# Performance Based Learning and Assessment Task

# *Calculating the Cost: Algebraic Planning for a First Car*

**I. ASSESSSMENT TASK OVERVIEW & PURPOSE:**

Scenario: Imagine that you are saving up money to buy a car. Given two different jobs and the salaries for each, you will need to choose which employment opportunity will help you to raise money for your car most efficiently. You also need to research cars so that you have an idea of how much cars cost and you can choose a type car that you aim to buy. This will help you to plan how much money you will need to earn and how long it will take before you are ready to purchase a car. You will also need to think about how much money you will need to have in order to supply gas for your car. You can calculate this amount using the distances that you will drive between school, work, and home. Planning your finances in advance will help you stay on track to reach your goal and to be sure that you always have enough money to keep you and your car moving.

**II. UNIT AUTHOR:**

Whitney Wall Bortz, Radford University

**III. COURSE:**

Algebra 1

**IV. CONTENT STRAND: Algebra: Expressions and Operations, Equations and Inequalities, and Functions**

**V. Virginia S.O.Ls:**

Activity 1: Expressions and Operations (A.1), Functions (A.7)

Activity 2: Equations and Inequalities (A.4 and A.6), Functions (A.7)

**VI. OBJECTIVES:**

The student will be able to:

Activity 1:

- Represent the quantitative scenarios described as algebraic expressions.
- Evaluate the expressions given replacement values for each variable.
- Solve for or isolate a variable in an equation
- Use technology (e.g. Excel, graphing calculator, Geogebra, online tool) to create an XY Scatterplot line graph

Activity 2:

- Represent the quantitative scenarios described as algebraic expressions.
- Graph linear equations with two variables.
- Recognize connections between a real-life scenario, a slope-intercept equation, and the graphical representation.

**VII. REFERENCE/RESOURCE MATERIALS:**

Matching game (algebraic expressions)

Computers with internet access

Activity Worksheets (see attached)
Graph paper (optional)
Rulers (optional)
Pencils

**VIII. PRIMARY ASSESSMENT STRATEGIES:**

The task includes an assessment component that performs two functions: (1) for the student it will be a checklist and provide a self-assessment and (2) for the teacher it will be used as a rubric. The assessment list for the first activity is intended to evaluate the student's use of mathematics to make reasonable decisions. It will also evaluate the use of Excel for graphing and reflections on the graph. The list for the second activity is intended to measure the graphs, calculations and critical thinking evidenced in the student's connections between the mathematics and the real life scenarios.

**IX. EVALUATION CRITERIA:**

Assessment List for Activity 1 &2, corresponding rubrics.

**X. INSTRUCTIONAL TIME:**

Activity 1 is estimated to take two 50 minute class periods, and Activity 2 to take 2 - 3 50 minute class periods, depending on the amount of scaffolding needed amongst students.

# Expressions, Operations, and Functions Task

**Strand(s)**
Expressions and Operations
Functions

**Related SOLs**

A.1 The student will represent verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variable.

A.4 The student will solve multi-step linear and quadratic equations in two variables. (a. solving literal equations (formulas) for a given variable; b. justifying steps used in simplifying expressions and solving equations; d. solving multistep linear equations algebraically and graphically; and f. solving real world problems using equations)

A.6 The student will graph linear equations and linear inequalities in two variables, including (a. Determining the slope of the line when given an equation of the line, the graph of the line, or two points on the line)

A.7 The student will investigate and analyze function (**linear** and quadratic) families and their characteristics both algebraically and graphically, including (a. Determining whether a relation is a function; d. x- and y-intercepts; f. making connections between and among multiple representations of functions, including concrete, verbal, numeric, graphic, and algebraic).

**NCTM Standards (Algebra)**:
- Use symbolic algebra to represent and explain mathematical relationships
- Analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.
- Understand the meaning of equivalent forms of expressions, equations, inequalities, and relations
- Draw reasonable conclusions about a situation being modeled
- Approximate and interpret rates of change from graphical and numerical data.

**Materials/Resources**
- Computers with internet access
- Worksheets (see attached)
- Paper/graph paper/pencils
- Rulers

**Assumption of Prior Knowledge**
- Knowledge of proper usage of variables in an expression.

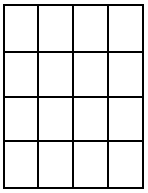
- Computation skills needed for solving equations with one variable
- Ability to graph ordered pairs
- A beginning understanding of y = mx + b and what the components represent
- Solving ratio problems

