

Simple & Compound Interest, Growth & Decay

Simple Interest / Compound Interest / Depreciation / Exponential Growth & Decay

Medium (16 questions)	/62
Hard (11 questions)	/54
Very Hard (6 questions)	/29
Total Marks	/145

Scan here to return to the course
or visit [savemyexams.com](https://www.savemyexams.com)



Medium Questions

- 1 Toby invested £7500 for 2 years in a savings account.
He was paid 4% per annum compound interest.

How much money did Toby have in his savings account at the end of 2 years?

(2 marks)

- 2 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?

(3 marks)

- 3 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?

(4 marks)

4 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.

(4 marks)

5 (a) Derek buys a house for £150 000

He sells the house for £154 500

Work out Derek's percentage profit.

(3 marks)

(b) Derek invests £154 500 for 2 years at 4% per year compound interest.

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

(3 marks)

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

Personal Bank Compound Interest 2% for each year	Secure Bank 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.

(3 marks)

7 (a) A virus on a computer is causing errors.
An antivirus program is run to remove these errors.

An estimate for the number of errors at the end of t hours is $10^6 \times 2^{-t}$

Work out an estimate for the number of errors on the computer at the end of 8 hours.

(2 marks)

(b) Explain whether the number of errors on this computer ever reaches zero.

(1 mark)

- 8 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.

(3 marks)

- 9 Zhi bought a house on 1st January 2017
When she bought the house, its value was 120 000 yuan.

The value of the house increased by 1.8% per year.

Work out the value of Zhi's house on 1st January 2020
Give your answer correct to 3 significant figures.

..... yuan

(3 marks)

- 10 Ali and Badia each have 25000 dollars to invest.

Cyclone Bank	Tornado Bank
Invest 25 000 dollars 4.5% compound interest per year for 3 years	Invest 25 000 dollars Receive 1150 dollars interest each year for 3 years

Ali invests in the Cyclone Bank for 3 years.
Badia invests in the Tornado Bank for 3 years.

By the end of the 3 years, Ali will have received more interest than Badia.

How much more?
Show your working clearly.
Give your answer correct to the nearest dollar.

..... dollars

(4 marks)

- 11** Hamish buys a new car for \$20 000
The car depreciates in value by 19% each year.

Work out the value of the car at the end of 3 years.
Give your answer to the nearest \$.

\$

(3 marks)

- 12 (a)** The price, £ P , of a car is £20 000 in 2019. The price is expected to decrease by 5% each year after 2019.

Jasmine says

This means the price in 2021 is expected to be £18 000.

She is incorrect.

Explain her error and work out the correct answer.

Her error is

The correct answer is £

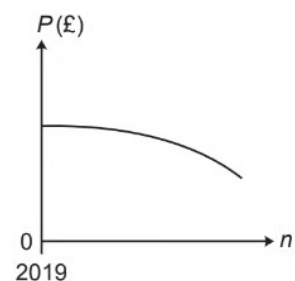
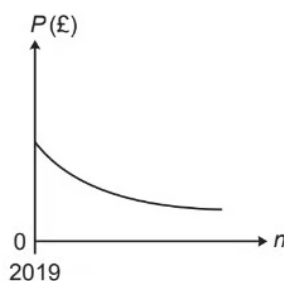
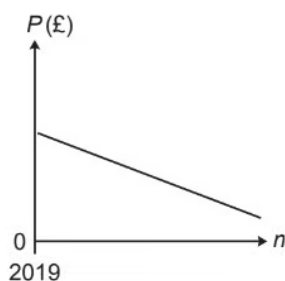
(4 marks)

- (b)** Write a formula for P in terms of n , where n is the number of years after 2019.

$P = \dots\dots\dots$

(2 marks)

- (c)** Circle the graph that best represents the price, £ P , of the car n years after 2019.



(1 mark)

13 (a) The value of a house, £ H , is given by the formula

$$H = 165\,000 \times 1.03^t$$

where t is the number of years after 1st January 2010.

Write down the value of the house on 1st January 2010.

£

(1 mark)

(b) Write down the annual percentage increase in the value of the house.

..... %

(1 mark)

(c) Show that the value of the house is over £200000 on 1st January 2017.

(1 mark)

14 Kay invests £1500 in an account paying 3% **compound** interest per year.
Neil invests £1500 in an account paying $r\%$ **simple** interest per year.

At the end of the 5th year, Kay and Neil's accounts both contain the same amount of money.

Calculate r .

Give your answer correct to 1 decimal place.

$r =$

(6 marks)

15 (a) Santandave have two types of accounts.

Both accounts pay compound interest.

Cash Savings Account	Shares Account
Interest	Interest
2.3% per annum	3.7% per annum

Aimee invests £1500 in the Cash Savings Account.

Jade invests £1000 in the Shares Account.

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

(4 marks)

(b) In the third year, the rate of interest for the shares account is changed to 5% per annum.

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

(1 mark)

16 A radioactive substance decays over time.

Every year its mass decreases by 12%.

How many **full years** will it take for 600kg of the substance to decay to a mass less than 350kg?

(3 marks)

Hard Questions

- 1 Viv wants to invest £2000 for 2 years in the same bank.

The International Bank Compound Interest 4% for the first year 1% for each extra year	The Friendly Bank Compound Interest 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?

(4 marks)

- 2 (a) The population of a city increased by 5.2% for the year 2014

At the beginning of 2015 the population of the city was 1 560 000

Lin assumes that the population will continue to Increase at a constant rate of 5.2% each year.

Use Lin's assumption to estimate the population of the city at the beginning of 2017
Give your answer correct to 3 significant figures.

