# Regression Equations and Real-World Data

# How much does gas cost now and in the future?

by John Hinojosa

### **Activity Overview**

In this activity, students will use data collected from the Energy Information Administration on the yearly price of regular gasoline and determine whether a relationship exists between our variables. Students will use the capabilities of the TI-Nspire to graph various regression equations and estimate future prices of gasoline.

### Concepts

Entering data in a spreadsheet, plotting data points on a graph and determining various types of regression equations (linear, quadratic and power).

#### **Teacher Preparation**

This activity is designed for use in an Algebra classroom. Prior to this activity, students should have basic knowledge of various types of functions (linear, quadratic, etc...) and how to enter data into a spreadsheet.

#### **Classroom Management Tips**

This activity is teacher centered. The teacher will lead the activity so that students can develop and understand the relationships encountered with various regression equations. Students should be allowed to explore various types of regression equations.

#### **TI-Nspire Applications**

Lists and Spreadsheets Data and Statistics Calculator

#### Materials needed:

TI Nspire calculator Excel worksheet with data Step-by-step directions

Press the (a) button and open a new Lists and Spreadsheets document	Image: With a Lists & Spreadsheet application to the open document.
You will now use the "Nav Pad" to move the cursor up to the text box next to the letter "A" in the first column. You will now label the column "years"	1.1   RAD AUTO REAL       A ye   B       A ye   B       C   D       E   F       G       I                       I         I                 I
If you want to resize the row, click on the menu button, select "Actions", 2:Resize, and then 1: Resize Column Width. Then press the right side of the "Nav pad" to widen the column. Once set to desired size, click the middle of "Nav pad" and then press bottom of "Nav pad."	A years     1: Actions     1: Actions     1: Move Column     1: Resize Column Width     2: Maximize Column Width     3: Minimize Column Width     4: Resize Row Height     1     6: Sort     2     3     4     5     4     5     6: Sort     7     6: Sort     7     7     7     8     9     9     9     1     1     1     2     3     4     4     1

# TI-*nspire*

TEXAS INSTRUMENTS Your Passion, Our Technology. Student Success.				Т	∣- <i>ns</i> p	ire <sup>-</sup>
	1.1		RAD /	AUTO RE	EAL	Î
Beginning with A1, you will now enter the data (TABLE 1) from the included excel data sheet	A years	B		E	F	G
provided to you.	1 1995	;				
	2 1996	5				
	3 1997	,				
	4 1998	3				
	5 1999	)				
	AI 1995	-II-				
Once completed, you will need to use the "Nav	1.1		RAD /	AUTO RE	EAL	Î
the letter "B". Label the column "price"	A years ◆	B price	e C	D	E	
Resize as needed following the same steps	1 1995	106	3	2		
	2 1996	107	.7			
Beginning with B1, you will now enter the data (TABLE 1) from the included excel data sheet	3 1997	12	22			
provided to you.	4 1998	108	.9			
	5 1999	91	.3			— <u>[]</u>
	B price	1	_	1 1	1	<u> </u>
Discovery Question:						
Does the data show any type of relationship? What types of Regression Equations do you believe will fit the data?						
Now we will calculate a linear regression.	😓 1: Action 🛍 2: Insert	S	).D /	AUTO RE	EAL	Î
While in "Lists and Spreadsheet", press the menu button. Select "4: Statistics", "1: Stat	<sup>135</sup> 3: Data ⊼ 4: Statist ⊠ 5: Euncti	ics 1	→ : Stat Ca : Distrib	D alculatio	e i ns	
Calculations" and then select Linear regression $(mx+b)$ .	1 1995	5 10 <sup>3</sup>	: Confid	ence In	tervals.	
	2 1996	107	: Stat Te ./]	ests	1	<u> </u>
	3 1997	' 12	22			
	4 1998	108	.9			
	5 1999	91	.3			
	B price	1				