**WARM-UP ACTIVITES**

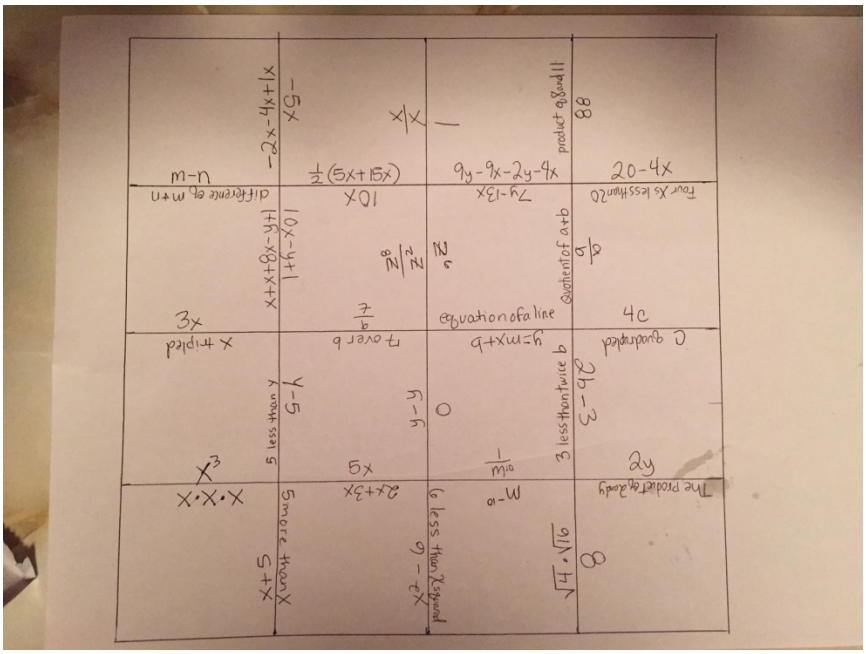
Small group warm-up activities (The puzzle activities will be used as a warm-up activity during the first 15-20 minutes of each class).

Students will be making puzzles with algebraic expressions. The point of this activity is to access prior knowledge related to expressions and equations prior to completing the two activities involving these skills.

Day 1: In small groups, students create an algebra puzzle that is a 4 x 4 square:



Each edge of each small square touches the edge of another with an equivalent expression. There will be a total of 10 equivalent expression pairs on the inside edges (see example to be shared with students below).




Day 2: Students continue to work on the puzzles during the warm-up time

Day 3: During the warm-up time, the teacher rotates and gives feedback to groups on their puzzles and checks for accuracy. Those who are finished can cut up the pieces.

Days 4 and 5: During the warm-up time, groups exchange puzzles and solve.

**Introduction: Setting Up the Mathematical Task (Day 1 following the warm-up)**
Teacher begins class discussion:
*How many of you hope to own a car someday? How much do you think you would need to spend in order to get a reasonably reliable car? Are there any other expenses you need to plan for in addition to buying a car?*
The teacher will facilitate the whole group discussion

*For the purpose of this activity, we will assume that your only expenses are purchasing the car and paying for gas. Your parents will cover your insurance and maintenance.*

Activity 1 (Days 1 and 2): Researching the Expense (SEE WORKSHEET FOR THIS SECTION OF THE PROJECT)

**Students' Actions**: Students will be both researching on the computer and also performing calculations. They will also use computers to make the graphs in Excel or they can use graphing calculators, an online tool, or graph paper if computer lab access is limited.

**Teacher's Actions**: The teacher should rotate and provide scaffolding to students as they complete this task.

Activity 2 (Days 3 and 4-5): Calculating the cost (SEE WORKSHEET FOR THIS SECTION OF THE PROJECT)

**Students' Actions:** Students work individually on the reflections and calculations as defined in the worksheet. Students will also collaborate with other students and share their learning.
**Teacher's Actions:** Teachers should rotate and provide scaffolding to students, as needed.
**Small Group sharing:** The extension activity provides the opportunity for students to verbally explain and defend their work.
**Whole Class Sharing/Discussion:** Students will share one project from each group with the class and students can comment on one another's projects (optional extension activity).

**Monitoring Student Responses**

- Student and Teacher actions
  - Students are to communicate their thinking by asking questions and listening to other's comments and contributions.
  - Students are to communicate with each other respectfully and supportively.
  - Teachers should monitor discussions that take place during warm-up activities and the extension activity
  - Teachers are to highlight the frequently asked questions and provide strategies for avoiding and resolving difficulty.
  - Teachers are to extend the material for students that are ready to move forward and emphasize real world applications.
- Possible challenges for students
  - Some students may have difficulty translating the scenarios in the activities into algebraic expressions. The teacher can provide scaffolding, and students who have mastered this can also be instructed to assist those who are struggling.
  - Some students may struggle with minor computation errors that throw off the accuracy of their entire projects. Suggests that students pair up with a peer to proof one another's work at certain stages of the activity.
- Summarizing the activities
  - The group presentations at the end of the activities are the first step in summarizing their learning.
  - Following the presentations, ask students to journal a short paragraph about what they have learned in this activity and how it can be applied to their lives.

