1. Rob is going to invest $20 000 at 9% pa compounding monthly.
   a. Calculate the value of the investment at the end of 6 years.

   \[ n = \quad I\% = \quad PV = \quad PMT = \quad FV = \quad P/Y = \quad C/Y = \quad ANSWER = \]

   b. How long will he need to leave the money in this account for the balance to be twice the original investment?

   \[ n = \quad I\% = \quad PV = \quad PMT = \quad FV = \quad P/Y = \quad C/Y = \quad ANSWER = \]

   c. Rob would really like to double his investment in 5 years. What interest rate would he need to do this? (Answer to 3 sig figs)

   \[ n = \quad I\% = \quad PV = \quad PMT = \quad FV = \quad P/Y = \quad C/Y = \quad ANSWER = \]

2. (2002 HSC question) Katherine and Liz are sisters. They both have $50 000 to invest for 5 years.
   
   Katherine invests at 3.1% pa, compounding annually
   
   Liz invests at 3% pa, compounding monthly

   a. How much will Katherine’s investment be worth at the end of 5 years?

   Katherine:

   \[ n = \quad I\% = \quad PV = \quad PMT = \quad FV = \quad P/Y = \quad C/Y = \quad ANSWER = \]

   b. Which sister makes the better investment? Justify your answer with appropriate calculations.

   Liz:

   \[ n = \quad I\% = \quad PV = \quad PMT = \quad FV = \quad P/Y = \quad C/Y = \quad ANSWER = \]
3. Gloria needs $35 000 in 3 years time.

a. How much should she invest today at 5.5% pa, compounding annually, to achieve $35 000 in 3 years time?

\[ n = \]
\[ I\% = \]
\[ PV = \]
\[ PMT = \]
\[ FV = \]
\[ P/Y = \]
\[ C/Y = \]

ANSWER =

b. How much less would Gloria need to invest today to achieve the $35 000 in 3 years time if the 5.5% pa interest compounded daily?

\[ n = \]
\[ I\% = \]
\[ PV = \]
\[ PMT = \]
\[ FV = \]
\[ P/Y = \]
\[ C/Y = \]

ANSWER =

4. A car is purchased for $42 000. Use the declining balance method to calculate the salvage value of the car after 4 years at a depreciation rate of 15% pa. (2001 HSC question)

\[ n = \]
\[ I\% = \]
\[ PV = \]
\[ PMT = \]
\[ FV = \]
\[ P/Y = \]
\[ C/Y = \]

ANSWER =

5. David is going to start saving for an overseas holiday. He plans to save $300 each month for the next 5 years. The account pays 6% pa with interest compounding monthly. How much will he have at the end of 5 years?

\[ n = \]
\[ I\% = \]
\[ PV = \]
\[ PMT = \]
\[ FV = \]
\[ P/Y = \]
\[ C/Y = \]

ANSWER =

6. Vicky plans to take a holiday in 2 years time and she estimates that she will need $12 000. At the end of each month Vicky invests $486.44 in an account that pays 4% pa, compounding monthly. Will she have enough in this account immediately after the 24\(^{th}\) payment to pay for her holiday? Justify your answer with calculations. (2003 HSC question)

\[ n = \]
\[ I\% = \]
\[ PV = \]
\[ PMT = \]
\[ FV = \]
\[ P/Y = \]
\[ C/Y = \]

ANSWER =
7. Brian has $250 000 in his superannuation account. After fees and charges, the account pays 5% pa compounding monthly. Brian wants to retire in 4 years time and he wants to have $500 000 in his account. How much should he contribute to the account each month to reach his retirement goal?

\[ \begin{align*}
    n &= \text{ } \\
    I\% &= \text{ } \\
    PV &= \text{ } \\
    PMT &= \text{ } \\
    FV &= \text{ } \\
    P/Y &= \text{ } \\
    C/Y &= \text{ } \\
    \text{ANSWER} &= \text{ } \\
\end{align*} \]

8. Mary borrowed $140 000 at 7.2% pa, compounding monthly over 15 years.
   a. Calculate the value of Mary’s monthly repayments.

\[ \begin{align*}
    n &= \text{ } \\
    I\% &= \text{ } \\
    PV &= \text{ } \\
    PMT &= \text{ } \\
    FV &= \text{ } \\
    P/Y &= \text{ } \\
    C/Y &= \text{ } \\
    \text{ANSWER} &= \text{ } \\
\end{align*} \]

   b. How much did Mary repay in total?

   c. How much interest will Mary pay during the 15 years?
FINANCIAL MATHEMATICS WORKSHEET 3
(for Casio Graphics Calculators – TVM Mode)

NOTE: The questions with a # at the end should provide an interesting answer when compared to the previous question!!

SOLUTIONS

1. Rob is going to invest $20 000 at 9% pa compounding monthly.
   a. Calculate the value of the investment at the end of 6 years.

   \[ n = 6 \times 12 = 72 \]
   \[ I\% = 9 \]
   \[ PV = -20 000 \]
   \[ PMT = 0 \]
   \[ FV = ? \]
   \[ P/Y = 12 \]
   \[ C/Y = 12 \]
   \[ \text{ANSWER} = \$34 251.05 \]

   b. How long will he need to leave the money in this account for the balance to be twice the original investment?

   \[ n = ? \]
   \[ I\% = 9 \]
   \[ PV = -20 000 \]
   \[ PMT = 0 \]
   \[ FV = 40 000 \]
   \[ P/Y = 12 \]
   \[ C/Y = 12 \]
   \[ \text{ANSWER} = 92.77 \text{ months} = 7.7 \text{ years} (1 \text{dp}) \]

   c. Rob would really like to double his investment in 5 years. What interest rate would he need to do this?

