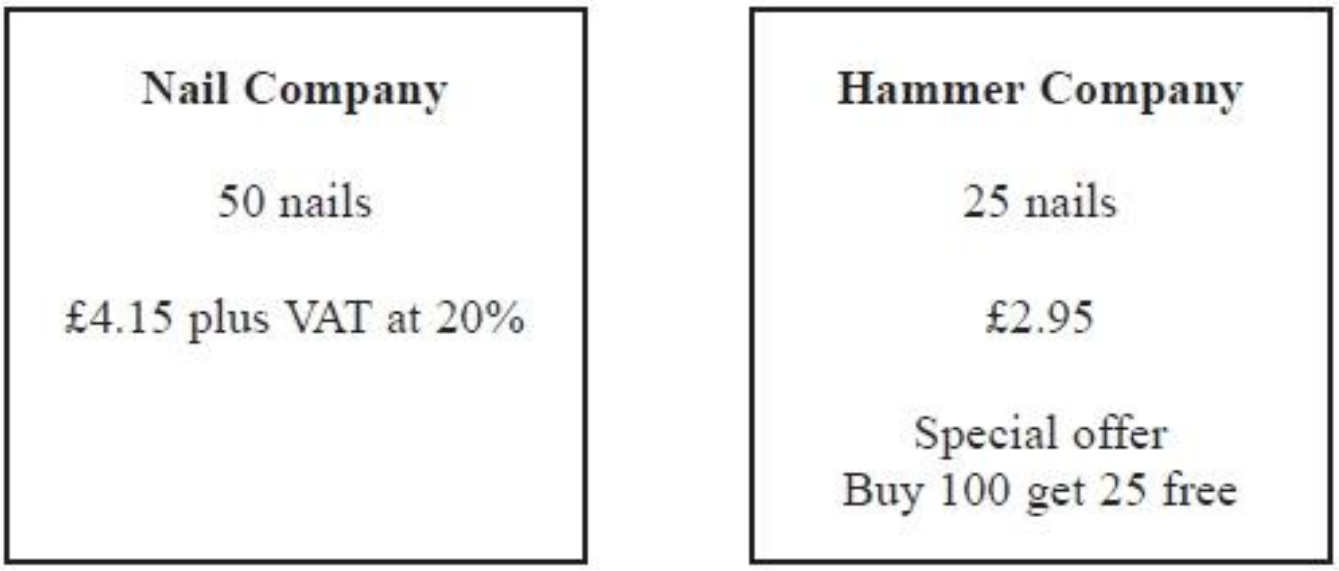
Q14. A TV costs £400
Peter pays a deposit of 15%.
How much does Peter still have to pay for the TV?

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

Q15. A set of tyres normally costs £500
In a sale there is a 30% discount.
Work out the sale price of the set of tyres.

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

Q16. *



Barak is going to buy 550 nails from one of these companies.
He wants to buy the nails at the cheaper cost.
Where should he buy the nails, from the Nail Company or from the Hammer Company?

(Total for question = 5 marks)

Q17. Tony buys and sells cars.
He has to reach a target of at least 40% profit on each car he sells.
On Monday, Tony buys a car for £1500
On Tuesday, Tony sells the car for £2150
Show that Tony reaches his target for this car.

(Total for question = 3 marks)

Q18. £500 is invested at a simple interest rate of 3% per year.
After how many years is the total interest £60?

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

Q19.* Here are two schemes for investing £2500 for 2 years.

Scheme A

gives 4% simple interest each year.

Scheme B

gives 3.9% compound interest each year.

Which scheme gives the most total interest over 2 years?

You must show all your working.

(Total for Question is 4 marks)

Q20. Derek buys a house for £150 000
He sells the house for £154 500
(a) Work out Derek's percentage profit.

. . . . . % (3)

Derek invests £154 500 for 2 years at 4% per year compound interest.
(b) Work out the value of the investment at the end of 2 years.

£ . . . . . (3)
(Total for Question is 6 marks)

Examiner's Report Key Points

- Marks are often lost in reverse percentage questions. Remember to work backwards and check your answer at the end.
- Make sure that your answers are clearly set out, especially when you are comparing.
- Always show all of your working out. In percentages questions you often loose marks if you have not shown your calculations.

