Chhetri Academy

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GCSE MATHS

Ratio, proportion and rates of change

Edexcel 1MA1 | Subtopic collection Topic 33

Compound interest, growth and decay

Higher tier

Past paper question booklet

57	2003-2025	Higher
question groups	available papers	tier

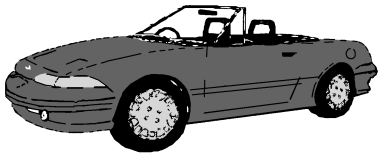
Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

2. Ben bought a car for £12 000.



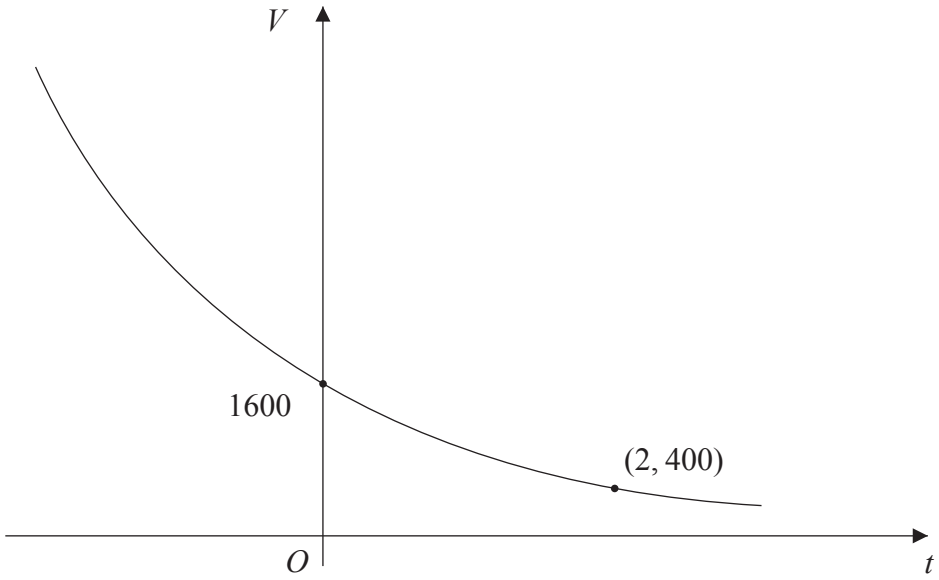
Each year the value of the car depreciated by 10%.

Work out the value of the car two years after he bought it.

£ .....

(3)

15. Mr Patel has a car.



The value of the car on January 1st 2000 was £1600
The value of the car on January 1st 2002 was £400

The sketch graph shows how the value, £V, of the car changes with time.
The equation of the sketch graph is

$$V = pq^t$$

where t is the number of years after January 1st 2000.
p and q are positive constants.

(a) Use the information on the graph to find the value of p and the value of q.

$p =$ ..... $q =$ .....
(3)

(b) Using your values of p and q in the formula $V = pq^t$ find the value of the car on January 1st 1998.

£ .....
(2)

Page Total

14. Bill invests £500 on 1st January 2004 at a compound interest rate of R% per annum.

The value, £V, of this investment after n years is given by the formula

$$V = 500 \times (1.045)^n$$

(a) Write down the value of R.

$R =$.....

(1)

(b) Use your calculator to find the value of Bill's investment after 20 years.

£.....

(2)

(Total 3 marks)

Q14

19. Toby invested £4500 for 2 years in a savings account.
He was paid 4% per annum compound interest.

(a) How much did Toby have in his savings account after 2 years?

£ .....
(3)

Jaspir invested £2400 for n years in a savings account.
He was paid 7.5% per annum compound interest.

At the end of the n years he had £3445.51 in the savings account.

(b) Work out the value of n.

.....
(2)

(Total 5 marks)

Q19

19. Arwen buys a car for £4000
The value of the car depreciates by 10% each year.

Work out the value of the car after two years.

£ .....

Q19

(Total 3 marks)

13 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 13 is 2 marks)

Question 07

7 Charlie invests £1200 at 3.5% per annum compound interest.

Work out the value of Charlie's investment after 3 years.

£ .....

(Total for Question 7 is 3 marks)

6 John earns £30 000 each year.
He knows that 20% of his monthly pay is deducted each month.

Work out how much money John has left each month after this deduction.

£ .....

(Total for Question 6 is 3 marks)

17 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 17 is 3 marks)

11 Danny bought a car for £10 000

The value of the car depreciated by 20% in the first year.
Then the value of the car depreciated by 10% in the second year.

Work out the value of Danny's car at the end of two years.

£.....

