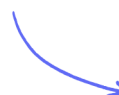


Simple & Compound Interest, Growth & Decay

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

Medium (23 questions)	/65
Hard (7 questions)	/31
Very Hard (18 questions)	/66
Total Marks	/162

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Medium Questions

- 1 A town has a population of 45 000. This population increases exponentially at a rate of 1.6% per year.

Find the population of the town at the end of 5 years. Give your answer correct to the nearest hundred.

(3 marks)

- 2 The population of a town decreases exponentially at a rate of 1.7% per year.

The population now is 250 000.

Calculate the population at the end of 5 years.

Give your answer correct to the nearest hundred.

(3 marks)

- 3 Paula invests \$600 at a rate of $r\%$ per year simple interest.
At the end of 10 years, the total interest earned is \$90.

Find the value of r .

$r = \dots\dots\dots$

(2 marks)

- 4 Eric invests an amount in a bank that pays compound interest at a rate of 2.16% per year.

At the end of 5 years, the value of his investment is \$6999.31.

Calculate the amount Eric invests.

\$

(3 marks)

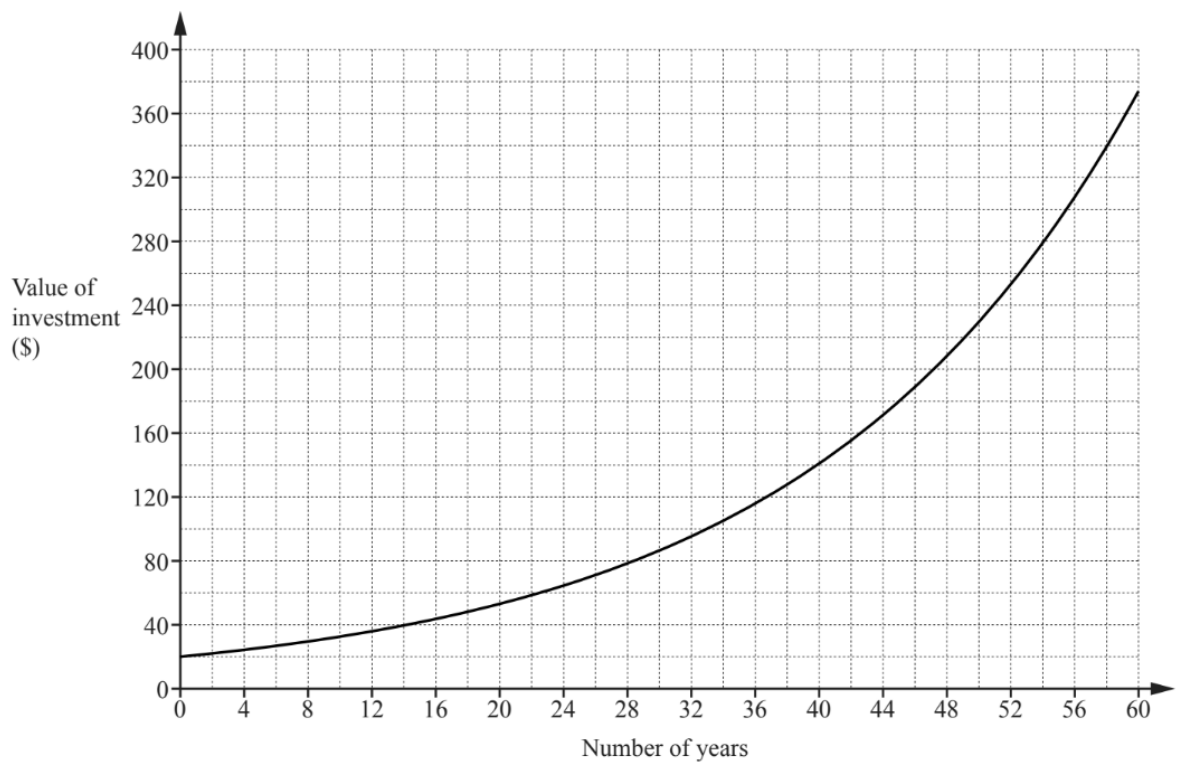
- 5 Jan invests \$800 at a rate of 3% per year simple interest.

