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To Buy a Hybrid or Not…That is the Question
by John Hinojosa

Activity Overview

In this activity, students determine if the operating costs of a hybrid vehicle outweigh the price when compared to a non-hybrid vehicle

Concepts

Typing data into a spreadsheet, evaluating linear regressions using the data from a spreadsheet, graphing the functions determined by the regression equations and finding the intersection point.

Teacher Preparation

This activity is designed for use in an Algebra classroom. Prior to this activity, students should have basic knowledge of linear functions, how to enter data into a spreadsheet and create graphs on the handheld.

Classroom Management Tips

This activity is teacher centered. The teacher will begin the activity by discussing the differences between a hybrid vehicle and non-hybrid vehicle. This activity will compare a Honda Civic with a Honda Civic Hybrid. The attached WORD document will give the basic facts about estimated gas mileage as well as yearly cost of gas. (You may also go to the Honda website for current information.)

TI-Nspire Applications

Lists and Spreadsheets
Graphs and Geometry

Materials needed:

TI-Nspire™ calculator
WORD Document (with information)
Computer for extended activity (Internet Research)

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Step-by-step directions:

Students will use the data provided in the WORD document to compare both the hybrid and non-hybrid vehicle. Each student will discover an equation that corresponds to the cost of the vehicle plus the yearly cost of gas.

