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Regression Equations and Real-World Data
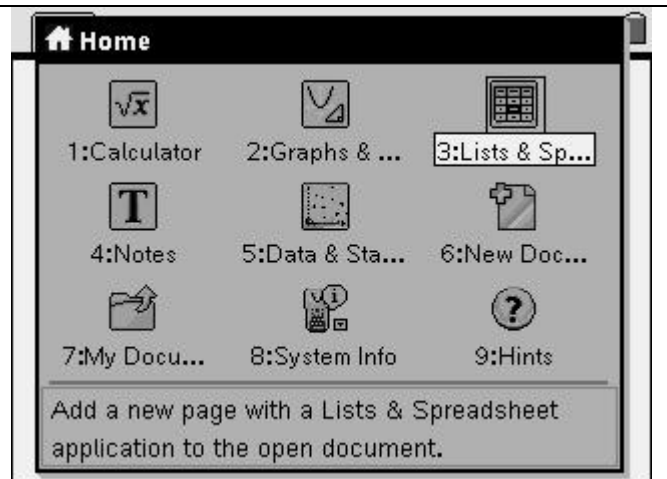
How much does gas cost now and in the future?

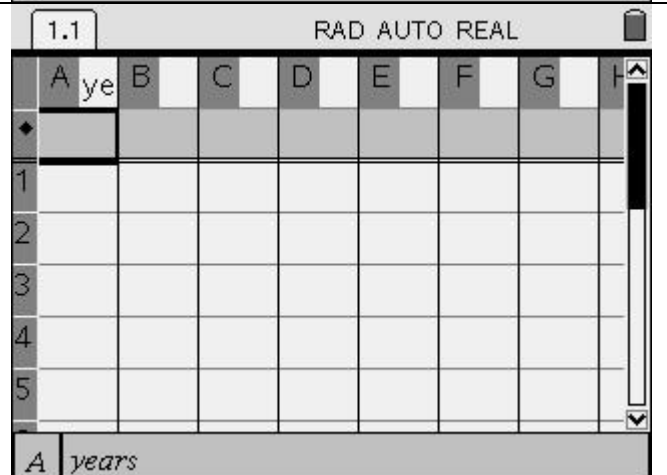by John Hinojosa

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.

Step-by-step directions

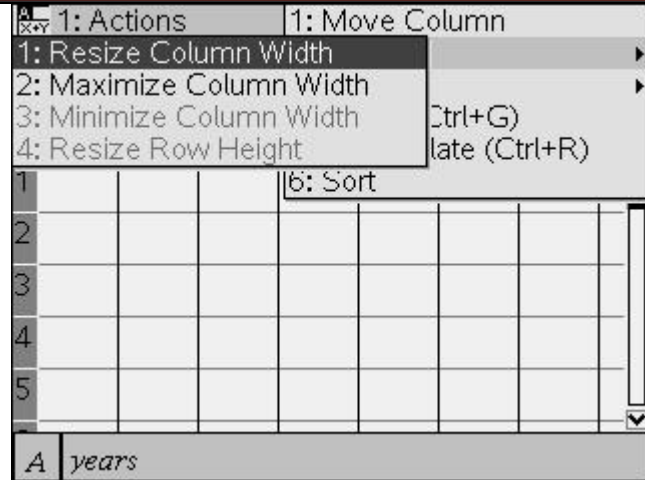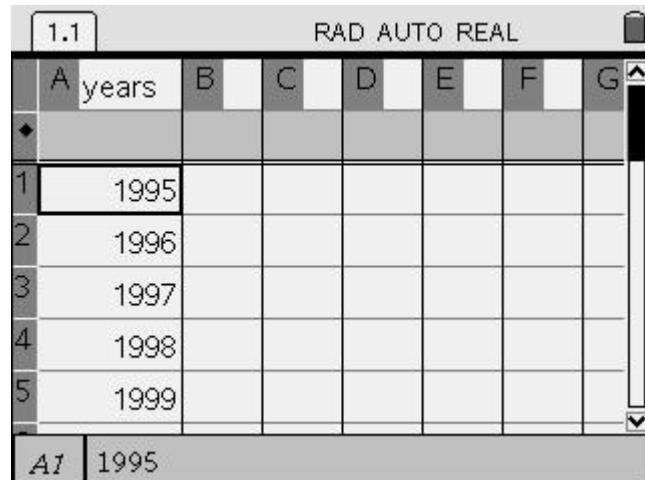|	
Press the (⌂) button and open a new **Lists and Spreadsheets** document	**⌂ Home** √x **1:Calculator** **2:Graphs & ...** **3:Lists & Sp...** **T** **4:Notes** **5:Data & Sta...** **6:New Doc...** **7:My Docu...** **8:System Info** **9:Hints** Add a new page with a Lists & Spreadsheet application 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" 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	1.1 RAD AUTO REAL A ye B C D E F G H 1 2 3 4 5 A *years*

