INVESTIGATING LONG-TERM INVESTMENTS
You are an HSC student and decide that you will start saving some money for the future.

1. INVESTMENT SCENARIO ONE:
You decide to deposit $200 into an account every 6 months. The account pays 6% pa, compounding 6 monthly.

i. How much will you have in the account in 10 years time?

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

ii. If you maintained this investment strategy, how much would be in this account after 30 years? (when you are about age 47) #

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

iii. How much would be in this account after 50 years? (when you are about age 67) #

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

iv. How much would this investment strategy give you by the time you turned 80? (assuming you live that long!) #

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

2. INVESTMENT SCENARIO TWO:
Rather than depositing $200 into an account every 6 months, let’s say a generous relative gave you $20 000 to invest in a long term account. You decide to invest the $20 000 at 6% pa, compounding monthly, without making any additional contributions into the account.

i. How much will the $20 000 grow to in 10 years?

\[ n = \]  
\[ I\% = \]  
\[ PV = \]  
\[ PMT = \]  
\[ FV = \]  
\[ P/Y = \]  
\[ C/Y = \]  
\[ ANSWER = \]
ii. How much will the $20 000 grow to in 30 years at 6% pa compounding monthly? #
(ie when you are about age 47)

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

iii. How much will be in this account in 50 years? (ie when you are about 67 years of age) #

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

iv. How much will the $20 000 grow to in 50 years if the interest rate was 12% pa, compounding monthly (instead of 6% pa, as before)? ##

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

v. How much will the $20 000 grow to in 50 years if the interest rate was 18% pa, compounding monthly? ##

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

vi. Does the interest rate make a much of a difference to the future value over a long period of time? Explain.

\[
\begin{array}{ll}
\end{array}
\]

vii. In part (v) (at the top of this column) we looked at investing $20 000 over 50 years at 18% pa, compounding monthly. How much more will the investment grow to if the 18% is compounded daily? Would you say the effect of the interest compounding daily compared to monthly makes a significant difference over 50 years? ##

\[
\begin{array}{ll}
n &= \\
I\% &= \\
PV &= \\
PMT &= \\
FV &= \\
P/Y &= \\
C/Y &= \\
\text{WORKING:} &= \\
\text{ANSWER:} &= \\
\end{array}
\]
3. INVESTMENT SCENARIO 3:

Your generous relative gives you $20,000 and you invest this at 6% pa, compounding monthly for 10 years. By this time you are around 27 years of age. You then decide to make monthly contributions into the account. The interest rate changes once you start making payments (now you have enough money to attract a higher interest rate). Now you make monthly payments of $200 at 12% pa interest, compounding monthly.

i. How much will your account be worth after 10 years of making payments (by the time you are approx 37 years old).

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

ii. How much will this account grow to if you contribute the $200 per month for 30 years (you would be approx 57 years old)? 

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

iii. How much would this account grow to if you contribute the $200 per month for 50 years (you would be approx 77 years old)? 

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

iv. Let’s see what happens if we increase the monthly payment. Let’s assume that after letting the $20,000 grow for 10 years at 6% pa interest compounded monthly (the start of this investment scenario) you then make monthly contributions of $800 per month (rather than $200 per month) at 12% pa interest compounding monthly. How much will your account grow to after making $800 monthly contributions for 10 years (you would be approximately 37 years old)? 

\[ n = \]
\[ I\% = \]
\[ PV = \]
\[ PMT = \]
\[ FV = \]
\[ P/Y = \]
\[ C/Y = \]
\[ ANSWER = \]
v. How much will your account grow to after making monthly contributions of $800 for 30 years (you would be approximately 57 years old)

\[ \text{n} = \text{I}\% = \text{PV} = \text{PMT} = \text{FV} = \text{P/Y} = \text{C/Y} = \text{ANSWER} = \]

vi. What about over 50 years? #

\[ \text{n} = \text{I}\% = \text{PV} = \text{PMT} = \text{FV} = \text{P/Y} = \text{C/Y} = \text{ANSWER} = \]

vii. What if this investment could have grown at 15% pa, compounding monthly over 50 years? #

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

THINKING ABOUT INVESTING.

10a. What is this worksheet telling you about investing long term from a young age.

b. What is this worksheet telling you about the significance of making regular contributions when investing money for a long period of time (with compound interest).

c. Has this worksheet caused you to think about long-term investing for yourself?
INVESTIGATING LONG-TERM INVESTMENTS
You are an HSC student and decide that you will start saving some money for the future.