|	
Press the "Menu" button and open a new **Lists and Spreadsheets** 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 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 (...) B C D E F G 1 2 3 4 5 A | **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 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 2: Insert ▸ 2: Resize 3: Data ▸ 3: Select ▸ 4: Statistics ▸ 4: Go To (Ctrl+G) 5: Function Table ▸ 5: Recalculate (Ctrl+R) 6: Sort 1 2 3 4 5 A | **years**
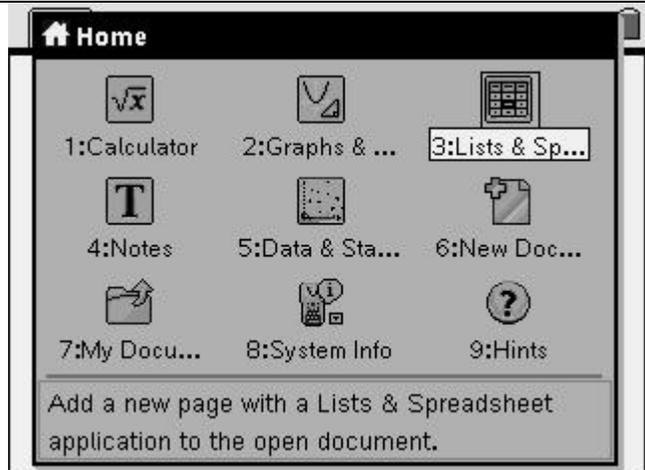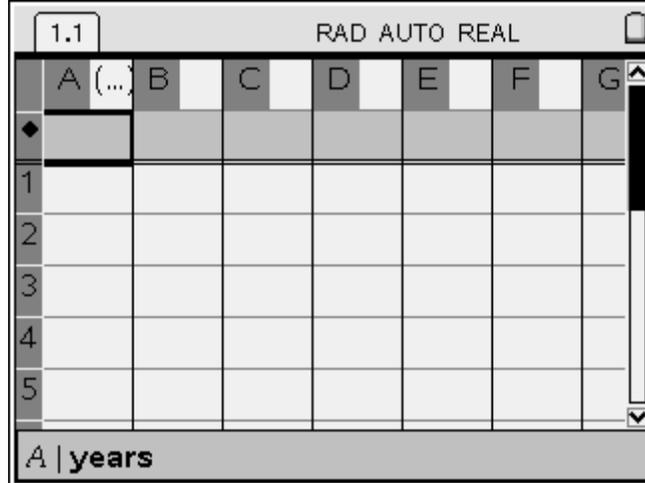
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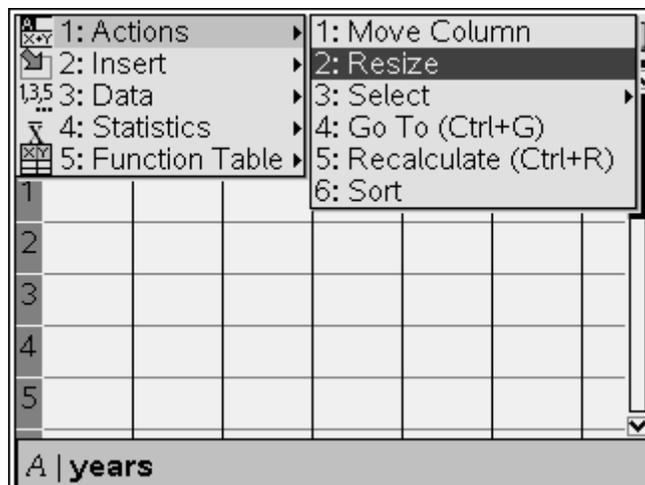
|	
Beginning with A1, you will now enter the number of years from 1 to 25. This can be done by manually typing the numbers 1 to 25 or by using the "fill down" feature.	**1.1** RAD AUTO REAL A years / B / C / D / E / F 1 → 1 2 → 2 3 → 3 4 → 4 5 → 5 A1 | 1
Once completed, you will need to use the "Nav pad" to move the cursor to the text box next to the letter "B". Label the column "Civic" Resize as needed.	**1.1** RAD AUTO REAL A years / B civic / C / D / E / F 1 → 1 2 → 2 3 → 3 4 → 4 5 → 5 B1 |
The student will now enter their data in the spreadsheet. The following screens will show sample data. Students will follow the next steps using their data. In cell B1, enter the following equation: =15405+1925A1. The equation describes the cost of the vehicle plus the yearly cost of gas.	**1.1** RAD AUTO REAL CAPS A years / B civic / C / D / E / F 1 → 1 17330 2 → 2 3 → 3 4 → 4 5 → 5 B1 | =15405+1925·a1
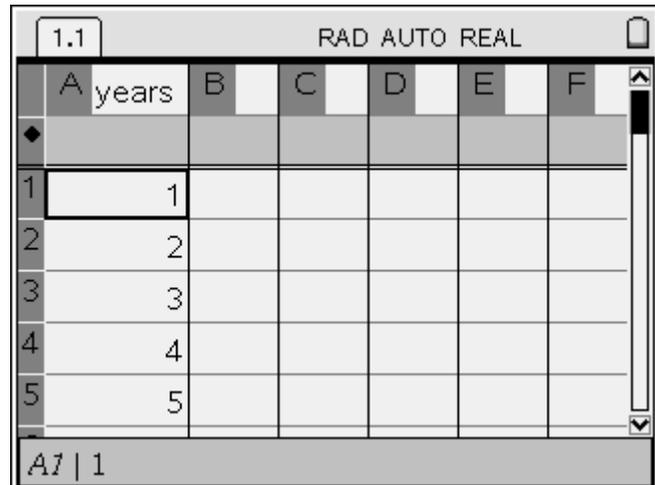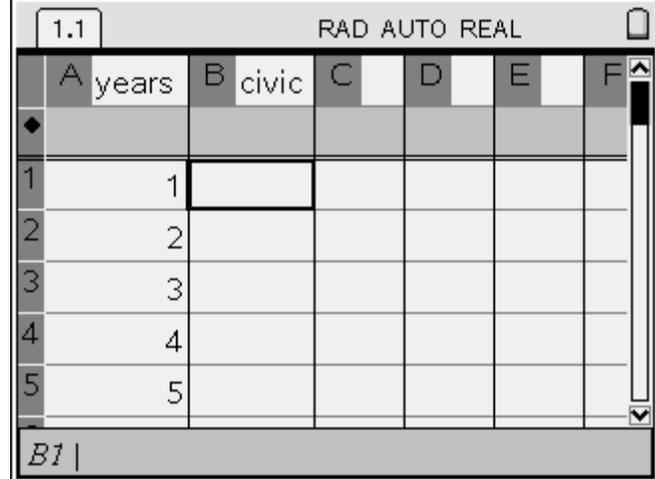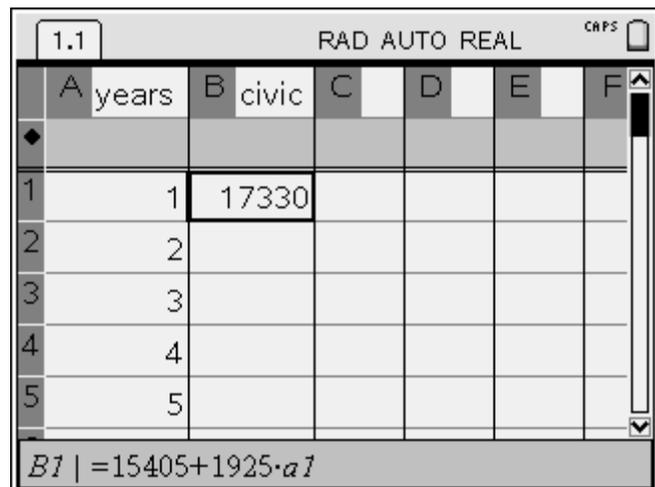
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You will now use the Fill Down option to paste the formula in the following cells. Select "Menu", "Data" and go to "3:Fill Down".