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widen the column.
Once set to desired size, click the middle of "Nav pad" and then press bottom of "Nav pad."

	1: Actions	1: Move Column
1: Resize Column Width		
2: Maximize Column Width		
3: Minimize Column Width		Ctrl+G)
4: Resize Row Height		late (Ctrl+R)
1	6: Sort	

2				
3				
4				
5				

A | years

Beginning with A1, you will now enter the data (TABLE 1) from the included excel data sheet provided to you.

1.1			RAD AUTO REAL	

A years	B	C	D	E	F	G
◆						
1	1995					
2	1996					
3	1997					
4	1998					
5	1999					

A1 | 1995

Once completed, you will need to use the "Nav pad" to move the cursor to the text box next to the letter "B". Label the column "price"

Resize as needed following the same steps previously given.

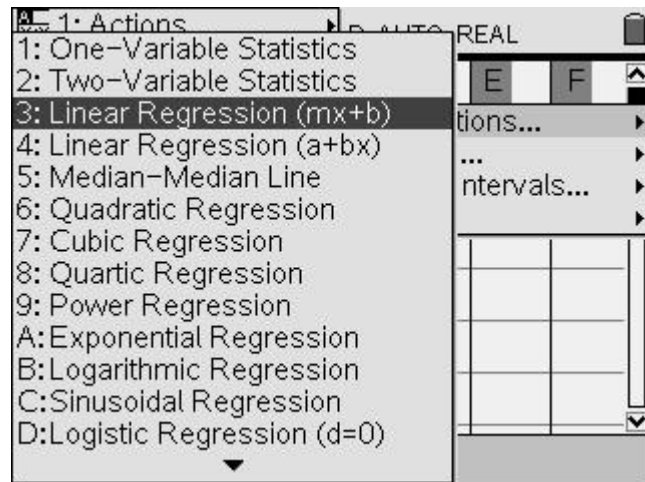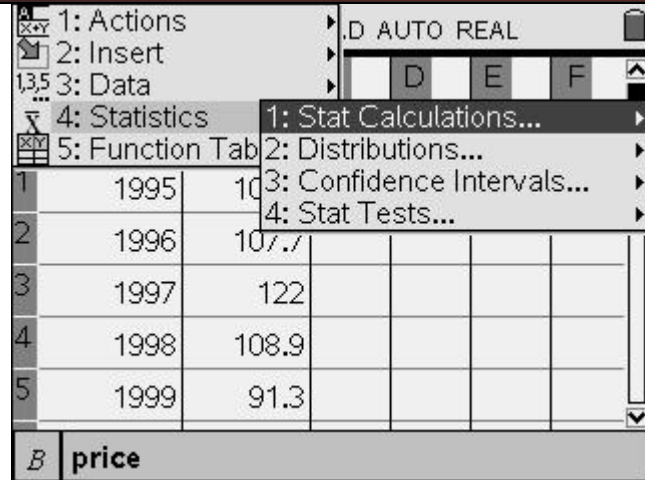Beginning with B1, you will now enter the data (TABLE 1) from the included excel data sheet provided to you.

1.1			RAD AUTO REAL	

A years	B price	C	D	E	F
◆					
1	1995	106.3			
2	1996	107.7			
3	1997	122			
4	1998	108.9			
5	1999	91.3			

B | **price**

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.