   (Answer to 3 sig figs)

   \[ n = 5 \times 12 = 60 \]
   \[ I\% = ? \]
   \[ PV = -20 000 \]
   \[ PMT = 0 \]
   \[ FV = 40 000 \]
   \[ P/Y = 12 \]
   \[ C/Y = 12 \]
   \[ \text{ANSWER} = 13.9\% \]

2. (2002 HSC question) Katherine and Liz are sisters. They both have $50 000 to invest for 5 years.

   \[ \text{Katherine invests at 3.1\% pa, compounding annually} \]
   \[ \text{Liz invests at 3\% pa compounding monthly} \]

   a. How much will Katherine’s investment be worth at the end of 5 years?

   \[ \text{Katherine:} \]
   \[ n = 5 \]
   \[ I\% = 3.1 \]
   \[ PV = -50 000 \]
   \[ PMT = 0 \]
   \[ FV = ? \]
   \[ P/Y = 1 \]
   \[ C/Y = 1 \]
   \[ \text{ANSWER} = \$58 245.63 \]

   b. Which sister makes the better investment? Justify your answer with appropriate calculations.

   \[ \text{Liz:} \]
   \[ n = 5 \times 12 = 60 \]
   \[ I\% = 3 \]
   \[ PV = -50 000 \]
   \[ PMT = 0 \]
   \[ FV = ? \]
   \[ P/Y = 12 \]
   \[ C/Y = 12 \]
   \[ \text{ANSWER} = \$58 080.84 \]

   Katherine makes the better investment by $164.79
3. Gloria needs $35 000 in 3 years time.
   a. How much should she invest today at 5.5% pa, compounding annually, to achieve $35 000 in 3 years time?
      
      \[
      \begin{align*}
      n & = 3 \\
      I\% & = 5.5 \\
      PV & = ? \\
      PMT & = 0 \\
      FV & = 35 000 \\
      P/Y & = 1 \\
      C/Y & = 1 \\
      \end{align*}
      \]
      
      ANSWER = $29 806.49

   b. How much less would Gloria need to invest today to achieve the $35 000 in 3 years time if the 5.5% pa interest compounded daily?
      
      \[
      \begin{align*}
      n & = 3 \times 365 = 1095 \\
      I\% & = 5.5 \\
      PV & = ? \\
      PMT & = 0 \\
      FV & = 35 000 \\
      P/Y & = 365 \\
      C/Y & = 365 \\
      \end{align*}
      \]
      
      ANSWER = $29 687.47
      
      I.e $119.02 less

4. A car is purchased for $42 000. Use the declining balance method to calculate the salvage value of the car after 4 years at a depreciation rate of 15% pa. (2001 HSC question)

   \[
   \begin{align*}
   n & = 4 \\
   I\% & = -15 \\
   PV & = -42 000 \\
   PMT & = 0 \\
   FV & = ? \\
   P/Y & = 1 \\
   C/Y & = 1 \\
   \end{align*}
   \]

   ANSWER = $21924.26

5. David is going to start saving for an overseas holiday. He plans to save $300 each month for the next 5 years. The account pays 6% pa with interest compounding monthly. How much will he have at the end of 5 years?

   \[
   \begin{align*}
   n & = 5 \times 12 = 60 \\
   I\% & = 6 \\
   PV & = 0 \\
   PMT & = -300 \\
   FV & = ? \\
   P/Y & = 12 \\
   C/Y & = 12 \\
   \end{align*}
   \]

   ANSWER = $20 931.01

6. Vicky plans to take a holiday in 2 years time and she estimates that she will need $12 000. At the end of each month Vicky invests $486.44 in an account that pays 4% pa, compounding monthly. Will she have enough in this account immediately after the 24th payment to pay for her holiday? Justify your answer with calculations. (2003 HSC question)

   \[
   \begin{align*}
   n & = 2 \times 12 = 24 \\
   I\% & = 4 \\
   PV & = 0 \\
   PMT & = -486.44 \\
   FV & = ? \text{ (needs 12 000)} \\
   P/Y & = 12 \\
   C/Y & = 12 \\
   \end{align*}
   \]

   ANSWER = yes, after 24 payments she will have $12 133.22 in her account, $133.22 more than she required.
7. Brian has $250,000 in his superannuation account. After fees and charges, the account pays 5% pa compounding monthly. Brian wants to retire in 4 years time and he wants to have $500,000 in his account. How much should he contribute to the account each month to reach his retirement goal?

\[
\begin{align*}
\text{n} & = 4 \times 12 = 48 \\
\text{I\%} & = 5 \\
\text{PV} & = -250,000 \\
\text{PMT} & = ? \\
\text{FV} & = 500,000 \\
\text{P/Y} & = 12 \\
\text{C/Y} & = 12 \\
\text{ANSWER} & = \$3,673.99
\end{align*}
\]

8. Mary borrowed $140,000 at 7.2% pa, compounding monthly over 15 years.
   a. Calculate the value of Mary’s monthly repayments.

\[
\begin{align*}
\text{n} & = 15 \times 12 = 180 \\
\text{I\%} & = 7.2 \\
\text{PV} & = 140,000 \\
\text{PMT} & = ? \\
\text{FV} & = 0 \\
\text{P/Y} & = 12 \\
\text{C/Y} & = 12 \\
\text{ANSWER} & = \$1,274.07 \text{ per month}
\end{align*}
\]

b. How much did Mary repay in total?

\[
\$1,274.07 \times 180 = \$229,331.78
\]

c. How much interest will Mary pay during the 15 years?

\[
\begin{align*}
\$1,274.07 \times 180 & = 229,331.78 \\
229,331.78 - 140,000 & = 89,331.78 \\
\text{ANSWER} & = \$89,331.78
\end{align*}
\]