

Topic 1: Number and algebra

Topic number	Content
1.1	Natural numbers \mathbb{N} . Integers \mathbb{Z} , rational numbers \mathbb{Q} , and real numbers \mathbb{R}
1.2	Approximation: decimal places, significant figures Percentage errors Estimation
1.3	Expressing numbers in the form $a \times 10^k$, where $1 \leq a < 10$ and k is an integer (scientific notations) Operations with numbers in this form. (calculator notation is NOT acceptable.)
1.4	SI (<i>Systeme International</i>) and other basic units of measurement: for example, kilogram (kg), metre (m), second (s), litre (l), metre per second (ms^{-1}), Celsius scale, we call SI the metric system
1.5	Currency conversions
1.6	Use of a GDC (graphing calculator) to solve <ul style="list-style-type: none"> • Pairs of linear equations in two variables • Quadratic equations
1.7	Arithmetic sequences and series, and their applications. Use of the formulae for the n th term and the sum of the first n terms of the sequence.
1.8	Geometric sequences and series Use of the formulae for the n th term and the sum of the first n terms of the sequence.
1.9	Financial applications of geometric sequences and series: <ul style="list-style-type: none"> • Compound interest • Annual depreciation

Brain Dump:

To get to the finance app on the calculator, push the APP key, choose 1: Finance and 1: TVM solver

N = number of years multiplied by how often compounded (monthly=12, quarterly = 4...)

Currency conversions are done with T-charts, just like unit conversions

Formulas for sequences and series are on the formula sheet- don't memorize

Formula for percentage error is on the formula sheet- don't memorize

1. Yun Bin invests 5000 euros in an account which pays a nominal annual interest rate of 6.25%, **compounded monthly**.

Give all answers correct to two decimal places.

Find

a) The value of the investment after 3 years; (3 marks)

b) The difference in the final value of the investment if the interest was compounded quarterly at the same nominal rate. (3 marks)

2. Let $p = \frac{2\cos x - \tan x}{\sqrt{y} - z}$

a) Calculate the value of p when $x = 45^\circ$, $y = 8192$ and $z = 64$. Write down your full calculator display. (2 marks)

b) Write down your answer to part (a)

i. Correct to two decimal places;

ii. Correct to four significant figures;

iii. In the form $a \times 10^k$, where $1 \leq a < 10$, $k \in \mathbb{Z}$ (4 marks)

3. In this question give all answers correct to two decimal places.

Dumisani has received a scholarship of 5000 US dollars (USD) to study in Singapore. He has to travel from South Africa and must change USD for his airfare of 6600 South African rand (ZAR).

The exchange rate is 1 USD=8.2421 ZAR

- a) Calculate the number of USD that Dumisani must change to pay for his airfare. (2 marks)

On arrival in Singapore, Dumisani changes 3000 USD to Singapore dollars (SGD) to pay for his school fees. There is a 2.8% commission charged on the exchange.

- b) Calculate the value, **in USD**, of the commission that Dumisani has to pay. (2 marks)

The exchange rate is 1 USD=1.29903 SGD.

- c) Calculate the number of SGD Dumisani receives. (2 marks)

4. Ludmila takes a loan of 320 000 Brazilian Real (BRL) from a bank for two years at a nominal annual interest rate of 10% compounded half yearly.

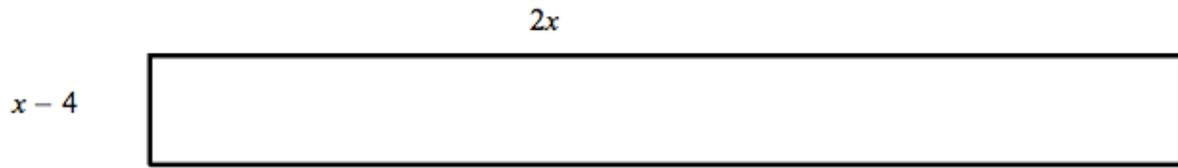
- a) Write down the number of time interest is added to the loan in the two years. (1 mark)
- b) Calculate the **exact** amount of money that Ludmila must repay at the end of the two years. (3 marks)

Ludmila estimates that she will have to repay 360 000 BRL at the end of the two years.