**Worksheet for Activities 1 and 2**

**Planning for a car**

*Read the instructions carefully for each step. You may ask the teacher or a classmate for help, but your answers should NOT be the same as a classmate's. This portion of the project should be completed individually. We will have an opportunity to discuss and share with partners later in the unit.*

*You can either print and handwrite your responses or you can create your own typed version. Graphs can either be done on graph paper or on Excel but should be neat and readable.*

**Note: "Hints" should be removed if this activity is being used with stronger students who should not need them.*

**ACTIVITY 1: Planning your Purchase and your Work**

Part 1: Review your job options

*In order to earn the money to buy a car, you will need to start a job. You have two options and should decide which job to take.*

1. You can either work in your dad's office after school at $8/hr or work in a restaurant at $5.50/hour plus about 60% of your salary in tips. Your dad's boss really needs the help, so as an incentive, he offers you $10 each week to cover transportation costs. Assuming that you work 15 hours per week at each job, in which job will you earn the most money? Define your variables, and write an equation to represent each situation. (Hint: your variables should represent the amount earned and the amount of time you work)*. Show all of your work.

2. What if you decide you would like to work more hours? Your dad's office can raise your hours to 20, but the restaurant can only raise your hours to 18? At which job would you make the most money per week? Show all of your calculations.

3. Which job would you choose? Explain your reasoning.

Part 2: Choosing a Car

1. Search car prices for various makes and models and years of cars. Prices will determine how old or new of a car you will be able to buy.

Some helpful sites:

www.craigslist.com

www.carmax.com

www.autotrader.com

2. Complete the following based on your search:

   Make: _____ Model: _____

3. Explain your reasoning for choosing this car. List at least 3 other cars that you considered and explain why you have chosen the car above.

4. Complete a table like the one below for at least 5 different years. You can either find average prices online or find examples from your own zipcode. Keep in mind that one example may not represent the average or a price similar to what you would find and your local area may have different pricing than the national average. This is just to give you a rough idea of what you will be able to afford.

   Motor Trend has a helpful pricing tool: www.motortrend.com

| Year | Example Price |
|---|---|
| 2004 | |
| 2005 | |
| 2006 | |
| 2007 | |
| 2008 | |
| 2009 | |
| 2010 | |
| 2011 | |
| 2012 | |

5. Which variable is the independent variable, and which is the dependent variable? In other words, which variable affects the other?

6. Create a line graph from the data in the table above. You may choose a graphing tool. The graph should have the years on the x axis, and the prices on the y axis. Explain what the graph represents. Is this a function? Why or why not? Is this a linear equation? Why or why not?
7. For your car, what year would you choose to buy based on the prices above? How did you come to this decision?

**ACTIVITY 2: Calculating the Cost**

Part 3: Gas Money

You will not only need to purchase the car. You will also have to pay car insurance, maintenance and gas. Assume that your parents are helping with insurance and maintenance. You should still plan for weekly gas costs.

1. For the car you have chosen, find the gas mileage (miles per gallon) for city driving.

MPG = _____

2. Use the internet to find the average price of gas per gallon in your area.

Gas Price = _____

3. Use a mapping site on the internet to find the distances between the places you will usually drive each week. You can choose any restaurant in town.

| **Commute** | **Distance** |
|---|---|
| Home to School | |
| School to Work | |
| Work to Home | |

4. Assume that you will drive from home to school, school to work and then work to home on Monday, Wednesday, Friday, and Saturday. On Tuesday and Thursday, you will only drive form home to school and back, and on Sunday, you will ride your bike anywhere else you decide to go. Make a table to show the daily distance driven and the corresponding cost of gas.

5. How did you calculate the cost? Show all of your work and explain your calculations.

6. You realize that your weekly driving may vary, and you would like to be able to calculate the cost more quickly. Can you think of a rule/equation that will always work for finding the cost if you know your miles driven per week? How did you discover the rule? Explain your thinking.

Part 4: Total cost

1. Write an equation for the cost of the car plus the cost of gas for one week in terms of miles driven (hint: use a variable for miles)*. This will represent your total cost in your first week of driving.

2. Graph this equation. What is the slope of the line? What does this slope tell you about the situation that you are graphing?

3. What is the y intercept? Explain the meaning of the y interecept here and how it relates to the situation that you are graphing.

4. How would the graph described above change if the car got less miles per gallon?

5. Use the equations from part 1 that represent your earnings. Graph your earnings by week. Therefore, your x axis scale should represent each week. Think about how you may need to change your equation now. Include the equation as well as a table of the data points that you used.