1: Actions ▸	RAD AUTO REAL	CAPS
2: Insert ▸		
3: Data ▸	1: Generate Sequence	
4: Statistics ▸	2: Data Capture ▸	
5: Function Table ▸	3: Fill Down	
1	17330	4: Quick Graph

2	2
3	3
4	4
5	5

$B1 \mid =15405+1925 \cdot a1$

You will highlight the cells up to B25 and select "Enter".

1.1			RAD AUTO REAL			CAPS
A years	B civic	C	D	E	F
◆					
1	1	17330			
2	2				
3	3				
4	4				
5	5				

$B1 \mid =15405+1925 \cdot a1$

Your data is now filled in on all cells

1.1			RAD AUTO REAL			CAPS
A years	B civic	C	D	E	F
◆					
1	1	17330			
2	2	19255			
3	3	21180			
4	4	23105			
5	5	25030			

$B4 \mid =15405+1925 \cdot a4$

You will need to use the "Nav pad" to move the cursor to the text box next to the letter "C". Label the column "Hybrid"

Resize as needed.

1.1			RAD AUTO REAL		CAPS
A years	B civic	C hybrid	D	E	
◆					
1	1	17330			
2	2	19255			
3	3	21180			
4	4	23105			
5	5	25030			

C | **hybrid**

In cell C1, enter the following equation: =23550+1328A1. The equation describes the cost of the hybrid vehicle plus the yearly cost for gas.

1.1			RAD AUTO REAL		CAPS
A years	B civic	C hybrid	D	E	
◆					
1	1	17330	24878		
2	2	19255			
3	3	21180			
4	4	23105			
5	5	25030			

C1 | =23550+1328·a1

You will now use the Fill Down option to paste the formula in the following cells as previously directed.

1.1			RAD AUTO REAL		CAPS
A years	B civic	C hybrid	D	E	
◆					
1	1	17330	24878		
2	2	19255	26206		
3	3	21180	27534		
4	4	23105	28862		
5	5	25030	30190		

