NAME :

Centre of Excellence in Mathematics
S201 / 414 GARDENERS RD. ROSEBERY 2018
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YEAR 12 – ADVANCED MATHS

REVIEW TOPIC (SP3)

FINANCE MATHS

PAST HSC EXAMINATION QUESTIONS: (* indicates difficult questions)

HSC 06

(8)

(b) Joe borrows \$200 000 which is to be repaid in equal monthly instalments. The interest rate is 7.2% per annum reducible, calculated monthly.

It can be shown that the amount, $\$A_n$, owing after the nth repayment is given by the formula:

$$A_n = 200\,000r^n - M(1 + r + r^2 + \ldots + r^{n-1}),$$

where $r = 1.006$ and $\$M$ is the monthly repayment. (Do NOT show this.)

(i) The minimum monthly repayment is the amount required to repay the loan in 300 instalments. **3**

Find the minimum monthly repayment.

\$1439.18 per month

(ii) Joe decides to make repayments of \$2800 each month from the start of the loan. **2**

How many months will it take for Joe to repay the loan?

94 months

HSC 05

(8)

(c) Weelabarrabak Shire Council borrowed \$3 000 000 at the beginning of 2005. The annual interest rate is 12%. Each year, interest is calculated on the balance at the beginning of the year and added to the balance owing. The debt is to be repaid by equal annual repayments of \$480 000, with the first repayment being made at the end of 2005.

Let A_n be the balance owing after the n-th repayment.

(i) Show that $A_2 = (3 \times 10^6)(1.12)^2 - (4.8 \times 10^5)(1 + 1.12)$. **1**

(ii) Show that $A_n = 10^6\left[4 - (1.12)^n\right]$. **2**

(iii) In which year will Weelabarrabak Shire Council make the final repayment? **2**

2017

HSC 04

(7)

(c) Betty decides to set up a trust fund for her grandson, Luis. She invests \$80 at the beginning of each month. The money is invested at 6% per annum, compounded monthly.

The trust fund matures at the end of the month of her final investment, 25 years after her first investment. This means that Betty makes 300 monthly investments.

(i) After 25 years, what will be the value of the first \$80 invested? **2**

\$357.20

(ii) By writing a geometric series for the value of all Betty's investments, calculate the final value of Luis' trust fund. **3**

$55 716.71

***HSC 2003**

(10)

(a) Barbara borrows \$120 000 to be repaid over a period of 25 years at 6% per annum reducible interest. Each year there are k regular repayments of \$$F$. Interest is calculated and charged just before each repayment.

(i) Write down an expression for the amount owing after two repayments. **1**

$$120000\left(1+\frac{0.06}{k}\right)^2-F\left(2+\frac{0.06}{k}\right)$$

(ii) Show that the amount owing after n repayments is **2**

$$A_n = 120\,000\,\alpha^n - \frac{kF\left(\alpha^n-1\right)}{0.06},$$

where $\alpha = 1+\frac{0.06}{k}$.

(iii) Calculate the amount of each repayment if the repayments are made quarterly (ie. $k = 4$). **2**

$\boxed{\$2324.47}$

(iv) How much would Barbara have saved over the term of the loan if she had chosen to make monthly rather than quarterly repayments? **2**

$\boxed{\$498}$

HSC 02

(a) Josh invests \$1000 in a term deposit that earns 3.5% per annum compounded annually. **2**

What is the value of the investment at the end of 20 years?

(3)

\$1989.79

(b) A superannuation fund pays an interest rate of 8.75% per annum which compounds annually. Stephanie decides to invest \$5000 in the fund at the beginning of each year, commencing on 1 January 2003. **4**

What will be the value of Stephanie's superannuation when she retires on 31 December 2023?

(9)

\$299604.86

HSC 01

(10) (a) Helen sets up a prize fund with a single investment of \$1000 to provide her school with an annual prize valued at \$72. The fund accrues interest at a rate of 6% per annum, compounded annually. The first prize is awarded one year after the investment is set up.

(i) Calculate the balance in the fund at the beginning of the second year. **1**

\$988

(ii) Let $\$B_n$ be the balance in the fund at the end of n years (and after the nth prize has been awarded). Show that $B_n = 1200 - 200 \times (1.06)^n$. **2**

(iii) At the end of the tenth year (and after the tenth prize has been awarded) it is decided to increase the prize value to \$90. **3**

For how many more years can the prize fund be used to award the prize?

14 more years

HSC 2000

(a) A store offers a loan of \$5000 on a computer for which it charges interest at the rate of 1% per month. As a special deal, the store does not charge interest for the first three months however, the first repayment is due at the end of the first month. **6**

(10)

A customer takes out the loan and agrees to repay the loan over three years by making 36 equal monthly repayments of \$$M$.

Let \$$A_n$ be the amount owing at the end of the nth repayment.

(i) Find an expression for A_3.

$\boxed{\$5000 - 3M}$

(ii) Show that $A_5 = (5000 - 3M)1{\cdot}01^2 - M(1 + 1{\cdot}01)$

(iii) Find an expression for A_{36}.

$$\left(5000-3M\right)1.01^{33}-\frac{M\left(1.01^{33}-1\right)}{0.01}$$

(iv) Find the value of M.

$\$161.34$