6. How much time will it take for you to have enough money to purchase your car and pay your first week of gas? Show your work.

Part 5: Extension Activity – Group discussion and presentation

Present your plan to your teammates and try to convince them that you have made good choices. See if your teammates can be convinced to adopt your plan. You will choose one of your three plans to present to the class in a PPT presentation.

**Assessment List and Benchmarks**

Assessment List for Activity 1: Researching the Expense

| | | | Earned Assessment | |
|---|---|---|---|---|
| **Num** | **Element** | **Point Value** | **Self** | **Teacher** |
| **1** | Part 1: Variables are defined. | 2 | | |
| **2** | Part 1: Calculated earnings for office job | 2 | | |
| **3** | Part 1: Calculated earnings for restaurant job | 2 | | |
| **4** | Part 1: Calculated earnings for office job with increased hours | 2 | | |
| **5** | Part 1: Calculated earnings for restaurant job with increased hours. | 2 | | |
| **6** | Part 1: Explanation provided for job choice. | 2 | | |
| **7** | Part 2: Car chosen and reasoning provided. | 2 | | |
| **8** | Part 2: Table completed showing 5 years of average prices for the car. | 2 | | |
| **9** | Part 2: Line graph provided to represent the table of average prices. | 2 | | |
| **10** | Part 2: Explanation provided of what the graph represents. | 2 | | |
| **11** | Part 2: States whether the graph is a function with reasoning | 2 | | |
| **12** | Part 2: States whether the graph is a linear equation with reasoning | 2 | | |
| **13** | Part 2: States car of choice with reasoning provided. | 2 | | |
| **14** | All materials are neat | 2 | | |
| **15** | The assignment materials are well-organized. | 2 | | |
| | Total | 30 | | |

| RUBRIC FOR ACTIVITY 1 | | | | |
|---|---|---|---|---|
| **#** | **Element** | **0** | **1** | **2** |
| **1** | Variables defined | No definition provided | Only one variable is defined | Both variables defined |
| **2** | Calculated earnings for office job | No calculation provided | Calculation is incorrect or incomplete | Calculation is correct. |
| **3** | Calculated earnings for restaurant job | No calculation provided | Calculation is incorrect or incomplete | Calculation is correct. |
| **4** | Calculated earnings for office job with increased hours | No calculation provided | Calculation is incorrect or incomplete | Calculation is correct. |
| **5** | Calculated earnings for restaurant job with increased hours | No calculation provided | Calculation is incorrect or incomplete | Calculation is correct. |
| **6** | Explanation for job choice | No explanation | Minimal or illogical explanation | Sound explanation |
| **7** | Car choice | No car choice provided | Car choice without reasoning | Car choice with reasoning |
| **8** | Table of average prices | No table | Table is incomplete or inaccurate | Table is complete and accurate |
| **9** | Line graph | No line graph | Line graph is incomplete or inaccurate | Line graph is accurate |
| **10** | Explanation of graph | No explanation | Explanation is insufficient | Well-thought explanation |
| **11** | Is the graph a function? | No response | Correct answer but insufficient explanation | Correct answer and explanation |
| **12** | Is the graph a linear equation? | No response | Correct answer but insufficient explanation | Correct answer and explanation |
| **13** | Car choice with reasoning | No choice provided | Choice but insufficient reasoning | Choice and reasoning |
| **14** | Neatness of materials | Materials are not neat | Materials are lacking in neatness | Materials are neat and easy to read. |
| **15** | The components of the project are organized. | No organization | Some organization | Materials are well-organized when handed in. |

Assessment List for Activity 2: Calculating the Cost

| | | | Earned Assessment | |
|---|---|---|---|---|
| **Num** | **Element** | **Point Value** | **Self** | **Teacher** |
| **1** | Part 3: Provides the car's MPG and the average cost of gas, and the distances driven in town. | 3 | | |
| **2** | Part 3: Second table provides daily driving distances and cost of gas | 3 | | |
| **3** | Part 3: Calculations for gas costs are provided. | 3 | | |
| **4** | Part 3: Rule provided for the weekly cost of gas based on miles driven. | 3 | | |
| **5** | Part 3: Student explains how he/she discovered the rule. | 3 | | |
| **6** | Part 4: Writes an equation to represent the cost of the car plus one week of gas. | 3 | | |
| **7** | Part 4: Identifies what the slope and y-intercepts would be for the equation above. | 3 | | |
| **8** | Part 4: Explains how the slope and y-intercepts describe the real-life situation represented by the equation. | 3 | | |
| **9** | Part 4: Describes how the graph would be different if the car got less MPGs. | 3 | | |
| **10** | Part 4: Provides a graph for earnings by week. | 3 | | |
| **11** | Part 4: Provides calculations for finding earnings by week. | 3 | | |
| **12** | Part 4: Provides the equation and data points used for the graph of earnings by week. | 3 | | |
| **13** | Part 4: Calculates the number of weeks it will take to be able to buy a car. | 3 | | |
| **14** | The student shows work on calculations and these are neat. | 3 | | |
| **15** | The project as a whole is neatly written or typed and well-organized. | 3 | | |
| | TOTAL POINTS | 45 | | |

