

Chapter 7 / Example 14

Exponential modelling

A rock band the VJs published a new video on their YouTube channel. The weekly views up to and including the 20th week of publication were as follows:

| Week | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th |
|-------|---------|--------|--------|--------|-------|--------|-------|-------|-------|-------|
| Views | 102 365 | 38 716 | 21 617 | 24 305 | 9 321 | 14 148 | 2 103 | 8 285 | 5 098 | 3 777 |
| Week | 11th | 12th | 13th | 14th | 15th | 16th | 17th | 18th | 19th | 20th |
| Views | 831 | 1007 | 834 | 34 | 378 | 204 | 6 | 42 | 54 | 31 |

- Explain why an exponential model would be suitable to model this set of data.
- Use exponential regression to determine the best fit exponential model.
- Determine R^2 the coefficient of determination of the model function.
- Sketch a graph showing the data points with the model function.
- For their next video, the band wants to start advertising it as soon as it falls below 1000 views per week. Assuming it follows the same pattern as the first video, predict after how many days they should do so.

Press **[STAT]** 1:Edit and press **[ENTER]**

Enter the x-coordinates in the first column.

Press **[ENTER]** or **[▼]** after each number to move to the next cell.

Note: If the list contains other numbers, you can clear it by pressing **[STAT]** 4:ClrList and press **[ENTER]**. The home screen displays ClrList. Press **[2nd]** **[1]** **[L1]** and press **[ENTER]**. Press **[STAT]** 1:Edit and press **[ENTER]** to return to the table.

| L1 | L2 | L3 | L4 | L5 | 1 |
|----|----|----|----|----|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |

L1(11)= 11

Press **[▶]** to move to the next column.

Enter the y-coordinates in the second column.

| L1 | L2 | L3 | L4 | L5 | 2 |
|----|--------|----|----|----|---|
| 1 | 102365 | | | | |
| 2 | 38716 | | | | |
| 3 | 21617 | | | | |
| 4 | 24305 | | | | |
| 5 | 9321 | | | | |
| 6 | 14148 | | | | |
| 7 | 2103 | | | | |
| 8 | 8285 | | | | |
| 9 | 5098 | | | | |
| 10 | 3777 | | | | |
| 11 | 831 | | | | |

L2(11)= 831

Press **[2nd]** **[F1]** **[STAT PLOT]**.

Press **[ENTER]**.

| STAT PLOTS | | | | |
|------------|-----|--|--|--|
| 1:Plot1... | Off | | | |
| 2:Plot2... | Off | | | |
| 3:Plot3... | Off | | | |
| 4:PlotsOff | | | | |
| 5:PlotsOn | | | | |

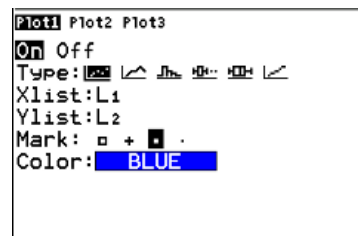
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Navigate through the list using \rightarrow \leftarrow \uparrow \downarrow keys.

Select Type \square , Xlist L_1 and Ylist L_2 and Mark \square . Choose any color.

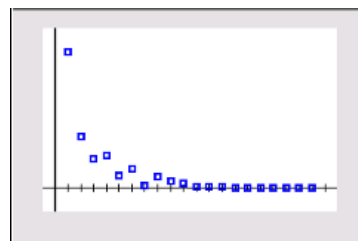
Press **ENTER** after each choice.



Press **[F3] ZOOM** 9:ZoomStat

The GDC displays a scatter diagram of x against y .

Because the data is approximately exponential, exponential regression is appropriate.



Before calculating the equation of exponential regression, switch the option of calculating the coefficient of determination.

Press **MODE**

Using \downarrow and \downarrow , navigate down to STAT DIAGNOSTICS and select 'ON' by pressing **ENTER**.



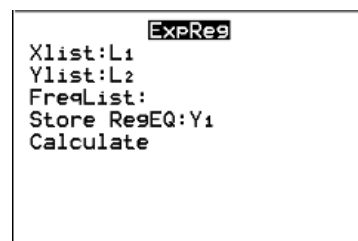
To calculate the equation of exponential regression press **STAT** and \rightarrow to access the CALC menu.

Select 0:ExpReg and press **ENTER**.

Leave the X List as L_1 and the Y List as L_2 .