Calculate the value of her investment at the end of 4 years.

\$

(3 marks)

6 (a)



When Heidi was born, her grandfather invested some money in an account that paid compound interest.

The graph shows the exponential growth of this investment.

i) Use the graph to find the original amount of money invested,

\$ [1]

ii) Use the graph to find the number of years it took for the original amount to double,

..... years [1]

(2 marks)

(b) This account earned compound interest at a rate of $r\%$ per year.

Use your answers to **part (a)(i)** and **part (a)(ii)** to write down an equation in terms of r .
You do not have to solve your equation.

(2 marks)

- 7** There are 30 000 lions in Africa.
The number of lions in Africa decreases exponentially by 2% each year.
- Find the number of lions in Africa after 6 years.
Give your answer correct to the nearest hundred.

(2 marks)

- 8** Newton has a population of 23 000.
The population decreases exponentially at a rate of 1.4% per year.
- Calculate the population of Newton after 5 years.

(2 marks)

- 9** 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)

10 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)

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

He finds information about two savings accounts.

Simple Simple interest 2.3% each year	Compound Compound interest 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)

12 (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)

13 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)

- 14** 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)

- 15** Gretal invests \$5000 at a rate of 2% per year compound interest.

Calculate the value of her investment at the end of 3 years.

\$

(2 marks)

- 16** Dean invests \$500 for 10 years at a rate of 1.7% per year simple interest.

Calculate the total interest earned during the 10 years.

\$

(2 marks)

- 17** Boris invests \$550 at a rate of 2% per year simple interest.

Calculate the value of the investment at the end of 10 years.

\$

(3 marks)

- 18** Marlene invests \$550 at a rate of 1.9% per year compound interest.

Calculate the value of the investment at the end of 10 years.

\$

(2 marks)

- 19** Dina invests \$600 for 5 years at a rate of 2% per year compound interest.

Calculate the value of this investment at the end of the 5 years.

\$

(2 marks)

- 20** Scott invests \$500 for 7 years at a rate of 1.5% per year simple interest.

Calculate the value of his investment at the end of the 7 years.

\$.....

(3 marks)

- 21** The population of a city is increasing exponentially at a rate of 2% each year.
The population now is 256 000.

Calculate the population after 30 years.
Give your answer correct to the nearest thousand.

(3 marks)

- 22** Roland invests \$12 000 in an account that pays compound interest at a rate of 2.2% per year.

Calculate the value of his investment at the end of 6 years.
Give your answer correct to the nearest dollar.

\$

(3 marks)

- 23** Sara invests \$500 for 15 years at a rate of 2% per year simple interest.

Calculate the total interest Sara receives.

\$

(2 marks)

Hard Questions

1 (a) Hong has \$4000 to invest.

She invests \$2000 at a rate of 2.5% per year **simple** interest.

She also invests \$2000 at a rate of 2% per year **compound** interest.

i) Find the value of each investment at the end of 8 years.

Simple interest investment \$

Compound interest investment \$[5]

ii) Find the overall percentage increase in the \$4000 investment at the end of 8 years.

.....% [2]

(7 marks)

(b) Find the number of complete years it takes for the compound interest investment of \$2000 to become greater than \$2500.

[3]

(3 marks)

2 Beth invests \$2000 at a rate of 2% per year compound interest.

i) Calculate the value of this investment at the end of 5 years.

\$ [2]

ii) Calculate the overall percentage increase in the value of Beth's investment at the end of 5 years.

..... % [2]

iii) Calculate the minimum number of complete years it takes for the value of Beth's investment to increase from \$2000 to more than \$2500.

[3]

(7 marks)

3 Ollie invests \$200 at a rate of 0.0035% per day compound interest.

Calculate the value of Ollie's investment at the end of 1 year. [1 year = 365 days.]

\$

(2 marks)

- 4 The value of a gold ring increases exponentially at a rate of 5% per year. The value is now \$882.

i) Calculate the value of the ring 2 years ago.

\$ [2]

ii) Find the number of complete years it takes for the ring's value of \$882 to increase to a value greater than \$1100.

[2]

(4 marks)

- 5 Mohsin's earnings increase exponentially at a rate of 8.7% each year. During 2018 he earned \$195 600.

