



UNIT 3 & 4 SCHOOL ASSESSED COURSEWORK (SAC)

STUDENT NAME: _____

TEACHER NAME: _____

SUBJECT: FURTHER MATHEMATICS

TITLE OF TASK: Recursion and Financial Modelling

Reading Time: 10 minutes

Writing Time: 90 minutes

<i>Section</i>	<i>Number of questions</i>	<i>Number of marks</i>
A	11	Total 54

Instructions:

All students should receive a question and answer booklet including all required data.

No writing is permitted during reading time.

All questions to be answered in the booklet provided.

SAC to be completed under test conditions.

Materials allowed:

CAS Calculator (Ti-Nspire)

Scientific Calculator

Class Workbook

Students are **NOT** permitted to bring mobile phones and/or any other unauthorized electronic devices into the examination room.

*Please note score listed is "conditional" – coursework scores may change following statistical moderation.

Question one:

Andrew has borrowed \$7500 to purchase a car. He is being charged 12% p.a. with interest compounding monthly. He will make monthly payments of \$1545 over 5 months. The first payment calculations are shown in the table below.

Payment number	Payment amount	Interest paid	Principal reduction	Balance of loan
0	0	0	0	7500.00
1	1545	75	1470	6030.00
2	1545	60.30		4545.30
3	1545		1499.55	3045.75
4	1545	30.46		
5	1545	15.31	1529.69	1.52

- (i) Fill in the missing entries in the amortisation table above. (2 marks)
- (ii) In order to fully repay the loan after 5 payments, what should the last payment be? (1 mark)
- (iii) Find the total cost of repaying the loan. (1 mark)
- (iv) Find the total amount of interest paid in repaying the loan. (1 mark)

Question Two

The amortisation table below shows the growth of a quarterly compound interest investment with regular payments made to the principal each quarter.

Payment number	Payment made	Interest earned	Principal increase	Balance of investment
0	0	0	0	10000.00
1	500	200	700	10700.00
2	500	214	714	11414.00
3	500			
4	500	242.85		12885.13

- (i) State the original amount that was invested. (1 mark)
- (ii) What payment is added to the investment each quarter? (1 mark)
- (iii) Find the quarterly interest rate used. (1 mark)
- (iv) Fill in the missing entries in the table above. (2 marks)
- (v) Find the total amount of interest earned after 4th quarterly payment ie. 1 year. (2 marks)

Question Three

Koby business purchased a \$1500 laptop. The value of this laptop can be modelled by the recurrence relation:

$$V_0 = 1500 \quad V_{n+1} = V_n - 220,$$

- (i) What is the depreciation amount of the laptop each year? (1 mark)

(ii) Find the value of the laptop after 3 years. (1 mark)

(iii) The laptop will be sold when the value first drops below \$300. After how many years will the laptop be sold? (1 mark)

Question Four

The value of a car after n kilometres, V_n , can be calculated from the rule $V_n = 18000 - 0.20n$

(i) What was the purchase price of the car? (1 mark)

(ii) How much per kilometre is the car depreciating? (1 mark)

(iii) What is the value of the car after travelling 25,000 km in the first year of driving? (1 mark)

(iv) Find how many kilometres have been travelled when the car reaches a value of \$5400. (1 mark)

Question Five

Colin invested \$20,000 in an account that earns 3% p.a. compounded monthly.

(i) Write a recurrence relation for this investment. (2 marks)

- (ii) Using this recurrence relation to find the value of the investment after 5 months. (1 mark)
- (iii) Let V_n be the value of the investment after n months. Write down a rule for the value of the investment after n months. (1 mark)
- (iv) Using this rule or otherwise, find the value of the investment after 60 months. (1 mark)
- (v) How long will it take for the investment to double in value? (1 mark)

Question Six

Jackson borrowed \$570,000 to purchase his first house. Interest is charged at 3.6 % p.a. compounding monthly. Monthly repayments of \$2593 are made to pay off this loan.

- (i) Write down this loan as a recurrence relation. (2 marks)
- (ii) Find the amount of money paid off the loan *during* the 5th month. (2 marks)

- (iii) Use the Finance Solver to calculate how much is owing on the loan after 10 years. (1 mark)
- (iv) Calculate the amount of interest that will be paid off the loan during the first 10 years. (2 marks)
- (v) Find the length of time it will take to pay off the loan. (1 mark)
- (vi) Find the value of the last payment needed to pay off the loan. (1 mark)

Question Seven

Rudi wants to borrow \$50,000. He is looking at two reducing balance loan options:

Option A: 4.80 % p.a , compounding monthly

Option B: 4.75% p.a. compounding weekly

(i) Calculate the effective interest rate for each of the loan options, correct to 2 decimal places. (2 marks)

(ii) Which loan option would you recommend to Rudi? Why? (1 mark)

Question Eight

(i) Fiona has arranged a perpetuity investment at 5% p.a. to fund a scholarship for a Further Maths student each year. How much money does she need to invest in the perpetuity to receive interest each year of \$2000 to use for the scholarship? (1 mark)

(ii) How much money remains in the perpetuity after eight years? (1 mark)

Question Nine

Bridget borrows \$480,000 on a reducing balance loan of a 4% p.a. compounding fortnightly for 25 years.

(i) What repayment amount is needed to pay off this loan? (1 mark)

(ii) How much is owing after 8 years? (1 mark)

(iii) After 8 years the interest rate increases to 4.25 %. Find the new payment amount that will see her still repay the loan off in 25 years. (1 mark)

(iv) How much extra will Bridget now pay on her home loan over the term of 25 years? (2 marks)

Question Ten

Tony bought an investment property for \$620,000. He borrowed the entire \$620,000 at 3.25% p.a. on an 'interest only loan'.

(a) If interest is compounded monthly, calculate the monthly payments. (1 mark)

(b) Tony plans on selling the investment property after 5 years. Taking into account all the repayments he has made, what price would he need to sell the house for so he makes a profit? (1 mark)

Question Eleven

Nic and Ally recently got married and are excited to have found a house they want to buy. They are trying to be careful with their money and have narrowed the best two loans down to the following options.

Option 1:

Northpac Bank
2.45% p.a.
Interest compounded monthly
Monthly payments of \$3000

Option 2:

Bank of Geelong
2.6% p.a.
Interest compounded fortnightly
Fortnightly payments of \$1500

If Nic and Ally need to borrow \$525,000, investigate which will be the best option for them to choose.

(a) Calculate the length of time it takes to pay of each loan. (2 marks)

(b) Calculate the exact amount of money will Nic and Ally end up paying back for each loan? (4 marks)

(c) Which is the best loan for Nic and Ally to choose? Give reasons. (2 marks)

The end!

