

Title: Paying for your wheels

**Math II**

Students will:

- Use proportions to calculate distance and miles per gallon (mpg)
- Analyze data using a graphing utility
- Determine a curve of best fit
- Extrapolate data

In the current economy it is important to become familiar with the costs associated with owning a car. One of the main costs of owning a care is fuel consumption. You will analyze the amount of fuel used by a car at various speeds and attempt to identify the “optimal speed” by performing regression analysis on speed versus fuel economy data.



You have saved up all of your money from all of your part-time jobs, birthday and Christmas money and finally have enough money to buy a good used car. You have scoured the local papers and internet and you have found the car below. You have called the dealer and you feel that this is a good car for a good price. So you buy the car.

**2006 Toyota Camry LE**

<p>Color: Silver          Engine: 3.0L V6          Body Style: FWS 4/dr sedan</p>	<p><b>\$13,999</b>          Transmission: 5 speed automatic          Odometer: 95,907 mi.</p>
<ul style="list-style-type: none"> <li>• <b>Convenience</b> <ul style="list-style-type: none"> <li>○ Tachometer</li> <li>○ Rear defogger</li> <li>○ Cruise control</li> <li>○ Clock - In-dash</li> <li>○ Tilt steering wheel</li> <li>○ Remote power door locks</li> <li>○ Interior air filtration</li> <li>○ External temperature display</li> <li>○ Power windows with 1 one-touch</li> <li>○ Audio controls on steering wheel</li> <li>○ Speed-proportional power steering</li> <li>○ Overhead console - Mini with storage</li> <li>○ Multi-function remote - Trunk/hatch/door</li> <li>○ Center Console - Full with covered storage</li> </ul> </li> <li>• <b>Exterior</b> <ul style="list-style-type: none"> <li>○ Intermittent window wipers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Technical</b> <ul style="list-style-type: none"> <li>○ 4 Doors</li> <li>○ 190 horsepower</li> <li>○ Front-wheel drive</li> <li>○ Automatic Transmission</li> <li>○ 3.0 liter V6 DOHC engine with variable valve timing</li> <li>○ Fuel economy EPA highway (mpg): 28 and EPA city (mpg): 20</li> </ul> </li> <li>• <b>Safety</b> <ul style="list-style-type: none"> <li>•                             <ul style="list-style-type: none"> <li>○ Passenger Airbag</li> <li>○ 4-wheel ABS brakes</li> <li>○ Daytime running lights</li> <li>○ Dusk sensing headlights</li> </ul> </li> </ul> </li> <li>• <b>Interior</b> <ul style="list-style-type: none"> <li>○ Rear bench seats</li> <li>○ Front seat type - Bucket</li> <li>○ 8-way power adjustable driver’s seat</li> </ul> </li> </ul>

Source: Marquez, E., and P. Westbrook. 2007. *Teaching Money Applications to Make Mathematics Meaningful*. Thousand Oaks, CA: Corwin Press. Adapted by Shawna Tucker, Jordan High School (2012)

Now you are a proud owner of your very own car. Now you think of all the costs that it takes to actually own your car such as gas, insurance and maintenance.

Go to True Cost to Own powered by Edmunds.com at: <http://www.edmunds.com/tco.html>

Find the estimated cost to own for your new car. You need to find the estimated cost for three years:

Insurance: \_\_\_\_\_

Fuel: \_\_\_\_\_

Maintenance: \_\_\_\_\_

Depreciation: \_\_\_\_\_

Taxes & Fees: \_\_\_\_\_

Repairs: \_\_\_\_\_

Which of these costs do you have control over? What can you do to reduce your costs? \_\_\_\_\_

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### **Analyzing Fuel Costs**

Today you are going to focus on how you can drive on the gas that you buy. Remember that miles per gallon (mpg), is an important ratio that gives the average number of miles you can drive, city or highway, on one gallon of gasoline.

- How many miles will the Toyota Camry go on a full tank if driven only on the highway?

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- What is the city mpg if the car can go 440 miles on a full tank in the city?

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- What is the relationship between the amount of gas you use and the speed that you travel in the car?

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The following chart is data collected on the mpg of the Toyota Camry.

Speed (mph)	5	10	15	20	25	30	35	40	45	50	55	60	65
mpg	10	15	23	25	27	28	29	30	31	31.5	30	28.5	27

At what speed does the Camry get the best gas mileage? \_\_\_\_\_

Predict the mpg the Camry will get at 75 mpg. \_\_\_\_\_

**Input your data into your graphing calculator:**

- Would a line of best fit be the best model for this data? \_\_\_\_\_
- If not, what model would be the best? \_\_\_\_\_
- What is the equation of the graph that you chose?  
\_\_\_\_\_

**Real Word Questions:**

How could you calculate average miles per gallon for a car? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Why is highway driving more efficient than city driving? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Determine the speed at which the Camry obtains the greatest fuel economy, according to the quadratic regression graph. How does that value compare to the maximum mpg and the speed at which it occurs according to the data points given in the table of values? Explain the difference. \_\_\_\_\_

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Why do cars get optimal mileage at speeds less than 60 mph? \_\_\_\_\_

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What features do you think should be included in the design of a car to minimize the aerodynamic drag and maximize the gas mileage? \_\_\_\_\_

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Calculate the fuel cost for f driving from New York City to Los Angeles in the Camry. Use 2,800 miles as the distance, and assume that 20% of the trip is city driving. Since the price of gas varies across the country, have students use the average cost per gallon, which can be found at [fueleconomy.gov](http://fueleconomy.gov).

How many miles will be city driving? \_\_\_\_\_ How many miles will be highway driving? \_\_\_\_\_

Cost: \_\_\_\_\_

