Financial mathematics - practice test 4

Name: _____ Date: _____

10 questions | 60 marks | 75 minutes

Explain modelling errors and adapt recurrences to missed payments, changing rates and offsets.

Use a graphics calculator or appropriate digital tool for labelled tasks.

1. A saver says that 5% annual compound interest grows an amount by exactly 50% after 10 years because $5 \times 10 = 50$. [6 marks]

(a) Find the actual 10-year growth factor. [3 marks]

(b) Find the first whole year in which the balance is at least double. [3 marks]

2. A spreadsheet uses 0.06 as a monthly rate for a quote of 6% nominal annually compounded monthly. [6 marks]

(a) State and correct the error. [3 marks]

(b) Find the correct one-year balance of AUD 2,000. [3 marks]

3. An account starts with AUD 1,000 and earns 4% annually. Deposit AUD 300 at the ends of years 1 and 3, but nothing at year 2. [6 marks]

(a) Find the balance after year 2. [3 marks]

(b) Find the year 3 balance and explain why the usual three-payment annuity formula is unsuitable without an adjustment. [3 marks]

4. An account starts with AUD 2,000 and receives AUD 700 at each year end, earning 4%. Its goal is AUD 8,000. [6 marks]

(a) Find the first whole year reaching the goal. [3 marks]

(b) Check the balances at years 6 and 7. [3 marks]

5. Two two-year scenarios start at AUD 10,000 and add AUD 2,000 at each year end. Scenario A has returns of +10%, then −10%. Scenario B has returns of −10%, then +10%. [6 marks]

(a) Find both final balances. [3 marks]

(b) Explain why the same two returns give different outcomes. [3 marks]

6. AUD 30,000 earns 5% annually and pays AUD 4,000 at each year end. [6 marks]

(a) Find the first closing balance and the first principal reduction. [3 marks]

(b) Find the number of withdrawals needed to exhaust the balance if the final withdrawal is reduced. [3 marks]

7. A savings account starts at AUD 5,000, earns 3% annually and receives AUD 800 each year end. The year-end fixed fees are AUD 40, AUD 60 and AUD 80 in years 1-3. [6 marks]

Fees supplied

Year	Fee (AUD)
1	40
2	60
3	80

(a) Let B_k be the closing balance in year k and F_k that year's fee. Write the recurrence. [3 marks]

(b) Find the balance after year 3. [3 marks]

8. A sinking fund needs AUD 20,000 at time 6. It receives equal year-end deposits R for the first 3 years at 4%. The savings rate then becomes 2% for the final 3 years. [6 marks]

(a) If R was originally chosen assuming 4% throughout, calculate it and the time 3 balance. [3 marks]

(b) Find a revised equal deposit for the final 3 years that still reaches AUD 20,000. [3 marks]

9. A loan balance is AUD 4,000 at 1% monthly, but its monthly repayment is only AUD 30. [6 marks]

(a) Find the first two closing balances. [3 marks]

(b) Explain why a payoff-time solver cannot give a valid positive finite term under these assumptions. [3 marks]

10. A loan owes AUD 50,000; an offset holds AUD 8,000. Monthly interest is 0.5%, followed by an AUD 1,000 repayment. No interest is paid on the offset. [6 marks]

(a) Find the first month’s interest and closing loan balance. [3 marks]

(b) Find the debt minus offset after this payment, and explain what the offset does not change. [3 marks]