

**Stage 2 General Mathematics**  
**Financial Models – Practice Test**

1. Dimitrios needs \$150 000 to set up a new business. He obtains an interest-only loan from a financial institution that charges a flat interest rate of 4.3% per annum, payable half yearly. Dimitrios is setting up a sinking fund that he can use to repay the \$150 000 in full in 3 years' time

(a) Calculate the half-yearly interest payment for the interest-only loan.  
(1 mark)

$$\begin{aligned} \text{Half yearly interest payment} &= \$150\,000 \times 0.043 \times \frac{1}{2} \\ &= \$3\,325 \end{aligned}$$

(b) The sinking fund earns interest of 3.7% per annum, compounded monthly. Show that the amount that Dimitrios must pay into the sinking fund each month in order to save the \$150 000 in 3 years is approximately \$3940. (2 marks)

$$\begin{aligned} n &= 3 \times 12 = 36 && \text{Solve for } PMT = \$3946.11 \\ I\% &= 3.7 \\ PV &= 0 \\ FV &= 150\,000 \\ P/Y &= 12 \\ C/Y &= 12 \end{aligned}$$

(c) Calculate the total cost of the interest-only loan and sinking fund option.  
(2 marks)

$$\begin{aligned} \text{Total cost} &= (\$3\,325 \times 6) + (\$3946.11 \times 36) \\ &= \$161\,409.96 \end{aligned}$$

2. Laura is a 23-year-old who is setting up her first superannuation account. Laura's employer contributes \$1235 to her superannuation fund each quarter. Laura's superannuation fund pays 6.8% interest per annum, compounded quarterly.

(a) (i) Show that when Laura turns 45 she will have approximately \$250 000 in her superannuation account. (2 marks)

$$\begin{aligned}
 n &= 22 \times 4 = 88 \\
 I\% &= 6.8 \\
 PV &= 0 \\
 PMT &= -1235 \\
 P/Y &= 4 \\
 C/Y &= 4
 \end{aligned}$$

Solve for FV = \$247 582.85  
which is approximately \$250 000

(ii) Calculate the interest that will have been earned in Laura's superannuation account when Laura turns 45. (1 mark)

$$\begin{aligned}
 \text{Interest earned} &= \text{total} - \text{payments} \\
 &= 247582.85 - (88 \times 1235) \\
 &= 138902.85
 \end{aligned}$$

(b) (i) If Laura retires when her superannuation account balance reaches \$1 500 000, how old would she be when she retires? (2 marks)

$$\begin{aligned}
 n &= ? \\
 I\% &= 6.8 \\
 PV &= 0 \\
 PMT &= -1235 \\
 FV &= 1500000 \\
 P/Y &= 4 \\
 C/Y &= 4
 \end{aligned}$$

solve for n = 182.4 quarters  
= 45.6 years

23 + 45.6 = 68.6 years old.

When Laura retires, she decides to invest the \$1 500 000 balance of her superannuation account in an annuity. She has identified two options:

- Option A pays 3.75% interest per annum, compounded weekly.
- Option B pays 3.76% interest per annum, compounded monthly.

(c) (i) (1) Calculate the effective interest rate for both options (2 marks)

*Using graphics calculator*

$$A) 3.75, 52 = 3.82\%$$

$$B) 3.76, 12 = 3.83\%$$

(d) Laura decides not to invest in Option A or Option B. Instead she invests the \$1 500 000 in Option C, which pays 3.78% interest per annum, compounded fortnightly.

Calculate how much Laura will be paid fortnightly in retirement, if she wants her annuity to last 25 years, and wants to have \$100 000 remaining in the account at the end of that time. (2 marks)

$$n = 25 \times 26 = 650$$

$$I\% = 3.78$$

$$PV = -1\,500\,000$$

$$FV = 100\,000$$

$$P/Y = 26$$

$$C/Y = 26$$

$$\text{solve for PMT} = \$3976.33$$

3. Pia needs to borrow \$80 000 to renovate her house. She is aiming to repay the loan over 7 years and is investigating two loan options:

- Option A is a loan with an interest rate of 6.25% per annum, compounded monthly, with no set-up fee or ongoing fees.
- Option B is a loan with an interest rate of 6.15% per annum, compounded monthly, with a \$200 set-up fee and a \$7 monthly fee.

(a) Determine the comparison rates for option A and option B. (4 marks)

Option A = 6.25% as no additional fees

Option B  
①  $n = 7 \times 12 = 84$   
 $I\% = 6.15$   
 $PV = 80\ 200$  (set up fee added)  
 $FV = 0$   
 $P/Y = 12$   
 $C/Y = 12$

Solve for  
 $PMT = \$1177.38$

②  $n = 7 \times 12 = 84$   
 $PV = 80\ 000$   
 $PMT = -(1177.38 + 7)$   
 $= -1184.38$   
 $FV = 0$   
 $P/Y = 12$   
 $C/Y = 12$

Solve for  
 $I\% = 6.41\%$

(b) Complete the statement below:

Option A is the loan that represents the better value because

it has a lower comparison rate

\_\_\_\_\_ . (1 mark)

(c) State three separate interest minimisation techniques that Pia could use other than choosing the best comparison interest rate. (3 marks)

Any three of the following

- making larger payments
- making more frequent payments
- reducing the term of the loan
- refinancing loan (changing interest rate)
- making lump sum payments
- opening an offset account

Only the bank that offers Option A has approved Pia's loan application. She borrows \$80 000 at 6.25% per annum, compounded monthly for 7 years.

(d) Show that her minimum monthly repayment is approximately \$1180. (2 marks)

$$n = 7 \times 12 = 84$$

$$I\% = 6.25$$

$$PV = 80,000$$

$$FV = 0$$

$$P/Y = 12$$

$$C/Y = 12$$

$$\text{solve for } PMT = \$1178.30$$

which is approximately \$1180

(e) (i) Show that Pia's outstanding debt 3 months after taking out the loan will be approximately \$77 700. (1 mark)

$$n = 3$$

$$I\% = 6.25$$

$$PV = 80,000$$

$$PMT = -1178.30$$

$$P/Y = 12$$

$$C/Y = 12$$

$$\text{solve for } FV = 77,703.18$$

which is approximately 77,700

At this time, Pia sells some of her furniture for \$4000. She deposits this money in an offset account that is attached to her loan account.

(ii) If Pia continues the minimum monthly repayment in part (d), calculate how long it will take her to repay the loan now that she has \$4000 in the offset account. (1 mark)

$$\begin{aligned}I\% &= 6.25 \\PV &= 77\,703.18 - 4000 \\&= 73\,703.18 \\PMT &= -1178.30 \\FV &= 0 \\P/Y &= 12 \\C/Y &= 12\end{aligned}$$

$$\text{solve for } n = 75.9$$

or

approximately 76  
months to repay  
the loan

(iii) Calculate approximately how much interest will be saved by using the offset account. (2 marks)

The offset account was set up 3 months after taking out the loan so there are 81 months (84-3) remaining.

Therefore the time saved by using the offset account is 5 months (81-76)

$$\begin{aligned}\text{Interest saved} \\&= (5 \times 1178.30) - 4000 \\&= \$1891.50\end{aligned}$$