

# 1.4 Financial Applications

## Question Paper

Course	DPIB Maths
Section	1. Number & Algebra
Topic	1.4 Financial Applications
Difficulty	Medium

**Time allowed:** 80  
**Score:** /64  
**Percentage:** /100

**Question 1a**

At the start of 2021 Maro wants to open a savings account. Bank A offers him an account with 3.5% annual simple interest with an initial deposit of \$5000, and Bank B offers him an account with 2.5% nominal annual interest with an initial deposit of \$4000, **compounding annually**. The interest for both accounts is paid in monthly deposits.

- (a) Calculate the amount of money Maro would have saved by the start of 2030 if he opens the Bank A account.

[2 marks]

**Question 1b**

- (b) Calculate the amount of money Maro would have saved by the start of 2035 if he opens the Bank B account.

[2 marks]

**Question 1c**

- (c) Find the year in which the amount in the Bank B account would surpass the amount in the Bank A account.

[3 marks]

**Question 2a**

Daniel and Jonah have each been given \$5000 to save for university.

Daniel invests his money in an account that pays a nominal annual interest rate of 2.24%, **compounded quarterly**.

(a) Calculate the amount Daniel will have in his account after 8 years. Give your answer to 2 decimal places.

[3 marks]

**Question 2b**

Jonah wants to invest his money in an account such that his investment will double in 10 years. Assume the account pays a nominal annual interest of  $r\%$ , **compounded half-yearly**.

(b) Determine the value of  $r$ .

[3 marks]

**Question 3a**

Alice buys a new coffee machine for \$4499. The value of the coffee machine depreciates by 9% each year.

- (a) Find the value of the coffee machine after 5 years. Give your answer correct to 2 decimal places.

[2 marks]

**Question 3b**

- (b) Find the number years and months it will take for the value of the coffee machine to be approximately \$999.

[3 marks]

**Question 3c**

The shop offers Alice a finance option in the form of a 1 year loan. Terms of the loan are:

- a 17.2% nominal annual interest rate, **compounded monthly**
- repayments to be made each month

(c) Find the cost of each monthly repayment. Give your answer correct to 2 decimal places.

[2 marks]

**Question 4a**

A new car costs \$20 000 and its value depreciates to \$14 792 after 2 years.

(a) Calculate

- (i) the annual rate of depreciation of the car
- (ii) the value of the car after 5 years. Give your answer correct to 2 decimal places.

[3 marks]

**Question 4b**

(b) Find the number of years and months it will take for the car's value to be approximately \$4000.

[3 marks]

**Question 4c**

Gus purchases the new car from a dealership who offers him a finance option in the form of a 3 year loan. Terms of the loan are:

- a 9% nominal annual interest rate, **compounded monthly**
- repayments to be made each month

(c) Find the monthly repayment that would have to be made. Give your answer correct to 2 decimal places.

[2 marks]

**Question 5a**

**In this question, give all answers to two decimal places.**

Biddy decides to purchase a new van from a dealership which costs \$18 000, however she cannot afford the full amount.

The dealership offers her a finance option in the form of a 4 year loan. Terms of the loan are:

- a 12% nominal annual interest rate, **compounded quarterly**
- a 15% deposit
- repayments to be made each quarter

(a) Calculate the loan amount Biddy would receive.

[2 marks]

**Question 5b**

(b) (i) Find the repayment that would have to be made each quarter.

(ii) Find the total amount paid for the van.

[5 marks]

**Question 6a**

**In this question, give all answers to two decimal places.**

On his 40th birthday, Robert invests \$15 000 into a savings account that pays a nominal annual interest rate of 4.78%, **compounded monthly**.

- (a) (i) Write an expression for the total value of the investment after  $n$  years.
- (ii) Find the total amount in the savings account after 3 and 5 years.

[3 marks]

**Question 6b**

- (b) Find the age Robert will be when the amount of money in his account is 1.5 times the initial amount.

[2 marks]



**Question 6c**

Robert would earn the same amount of interest, **compounded quarterly**, for 5 years if he deposits his money in a second savings account.

(c) Calculate the nominal annual interest rate from the second savings account.

[3 marks]

**Question 7a**

Fraser decides to invest in a retirement plan for 25 years. In this plan, he will deposit \$500 at the end of every month, on which he will receive 5.5% nominal annual interest, **compounded monthly**.

(a) Find the value of the investment at the end of the 25 years. Give your answer correct to 2 decimal places.

[3 marks]

**Question 7b**

After the 25 year period, Fraser will start receiving regular monthly payments of \$1250.

(b) Find the number of years it will take for Fraser's monthly retirement payments to match the total value of the investment at the end of the 25 years.

[2 marks]

**Question 7c**

(c) Find the number of years it will take for Fraser's monthly retirement payments to match the total amount he invested.

[3 marks]

**Question 8a**

**In this question, give all answers to two decimal places.**

Lily takes a mortgage of \$220 000 to purchase a house at a nominal annual interest rate of 4.18%, **compounded monthly**. She agrees to pay the bank \$1600 at the end of every month to amortise the loan.

(a) Find

- (i) the number of years and months it will take Lily to pay back the loan
- (ii) the total amount that Lily will pay to purchase the house.

[4 marks]

**Question 8b**

Lily wants to pay off the loan within 10 years.

(b) Calculate the new monthly payment required to do this and justify this decision.

[3 marks]

**Question 9a**

At the beginning of each year, Nala invests \$2500 in a savings account that pays a nominal annual rate of 3.5%, **compounded half-yearly**.

(a) Find the number of years it will take until Nala has \$80 000 in her account.

[3 marks]

**Question 9b**

At the beginning of each year, Jessica invests \$3500 in a savings account that pays a nominal annual interest rate of  $r\%$ , **compounded quarterly**. After 20 years Jessica has \$120 000 in her account.

(b) Determine the value of  $r$ .

[3 marks]