| RUBRIC FOR ACTIVITY 2 | | | | | |
|---|---|---|---|---|---|
| **#** | **Element** | **0** | **1** | **2** | **3** |
| **1** | MPG, Gas price, and driving distances | Does not provide all elements | Provides one of the three elements | Provides 2 of the three elements | Provides all elements |
| **2** | Table with daily driving and gas costs | No table provided | Provides an incomplete table or table has significant errors | Table has some errors | Table is complete and free of errors |
| **3** | Gas cost calculations | No calculations provided | Calculations are minimal or full of errors | Calculations are acceptable with minimal errors. | Full calculations provided with no errors |
| **4** | Rule for weekly gas cost | No rule provided | Rule is incorrect | Rule is partially correct | Rule correctly explains the mathematical situation |
| **5** | Explanation of the rule | No explanation provided | Explanation is minimal or inaccurate | Explanation has minimal error | Explanation is thorough and correct |
| **6** | Equation for car plus one week of gas | Equation not provided | Equation is incorrect | Equation is partially correct | All parts of the equation are accurate |
| **7** | Identifies slope and y-intercept | Slope and y-intercept not identified | One of the two components is provided. Or both provided inaccurately | Both provided but one may be inaccurate | Both components provided accurately |
| **8** | Explains slope and y-intercept | No explanation | Minimal or insufficient explanation | Explanation is almost complete or contains minimal error | Full explanation with no errors |
| **9** | Description of change in graph for less MPGs | No description | Minimal or insufficient ddescription | Description is almost complete or contains minimal error | Thorough description with no errors |
| **10** | Graph: Earnings by week | No graph | Graph is incomplete, unlabeled or contains many errors | Graph is almost complete or contains minimal error | All components of graph are provided with no errors |
| **11** | Calculations for earnings by week | No calculations provided | Many errors in calculations or incomplete calculations | Minimal errors. | Complete and error free calculations |
| **12** | Equation and data table | Equation and table not provided | Only one provided or many errors | Minimal error in the equation and/or data table | Both graph and table provided with no or very minimal error |
| **13** | Number of weeks to | No response | Calculation and | Calculation and | Calculation and |

| | | | | | |
|---|---|---|---|---|---|
| | buy car | provided | response are inaccurate | response contain minimal error | response are complete with no errors. |
| **14** | Calculations are shown and neatly written or typed. | Lacks work shown or work lacks neatness. | Incomplete or unclear calculations | Calculations included but neatness needs some improvement | Calculations included and written or typed neatly |
| **15** | Each component and the project as a whole is well-organized. | No evidence of organization. | Organization needs improvement. | Organization is acceptable. | Well-organized |

**Benchmarks**

Bortz, Whitney

1. Job options:
    a. Working in Dad's office

Let h = time in hours

Let M = money earned

M = 8h + 10

M = (8)(15) + 10

**M = $130**

    b. Restaurant Job

Let h = time in hours

Let M = money earned

M = 5.5h + .6(5.5h)

M = 5.5h + 3.3h

M = 8.8h

M = 8.8 (15)

**M = $132**

2. Increased Hours (20 hrs in the office or 18 in the restaurant)

Office:

M = 8h + 10

M = (8)(20) + 10

M = 160 + 10

**M = $170**

Restaurant

M = 8.8h

M = (8.8)(18)

**M = $158.40**

3. Choosing the job:
   *Now, the job that would earn the most money would be the job in my dad's office. However, I would be working 2 additional hours per week. I may decide to go with the restaurant instead, since I still earn more per hour there, unless I really need to earn money more quickly. I also think I would enjoy the restaurant job more. I think my dad will understand.*

Step 2: Choosing the Car

Make: **Ford**
Model: **Focus**

*I searched on both AutoTrader and Craigslist. I knew I probably wouldn't be able to afford to pay any more than $9000, so I set that as the maximum price. However, I was hoping to find options a lot cheaper! I compared the Honda Civic, the Mazda M3 and a Volkswagon Bug. I chose the Ford Focus for several reasons.*