(Total for Question 11 is 3 marks)

Question 11

2 £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 2 is 3 marks)

11 Jozef invests £1700 for 2 years at 4% per annum **compound** interest.

Work out the value of his investment at the end of 2 years.

£ .....

(Total for Question 11 is 3 marks)

16 Neil invested £500 on 1st January 2000 at a fixed compound interest rate of R% each year.

The value V, in pounds, of this investment after n years is given by the formula

$$V = 500 \times (1.025)^n$$

(a) Write down the value of R.

.....

(1)

(b) Use your calculator to find the value of Neil's investment at the end of 12 years.

£ .....

(2)

(Total for Question 16 is 3 marks)

16 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 16 is 6 marks)

Question 15

11 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 11 is 3 marks)

***13** 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 13 is 4 marks)

***14** Viv wants to invest £2000 for 2 years in the same bank.

The International Bank	**The Friendly Bank**
Compound Interest	Compound Interest
4% for the first year 1% for each extra year	5% for the first year 0.5% for each extra year

At the end of 2 years, Viv wants to have as much money as possible.

Which bank should she invest her £2000 in?

(Total for Question 14 is 4 marks)

10 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.

..... years

(Total for Question 10 is 4 marks)

*15 Ella wants to invest £6000 in a savings account for 2 years.

She finds information about savings accounts at two different banks.

Northway Bank	Portland Bank
Compound interest of 3.8% per annum	Compound interest of 5% per annum in year 1 3.2% per annum in year 2

Ella wants to choose the bank that pays the greater total amount of interest for the 2 years.

Which bank should she choose?
You must show all your working.

(Total for Question 15 is 4 marks)

18 Katie invests £200 in a savings account for 2 years.

The account pays compound interest at an annual rate of

3.3% for the first year
1.5% for the second year

(a) Work out the total amount of money in Katie's account at the end of 2 years.

£.....

(3)

Katie travels to work by train.
The cost of her weekly train ticket increases by 12.5% to £225

Katie's weekly pay increases by 5% to £535.50

*(b) Compare the increase in the amount of money Katie has to pay for her weekly train ticket with the increase in her weekly pay.

(3)

(Total for Question 18 is 6 marks)

12 The value of a van depreciates at the rate of 20% per year.
Gary buys a new van for £27 500
After n years the value of the van is £11 264

Find the value of n.

.....

(Total for Question 12 is 2 marks)

14 The value of a car depreciates by 25% each year.

At the end of 2013 the value of the car was £4800

Work out the value of the car at the end of 2015

£ .....

(Total for Question 14 is 3 marks)

***14** 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 14 is 4 marks)

10 Mason invests £1500 at 2.5% per year compound interest.
Work out the value of Mason's investment at the end of 3 years.

£.....

(Total for Question 10 is 3 marks)

13 The value of an investment increases exponentially each year with a multiplier of 1.15

How long does it take for the investment to double in value?
Give your answer correct to the nearest whole number of years.

.....years

(Total for Question 13 is 2 marks)

*8 Anya has £40 000 to invest.
She is going to invest in a scheme from either the building society or the bank.

	Scheme
Building Society	Invest £40 000 in an account at 3% per annum compound interest for 2 years.
Bank	Invest £40 000 in a bond that pays £2550 interest at the end of 2 years.

Anya wants to invest in the scheme that gives the most interest.

Which scheme should Anya invest in?

(Total for Question 8 is 4 marks)

2 Jane invests £300 at a simple interest rate of 4.5% per year.
At the end of each year Jane gives the interest to a charity.

Work out the least number of years it will take for the total amount given to the charity to be greater than £50

.....

(Total for Question 2 is 3 marks)

7 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 7 is 3 marks)

***13** The value of a motor bike depreciates by 20% each year.

Brian says,

"After two years, the value of the motor bike will have reduced by 40%".

He is **wrong**.

Explain why.

(Total for Question 13 is 3 marks)

***15** This notice was in a car magazine.

> Most new cars lose more than half of their value in the first three years

Paul bought a new car.
The value of the car was £15 000

In the first year, the value of the car depreciated by 23%.
After the first year, the value of the car depreciated by 18% each year.

Work out if Paul's car lost more than half of its value by the end of three years.

(Total for Question 15 is 4 marks)

11 Danielle invested £2800 for n years in a savings account.

She was paid 2.5% per annum compound interest.
The interest is paid into the account at the end of each year.

At the end of n years, the amount of money in the savings account is greater than £3000 for the first time.

Work out the value of n.

.....

(Total for Question 11 is 2 marks)

21 Helen invested £6000 for n years in a savings account.
She got 3% compound interest each year.

At the end of n years Helen had £7379.24 in her savings account.

Work out the value of n.
You must show your working.

.....