1. INVESTMENT SCENARIO ONE:
You decide to deposit $200 into an account every 6 months. The account pays 6% pa, compounding 6 monthly.

i. How much will you have in the account in 10 years time?

\[ \begin{align*}
  n &= 10 \times 2 = 20 \\
  I\% &= 6 \\
  PV &= 0 \\
  PMT &= -200 \\
  FV &= ? \\
  P/Y &= 2 \\
  C/Y &= 2 \\
  \text{ANSWER} &= $5\ 374.07
\end{align*} \]

ii. If you maintained this investment strategy, how much would be in this account after 30 years? (when you are about age 47) #

\[ \begin{align*}
  n &= 30 \times 2 = 60 \\
  I\% &= 6 \\
  PV &= 0 \\
  PMT &= -200 \\
  FV &= ? \\
  P/Y &= 2 \\
  C/Y &= 2 \\
  \text{ANSWER} &= $32\ 610.69
\end{align*} \]

iii. How much would be in this account after 50 years? (when you are about age 67) #

\[ \begin{align*}
  n &= 50 \times 2 = 100 \\
  I\% &= 6 \\
  PV &= 0 \\
  PMT &= -200 \\
  FV &= ? \\
  P/Y &= 2 \\
  C/Y &= 2 \\
  \text{ANSWER} &= $121\ 457.55
\end{align*} \]

iv. How much would this investment strategy give you by the time you turned 80? (assuming you live that long!) #

\[ \begin{align*}
  n &= (80-\text{your age(17)}) \times 2 \\
  I\% &= 6 \\
  PV &= 0 \\
  PMT &= -200 \\
  FV &= ? \\
  P/Y &= 2 \\
  C/Y &= 2 \\
  \text{ANSWER} &= $269\ 644.89
\end{align*} \]

2. INVESTMENT SCENARIO TWO:
Rather than depositing $200 into an account every 6 months, let’s say a generous relative gave you $20 000 to invest in a long term account. You decide to invest the $20 000 at 6% pa, compounding monthly, without making any additional contributions into the account.

i. How much will the $20 000 grow to in 10 years?

\[ \begin{align*}
  n &= 10 \times 12 = 120 \\
  I\% &= 6 \\
  PV &= -20\ 000 \\
  PMT &= 0 \\
  FV &= ? \\
  P/Y &= 12 \\
  C/Y &= 12 \\
  \text{ANSWER} &= $36\ 387.93
\end{align*} \]
ii. How much will the $20 000 grow to in 30 years at 6% pa compounding monthly? #

(ie when you are about age 47)

\[
\begin{align*}
  n & = 30 \times 12 = 360 \\
  I\% & = 6 \\
  PV & = -20 000 \\
  PMT & = 0 \\
  FV & = ? \\
  P/Y & = 12 \\
  C/Y & = 12 \\
  ANSWER & = $120 451.50
\end{align*}
\]

iii. How much will be in this account in 50 years? (ie when you are about 67 years of age) #

\[
\begin{align*}
  n & = 50 \times 12 = 600 \\
  I\% & = 6 \\
  PV & = -20 000 \\
  PMT & = 0 \\
  FV & = ? \\
  P/Y & = 12 \\
  C/Y & = 12 \\
  ANSWER & = $398 719.11
\end{align*}
\]

iv. How much will the $20 000 grow to in 50 years if the interest rate was 12% pa, compounding monthly (instead of 6% pa, as before)? ##

\[
\begin{align*}
  n & = 50 \times 12 = 600 \\
  I\% & = 12 \\
  PV & = -20 000 \\
  PMT & = 0 \\
  FV & = ? \\
  P/Y & = 12 \\
  C/Y & = 12 \\
  ANSWER & = $7 831 667.94 !!
\end{align*}
\]

v. How much will the $20 000 grow to in 50 years if the interest rate was 18% pa, compounding monthly? ##

\[
\begin{align*}
  n & = 50 \times 12 = 600 \\
  I\% & = 18 \\
  PV & = -20 000 \\
  PMT & = 0 \\
  FV & = ? \\
  P/Y & = 12 \\
  C/Y & = 12 \\
  ANSWER & = $151 584 691.80 \\
  (151½ million dollars !!!)
\end{align*}
\]

vi. Does the interest rate make a much of a difference to the future value over a long period of time? Explain.

The interest rate makes a significant difference over a long period of time.