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While in "Lists and Spreadsheet", press the (menu) button. Select "4: Statistics", "1: Stat Calculations" and then select Linear regression (mx+b).

```
1: Actions              ▶  .D AUTO REAL
2: Insert               ▶        D   E   F
3: Data                 ▶
4: Statistics              1: Stat Calculations...    ▶
5: Function Tab            2: Distributions...        ▶
                           3: Confidence Intervals... ▶
  1    1995      10        4: Stat Tests...           ▶
  2    1996      107.7
  3    1997      122
  4    1998      108.9
  5    1999      91.3

  B  price
```

```
1: Actions              ▶  .D AUTO REAL
1: One−Variable Statistics        E   F
2: Two−Variable Statistics
3: Linear Regression (mx+b)    tions...      ▶
4: Linear Regression (a+bx)    ...           ▶
5: Median−Median Line          ntervals...   ▶
6: Quadratic Regression
7: Cubic Regression
8: Quartic Regression
9: Power Regression
A:Exponential Regression
B:Logarithmic Regression
C:Sinusoidal Regression
D:Logistic Regression (d=0)
             ▼
```
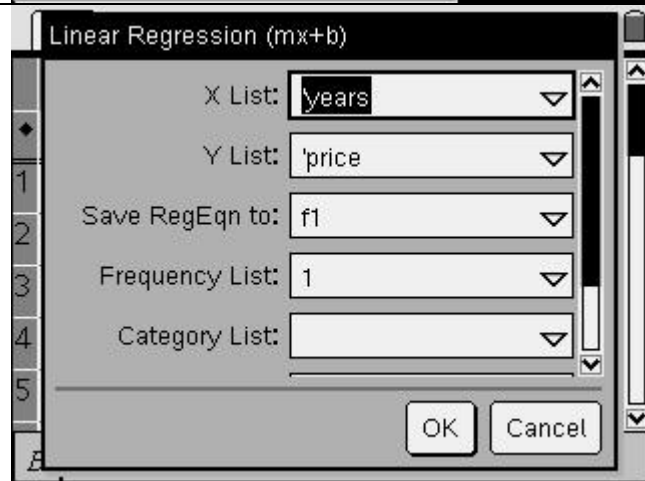
You will now select the parameters of the linear regression.

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 *f1* is selected.

Tab to the last item, "1st Result Column" and make sure that "c[]" is selected.

```
Linear Regression (mx+b)

           X List:  years      ▽
           Y List:  'price      ▽
  Save RegEqn to:  f1          ▽
   Frequency List:  1           ▽
    Category List:              ▽

                        OK   Cancel
```