(Total for Question 21 is 2 marks)

***14** Jack has £15 000 to invest in a savings account for 3 years.

He finds information about two savings accounts.

Simple	Compound
Simple interest	Compound interest
2.3% each year	2.15% each year

Jack wants to have as much money as possible in his savings account at the end of the 3 years.

Which of these two savings accounts should he choose?

(Total for Question 14 is 4 marks)

6 Anil wants to invest £25 000 for 3 years in a bank.

Personal Bank	**Secure Bank**
Compound Interest 2% for each year	Compound Interest 4.3% for the first year 0.9% for each extra year

Which bank will give Anil the most interest at the end of 3 years?
You must show all your working.

(Total for Question 6 is 3 marks)

Question 35

10 Naoby invests £6000 for 5 years.
The investment gets compound interest of x% per annum.

At the end of 5 years the investment is worth £8029.35

Work out the value of x.

.....

(Total for Question 10 is 3 marks)

13 At the beginning of 2009, Mr Veale bought a company.
The value of the company was £50 000

Each year the value of the company increased by 2%.

(a) Calculate the value of the company at the beginning of 2017
Give your answer correct to the nearest £100

£.....

(2)

At the beginning of 2009 the value of a different company was £250 000
In 6 years the value of this company increased to £325 000

This is equivalent to an increase of x% each year.

(b) Find the value of x.
Give your answer correct to 2 significant figures.

.....

(3)

(Total for Question 13 is 5 marks)

Question 37

9 Jean invests £12 000 in an account paying compound interest for 2 years.

In the first year the rate of interest is $x\%$
At the end of the first year the value of Jean's investment is £12 336

In the second year the rate of interest is $\frac{x}{2}\%$

What is the value of Jean's investment at the end of 2 years?

£.....

(Total for Question 9 is 4 marks)

4 Northern Bank has two types of account.
Both accounts pay compound interest.

Cash savings account
Interest
2.5% per annum

Shares account
Interest
3.5% per annum

Ali invests £2000 in the cash savings account.
Ben invests £1600 in the shares account.

(a) Work out who will get the most interest by the end of 3 years.
You must show all your working.

(4)

In the 3rd year the rate of interest for the shares account is changed to 4% per annum.

(b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

.....

.....

.....

(1)

(Total for Question 4 is 5 marks)

Question 39

2 Katy invests £200 000 in a savings account for 4 years.
The account pays compound interest at a rate of 1.5 % per annum.

Calculate the total amount of interest Katy will get at the end of 4 years.

£.....

(Total for Question 2 is 3 marks)

13 Sakira invested £3550 in a savings account for 3 years.

She was paid 2.6% per annum compound interest for each of the first 2 years.
She was paid R% interest for the third year.

Sakira had £3819.21 in her savings account at the end of the 3 years.

Work out the value of R.
Give your answer correct to 1 decimal place.

.....

(Total for Question 13 is 3 marks)

22 The number of rabbits on a farm at the end of month n is P_n
The number of rabbits at the end of the next month is given by $P_{n+1} = 1.2P_n - 50$

At the end of March there are 200 rabbits on the farm.

(a) Work out how many rabbits there will be on the farm at the end of June.

.....

(3)

(b) Considering your results in part (a), suggest what will happen to the number of rabbits on the farm after a long time.

.....

.....

(1)

(Total for Question 22 is 4 marks)

8 Tariq buys a laptop.

He gets a discount of 5% off the normal price.
Tariq pays £551 for the laptop.

(a) Work out the normal price of the laptop.

£.....

(2)

Joan invests £6000 in a savings account.
The savings account pays compound interest at a rate of

2.4% for the first year
1.7% for each extra year.

(b) Work out the value of Joan's investment at the end of 3 years.

£.....

(3)

(Total for Question 8 is 5 marks)

10 Louise invests £x in Better Investments for 3 years.
Sadiq invests £x in County Bank for 3 years.

Better Investments
Compound Interest
2.5% per annum

County Bank
Compound Interest
2% per annum for the first two years 3.5% per annum for each extra year

At the end of the 3 years, the value of Louise's investment is £344 605

Work out the value of Sadiq's investment at the end of the 3 years.

£.....

(Total for Question 10 is 4 marks)

19 At the start of year n, the number of animals in a population is P_n

At the start of the following year, the number of animals in the population is P_{n+1} where

$$P_{n+1} = kP_n$$

At the start of 2017 the number of animals in the population was 4000
At the start of 2019 the number of animals in the population was 3610

Find the value of the constant k.

.....

(Total for Question 19 is 3 marks)

Question 45

6 A new phone cost £679
The value of the phone decreases at a rate of 4% per year.

Work out the value of the phone at the end of 3 years.

