1. Use a Graphing Calculator

a) Make a scatter plot of the data. For simplicity, renumber the years from 0 to 4.

- Press (STAT) and select 1:Edit.
- Enter the data in lists L1 and L2.

- Press (Y=.). Clear any functions in the equation section. Then, turn on Plot1 only.
- Press (2nd) [STATPLOT] and select Plot1.
- Use the settings shown.

Press (ZOOM) and select 9:ZoomStat. A scatter plot of the data will appear.

The trend appears to be exponential. Use exponential regression to find a curve of best fit.

- Press (2nd) [QUIT] to return to the home screen.
- Press (STAT) Cursor over to CALC and select 0:ExpReg.

- Press (2nd) [L1] (2nd) [L2] and then press (Y-VARS). Select Y-VARS, and then select 1:Function.
- Select 1:Y1 and press (ENTER).

An exponential equation will appear.

Round the calculated values of \(a\) and \(b\) and substitute into the equation \(y = ab^x\) to obtain the approximate equation of the curve of best fit.

\[ y = 674 \times 1.025^x \]

Replace \(x\) and \(y\) with variables that make sense for the problem. Let \(n\) represent the number of years following 2002 and \(E\) represent the average Canadian's weekly earnings in year \(n\).

Then, the equation is \(E(n) = 674 \times 1.025^n\).

b) To predict the average Canadian's weekly earnings in 2010, find the value of \(E\) when \(n = 8\).

- Press (2nd) [CALC].
- Select 1:value and enter 8 when prompted.

Therefore, assuming that the trend continues, the average Canadian will earn approximately $819 per week in 2010.

c) To find when the average Canadian might expect to earn $1000 per week, find the intersection of the graph with the graph of \(y = 1000\).

- Press (2nd) [CALC].
- Select 5:intersect.

From the graph, you can see that the average Canadian can expect to earn $1000 per week in approximately 16.2 years after 2002, or in 2018.

2. a) Enter the data in L1 and L2 using the Table Editor. To calculate the first differences:

- Move the cursor to the top of the L3 column.
- Press (2nd) [LIST]. Cursor over to OPS.
- Select 7:List( and press (2nd) [L2].
- Press ( ) and then press (ENTER).

The first differences are decreasing at a decreasing rate, suggesting that the computer depreciates most quickly in the early years following purchase and less quickly as it ages.
Perform a linear regression and store the equation as Y1.

\[ \text{LinReg}(a \times b) \, L_1, L_2, Y_1 \]

The line of best fit corresponds approximately to the equation 
\[ v(n) = -160a + 1297, \] where \( v \) is the value of the computer, in dollars, \( n \) years after purchase.

To view the scatter plot and line of best fit, ensure that Plot1 and Y1 are turned on. From the ZOOM menu, choose 9:ZoomStat.

Although the line of best fit passes near most of the data points, it does not reflect the curved nature of the trend, which indicates a decreasing rate of depreciation. This may not be the best model for this situation.

**Quadratic Model**

Perform a quadratic regression and store the equation as Y2.

\[ \text{QuadReg} \, L_1, L_2, Y_2 \]

The quadratic curve of best fit corresponds approximately to the equation 
\[ v(n) = 17.6a^2 - 283a + 1461, \] where \( v \) is the value of the computer, in dollars, \( n \) years after purchase.

To view the scatter plot and quadratic curve of best fit, turn Y1 off and ensure that Plot1 and Y2 are turned on. From the (ZOOM) menu, select 9:ZoomStat.

The quadratic curve of best fit models the data trend well for the domain shown. However, this quadratic function does not indicate continuing depreciation. This can be observed by extrapolating beyond the data set. Press (ZOOM), select 3:Zoom Out, and press (ENTER).

According to the graph, the value function will reach a minimum and then begin to increase, which makes no sense in this situation. Therefore, the quadratic model is not effective for extrapolating beyond the given set of data for this scenario.

**Exponential Model**

Perform an exponential regression and store the equation as Y3.

\[ \text{ExpReg} \, L_1, L_2, Y_3 \]

The exponential curve of best fit corresponds approximately to the equation 
\[ v(n) = 1500 \times 0.8^n, \] where \( v \) is the value of the computer, in dollars, \( n \) years after purchase.

To view the scatter plot and exponential curve of best fit, turn Y1 and Y2 off and ensure that Plot1 and Y3 are turned on. From the (ZOOM) menu, select 9:ZoomStat.

The exponential model correctly reflects the continuous depreciation of the computer. It is the best model for this scenario.

**c)** Apply the exponential model to determine the purchase price of the computer by evaluating the function when \( n = 0 \).

**Method 1: Use the Graph**

Press 2nd [CALC] and select 1:value. When prompted, enter 0 and press (ENTER). The corresponding function value will be given.

**Method 2: Use the Equation**

\[ v(0) = 1500 \times 0.8^0 \]
\[ v(0) = 1500 \times 1 \]
\[ v(0) = 1500 \]

Both the graph and the equation indicate that the purchase price of the computer was \$1500.
Units 5 Days

3a) If you say no...
Justification:
First differences are increasing only slightly

If you say yes...
Justification:
First differences are increasing

b) y-int is 100 so \( a = 100 \). Goes through \((1,110)\)

\[
y = ab^x
\]

\[
110 = 100(b^1) \Rightarrow b = 1.1
\]

\[
\therefore y = 100(1.1^x)
\]

c) Difficult as we need to estimate the y-values from the graph when \( x = 2, 3 \).

I used:

\[
\begin{align*}
(0,100) \\
(1,110) \\
(2,122) \\
(3,133)
\end{align*}
\]

\[
a = 100.0973843 \\
b = 1.100657524 \\
r^2 = 0.99885898 \\
r = 0.99994
\]

\( \text{very good model very strong correlation} \)

So, \( y = 100(1.1^x) \)

d) \( x = 10 \) \( y = 100(1.1^{10}) \)

\[
\text{Using 2nd Calc Value: } 261.18
\]

\( \therefore \text{after 10 years she will have } 261.18 \)

e) \( x = ? \) when \( y = 200 \)

Using 2nd Calc Intersect

\[
x = 7.217
\]

\( \therefore \text{it will take } 7.2 \text{ years to double} \)

Trial and error

\[
1.17 = 1.95 \\
1.15 = 2.14
\]

\( a = 1.1^x \)
Note: $100(1.1)^x$

initial investment of $100$

after one year $100 \times 1.10 \Rightarrow$ she received 10% interest.

after two years $100 \times 1.10 \times 1.10 \Rightarrow$

she left the original $100$

invested and the interest has been added to the investment

so the interest is also gaining interest.

This is called "compound interest".

Accountants use something called the "rule of 72"

$72 \div \text{interest rate} = \text{approximate number of years for money to double}$

$72 \div 10 = 7.2 \Rightarrow \text{Money takes about 7.2 years to double.}$

Interest rate 5% (compound Interest).

$72 \div 5 = 14.4 \Rightarrow \text{Money takes about 14.4 years to double}$

Using $y = 100(1.05)^x$ and $y = 100$ on TI-83 to check this we get 14.2 years.

Interest rate 7%.

$72 \div 7 = 10.29 \Rightarrow \text{Money doubles in about 10.3 years}$

Using TI-83 $y = 100(1.07)^x$, $y = 200$ we get 10.3 years.