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**MATHEMATICS  
APPLICATIONS**

**Test 6 – Finance**

**Chapter 7 & 8**

**Semester 2 2018**

**Calculator Assumed**

Time allowed

Working time for this section: 55 minutes

Marks available: 60 marks

## Material required/recommended for this section

##### To be provided by the supervisor

This Question/Answer booklet

Formula sheet

##### To be provided by the candidate

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid, ruler, highlighters

Special items: drawing instruments, templates, notes on one unfolded sheet of A4 paper, and up to three calculators satisfying the conditions set by the Curriculum Council for this course.

## Important note to candidates

No other items may be used in this section of the examination. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

1. (8 marks)   
   Consider the recursive formula , This recursive formula can be used to calculate the value of an investment compounded annually for *t* years.
   1. What amount is being invested? [1]
   2. What annual interest rate is being applied? [1]
   3. What will be the value of this investment after 8 years? [1]
   4. How much interest is earned after 8 years? [1]
   5. How much interest is earned during the 8th year? [1]

Consider the terms of this investment being compounded monthly instead of compounded annually.

* 1. What will be the value of the investment after 8 years under the new terms? [1]
  2. How much interest is earned during the 8th year under the new terms? [1]
  3. What is the effective annual rate of interest under the new terms? [1]

1. (7 marks)

Elyse borrows $32 000 at a rate of 9.63% per annum compounded monthly. The loan is to be fully repaid with equal monthly instalments over 3 years.

1. Calculate the total amount of interest that will be paid on this loan. [2]
2. How long does it take to reduce the loan to half of the amount borrowed. [1]
3. If the repayment amount on this loan is halved, does the duration of the loan double. Justify your response mathematically. [1]
4. What monthly repayment amount will halve the duration of the loan? [1]
5. How much will be saved if the duration of the loan is halved by increasing monthly repayments? [2]
6. (12 marks)  
   In order to purchase a car, Ellen needs to borrow $8500 and plans to repay the loan by making a payment at the end of each year. Interest on this loan is charged at a rate of 8.5% per annum compounded annually.

The table below summarises Ellen’s repayments and outstanding balance.

|  |  |  |
| --- | --- | --- |
| Years (n) | Amount owing at the start of the year ($) | Amount owing at the end of the year ($) |
| 1 | 8500 | 7622.50 |
| 2 | 7622.50 | **A** |
| 3 | **A** | 5637.40 |
| 4 | 5637.40 | 4516.58 |
| 5 | 4516.58 | 3300.49 |
| 6 | 3300.49 | **B** |
| 7 | **B** |  |
| 8 |  |  |

* 1. Calculate the amount of the repayment Ellen made at the end of the first year. [2]
  2. What portion of the principal is repaid by this first repayment? [1]
  3. If Ellen repays the same amount at the end of each year for the first seven years determine the missing table values **A** and **B**. [2]
  4. Ellen makes one final repayment at the end of the eighth year and repays the loan. Find the amount of this final repayment. [1]
  5. Calculate the total interest paid on this loan. [2]
  6. Write a recursive formula for An, the amount owed at the end of *n* years. [2]
  7. Show how to use this recursive formula to find the value of **B**. [2]

1. (15 marks)  
   The table below shows the mortgage details on Laoghaire’s housing loan from May 2011 to May 2012.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year** | **Month** | **Balance at start of month** | **Interest** | **Repayment** | **Balance at end of month** |
| 2011 | May | 100 000.00 | 575.00 | 3000.00 | 97 575.00 |
|  | Jun | 97 575.00 | 561.06 | 3000.00 | 95 136.06 |
|  | Jul | 95 136.06 | 547.03 | 3000.00 | 92 683.09 |
|  | Aug | 92 683.09 | 532.93 | 3000.00 | 90 216.02 |
|  | Sep | 90 216.02 | 518.74 | 3000.00 | 87 734.76 |
|  | Oct | 87 734.76 | 504.47 | 3000.00 | 85 239.23 |
|  | Nov | 85 239.23 | 468.82 | 3000.00 | 82 708.05 |
|  | Dec | 82 708.05 | 454.89 | 3000.00 | 80 162.94 |
| 2012 | Jan | 80 162.94 | 440.90 | 3000.00 | 77 603.84 |
|  | Feb | 77 603.84 | 426.82 | 3000.00 | 75 030.66 |
|  | Mar | 75 030.66 | 412.67 | 3000.00 | 72 443.33 |
|  | Apr | 72 443.33 | 398.44 | 3000.00 | **A** |
|  | May | **B** | **C** | 3000.00 | **D** |

1. Examine the table and determine which month the monthly interest rate changed. [1]
2. Calculate the new annual interest rate. Show working. [2]
3. Write a recursive formula for Bn, the balance owed at the end of *n* months after the interest rate changed. [2]

1. Complete the table by finding the entries for A, B, C and D. [4]

1. When does the amount that Laoghaire owes fall below $50 000 for the first time? [1]
2. Write a recursive formula for At, the monthly opening balance of this mortgage account after *t* months before the interest rate was changed. [2]
3. **Show** how to use the recursive formula found in **f.** to calculate the balance at the start of August 2011. [2]
4. Calculate the total interest paid for this loan. [1]
5. (12 marks)  
   Adam deposits $100 into an account at the end of every month for 4 years. The account earns interest at a rate of 9% per annum compounded monthly.
6. Find the total amount of Adam’s deposits. [1]

1. Write a recursive rule that gives the amount An in Adam’s account after the nth month. [2]
2. What amount will be in Adam’s account after the 4 years? [1]
3. How much interest did the investment earn? [1]

Bianca deposits $100 into an account at the start of every month for 4 years. The account earns interest at a rate of 9% per annum compounded monthly.

1. Find the total amount of Bianca’s deposits. [1]

1. Write a recursive rule that gives the amount An in Bianca’s account after the nth month. [2]
2. What amount will be in Bianca’s account after the 4 years? [1]
3. How much interest did the investment earn? [1]
4. State the difference, if any,
   1. In the amount invested by Adam and Bianca. [1]
   2. In the amount of interest earned. [1]
5. (6 marks)
6. A sum of $400 000 is invested in a perpetuity at an interest rate of 8.1% per annum.
   1. Find the monthly payment that the perpetuity provides. [1]
   2. After 2 years of monthly payments what is the balance of the perpetuity account? [1]
7. Another perpetuity pays $1900 monthly when the interest rate is 5% per annum. If the interest rate increases to 7% per annum how much will the perpetuity pay monthly? [2]
8. Murtagh has $1 000 000 in his superannuation account and would like to receive an annuity of $10 000 per month. It is invested at a rate of 6% per annum compounded monthly.
   1. How long will his savings last? [1]
   2. If he would like this annuity to last for 10 years, what would be the value of his monthly payment? [1]

**End of Test**

Additional working space

Question number: \_\_\_\_\_\_