Enter Y_1 in Store RegEQ by pressing **[ALPHA] [F4] 1:Y1**

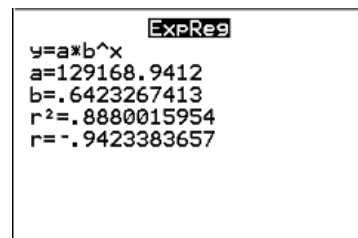
Navigate down to Calculate and press **ENTER**.



The exponential curve is given by the equation

$$y = 129\,000 \times 0.642^x$$

The coefficient of determination is $R^2 = 0.888$, which shows strong exponential association.

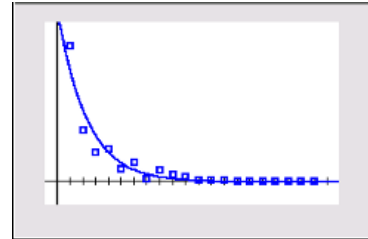


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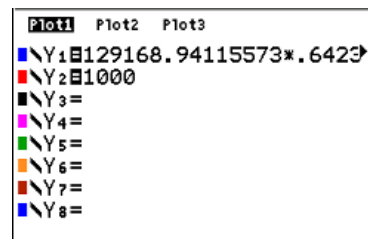
Press **[F5]** **GRAPH**.

The GDC displays the scatter diagram and the regression line.



Press **[F1]** **Y=** to display the equation entry screen.

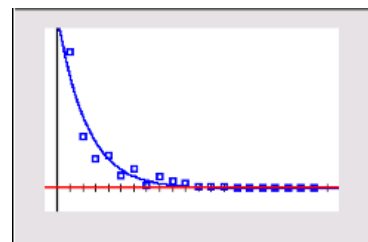
Type 1000 and press **[ENTER]** to enter the equation as Y_3 .



Press **[F5]** **GRAPH**.

The GDC displays $Y_1 = 129\,000 \times 0.642^x$ and $Y_2 = 1000$

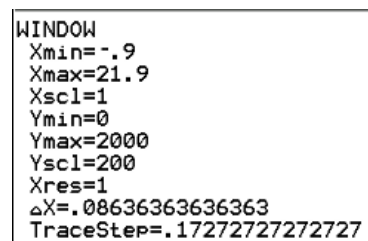
To see the intersection, you will need to change the window.



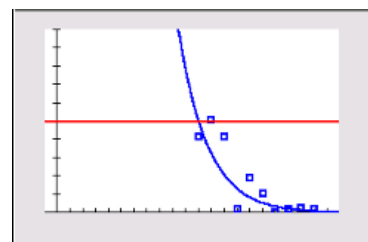
Press **[F2]** **WINDOW**

Set the axes to show $0 \leq y \leq 2000$ with a scale of 200, leaving the remaining items the same.

Press **[F5]** **GRAPH** when you have finished.



The GDC now shows the regression curve and the portion of the scatter diagram in the region of the intersection.

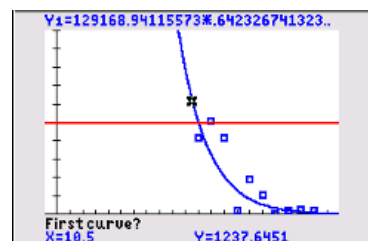


Press **[2nd]** **[F4]** **CALC** 5:intersect

To find the intersection you need to choose the two lines that intersect.

The GDC shows a cross on one of the lines and 'First curve?'.

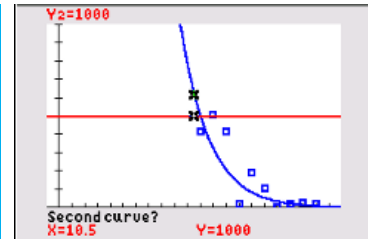
Press **[ENTER]**.



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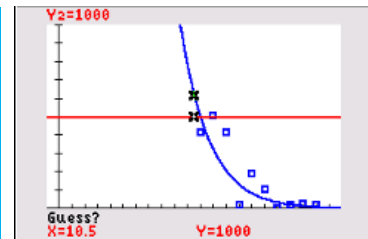
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The GDC shows a cross on the other line and 'Second curve?'. Press **ENTER**.



The GDC requires an initial guess for the position of the intersection. Choose the default position.

Press **ENTER**.



The GDC displays the intersection of the two straight lines at the point 10.98,1000

$x = 10.98$ weeks = 76.9 days

They have to start advertising their video again after 77 days.

