Student Name: _____

GENERAL MATHEMATICS 2024

Unit 3
Key Topic Test 6 – Recursion and Financial Modelling: Compound Interest Investments and Loans

Recommended writing time: 45 minutes
Total number of marks available: 25 marks

QUESTION BOOK

> * The recommended writing time is a guide to the time students should take to complete this test. Teachers may wish to alter this time and can do so at their own discretion.

Conditions and restrictions
- Students are permitted to bring into the room for this test: pens, pencils, highlighters, erasers, sharpeners and rulers, approved CAS calculator and one bound reference book.
- Students are NOT permitted to bring into the room for this test: blank sheets of paper and/or white out liquid/tape.

Materials supplied
- Question and answer book of 8 pages.

Instructions
- Print your name in the space provided on the top of the front page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the room for this test.

SECTION A – Multiple-choice questions

Instructions for Section A
• All questions are worth one mark.
• Answer all questions by circling the correct response.
• Marks are not deducted for incorrect answers.
• No marks will be awarded if more than one answer is completed for any question

Question 1

$280 000 is invested in the bank earning interest of 4.2% p.a. compounding monthly. The balance after 5 years is closest to:

A. $284 934

B. $345 303

C. $3 305 378

D. $343 951

E. $338 800

Question 2

Jamie borrows $25 000 and agrees to terms of 12.2% interest p.a. compounding quarterly. After 3 years Jamie will fully repay the loan in one lump sum. The amount of interest that Jamie pays is closest to:

A. $10 852

B. $35 850

C. $48 734

D. $12 520

E. $11 241

Question 3

Craig has an amount owing on his credit card which accrues interest of 18.4% p.a. compounding monthly. He makes no further charges to his card and no repayments for 12 months before paying the balance of $6241.76. The amount Craig owed 12 months ago was closest to:

    A. $4860

    B. $822

    C. $5000

    D. $5200

    E. $5340

Use the following information to answer Questions 4 and 5

The recurrence relation below can be used to model V_n, the value of a compound interest loan after n months.

$$V_0 = 520\,000, \qquad V_{n+1} = 1.008V_n$$

Question 4

The balance of this loan after four years is

A. $536\,840.75

B. $762\,270.10

C. $724\,321.68

D. $589\,262.22

E. $621\,438.08

Question 5

The annual compound interest rate is:

    A. 0.8%

    B. 1.008%

    C. 9.6%

    D. 8%

    E. 9.2%

SECTION B - Short-answer questions

Instructions for Section B

- Answer each question in the space provided.
- Please provide appropriate workings and use exact answers unless otherwise specified.

Question 1   (5 marks)

Jackie secures a personal loan of $20 000 to purchase furniture for her new home. The loan accrues interest of 12.6% p.a. compounding monthly. She plans to repay the loan in one lump sum after 2 years.

a. State a recurrence relation to model the balance of the loan V_n, after n months.

_____

2 marks

b. Find the balance of the loan after 1 year.

_____

_____

1 mark

c. Find the total amount repaid on the loan.

_____

_____

1 mark

d. Find the amount of interest Jackie pays on the loan.

_____

_____

1 mark

$2 + 1 + 1 + 1 = 5$ marks

Question 2   **(5 marks)**

Jeff invests $36 000 in a portfolio that earns 8% p.a. compounding quarterly.

    a. State a recurrence relation to model the balance of the loan V_n, after n quarters.

_____

<div align="right">2 marks</div>

    b. Find the balance of the investment after 5 years

_____

_____

<div align="right">1 mark</div>

    c. Find the amount of time until the investment first exceeds $70 000

_____

_____

_____

<div align="right">2 marks</div>

<div align="right">$2 + 1 + 2 = 5$ marks</div>

Question 3   **(7 marks)**

Katie borrows $640 000 from the bank to purchase a new home. The bank charges 5.10% interest p.a. compounding monthly. Katie makes regular monthly repayments of $3800.

    a. State a recurrence relation to model the balance of the loan V_n, after n months.

_____

_____

<div align="right">2 marks</div>

    b. Find the balance of the loan after 10 years

_____

_____

<div align="right">1 mark</div>

    c. How long will it take for Katie to fully repay the loan?

_____

_____

_____

_____

<div align="right">2 marks</div>

    d. Find the total amount of interest that Katie pays on the loan. Answer to the nearest dollar.

_____

_____

_____

_____

<div align="right">2 marks</div>

<div align="right">$2 + 1 + 2 + 2 = 7$ marks</div>

Question 4 (3 marks)

Peter invests an amount in shares that earns i % interest p.a. compounding quarterly.
After 1 year the investment is worth $56 369.50.
After 2 years the investment is worth $66 198.34.

Find the initial amount invested and the interest rate i. Round your answers to 2 decimal places.

_____

_____

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_____

_____

_____

_____

3 marks

END OF KEY TOPIC TEST