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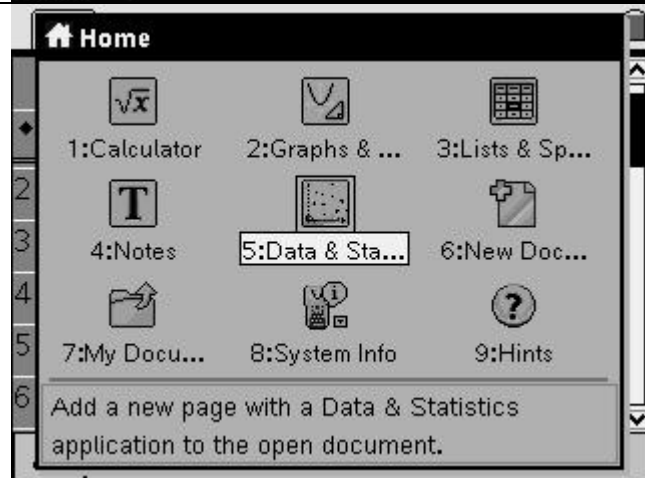|	
Select "OK" and your Linear Regression Equation will be listed and labeled using columns C and D. Once again, you may resize column widths.	**1.1** RAD AUTO REAL | A years	B price	C	D | |---|---|---|---|
			=LinRegMx
2 1996	107.7	RegEqn	m*x+b
3 1997	122	m	12.4292
4 1998	108.9	b	-24724.4
5 1999	91.3	r²	.71114
6 2000	126	r	.843291	 C6 ="r"
We will now select the ⌂ and add a new page with a "Data and Statistics" Application to the open document.	**Home** √x 1:Calculator 2:Graphs & ... 3:Lists & Sp... T 4:Notes 5:Data & Sta... 6:New Doc... 7:My Docu... 8:System Info 9:Hints 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. Use the "Nav pad" to move the cursor toward the bottom, middle of the screen (x axis). When "Click to change variable" appears select "years".	**1.1** **1.2** RAD AUTO REAL Click to add variable Click to add variable Click to add variable
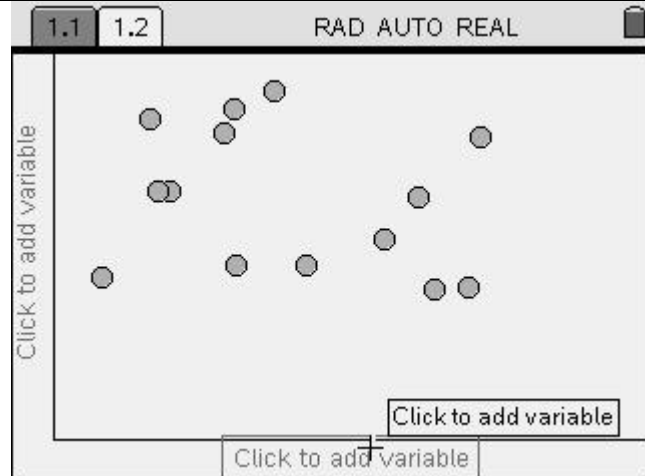
TEXAS INSTRUMENTS
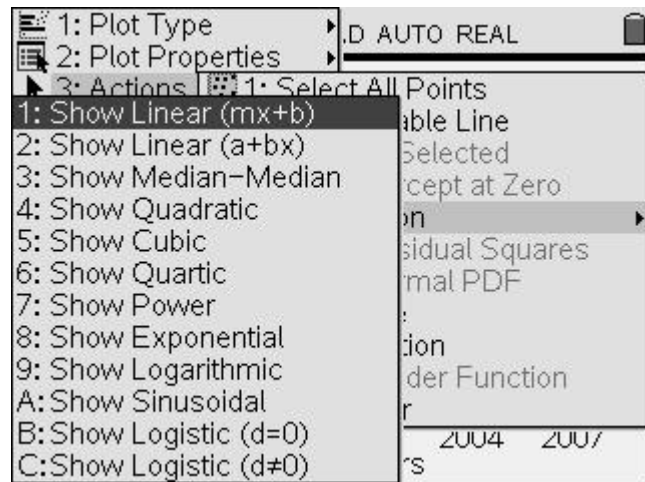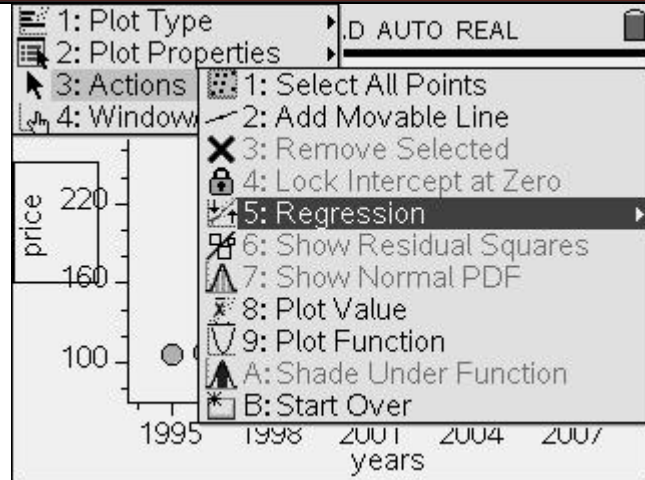Your Passion. Our Technology. Student Success.

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You will now use the "Nav pad" to move the cursor the the "y axis".

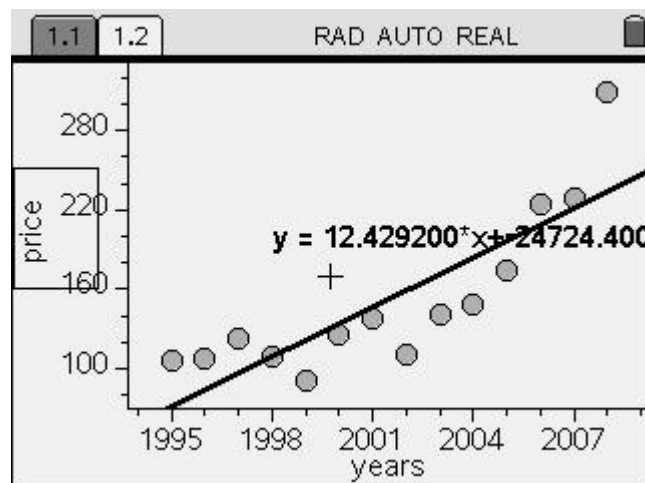Once again, when "Click to change variable" appears, select "price".