C1 | =23550+1328·a1

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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).
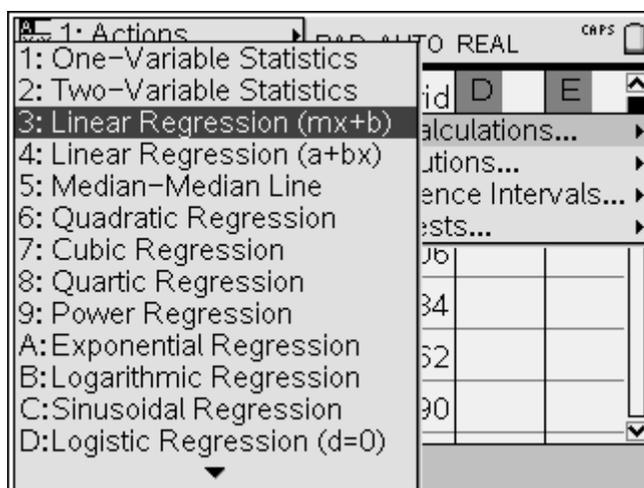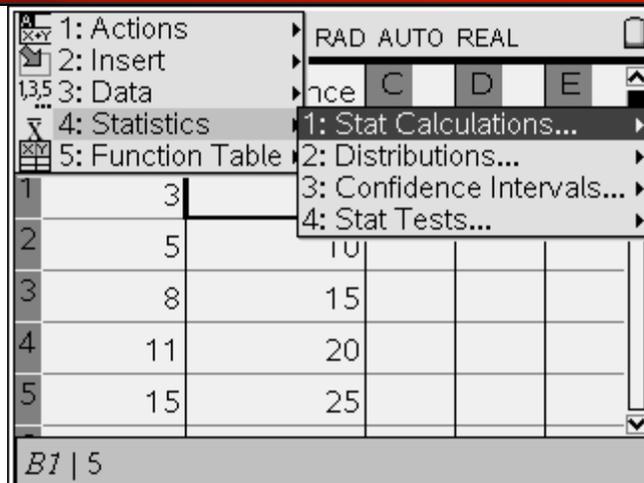
You will now select the parameters of the linear regression.

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 "civic"

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.

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Select "OK" and your Linear Regression Equation will be listed and labeled using columns D and E.

Once again, you may resize column widths.

1.1			RAD AUTO REAL	CAPS
A years	B civic	C hybrid	D	E
◆				=LinR
1	1	17330	24878 Title	Line...
2	2	19255	26206 Reg...	m*x...
3	3	21180	27534 m	1925.
4	4	23105	28862 b	154...
5	5	25030	30190 r²	1.

E1 | ="Linear Regression (mx+b)"

You will now find the linear regression using "years" and "hybrid" as my x-list and y-list, respectively. Make sure to save your equation to f2.
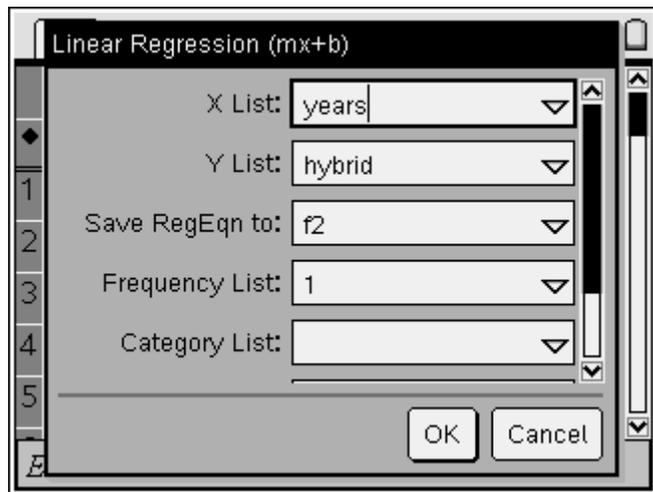
Linear Regression (mx+b)

X List: years

Y List: hybrid

Save RegEqn to: f2

Frequency List: 1

Category List:

OK   Cancel
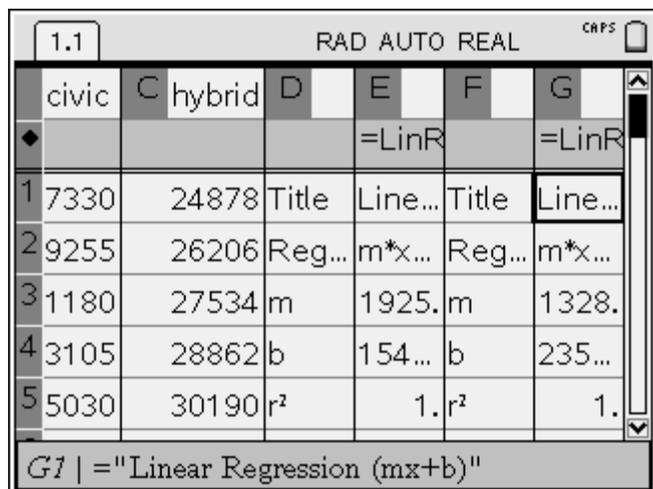
| 1.1			RAD AUTO REAL			CAPS
civic	C hybrid	D	E	F	G	
◆			=LinR		=LinR	
1 7330	24878	Title	Line...	Title	Line...	
2 9255	26206	Reg...	m*x...	Reg...	m*x...	
3 1180	27534	m	1925.	m	1328.	
4 3105	28862	b	154...	b	235...	
5 5030	30190	r²	1.	r²	1.	

G1 | ="Linear Regression (mx+b)"

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| We will now select the Home button and add a new page with a "Graphs and Geometry" Application to the open document. | Home

$\sqrt{x}$
1:Calculator 2:Graphs & ... 3:Lists & Sp...

T
4:Notes 5:Data & Sta... 6:New Doc...

7:My Docu... 8:System Info 9:Hints
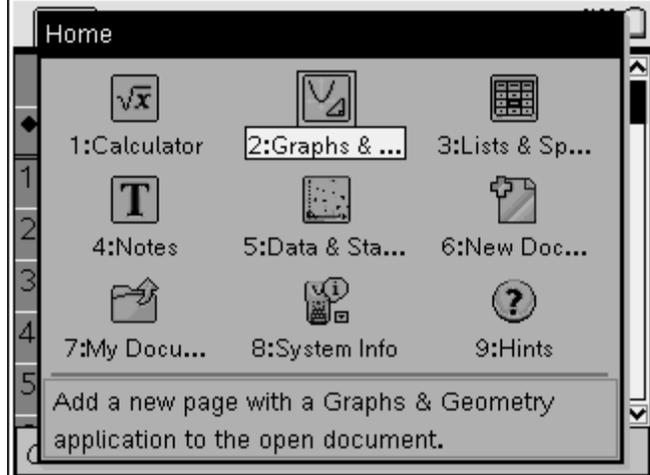
Add a new page with a Graphs & Geometry application to the open document. |
| You will now graph function 1 by selecting it. | 1.1 1.2   RAD AUTO REAL   CAPS
13.29 y

2

-20   2   20   x

👁 🔳 f3(x)=   ≫

1.1 1.2   RAD AUTO REAL   CAPS
13.29 y
f1(x)=1925.·x+15405.