Answers

Percentage change

1) 17.5% 2) 27.5% 3) 4.2% 4) 22.9%

Compound interest

1) a) £1605.87 b) £405.87 2) £285.84 3) £6336.80
4) £3524.68 5) £5033.40

Reverse percentages

1) £75 2) 3.75kg 3) A 4) 1200mbar
5) £65 6) £1800 7) £400

Mixed exam questions Mark Scheme

Q1.

Answer	Mark	Notes
2678.06	3	M1 for 2500 × 1.035 or 2500 + 2500 × 0.035 oe or for 2587.5(0) or 87.5(0) or 8750 or 2412.5(0) M1 (dep) for "2587.5" × 1.035 or for "2587.5" + "2587.5" × 0.035 or for "2578.5" + "90.56(25)" or for 2678 or 2678.1(0) or 2678.07 or 2678.06… A1 cao NB: if correct answer seen then ignore any extra years Alternative method: M2 for 2500×1.035^n where $n \geq 2$ or for 2678 or 2678.07 or 2678.06… A1 cao

Q2.

Answer	Mark	Notes
120	3	M1 for $80\% = 480$ or $\frac{480}{80}\ (=6)$ or $\frac{480}{80} \times 100\ (=600)$ oe M1 for $600 - 480$ or $\frac{480}{80} \times 20$ oe A1 cao

Q3.

Answer	Mark	Notes
1.25	3	M1 $100 - 12\ (=88)$ or 0.88 or $1.1 \div 88\ (=0.0125)$ M1 for complete method, eg $1.1 \div 0.88$ A1 cao (SC B2 for 1250 as answer)

Q4.

Answer	Mark	Notes
900	4	M1 for $0.2 \times 7000\ (=1400)$ or $1.2 \times 7000\ (=8400)$ oe M1 for $7000 + "1400" - 3000\ (=5400)$ oe M1 for "5400" ÷ 6 A1 cao

Q5.

Answer	Mark	Notes
Railtickets with correct calculations	4	NB. All work may be done in pence throughout M1 for correct method to find credit card charge for one company eg. 0.0225 × 60(=1.35) oe **or** 0.015 × 60 (=0.9) oe M1 (dep) for correct method to find total additional charge or total price for one company eg. 0.0225×60 + 0.80 **or** 0.015×60 + 1.90 **or** 2.15 **or** 2.8(0) **or** 62.15 **or** 62.8(0) A1 for 2.15 **and** 2.8(0) **or** 62.15 **and** 62.8(0) C1 (dep on M1) for a statement deducing the cheapest company, but figures used for the comparison must also be stated somewhere, and a clear association with the name of each company

Q6.

Answer	Mark	Notes
8.49	3	M1 64.8 – 59.3 (=5.5) M1 (dep) $\frac{\text{'5.5'}}{64.8}\times 100$ oe A1 8.48 – 8.49

Q7.

Answer	Mark	Notes
Bonus Saver with correct comparable values	4	M1 for a method to calculate 4% or 2.5% of 20000 (= 800 or 20800 or 500 or 20500) M1 for a method to calculate using a compound interest method, eg 1.025^2 oe or 1.04 followed by 1.015 oe A1 for 1.050625 or 1.0556 or 10556 or 556 or 21112 or 21012.5 or 1112 or 1012.5 C1 for a correct decision in a statement with two correct comparable values. **NB** all final money values can be rounded or truncated to nearest integer or left unrounded.

Q8.

Answer	Mark	Notes
116	3	M1 for 80% or 0.8 seen oe or $\frac{464}{0.8}$ (=580) M1 for $\frac{464}{0.8} - 464$ A1 cao **OR** M1 for 80% or 0.8 seen oe M1 for 464 ÷ 4 or 464 ÷ (80÷20) A1 cao

Q9.

Answer	Mark	Notes
6676.72	3	M2 for 6200×1.025^3 (= 6676.72...) (M1 for 6200×1.025^n, $n \neq 3$) A1 for 6676.72, accept 6676.71 or 6676.73

Q10.

Answer	Mark	Notes
3	4	M1 for a complete correct method to find 15% of 20 000 (=3000) or 100-15 (=85) M1 for a complete correct method to find 85% of 20 000 e.g. 20 000 – '3000' (=17000) or 20 000 × '0.85' (=17000) M1 for a complete method to find 90% of '17 000' A1 cao but MUST be supported: 3 without working scores 0 marks and 3 from incorrect working may gain some method marks.