(3 marks)

- (b)** i) Use Lin's assumption to work out the year in which the population of the city will reach 2000000
- ii) If Lin's assumption about the rate of increase of the population is too low, how might this affect your answer to (b)(i)?

(3 marks)

3 (a) 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

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

(3 marks)

(b) 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

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 marks)

4 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?

(4 marks)

- 5 (a)** Ian invested an amount of money at 3% per annum compound interest.
At the end of 2 years the value of the investment was £2652.25

Work out the amount of money Ian invested.

(3 marks)

(b) Noah has an amount of money to invest for five years.

Saver Account

4% per annum
compound interest.

Investment Account

21% interest paid at the
end of 5 years.

Noah wants to get the most interest possible.

Which account is best?

You must show how you got your answer.

(2 marks)

- 6 (a)** 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%.

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

(2 marks)

- (b)** 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.

Find the value of x .

Give your answer correct to 2 significant figures.

(3 marks)

- 7** Max invests \$6000 in a savings account for 3 years.
The account pays compound interest at a rate of 1.5% per year for the first 2 years.

The compound interest rate changes for the third year.

At the end of 3 years, there is a total of \$6311.16 in the account.

Work out the compound interest rate for the third year.

Give your answer correct to 1 decimal place.

.....%

(3 marks)

- 8 Jan invests \$8000 in a savings account.
The account pays compound interest at a rate of $x\%$ per year.

At the end of 6 years, there is a total of \$8877.62 in the account.

Work out the value of x .

Give your answer correct to 2 decimal places.

$x = \dots\dots\dots$

(3 marks)

- 9 (a) Amelia buys a new car.
The expected future value of this car, £ V , is given by

$$V = 16\,000 \times 0.75^t$$

where t is the age of the car in complete years.

- i) Write down the value of the car when new.

£ [1]

- ii) Write down the annual percentage decrease in the expected value of the car.

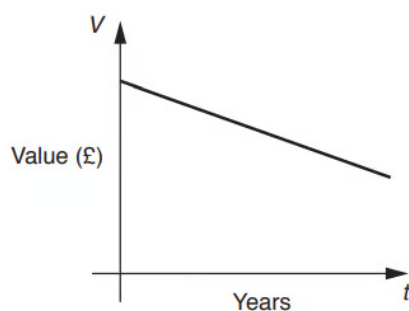
[1]

(2 marks)

- (b) Show that the expected value of the car when 2 years old is £9000.

(2 marks)

(c) Amelia sketches a graph to show the expected value of her car as it gets older.



Explain how you know that Amelia's graph is incorrect.

(1 mark)

(d) Amelia assumes that her car will have no value at all after 20 years.

Explain why her assumption is mathematically incorrect.

(1 mark)

- 10 (a)** On 1st November 2015 there were 4200 trees planted in a wood. On 1st November 2016, only 3948 of these trees were still alive.

It is assumed that the number of trees still alive is given by

$$N = ar^t$$

where N is the number of trees still alive t years after 1st November 2015.

Write down the value of a .

(1 mark)

- (b)** Show that r is 0.94.

(2 marks)

- (c)** Show that on 1st November 2030 the number of trees still alive is predicted to have decreased by over 60% compared with 1st November 2015.

(3 marks)

11 (a) Here are the interest rates for two accounts.

Account A	Account B
Interest: 3% per year compound interest.	Interest: 4% for the first year, 3% for the second year and 2% for the third year.
No withdrawals until the end of three years.	Withdrawals allowed at any time.

Derrick has £10000 he wants to invest.

Calculate which account would give him most money if he invests his money for 3 years.
Give the difference in the interest to the nearest penny.

Account by p

(5 marks)

(b) Explain why he might **not** want to use Account A.

(1 mark)

Very Hard Questions

- 1 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 .

(3 marks)

- 2 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 £12336

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?

(4 marks)

- 3 (a) Jack bought a new boat for £12 500

The value, £ V , of Jack's boat at the end of n years is given by the formula

$$V = 12500 \times (0.85)^n$$

At the end of how many years was the value of Jack's boat first less than 50% of the value of the boat when it was new?

(2 marks)

- (b)** A savings account pays interest at a rate of $R\%$ per year.
Jack invests £5500 in the account for one year.

At the end of the year, Jack pays tax on the interest at a rate of 40%.
After paying tax, he gets £79.20

Work out the value of R .

(3 marks)

- 4 (a)** Katy invests £2000 in a savings account for 3 years.

The account pays compound interest at an annual rate of

2.5% for the first year

$x\%$ for the second year

$x\%$ for the third year

There is a total amount of £2124.46 in the savings account at the end of 3 years.

Work out the rate of interest in the second year.

(4 marks)

- (b)** Katy goes to work by train.

The cost of her weekly train ticket increases by 12.5% to £225

Work out the cost of her weekly train ticket before this increase.

(4 marks)

- 5** Himari invests 200 000 yen for 3 years in a savings account paying compound interest. The rate of interest is 1.8% for the first year and $x\%$ for each of the second year and the third year.

The value of the investment at the end of the third year is 209 754 yen.

Work out the value of x

Give your answer correct to one decimal place.

$x = \dots\dots\dots$

(3 marks)

6 (a) At the start of 2018, the population of a town was 17150.

At the start of 2019, the population of the town was 16807.

It is assumed that the population of the town is given by the formula

$$P = ar^t$$

where P is the population of the town t years after the start of 2018.

Write down the value of a .

(1 mark)

(b) Show that $r = 0.98$.

(1 mark)

(c) Show that the population is predicted to be less than 16 000 at the start of 2022.

(2 marks)

(d) Use the formula to work out what the population might have been at the start of 2017.

(2 marks)