In the last example the $20 000 investment grew by over $140 million extra with an 18% pa interest rate over 50 years compared to an interest rate of 12% pa!

vii. In part (v) (at the top of this column) we looked at investing $20 000 over 50 years at 18% pa, compounding monthly. How much more will the investment grow to if the 18% is compounded daily? Would you say the effect of the interest compounding daily compared to monthly makes a significant difference over 50 years? ##

\[
\begin{align*}
  n & = 50 \times 365 = 18250 \\
  I\% & = 18 \\
  PV & = -20 000 \\
  PMT & = 0 \\
  FV & = ? \\
  P/Y & = 365 \\
  C/Y & = 365 \\
  WORKING: \\
  FV & = $161 702 551.50 \\
  161 702 551.50 - 151 584 691.80 \\
  ANSWER: The effect of the interest compounding daily rather than monthly in this situation is $10 117 859.72 (over 10 million dollars difference!!)
\end{align*}
\]
3. INVESTMENT SCENARIO 3:

Your generous relative gives you $20 000 and you invest this at 6% pa, compounding monthly for 10 years. By this time you are around 27 years of age. You then decide to make monthly contributions of $200 into the account. The interest rate changes once you start making the payments (now you have enough money to attract a higher interest rate). The new interest rate is 12%, compounding monthly.

i. How much will your account be worth after 10 years of making payments (by the time you are approx 37 years old).

(The first part – compound interest for 10 yrs @ 6% - gives you $36 387.93)

\[
\begin{align*}
n &= 10 \times 12 = 120 \\
I\% &= 12 \\
PV &= -36 387.93 \\
PMT &= -200 \\
FV &= ? \\
P/Y &= 12 \\
C/Y &= 12 \\
\end{align*}
\]

\[\text{ANSWER} = $166 101.99\]

ii. How much will this account grow to if you contribute the $200 per month for 30 years (you would be approx 57 years old)? **##**

\[
\begin{align*}
n &= 30 \times 12 = 360 \\
I\% &= 12 \\
PV &= -36 387.93 \\
PMT &= -200 \\
FV &= ? \\
P/Y &= 12 \\
C/Y &= 12 \\
\end{align*}
\]

\[\text{ANSWER} = $2 007 125.86 \text{ (2 million dollars!)}\]

iii. How much would this account grow to if you contribute the $200 per month for 50 years (you would be approx 77 years old)? **##**

\[
\begin{align*}
n &= 50 \times 12 = 600 \\
I\% &= 12 \\
PV &= -36 387.93 \\
PMT &= -200 \\
FV &= ? \\
P/Y &= 12 \\
C/Y &= 12 \\
\end{align*}
\]

\[\text{ANSWER} = $22 060 577.18 \text{ (over 22 million dollars!)}\]

iv. Let’s see what happens if we increase the monthly payment. Let’s assume that after letting the $20 000 grow for 10 years at 6% pa interest compounded monthly (the start of this investment scenario) you then make monthly contributions of $800 per month (rather than $200 per month) at 12% pa interest compounding monthly. How much will your account grow to after making $800 monthly contributions for 10 years (you would be approximately 37 years old)? **##**

\[
\begin{align*}
n &= 10 \times 12 = 120 \\
I\% &= 12 \\
PV &= -36 387.93 \\
PMT &= -800 \\
FV &= ? \\
P/Y &= 12 \\
C/Y &= 12 \\
\end{align*}
\]

\[\text{ANSWER} = $304 125.20 \text{ (2 million dollars!)}\]

v. How much will your account grow to after making monthly contributions of $800 for 30 years (you would be approximately 57 years old)? **##**

\[
\begin{align*}
n &= 30 \times 12 = 360 \\
I\% &= 12 \\
PV &= -36 387.93 \\
PMT &= -800 \\
FV &= ? \\
P/Y &= 12 \\
C/Y &= 12 \\
\end{align*}
\]

\[\text{ANSWER} = $4 104 104.34 \text{ (2 million dollars!)}\]
vi. What about over 50 years? #
\[
\begin{align*}
n &= 50 \times 12 = 600 \\
I\% &= 12 \\
PV &= -36\,387.93 \\
PMT &= -800 \\
FV &= ? \\
P/Y &= 12 \\
C/Y &= 12 \\
\text{ANSWER} &= $45\,495\,581 \\
(45 \text{ million dollars}!!)
\end{align*}
\]

vii. What if this investment could have grown at 15% pa, compounding monthly over 50 years? #
\[
\begin{align*}
n &= 50 \times 12 = 600 \\
I\% &= 15 \\
PV &= -36\,387.93 \\
PMT &= -800 \\
FV &= ? \\
P/Y &= 12 \\
C/Y &= 12 \\
\text{ANSWER} &= $173\,196\,926 \\
(173 \text{ million dollars}!!)
\end{align*}
\]

THINKING ABOUT INVESTING.

a. What is this worksheet telling you about investing long term from a young age.

b. What is this worksheet telling you about the significance of making regular contributions when investing money for a long period of time (with compound interest).

c. Has this worksheet caused you to think about long-term investing for yourself?