You will now see your data points from your spreadsheet plotted.

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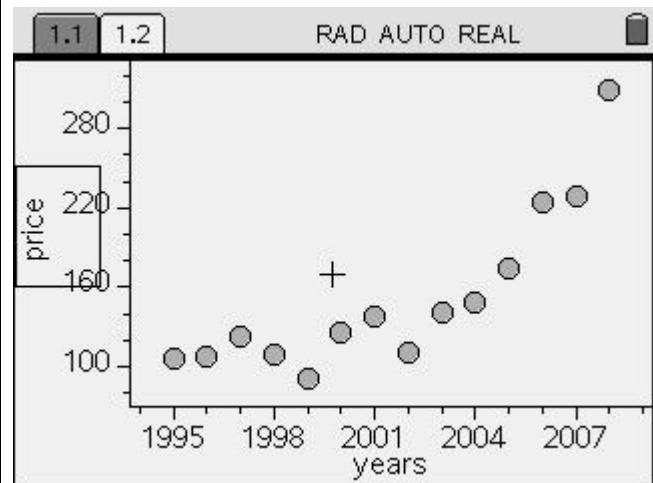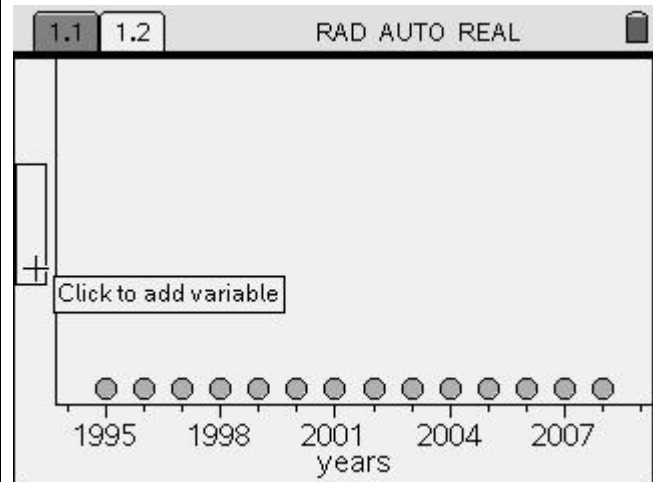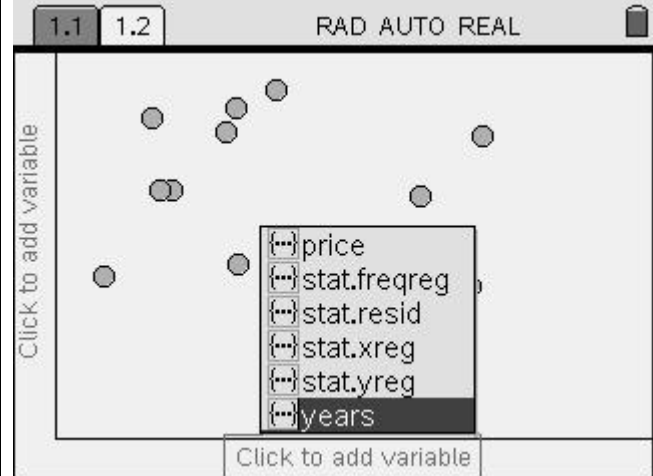
At this point, select (menu) and scroll down (using your "Nav pad") to "3: Actions", select "5: Regression" and then "1: Show linear (mx + b).
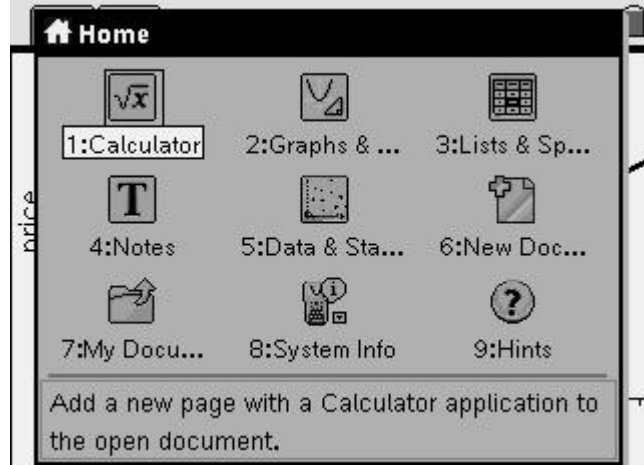
1: Plot Type ▸ .D AUTO REAL
2: Plot Properties ▸
3: Actions ▦ 1: Select All Points
4: Window ╱ 2: Add Movable Line
✕ 3: Remove Selected
🔒 4: Lock Intercept at Zero
5: Regression ▸
6: Show Residual Squares
△ 7: Show Normal PDF
8: Plot Value
▽ 9: Plot Function
▲ A: Shade Under Function
B: Start Over