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	I: One-Variable Statistics         2: Two-Variable Statistics         3: Linear Regression (mx+b)         4: Linear Regression (a+bx)         5: Median-Median Line         6: Quadratic Regression         7: Cubic Regression         8: Quartic Regression         9: Power Regression         9: Power Regression         A: Exponential Regression         B: Logarithmic Regression         D: Logistic Regression (d=0)
You will now select the parameters of the linear	Linear Regression (mx+b)
On the "X List:" press down with your "Nav pad" and select "years". Tab to the next item "Y List:". Again press down with your "Nav pad" and select "price" Tab to the next item "Save RegEqn to:" and make sure <i>f1</i> is selected. Tab to the last item, "1 <sup>st</sup> Result Column" and make sure that "c[]" is selected.	X List: Vears ✓ Y List: 'price ✓ Save RegEqn to: f1 ✓ Frequency List: 1 ✓ Category List: ✓ OK Cancel
Select "OK" and your Linear Regression	1.1 RAD AUTO REAL
columns C and D.	A years B price C D ← ◆ LinRegMx
Once again, you may resize column widths.	2 1996 107.7 RegEqn m*x+b
	3 1997 122 m 12.4292
	4 1998 108.9 b -24724.4
	5 1999 91.3 r <sup>2</sup> .71114
	<sup>6</sup> 2000 126 <u>r</u>
	C6 = "r"

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We will now select the (a) and add a new page with a "Data and Statistics" Application to the open document.	Home         Vx       Value         1:Calculator       2:Graphs &         2       1         3       4:Notes         5:Data & Sta       6:New Doc         4       2         5       7:My Docu         8:System Info       9:Hints         6       Add a new page with a Data & Statistics application to the open document.
We now need to select the variables we wish to plot on the graph.	1.1 1.2 RAD AUTO REAL
Use the "Nav pad" to move the cursor toward the bottom, middle of the screen (x axis).	Click to add variable
When "Click to change variable" appears select "years".	Click to add variable Click to add variable Click to add variable I.1 1.2 RAD AUTO REAL
	Click to add variable

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You will now use the "Nav pad" to move the cursor the the "y axis".	1.1     1.2     RAD AUTO REAL       H     Click to add variable       Q     Q     Q     Q       1995     1998     2001     2004     2007       years     Years     Years     Years
Once again, when "Click to change variable" appears, select "price". You will now see your data points from your spreadsheet plotted.	1.1     1.2     RAD AUTO REAL       280
At this point, select me and scroll down (using your "Nav pad") to "3: Actions", select "5: Regression" and then "1: Show linear (mx + b).	1: Plot Type     2: Plot Properties     1: Select All Points     4: Window     2: Add Movable Line     3: Remove Selected     4: Lock Intercept at Zero     5: Regression     6: Show Residual Squares     7: Show Normal PDF     8: Plot Value     100     9: Plot Function     A: Shade Under Function     1995 1998 2001 2004 2007     years

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	1: Plot Type       D AUTO REAL         2: Plot Properties       D AUTO REAL         3: Actions       1: Select All Points         1: Show Linear (mx+b)       ble Line         2: Show Linear (a+bx)       ble Line         3: Show Median-Median       Selected         4: Show Quadratic       sidual Squares         5: Show Cubic       sidual Squares         6: Show Quartic       mal PDF         7: Show Power       ion         8: Show Logarithmic       der Function         A: Show Sinusoidal       r         2: Show Logistic (d=0)       2004         2: Show Logistic (d=0)       rs
Your regression is now plotted along with your data points.	1.1     1.2     RAD AUTO REAL       280
<b>Discovery Question:</b> Does the "Linear Regression" model the data points? Why or why not?	
We will now select the (a) and add a new page with a "Calculator" Application to the open document.	Home         I:Calculator       2:Graphs &       3:Lists & Sp         I:Calculator       I:Calculator       0:Calculator         I:Calculator       8:System Info       9:Hints         Add a new page with a Calculator application to the open document.       The second column to the open document.

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	1.1 1.2 1.3	RAD AUTO REAL
You can know use the linear regression equation saved in f1 to "guess" what the price of gas might be for other years. In the Calculator application, type $f1(2015)$ and press (a) to calculate "guess" the price of gas in the year 2015.	<i>f1</i> (2015)	320.487
Follow the same steps to view the price of gas for various years.		
Discovery Question:	1.1     1.2     1.3       f1(2015)       f1(2025)	RAD AUTO REAL         320.487         444.78         444.78         2/99
What other types of Regression Equations might model this data more accurately? Why?	dratic regression expon	ential regression and power
regression equations. Discussion can then lead to data.	which regression equati	on is better suited to model the

# **EXTENSION:**

The attached Excel data sheet contains a separate set of data (TABLE 2) that may be used as an extension. Students can work in groups and compare the regression models with the different data sets.