- c) Calculate the percentage error in her estimate. (2 marks)

5. The surface of a red carpet is shown below. The dimensions of the carpet are in metres.

Diagram not to scale



- a) Write down an expression for the area, A , in m^2 , of the carpet. (1 mark)

The area of the carpet is $10 m^2$.

- b) Calculate the value of x . (3 marks)

- c) Hence, write down the value of the length and the width of the carpet, in metres. (2 marks)

6. In this question give all answers correct to the nearest whole number,

- a) Fumie is going for a holiday to Great Britain. She changes 100 000 Japanese Yen (JPY) into British Pounds (GBP) with no commission charged,

The exchange rate between GBP and JPY is

$$1 \text{ GBP} = 120 \text{ JPY}$$

Calculate the value of 100 000 JPY in GBP.

(2 marks)

- b) At the end of Fumie's holiday in Great Britain she has 239 GBP. She converts this back to JPY at a bank, which does not charge commission, and receives 30 200 JPY.

i. Find the exchange rate of this second transaction.

- ii. Determine, when changing GBP back to JPY, whether the exchange rate found in part (b)(i) is better value for Fumie than the exchange rate in part (a). Justify your answer, (4 marks)

7. $z = \frac{17x^2}{a-b}$.

a) Find the value of z when $x = 12.5$, $a = 0.572$ and $b = 0.447$.
Write down your full calculator display. (2 marks)

b) Write down your answer to part (a)
i. Correct to the nearest 1000;

ii. Correct to three significant figures. (2 marks)

c) Write your answer to **part (b)(ii)** in the form $a \times 10^k$ where $1 \leq a < 10$, $k \in \mathbb{Z}$.
(2 marks)

8. The fourth term, u_4 , of a geometric sequence is 135. The fifth term, u_5 , is 101.25.

a) Find the common ratio of the sequence. (2 marks)

b) Find u_1 , the first term of the sequence. (2 marks)

c) Calculate the sum of the first 10 terms of the sequence. (2 marks)

9. In an arithmetic sequence, the fifth term, u_5 , is greater than the first term u_1 . The difference between these terms is 36.

a) Find the common difference, d . (2 marks)

The tenth term of the sequence is double the seventh term.

b)

i. Write down an equation in u_1 and d to show this information,

ii. Find u_1 (4 marks)

10. Consider the numbers $3, -5, \sqrt{7}, 2^{-3}$ and 1.75 .

Complete the table below, placing a tick (\checkmark) to show which of the number sets, \mathbb{N}, \mathbb{Q} and \mathbb{R} these numbers belong to. The first row has been completed as an example. (6 marks)

	\mathbb{N}	\mathbb{Q}	\mathbb{R}
3	\checkmark	\checkmark	\checkmark
-5			
$\sqrt{7}$			
2^{-3}			
1.75			

11. Given $p = x - \frac{\sqrt{y}}{z}$, $x = 1.775$, $y = 1.44$ and $z = 48$,

a) Calculate the value of p . (2 marks)

Barry **first** writes x , y and z correct to one significant figure and **then** uses these values to estimate the value of p .

b)

i. Write down x , y and z each correct to one significant figure.

ii. Write down Barry's estimate of the value of p . (2 marks)

c) Calculate the percentage error in Barry's estimate of the value of p . (2 marks)

12.

a) List the elements of the set $A = \{x \mid -4 \leq x \leq 2, x \text{ is an integer}\}$ (1 mark)

A number is chosen at random from set A

Write down the probability that the number chosen is

b) A negative integer; (2 marks)

c) A positive even integer; (1 mark)

d) An odd integer less than -1 . (2 marks)

13. The seventh term, u_7 , of a geometric sequence is 108. The eighth term, u_8 , of the sequence is 36.

a) Write down the common ratio of the sequence. (1 mark)

b) Find u_1 . (2 marks)

The sum of the first k terms in the sequence is 118096.

c) Find the value of k . (3 marks)

14. A teacher earns an annual salary of 45 000 USD for the first year of her employment. Her annual salary increases by 1750 USD each year.

a) Calculate the annual salary for the fifth year of her employment. (3 marks)

She remains in this employment for 10 years.

b) Calculate the total salary she earns in this employment during these 10 years. (3 marks)