During 2027, how much **more** does he earn than during 2018?

\$

(3 marks)

- 6 Bryan invested \$480 in an account 4 years ago. The account pays compound interest at a rate of 2.1% per year. Today, he uses some of the money in this account to buy a bicycle costing \$430.

Calculate how much money remains in his account.

\$

(3 marks)

- 7 In a city the population is increasing exponentially at a rate of 1.6% per year.
Find the overall percentage increase at the end of 20 years.

..... %

(2 marks)

Very Hard Questions

- 1 Alain invests \$5000 at a rate of $r\%$ per year compound interest. At the end of 15 years, the value of the investment is \$7566.

Find the value of r .

$r = \dots\dots\dots$

(3 marks)

- 2 Paddy and Anna each invest \$2000 for 5 years.
Paddy earns simple interest at a rate of 1.25% per year.
Anna earns compound interest at a rate of $r\%$ per year.
At the end of 5 years, Paddy's investment is worth the same as Anna's investment.

Calculate the value of r .

$r = \dots\dots\dots$

(5 marks)

- 3** 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)

- 4 (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)

- 5** Jean invests £12000 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)

6 (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)

- 7 Alan invests \$200 at a rate of r per year compound interest.
After 2 years the value of his investment is \$206.46.

Show that $r^2 + 200r - 323 = 0$.

(3 marks)

- 8 The population of a village decreases exponentially at a rate of 4% each year.
The population is now 255.

Calculate the population 16 years ago.

(3 marks)

- 9 The population of the Earth in 2017 was estimated to be 7.53×10^9 .
The population of the Earth in 2000 was estimated to be 6.02×10^9 .
Assume that the population of the Earth increased exponentially by $y\%$ each year for these 17 years.

Find the value of y .

$$y = \dots\dots\dots$$

(3 marks)

- 10** Edna invests \$500 at a rate of $r\%$ per year compound interest. At the end of 6 years, the value of Edna's investment is \$559.78.

Find the value of r .

$$r = \dots\dots\dots$$

(3 marks)

- 11** The value of the campsite has increased exponentially by 1.5% every year since it opened 30 years ago.

Calculate the value of the campsite now as a percentage of its value 30 years ago.

$$\dots\dots\dots \%$$

(2 marks)

- 12** The value of Dhanu's model railway is \$550.
This value increases exponentially at a rate of $r\%$ per year.
At the end of 5 years the value will be \$736.

Calculate the value of r .

$$r = \dots\dots\dots$$

(3 marks)

- 13** Hans invests \$550 at a rate of $x\%$ per year compound interest. At the end of 10 years, the value of the investment is \$638.30, correct to the nearest cent.

Find the value of x .

$x = \dots\dots\dots$

(3 marks)

- 14** The population of a village is 6400.
The population is decreasing exponentially at a rate of $r\%$ per year.
After 22 years, the population will be 2607.

Find the value of r .

$r = \dots\dots\dots$

(3 marks)

- 15** The number of a particular newspaper sold decreases exponentially by $x\%$ each year.
Over a period of 21 years the number of newspapers sold decreases from 1 763 000 to 58 000.

Calculate the value of x .

$x = \dots\dots\dots$

(3 marks)

- 16 A bacteria population increases exponentially at a rate of $r\%$ each day.
After 32 days, the population has increased by 309%.

Find the value of r .

$r = \dots\dots\dots$

(3 marks)

- 17 Over a period of 3 years, a company's sales of biscuits increased from 15.6 million packets to 20.8 million packets.
The sales increased exponentially by the same percentage each year.

Calculate the percentage increase **each year**.

$\dots\dots\dots\%$

(3 marks)

- 18 Tomas has two cars.

i) The value, today, of one car is \$21 000.

The value of this car **decreases** exponentially by 18% each year.

Calculate the value of this car after 5 years. Give your answer correct to the nearest hundred dollars.

\$ $\dots\dots\dots$ [3]

ii) The value, today, of the other car is \$15 000.

The value of this car **increases** exponentially by $x\%$ each year. After 12 years the value of the car will be \$42 190.

Calculate the value of x .

$x = \dots\dots\dots$ [3]

(6 marks)