

**Mathematics Applications Unit 3/4  
Test 5 2020**

Calculator Assumed  
Finance

**STUDENT'S NAME** \_\_\_\_\_

**DATE:** Friday 14<sup>th</sup> August

**TIME:** 55 minutes

**MARKS:** 52

**INSTRUCTIONS:**

Standard Items: Pens, pencils, drawing templates, eraser

Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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1. (7 marks)

- (a) What value must be invested into an account paying 5% simple interest if it accrues \$2390 interest over 8 years [2]
- (b) Calculate, to 2 decimal places, the annual compound interest rate required to see an initial investment of \$20 000 grow to \$48 000 in 10 years. [2]
- (c) Darren invests \$650 000 in an account that returns 4.2% p.a. compounded quarterly and withdraws an annual perpetuity. How much will Darren receive each year from this investment? [3]

2. (6 marks)

To save money for a car, Josh started an investment account which accrues 9.6% interest p.a. He placed an initial deposit of \$6000, and then deposited an extra \$200 at the end of each month for a year.

The table below shows the amount in the account at the beginning of each month ( $A_n$ ), the interest added to the account each month ( $I_n$ ), the deposit made at the end of each month ( $D_n$ ), and the amount in the account at the end of each month ( $A_{n+1}$ ) for the first 6 months.

Month ( $n$ )	Amount at beginning of month ( $A_n$ )	Interest for month ( $I_n$ )	Deposit for month ( $D_n$ )	Amount at end of month ( $A_{n+1}$ )
1	\$6000.00	\$48.00	\$200.00	\$6248.00
2	\$6248.00	\$49.98	\$200.00	\$6497.98
3	\$6497.98	\$51.98	\$200.00	\$6749.97
4	\$6749.97	\$54.00	\$200.00	\$7003.97
5	\$7003.97	\$56.03	\$200.00	\$7260.00
6	\$7260.00	\$58.08	\$200.00	\$7518.08

(a) What is the monthly interest rate? [1]

(b) Write a recursive rule to determine the amount in the account at the end of each month. [2]

(c) What is the amount in the account at the end of the 12 months? [1]

(d) What is the total amount of interest earned over the course of the year? [2]

3. (7 marks)

Bailey was selected to play on a TV game show. He wins a round called “Higher or Lower”, the prize for which was a 30 m yacht. The recursive formula  $B_{n+1} = 0.84B_n$ ,  $B_0 = 580000$  can be used to calculate the value of the yacht after  $n$  years.

(a) What is the significance of  $B_0 = 580000$ ? [2]

(b) State the annual rate of depreciation of the yacht. [1]

(c) To the nearest thousand dollars, what is the value of his yacht after 4 years? [2]

(d) When the value of the yacht has fallen below \$200 000, Bailey sells the yacht. For how many years did he have the yacht? [2]

4. (8 marks)

A sum of \$100 000 was borrowed at an interest rate of 12% p.a. It was agreed that the loan had to be repaid by equal investments over 20 years. The repayment options were as follows and interest is compounded at the same frequency as the repayments:

Option 1	Annual repayments of \$13387.88
Option 2	Quarterly repayments of \$3311.17
Option 3	Monthly repayments of \$1101.09

(a) Calculate, for each option, the total amount that must be paid back to the loan and state the cheapest option. [3]

(b) For the option chosen in part (a), calculate the balance owing after

(i) 2 years. [2]

(ii) 20 years. [2]

(c) Explain why the amount owing after 20 years is not \$0. [1]

5. (8 marks)

Aiden plans to complete a university course over a period of 3 years. He estimates that he will require \$250 per week over the three years to cover living expenses, which he will draw from an investment account that accrues 7.5% p.a. compounded weekly.

- (a) How much, to the nearest thousand dollars, must he initially deposit into the account to cover the cost of his living expenses? [2]
- (b) How much will Aiden withdraw from the account over the 3-year period. [1]
- (c) Write a recurrence relation that will allow Aiden to keep track of his weekly balances in the account. [3]
- (c) What is the balance of Aiden's account halfway through his first year of university? [2]

6. (16 marks)

Dylan has a mortgage of \$600 000 on his luxury apartment. The table given below shows the state of his reducible balance mortgage account for month 117 of his loan. Assume that the interest rate remains unchanged throughout the life of the loan. Dylan repays \$6000 per month.

<b>Month</b>	<b>Initial Amount Owing</b>	<b>Interest Added</b>	<b>Repayment</b>	<b>Final Amount Owing</b>
117	\$316 516.02	\$2347.29	\$6000	\$312 863.52

(a) Calculate the annual interest rate charged, rounded to 2 decimal places. [2]

(b) How much is the principal reduced over the 118<sup>th</sup> month? [2]

(c) Determine in which month Dylan will reduce the amount owing to less than half the original amount borrowed and the value of the account at the end of this month. [3]

In the month that Dylan reduces the loan to less than half its original value he loses his job in the pandemic and from the next month converts his loan to an “interest only” non-reducible loan. This means his monthly repayments are just enough to cover the interest charged for that month.

(d) What is the monthly repayment that Dylan makes during this time? [2]

After 6 months of “interest only” payments, Dylan is again able to make reducible balance repayments, now \$7000 per month to his loan.

(e) How long will it take Dylan to pay off the loan entirely? [3]

(f) What will be the value final repayment of the loan? [2]

(g) Calculate the total interest Dylan will pay on the loan. [2]