Student Name: _____

TSSM
Creating VCE Success

GENERAL MATHEMATICS 2024

Unit 3
Key Topic Test 7 – Recursion and Financial Modelling: Annuities and Perpetuities

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.

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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.

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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
Maggie invests her retirement funds in a perpetuity that earns 4.2% per annum compounding quarterly. She receives quarterly payments of $8 200. The amount Maggie invested, rounded to the nearest thousand is:

A. $456 000

B. $802 000

C. $781 000

D. $745 000

E. $786 000

Question 2
Peter takes out an interest only loan on an investment property for $610 000. The loan has an interest rate of 5.86% p.a. compounding monthly. The monthly repayment would be closest to:

A. $2980

B. $2956

C. $2678

D. $2979

E. $3021

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Use the following information to answer Questions 3 and 4

Jeff invests $225 000 in an annuity that will last for ten years. The annual interest rate offered to him is 3.8% per annum compounded monthly. Jeff receives monthly payments from the annuity.

Question 3

The monthly payment that Jeff receives is closest to:

A. $225 000

B. $2260

C. $2040

D. $1850

E. $2140

Question 4

The balance of Jeff's investment after 5 years is:

A. $225 000

B. $184 300.13

C. $118 252.22

D. $123 138.74

E. $113 223.75

Question 5

Amara invests $845 000 in an annuity at an annual rate of 2.4% per annum compounded monthly. She wishes to withdraw $3100 each month for her monthly expenses.

A recurrence relation that models Amara's annuity after *n* months is

A. $A_0 = 845\,000,\ A_{n+1} = 1.002A_n - 3100$

B. $A_0 = 845\,000,\ A_{n+1} = 1.024A_n - 3100$

C. $A_0 = 845\,000,\ A_{n+1} = 1.02A_n - 3100$

D. $A_0 = 845\,000,\ A_{n+1} = 1.0024A_n - 845\,000$

E. $A_0 = 845000,\ A_{n+1} = 1.024A_n - 845\,000$

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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 (9 marks)

Pam inherits $210 000 from her aunty and plans to invest it in an annuity. The table below shows the first two months of Pam's annuity investment.

Payment number	*Payment*	*Interest*	*Principal reduction*	*Balance of the annuity*
0	-	-	-	210 000
1	1800.00	1085	715	209 285
2	1800.00	1081.31	718.69	208 566.31
3	1800.00			

a. Show that the annual interest rate for this annuity is 6.2%.

_____

_____

1 mark

b. Calculate the balance of the annuity after payment number 3.

_____

_____

_____

_____

3 marks

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c. For how long will Pam continue to receive payments from this annuity?

_____

_____

_____

2 marks

d. Calculate the total interest that Pam received from this annuity.

_____

_____

_____

_____

3 marks

1 + 3 + 2 + 3 = 9 marks

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Question 2 (11 marks)

Campbell wishes to invest his retirement funds of $922 500 at a rate of 4.8% per annum compounded monthly. Campbell will withdraw $4800 at the end of each month for living expenses

a. Write down a recurrence relation that models the value, V_n, of his annuity after *n* months.

_____

_____

2 marks

The annuity table for Campbell's annuity is shown below.

Payment number	*Payment*	*Interest*	*Principal reduction*	*Balance of the annuity*
0	-	-	-	922 500.00
1	4800	3690.00	1110.00	921 390.00
2				

b. Complete the table above by filing in the row for payment number 2.

_____

_____

_____

3 marks

c. Calculate the amount of his annuity after 3 years.

_____

_____

_____

2 marks

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10 years after Campbell invests in this annuity, he increases his monthly payment to $5500.

d. Calculate the amount of his investment 15 years after he first invested.

_____

_____

_____

_____

1 mark

Campbell would prefer a regular payment that lasts forever under the original conditions.

e. Find the amount that he would receive each month.

_____

_____

_____

2 marks

f. Name this type of investment

_____

1 mark

2 + 3 + 2 + 1 + 2 + 1 = 11 marks

END OF KEY TOPIC TEST

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