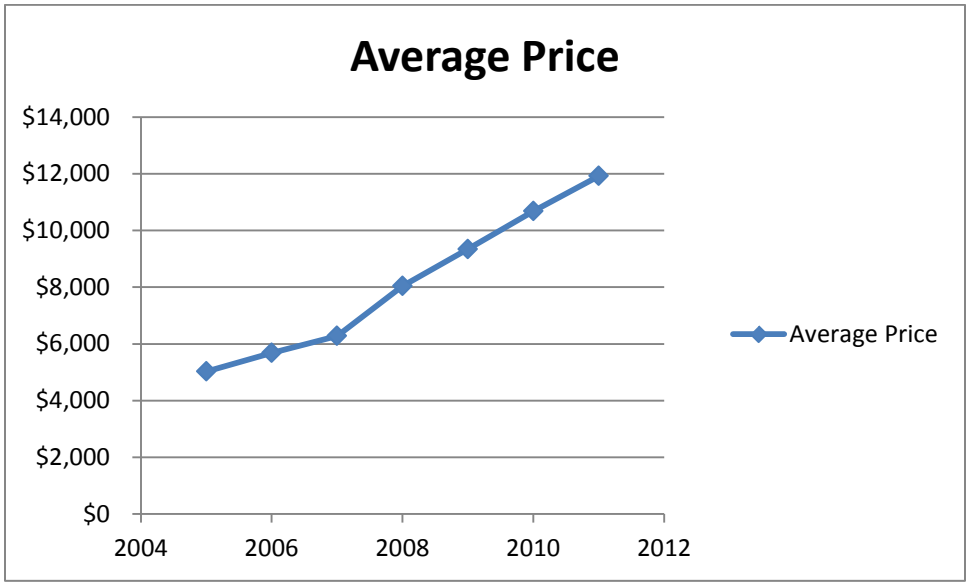
*As a new driver, I wanted to find a car that was affordable and also compact. My older sister has a Toyota Highlander, and she hit another car when she was trying to parallel park her car on Main Street. I have watched my mom and dad parallel park, and it seems easier in a smaller car. I really don't want to have an accident like my sister's, because it was expensive.*

*The Focus was cheaper than several other cars of similar size. For example, I found one 2007 Ford Focus in my zip code for only $5900 on Craigslist, and I found a 2006 Ford Focus on Autotrader for $6950. A 2006 Honda Civic with more miles on Autotrader was $7995. I found a 2007 Honda Civic on Craigslist for $7500 which is $1600 more than the 2007 Ford Focus.*

Based on www.motortrend.com:

| Year | Average Price |
|---|---|
| 2005 | $5,029 |
| 2006 | $5,684 |
| 2007 | $6,278 |
| 2008 | $8,043 |
| 2009 | $9,346 |
| 2010 | $10,679 |
| 2011 | $11,922 |

The Graph:




*The graph above shows the average price (as found on [www.motortrend.com](http://www.motortrend.com)) of a Ford Focus by year. The basic trend is that the newer the car, the more expensive it will be. There are sharper climbs between some years. It looks like 2007 and older cars are closer in price than once you get beyond 2007.*

*Yes, this graph represents a function, because for every x value (or year), there is only one y value (or price) represented in the graph. This makes sense, because there can only be one average price in a year when we are discussing the same vehicle.*

*It does not represent a linear equation, because the rate of change is not constant, so we cannot write an equation that would represent this exact line graph. We could write a line for a line of best fit, which would approximate the rate of change in price as you move from 2004 to 2012, but it would not represent the actual data points for the average prices each year.*

*In this example, the independent variable is the year, and the dependent variable is the cost. This is because the newer the car, the higher the price. As the year goes down, the cost also goes down.*

*I would aim to be able to purchase a 2008 Ford Focus. It is under $9000, so I will be able to earn enough to buy it in less time than something newer. Also, the increase in average price between 2007 and 2008 is the largest increment in the table. This implies that perhaps the cars older than 2008 are considered less safe. I have not researched this, but there could be some revision to the model that occurred for the 2008s that makes it safer or more reliable.*

Part 3: Gas Money

1. What is the city gas mileage for the 2008 Ford Focus?

MPG = **24**

2. Gas price locally

**$3.10**

3. What distances will you travel in town?

| **Commute** | **Distance** |
|---|---|
| Home to School | 2.1 |
| School to Work | 1.3 |
| Work to Home | 1.5 |

4. Table of weekly driving

| DAY | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday | Totals |
|---|---|---|---|---|---|---|---|---|
| Distance | 4.9 mi. | 4.2 | 4.9 | 4.2 | 4.9 | 3 | 0 | 26.1 |
| Cost | 0.63 | 0.54 | 0.63 | 0.54 | 0.63 | 0.39 | 0 | 3.36 |

5. How did you calculate the total cost? Show your work and explain your calculations.

Information I know:

- It costs $3.10 for 1 gallon of gas
- My car can drive 24 miles on that 1 gallon.
- It costs $3.10 to drive 24 miles

We need to find

- The cost for shorter distances.
- After writing out the information that I know, it looks like this can be a proportion problem:

For Monday, Wednesday, Friday driving:

$$\frac{mi}{\$} = \frac{24}{3.10} = \frac{4.9}{x}$$

$$24x = (4.9)(3.1)$$

$$24x = 15.19$$

$$x = \frac{15.19}{24}$$

$$\boldsymbol{x \approx 0.63}$$

Therefore, it will cost about 63 cents for gas used on Monday, Wednesday, and Friday.

