Hybrid Cars System of Equations Task

Assignment: You will analyze data about hybrid and traditional cars to determine how cost-effective it is to drive a hybrid car. You will use what you know about solving systems of equations algebraically and by graphing to answer questions about this topic.

Background: Traditional cars run on gasoline, while hybrid cars run on gasoline and electricity. Hybrid cars cost more to purchase, but since they get better mileage (they can go more miles on a single gallon of gas), owners of hybrid cars don't have to spend as much money every year on gasoline to drive. This is often promoted as a good reason to buy a hybrid car. People also like hybrid cars because they are better for the environment (because they burn less gasoline and produce fewer emissions).

Important Data: You are going to compare a hybrid car with its traditional equivalent. Choose ONE PAIR of the following to compare costs of ownership.

Honda Civic $18,640 31 mpg city/42 mpg highway
Honda Civic Hybrid $24,735 44 mpg city/47 mpg highway
Volkswagen Jetta $17,680 28 mpg city/40 mpg highway
Volkswagen Jetta Hybrid $31,120 42 mpg city/48 mpg highway
Ford Fusion $22,610 24 mpg city/36 mpg highway
Ford Fusion Hybrid $25,675 44 mpg city/41 mpg highway

Other Important Information:
The average driver travels 12,000 miles per year.
The average cost of regular gas in California last year was $2.36 per gallon.
The average buyer of a new car in the USA owns their car for 6 years.

What to turn in—all of this may be typed or neatly handwritten:

☐ This packet complete. All boxes and tables filled in and all questions answered in complete sentences. You can type answers or write on the worksheet.

☐ A full page 1-quadrant graph of your data. X axis will be Time in Years, Y axis will be Cost of Ownership in Dollars. Scale the graph so that the point of intersection fits on the page. You must include: labeled axes, a graphed line for each of your two cars clearly labeled, the point of intersection clearly labeled, your two equations, and a table.
1. First, let’s compare your two cars. Record your data and fill in the table completely.

**To compute the cost of gas for one year**, you would divide 12,000 miles by the Average miles per gallon of the car. Multiply that number by the average cost of gasoline. Round to the nearest dollar. In equation terms:

Cost of gas for a year = \([12000 / (\text{average mpg})] \times (\text{cost of gasoline})\)

Calculate the cost of gas for one year for each car, and fill in your table:

<table>
<thead>
<tr>
<th>Car</th>
<th>Cost of car</th>
<th>City Mi/Gal</th>
<th>Highway Mi/Gal</th>
<th>Average Mi/Gal (city + highway)/2</th>
<th>Cost of Gas for 1 year (for 12,000 miles, round to nearest dollar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Car:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hybrid Car:</td>
<td></td>
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</tr>
</tbody>
</table>

2. Create a linear equation to model this situation, with an equation in slope-intercept form

\[(y = mx + b)\]

Car Total Cost after X years = (Cost of Gas for 1 year) X + (Cost of Vehicle)

What does X represent in these equations? What does Y represent?

3. X represents _______________ and Y represents _______________

That will give us the following equations (fill them in):

**Traditional Car Total Cost:**

**Hybrid Car Total Cost:**
4. Using the two equations you found, solve the system of equations, using any algebraic method of your choice (equal values method, substitution, or elimination). Show your work. You may use a calculator for the calculations, be careful of rounding too soon.

5. Graph your two equations on a separate sheet of graph paper. Follow the directions on the first page, being careful to title your graph and label each axis with what each variable represents and the units.

For Discussion:

1. Find the point of intersection. What is it? _________________

2. Describe what the point of intersection means in this situation.

3. After one year, is it cheaper to own a hybrid car or a traditional car? How do you know?
4. After **how many** years is it cheaper to own a hybrid car than a traditional car? How do you know?

5. Using the information that you found in the above problems, do you think it is a good financial investment to purchase a hybrid vehicle? Explain why or why not. Consider that the average buyer of a new car owns their car for 6 years.

6. Taking the environment into consideration, and the information above, if you were shopping for a new car, would you purchase a hybrid vehicle? Explain why or why not.

7. One of the least expensive cars on the market is the Chevy Spark at a base cost of $12,660. It gets 31mpg city/41 mpg highway. How do you think this line would look on your graph? Where might you expect it to intersect the other lines in your system?

8. What do you think the line would look like for an all electric vehicle? Why?