1: Plot Type ▸ .D AUTO REAL
2: Plot Properties ▸
3: Actions ▦ 1: Select All Points
1: Show Linear (mx+b) | able Line
2: Show Linear (a+bx) | Selected
3: Show Median−Median | cept at Zero
4: Show Quadratic | n
5: Show Cubic | sidual Squares
6: Show Quartic | rmal PDF
7: Show Power
8: Show Exponential | ion
9: Show Logarithmic | der Function
A: Show Sinusoidal
B: Show Logistic (d=0) | 2004 2007
C: Show Logistic (d≠0) | rs

Your regression is now plotted along with your data points.

1.1 | 1.2   RAD AUTO REAL

$y = 12.429200^+ x + 24724.400$

Discovery Question:
Does the "Linear Regression" model the data points? Why or why not?

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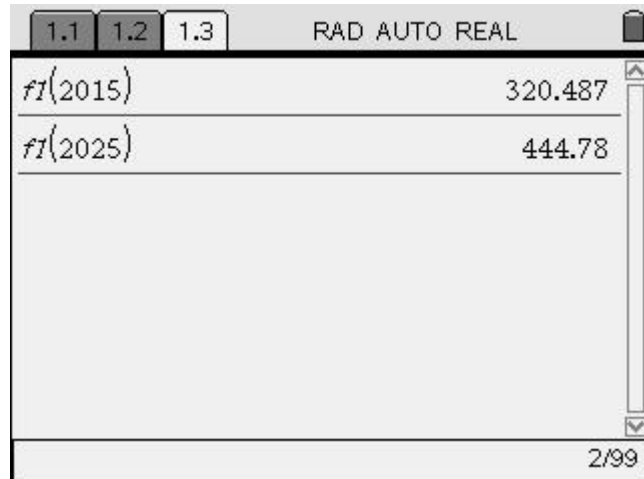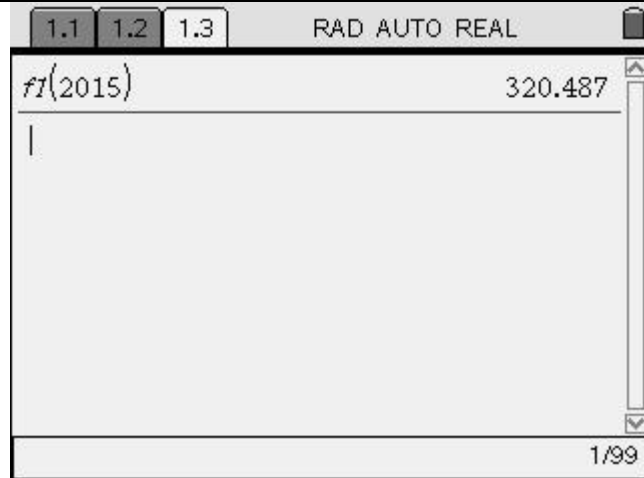| We will now select the (⌂) and add a new page with a "Calculator" Application to the open document.	**Home** 1:Calculator 2:Graphs & ... 3:Lists & Sp... 4:Notes 5:Data & Sta... 6:New Doc... 7:My Docu... 8:System Info 9:Hints Add a new page with a Calculator application to the open document.
You can 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 (enter) to calculate "guess" the price of gas in the year 2015. Follow the same steps to view the price of gas for various years.	1.1 1.2 1.3 RAD AUTO REAL $f1(2015)$ 320.487 1/99
	1.1 1.2 1.3 RAD AUTO REAL $f1(2015)$ 320.487 $f1(2025)$ 444.78 2/99
Discovery Question: What other types of Regression Equations might model this data more accurately? Why?	

You can follow the same procedures to find a quadratic regression, exponential regression and power regression equations. Discussion can then lead to which regression equation is better suited to model the data.