Q11.

Answer	Mark	Notes
1330.46	3	M2 for 1200×1.035^3 A1 1330.46 – 1330.47 Or M1 1200 × 1.035 M1(dep) for ' 1242'× 1.035 and '1285.47'× 1.035 A1 1330.46 – 1330.47 [SC: B1 for 42 or 84 or 126 or 1242 or 1284 or 1326 seen, if M0 scored]

Q12.

Answer	Mark	Notes
4	2	M1 for an attempt to evaluate 2500×1.03^n for at least one value of n (not equal to 1) Or $\frac{2813.77}{2500}$ (=1.1255...) and 1.03^n evaluated, $n \geq 2$ Or finding at least two correct interest payments. ie 75 and 77.25 A1 for 4 cao

Q13.

Answer	Mark	Notes
4	3	M1 0.8 or 960 or 2160 seen M1 for 0.8^n where n is 2 or greater or for 768 or 614.40 A1 cao and supported by working

Q14.

Answer	Mark	Notes
340	3	M1 for $\frac{15}{100} \times 400$ (= 60) oe or 40 + 20 or 400 × 0.15 M1 (dep) for 400 – "60" A1 for 340 cao OR M1 for 100–15 (=85) M1 (dep) for $\frac{'85'}{100} \times 400$ or '0.85' × 400 A1 for 340 [SC: B1 for an answer of 460 if M0 scored]

Q15.

Mark	Notes
3	M1 for finding 30% of 500 (=150) M1 dep for subtraction of discount from 500 A1 cao

Q16.

Answer	Mark	Notes
Hammer company	5	M1 for 20% of a cost in Nail Company, eg 4.15 × 0.2 (= 0.83) oe M1(dep) for adding their 20% to their cost, eg 4.15 × 1.2 (= 4.98) oe M1 for using special offer in Hammer Company M1 for 4 × 125 and 2 × 25 in Hammer Company C1 for Hammer Company and figures 54.78 [Nail Company] and 53.1(0) [Hammer Company]

Q17.

Answer	Mark	Notes
Shows sales target	3	M1 for 2150 – 1500 (= 650) M1 for "650"/1500 × 100 (= 43.3…) A1 for 43.3(3…)%

Q18.

Answer	Mark	Notes
4	3	M2 correct method to calculate simple interest over 4 years eg, $^{3}/_{100}$ ×500× 4 or "15" × 4 (M1 correct method to simple calculate interest over one year, eg $^{3}/_{100}$ ×500 oe or 15 seen or 515 seen) A1 cao OR M1 for subs into $^{PRT}/_{100} = I$, eg $\frac{500\times3\times?}{100}$ = 60 oe M1 for 15T = 60 or attempt to rearrange, eg, 1500T = 6000 A1 cao SC Award B1 for 4 from compound interest methods.

Q19.

Answer	Mark	Notes
statement	4	M1 for a correct method to find 4% of 2500 or 3.9% of 2500 A1 for a correctly calculated amount 2700 or 2698.8(0) or 200 or 198.8(0); or percentage rate calculated over the 2 years for comparison: 3.93% or 3.976% oe M1 for a correct compound interest method using 3.9% and 2500 over 2 years C1 for statement of scheme A, with two correct comparable figures.

Q20.

Answer	Mark	Notes
3	3	M1 for 154500 – 150000 or 4500 M1 for $\frac{\text{'154500 – 150000'}}{150000} \times 100$ oe A1 cao **OR** M1 for $\frac{154500}{150000}$ (× 100) M1 for "$\frac{154500}{150000} \times 100$" – 100 oe A1 cao
167107.20	3	M1 for 154500 × $\frac{4}{100}$ or 6180 **or** 12360 **or** 160680 **or** 166860 **or** 1.04 × 154500 M1 (dep) for (154500 + '6180') × $\frac{4}{100}$ or 6427.2(0) or ' 160680' × 1.04 A1 for 167107.2(0) as final answer **OR** M2 for 154500×1.04^2 (M1 for 154500 × 1.04) A1 167107.2(0) as final answer