Unit 3 Further Mathematics, Semester 1

Due date:

Total marks 29

UNIT 3 - 06

Question 1

The Freewings Flying Club borrow $75 000 to pay for an expansion to their hangar space. The amortisation table showing the first 5 payments on this loan is shown below.

Payment number	*Payment amount*	*Interest paid*	*Principal reduction*	*Balance of loan*
0	0	0	0	75 000.00
1	1500	450.00	*A*	73 950.00
2	1500	443.70	1056.30	72 893.70
3	*B*	437.36	2062.64	70 831.06
4	2500	424.99	2075.01	68 756.05
5	2500	412.54	2087.46	*C*

a) Use the information for payment number 0 and payment number 1 to:

(i) Calculate the monthly interest rate for this loan

(ii) Calculate the annual interest rate for this loan

(iii) Calculate the value of A, the amount by which the first payment reduces the balance of the loan

b) Determine the value of B, the amount of the third payment.

c) Show that the value of C, the balance of the loan after 5 payments, is $66 668.59, correct to the nearest cent.

(3+1+1 = 5 marks)

Question 2

Humpty Dumpty's son Tom inherited $35 000 and wanted to invest this money in either Alpha Bank or Beta Bank.

Alpha Bank offer an interest rate of 6.5% p.a. compounding quarterly while Beta Bank offer an interest rate of 6.4% p.a. compounding monthly.

a) Tom was told by his maths teacher that Alpha Bank offered the better terms. Using effective interest rates explain why the teacher's advice is correct.

b) Calculate as a percentage, correct to 2 decimal places, the minimum interest rate that Beta Bank would have to offer Tom for their terms to be better than that of Alpha Bank. Assume that the compounding periods do not change.

Tom invested the money in Alpha Bank.

c) Write a recurrence relation that could be used to model this investment, where V_n is the value of the investment after n quarters.

Tom planned to go on an extended holiday when his investment reached $45000.

d) How many years did it take for the investment to reach $45000?

(3 + 2 + 1 + 2 = 8 marks)

Question 3

Mary bought a new house with a lovely garden. The loan for the house is $450 000. The interest rate is 4.8% p.a. compounding monthly.

a) What will be her monthly repayments if she is to pay off the loan in 25 years?

b) If the interest rate was to increase to 5.0% p.a. by how much would her monthly repayments need to increase?

c) If Mary is charged interest at a rate of 4.8% per annum and agrees to pay $3 000 a month:
   (i) Will she have the loan fully paid off after 220 repayments? Justify your answer.

   (ii) What is the value of the final repayment to ensure the loan is fully repaid after 229 repayments?

(2 + 2 + 2 + 2 = 8 marks)

Question 4

Phil inherits a sum of $35 000.

a. He invests $20 000 in a perpetuity and receives $210 from it each quarter. What is the annual interest rate for this perpetuity?

b. Phil invests the remaining $15 000 and obtains interest at the rate of 5.4% per annum, compounding quarterly. What is this investment worth after 2 years?

c. **i.** Phil had the opportunity at the end of each quarter to add his perpetuity payment of $210 to his investment of $15 000 outlined in part **b**. If Phil had elected to do this, what would his investment have been worth after 2 years?

ii. How much more interest would Phil earn on his investment over the 2 years if he had elected to add, each quarter, the $210 to his initial investment of $15000?

Phil has a son who is going to university and needs financial assistance. He decides to use $10000 of his savings to buy an annuity that will provide his son with a regular fortnightly payment of $400.

d. If Phil is able to get an annuity at an interest rate of 6.9%per annum, calculated fortnightly, how long will the annuity last? Express your answer to the nearest whole number.

In order to upgrade some equipment at his business, Phil takes out a reducing balance business loan of $85 000 at 6.6% per annum interest.

He agrees to make 48 monthly payments of $2000.

e. **i.** After 48 months how much will Phil still owe the bank?

ii. If the loan is to be paid out with a final payment **one month later** find the amount required.

(1+1+1+2+1+1+1 = 8 marks)