2

-20   2   20   x

👁 🔳 f2(x)=1328.·x+23550.   ≫ |

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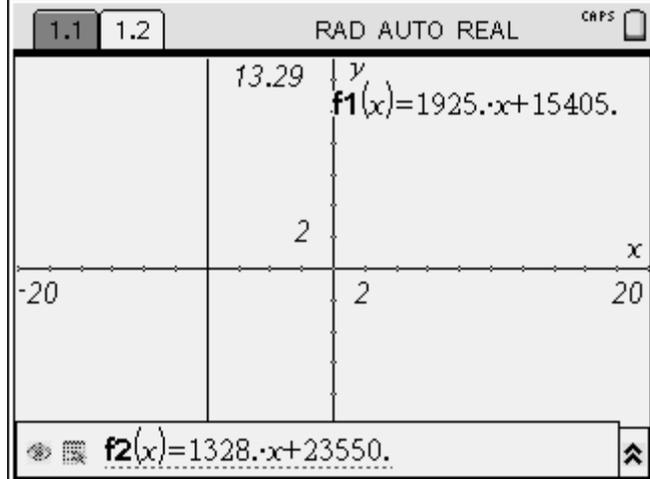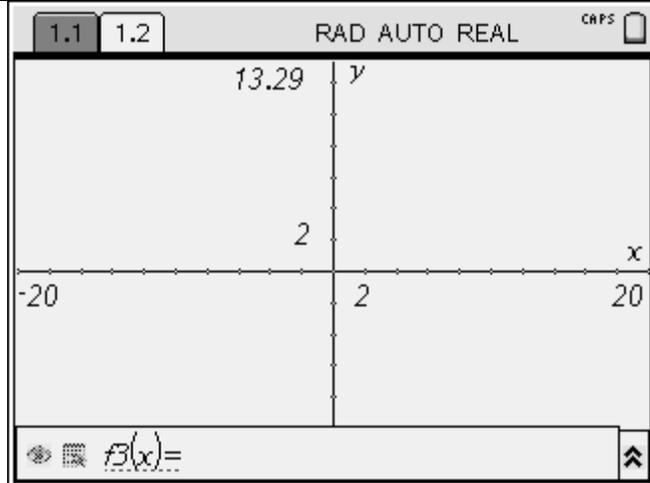
You will now graph function 2.
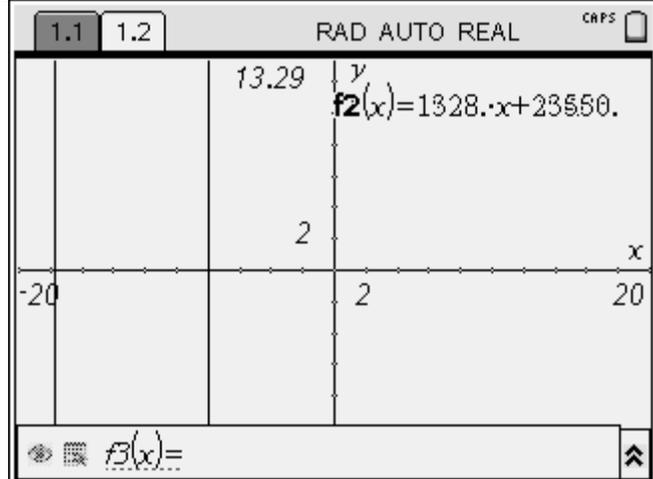
At this point, you need to change the window to view the point of intersection. Select "Menu", "Window" and "1: Window Settings".
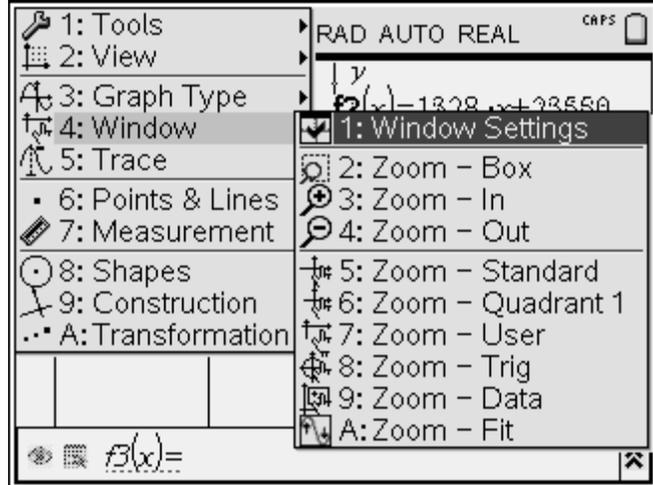

Suggested window settings:

XMin: 0
XMax: 25
YMin: 15000
YMax:60000

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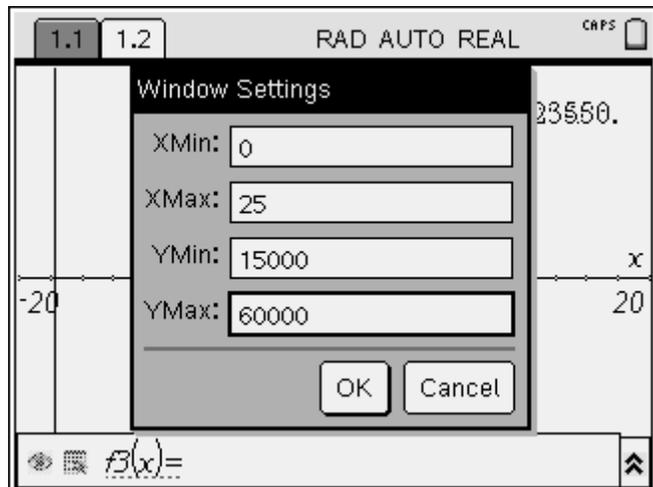
Your graph should look like the following.
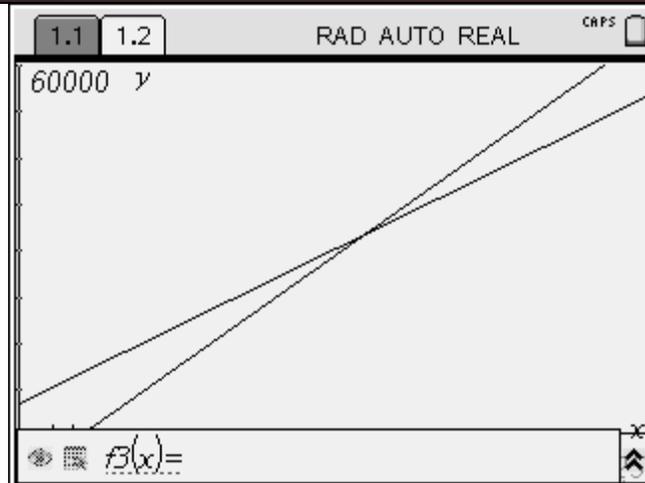
Find the point of intersection. Select "Menu", "6:Points and Lines", and "3: Intersection Point(s)" and select Enter.
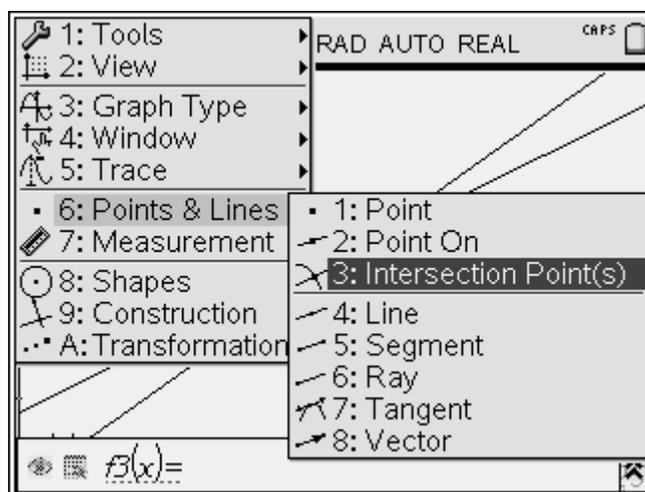
Move cursor until both lines are selected (blinking) and select Enter.

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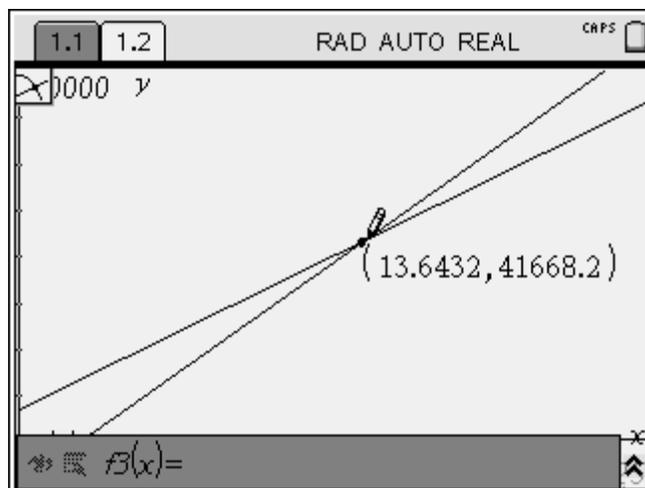
Discovery Question: What does the point of intersection mean? How many years will it be before a hybrid is cost effective? What other factors does a consumer need to take into consideration?	
Enrichment: Have students go online and research other vehicles and hybrids and compare the initial cost to their fuel savings.	