Tuesday and Thursday

$$\frac{mi}{\$} = \frac{24}{3.10} = \frac{4.2}{x}$$

$$24x = (4.2)(3.1)$$

$$24x = 13.02$$

$$x = \frac{13.02}{24}$$

$$\boldsymbol{x \approx 0.54}$$

Saturday

$$\frac{mi}{\$} = \frac{24}{3.10} = \frac{3}{x}$$

$$24x = (3)(3.1)$$

$$24x = 9.3$$

$$x = \frac{9.3}{24}$$

$$\boldsymbol{x \approx 0.39}$$

*To find the total cost, I just added all of the amounts in the row of costs. Then, I realized that I could have also set up a ratio like above and set 26.1mi. over x equal to 24 mi. over 3.1.*

6. You realize that your weekly driving may vary, and you would like to be able to calculate the cost more quickly. Can you think of a rule/equation that will always work for finding the cost if you know your miles driven per week?

First, I'd need to find the cost per mile. To find the cost per mile:

$$\frac{24}{3.1} = \frac{1}{x}$$

$$24x = 3.1$$

$$\boldsymbol{x \approx 0.13}$$

*Each mile I drive costs about 13 cents! Now, I can write an equation for my cost in terms of miles driven!*

**C = 0.13m**

<u>Part 4: Total cost</u>

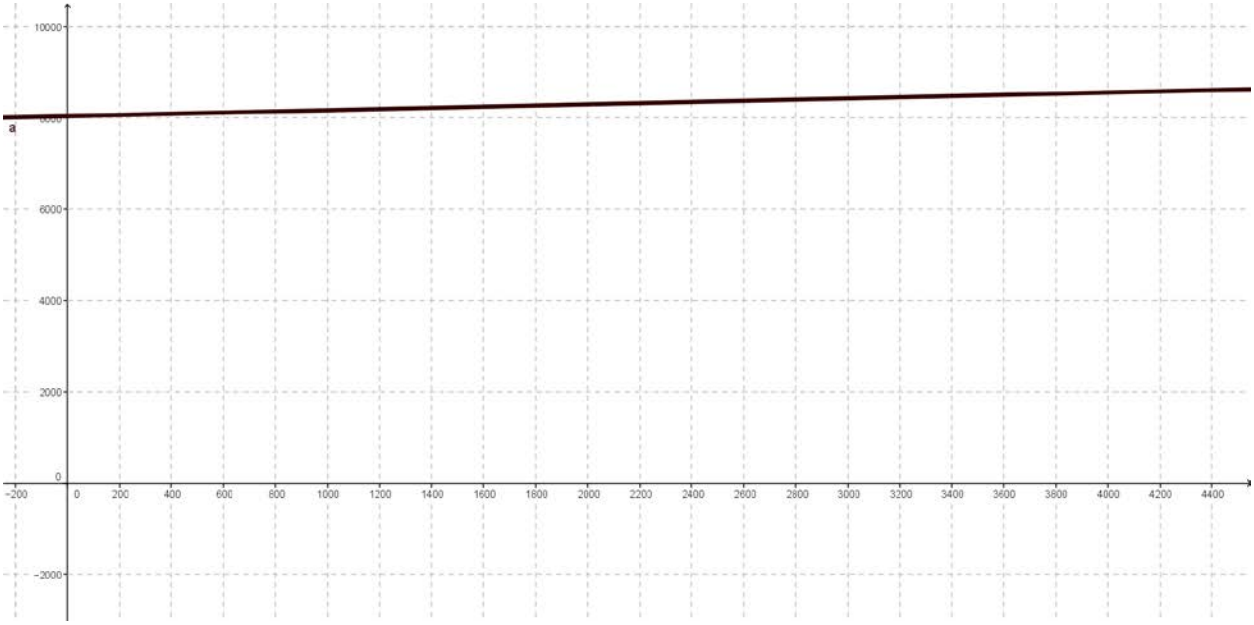
1. Write an equation for the cost of the car plus the cost of gas for one week in terms of miles driven (hint: use a variable for miles). This will represent your total cost in your first week of driving. Find your cost for the first week based on your table of miles driven.

