

Compound Interest, Growth and Decay

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 (2 marks)

£3400 is put into a savings account.

The account pays 2.5% compound interest per year.

Work out the amount in the account at the end of 6 years.

2.5% compound interest: multiplier 1.025

6 years: $3400 \times 1.025^6 = 3942.957 \dots$

Round to the nearest penny: £3942.96

Answer: £3942.96

Tip: 2.5% as a multiplier is 1.025, not 1.25.

Marks: 1 mark for 3400×1.025^6 . 1 mark for £3942.96.

2 (3 marks)

Olu takes out a loan of £4500

Compound interest of 6.5% per annum is added to the loan at the end of each year.

Olu pays nothing back for 2 years.

Calculate the total amount of interest added to the loan in the 2 years.

6.5% compound interest: multiplier 1.065

After 2 years: $4500 \times 1.065^2 = 5104.0125$

Interest = final amount – amount borrowed

$5104.0125 - 4500 = 604.0125$

To the nearest penny: £604.01

Answer: £604.01

Tip: The question asks for the **interest**, so subtract the £4500 at the end. Interest is added to the loan, so the multiplier is 1.065, not 0.935.

Marks: 1 mark for 1.065^2 . 1 mark for $4500 \times 1.065^2 - 4500$. 1 mark for £604.01.

3 (3 marks)

A farmer buys a new tractor for £64 000

The value of the tractor falls by

18% in the first year

9% in each year after the first year.

Work out the value of the tractor at the end of 4 years.

Give your answer to the nearest pound.

First year, an 18% decrease: multiplier 0.82

The other 3 years, a 9% decrease each year: multiplier 0.91 each year

$$64\,000 \times 0.82 \times 0.91^3 = 39\,547.406 \dots$$

To the nearest pound: £39 547

Answer: £39 547

Tip: After the first year there are only **3** more years, so use 0.91^3 , not 0.91^4 .

Marks: 1 mark for $64\,000 \times 0.82$. 1 mark for $\times 0.91^3$. 1 mark for £39 547.

4 (2 marks)

The number of fish in a lake at the end of year n is F_n

$$F_{n+1} = 0.9 F_n$$

$$F_0 = 5000$$

Work out the value of F_3

$F_{n+1} = 0.9 F_n$ means: each year, multiply the number of fish by 0.9.

$$F_1 = 0.9 \times 5000 = 4500$$

$$F_2 = 0.9 \times 4500 = 4050$$

$$F_3 = 0.9 \times 4050 = 3645$$

Answer: 3645

Tip: F_0 is the start, so F_3 means using the rule three times, not two.

Marks: 1 mark for 5000×0.9^3 (or three correct steps). 1 mark for 3645.

5 (3 marks)

The value of a machine decreases by 20% each year.

After 3 years its value is £12 800

Work out its original value.

A 20% decrease each year: multiplier 0.8

$$\text{Original value} \times 0.8^3 = 12\,800$$

$$0.8^3 = 0.512$$

$$\text{Original value} = 12\,800 \div 0.512 = £25\,000$$

$$\text{Check: } 25\,000 \times 0.512 = 12\,800 \quad \checkmark$$

Answer: £25 000

Tip: To work backwards, **divide** by the multiplier. Adding 20% on each year does not undo a 20% decrease.

Marks: 1 mark for 0.8^3 (or 0.512). 1 mark for $12\,800 \div 0.512$. 1 mark for £25 000.

6 (3 marks)

There were 4000 deer in a nature reserve at the start of 2023

The number of deer increases by $x\%$ each year.

At the start of 2025 there were 4410 deer in the reserve.

Work out the value of x .

From the start of 2023 to the start of 2025 is 2 years.

$$\text{Let the yearly multiplier be } m. \text{ Then } 4000 \times m^2 = 4410$$

$$m^2 = 4410 \div 4000 = 1.1025$$

$$m = \sqrt{1.1025} = 1.05$$

A multiplier of 1.05 means a 5% increase each year.

Answer: 5

Tip: Don't halve the total increase of 10.25%. The increase compounds, so square root the multiplier instead.

Marks: 1 mark for $4410 \div 4000$. 1 mark for $\sqrt{1.1025}$. 1 mark for 5.

7 (3 marks)

Sam invests £4000 at 3.5% compound interest per year.

Tia invests £4000 at 4% simple interest per year.

Who has more money after 5 years? You must show your working.

Sam (compound interest): multiplier 1.035

$$4000 \times 1.035^5 = £4750.75 \dots$$

Tia (simple interest): each year she gets 4% of £4000 = £160

$$4000 + 5 \times 160 = £4800$$

$4800 > 4750.75$, so Tia has more money.

Answer: Tia (£4800 vs £4750.75)

Marks: 1 mark for Sam's amount. 1 mark for Tia's amount. 1 mark for Tia, with both amounts correct.

8 (3 marks)

A house was bought for £240 000

In the first year its value increased by 5%.

In the second year its value decreased by $R\%$.

At the end of the second year the house was worth £239 400

Work out the value of R .

$$\text{After the first year: } 240\,000 \times 1.05 = £252\,000$$

Multiplier for the second year: $239\,400 \div 252\,000 = 0.95$

0.95 means 95% of the value is left.

So the value decreased by $100 - 95 = 5\%$, and $R = 5$.

Answer: 5

Tip: Work out the value after the first year before you find the second multiplier. Comparing £239 400 with £240 000 gives the wrong answer.

Marks: 1 mark for £252 000. 1 mark for $239\,400 \div 252\,000$. 1 mark for 5.

9 (4 marks)

Ezra opened a savings account with £2000 at the start of 2024

Interest of 3% is added to the account at the end of every year.

On 31 December 2024, straight after the interest was added, Ezra deposited £ P

On 31 December 2025, after the interest was added, the balance was £2636.80

Work out the value of P .

You must show all your working.

End of 2024, after interest: $2000 \times 1.03 = £2060$

Then Ezra paid in £ P , so the account had $2060 + P$.

End of 2025, interest was added: $(2060 + P) \times 1.03 = 2636.80$

$2060 + P = 2636.80 \div 1.03 = 2560$

$P = 2560 - 2060 = 500$

Answer: 500

Tip: To undo a year of 3% interest, divide by 1.03. Multiplying by 0.97 does not undo it.

Marks: 1 mark for £2060. 1 mark for $2636.80 \div 1.03$. 1 mark for £2560. 1 mark for 500.