£.....

(Total for Question 6 is 3 marks)

Question 46

10 Jane bought a new car three years ago.

At the end of the first year the value of the car had decreased by 12.5%
The value of the car then decreased by 10% each year for the next two years.

At the end of the three years, the value of the car was £17 010

Work out the value of the car when Jane bought it three years ago.

£.....

(Total for Question 10 is 3 marks)

20 The profit made by a shop increases each year.

The profit made by the shop in year n is £P_n

Given that the profit made by the shop in the next year is £P_{n+1} then

$$P_{n+1} = aP_n + 800 \text{ where } a \text{ is a constant.}$$

The table shows the profit made by the shop in 2018 and in 2019

Year	2018	2019
Profit	£24 000	£29 600

Work out the profit predicted to be made by the shop in 2021

£.....

(Total for Question 20 is 4 marks)

Question 48

November 2022 | 1MA1/2H | Original Q6

6 Ella invests £7000 for 2 years in an account paying compound interest.

In the first year, the rate of interest is 3%
In the second year, the rate of interest is 1.5%

Work out the value of Ella's investment at the end of 2 years.

£.....

(Total for Question 6 is 3 marks)

10 Aaliyah bought a car.

In the first year after she bought the car, its value depreciated at a rate of 23% per annum.
In the second year after she bought the car, its value depreciated at a rate of 19% per annum.

At the end of the second year the car was worth £10 914.75

What was the value of the car when Aaliyah bought it?

£.....

(Total for Question 10 is 3 marks)

12 The number of insects in a population at the start of the year n is P_n

The number of insects in the population at the start of year $(n + 1)$ is P_{n+1} where

$$P_{n+1} = kP_n$$

Given that k has a constant value of 1.13

(a) find out how many years it takes for the number of insects in the population to double. You must show how you get your answer.

.....

(2)

The value of k actually increases year on year from its value of 1.13 in year 1

(b) How does this affect your answer to part (a)?

.....

.....

.....

(1)

(Total for Question 12 is 3 marks)

8 Tamsin buys a house with a value of £150 000
The value of Tamsin's house increases by 4% each year.

Rachel buys a house with a value of £160 000
The value of Rachel's house increases by 1.5% each year.

At the end of 2 years, whose house has the greater value?
You must show how you get your answer.

(Total for Question 8 is 4 marks)

16 At the start of year n the population of a species is P_n

At the start of the following year the population of the species is given by

$$P_{n+1} = kP_n \quad \text{where } k \text{ is a positive constant.}$$

The population of the species at the start of year 1 is 8 million.
The population of the species at the start of year 2 is 6 million.

(a) Work out the population of the species at the start of year 3

..... million

(3)

At the start of year 5 the value of k is increased by 0.3 to a new constant value.

Louise thinks that from the start of year 5 the population of the species would increase year on year.

(b) Is Louise correct?
You must give a reason for your answer.

.....

.....

.....

(1)

(Total for Question 16 is 4 marks)

Question 53

November 2023 | 1MA1/2H | Original Q3

3 Andrew invests £4500 in a savings account for 2 years.
The account pays compound interest at a rate of 3.4% per year.

Calculate how much Andrew has in this savings account at the end of the 2 years.

£.....

(Total for Question 3 is 2 marks)

4 A company has 25 000 workers.
The number of workers increases at a rate of 6% per year for 3 years.

Calculate the total number of workers at the end of the 3 years.

.....

(Total for Question 4 is 4 marks)

14 At the start of 2022 Kim invested some money in a savings account.
The account paid 3.5% compound interest each year.

At the end of 2022
interest was added to the account then Kim took £750 from the account.

At the end of 2023
interest was added to the account then Kim took £1000 from the account.

There was then £2937.14 in the account.

Work out how much money Kim invested at the start of 2022
You must show all your working.

£.....

(Total for Question 14 is 4 marks)

12 Rudi invests £4500 in a savings account.

He gets compound interest at a rate of

2.4% for the first year
1.8% for each extra year.

(a) Work out the value of Rudi's investment at the end of 3 years.

£.....

(3)

Bruna buys a car for £7500

The value of the car depreciates by x% each year.
At the end of 2 years the value of the car is £4107

(b) Work out the value of x.

x = ...

(3)

(Total for Question 12 is 6 marks)

18 At the start of year n, the population of deer in a park is D_n
At the start of the following year, the population of the deer is D_{n+1}

$$D_{n+1} = K D_n \qquad \text{where } K \text{ is a constant.}$$

At the start of 2019, the population of the deer was 2000
At the start of 2020, the population of the deer was 2400

Show that, at the start of 2022, the population of the deer was greater than 3000

(Total for Question 18 is 3 marks)