   **C = $8,043 + 0.13m**

   C = 8,043 + (0.13)(26.1)
   C = 8,043 + 3.39
   **C = $8,046.39**

2. Graph this equation. What is the slope of the line? What does this slope tell you about the situation that you are graphing?

3. What is the y intercept? Explain the meaning of the y interecept here and how it relates to the situation that you are graphing.




*The slope of the line would be 0.13, or the cost per mile driven. It makes sense that the slope is the cost per mile because that cost is what influences how much the person's expenses go up as they drive more miles. This means that every mile I drive will cost me 13 cents in gas. The y intercept is 8,043, or the cost of the car. It also makes sense for the y-intercept to be the cost of the car, because that is the part of the person's expenses that stays constant. This is the starting point before even paying for one gallon of gas. It's difficult to tell the slope of the line without looking at the equation, because it is a very gradual slope. I had to use the equation to determine the slope. Depending on the scales used, it can actually look like a horizontal line. The reason it looks like a horizontal line is because the slope is so close to zero. This is an*

*example of why it is useful to be able to use both the equation and the graph to make inferences about a function.*

*Overall, the graph represents a person's total cost for the first week of driving based on the number of miles they drive.*

4. How would the graph described above change if the car got less miles per gallon?

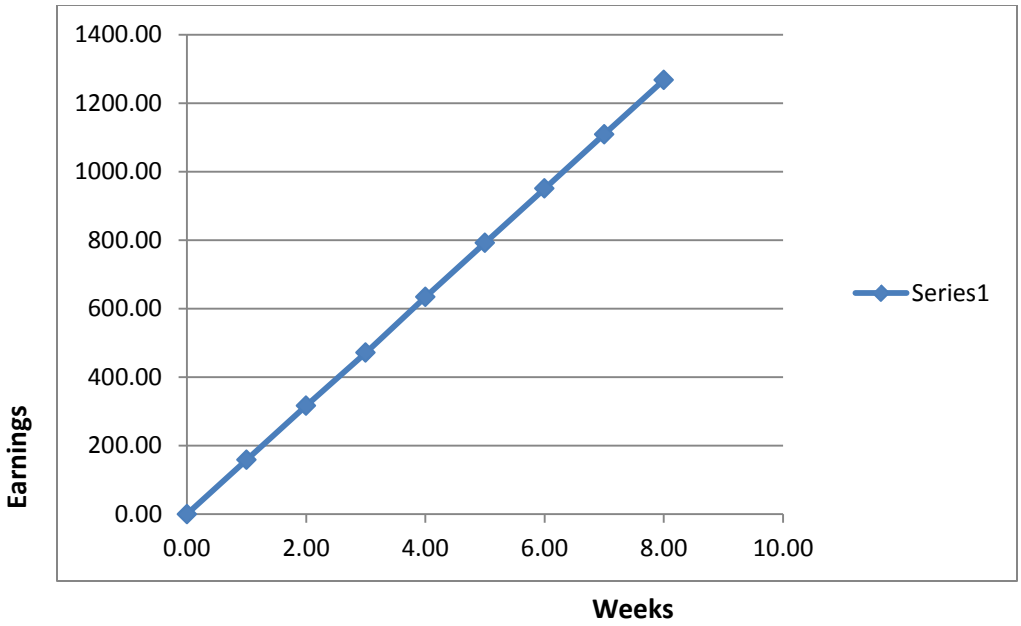
   *If the car got less miles per gallon, this would mean that each mile you drive is more expensive, so the slope would be larger, and the line would be steeper.*

5. Use the equations from part 1 that represent your earnings. Graph your earnings by week to show 8 weeks of work. Therefore, your x axis scale should represent each week. Think about how you may need to change your equation now.

   *M = 8.8h is in terms of hours, but I want my money earned on the graph to be in terms of weeks. I know that I will be working 18 hours per week in the restaurant, so I can multiply the number of hours I work by my hourly rate to get the money that I earn each week. Therefore:*
   M = (8.8)(18)W
   **M = 158.4W**

**Data points:**

| | |
|---|---|
| 0.00 | 0.00 |
| 1.00 | 158.40 |
| 2.00 | 316.80 |
| 3.00 | 471.20 |
| 4.00 | 633.60 |
| 5.00 | 792.00 |
| 6.00 | 950.40 |
| 7.00 | 1108.80 |
| 8.00 | 1267.20 |




6. How much time will it take for you to have enough money to purchase your car and pay your first week of gas? Show your work.

M = 158.4W

$8,046.39 = 158.4W

$$\frac{8{,}046.39}{158.4} = W$$

**W = 50.8**

*Therefore, it will take 51 weeks of work to earn enough to purchase the car and pay for the first week of gas. This is almost one year, but not quite, since there are 52 weeks in a year. If I take some vacation at holidays, it will take a little over a year for me to have enough money to purchase my own car.*