Rockets and Functions

Grade Levels

This activity is intended for grades 6 - 8.

Objectives and Topics

In this lesson, students will be making a line of best fit from data obtained from making and launching their own paper rockets. Students will also briefly review beginning concepts of linear functions.

Materials

- worksheet
- open field with at least 100 yards of open space to launch
- PVC rocket launcher. A video on its construction can be found at `https://www.youtube.com/watch?v=3lCv3ht5Wz0`
- printer paper or construction paper
- masking tape
- scissors
- bike pump or air compressor with PSI gauge
- marked rope, or some other means of measuring distance travelled by the student rockets
- PVC pipes

Outline

First, you will go over the construction of the rocket with the students. It is helpful to have a premade rocket with you to show them the finished product, as well as some paper, tape, and scissors to demonstrate what they need to do with their own rocket-building materials.

MATHEMATICS DEPARTMENT

1. Roll the paper around the pipe so that it is tight, yet loose enough to slide off. Tape the paper along the entire seam outside of its body.
2. Tell your students to check their work by sliding your rocket body on and off of the tube. It shouldnt fall right off, but should slide easily. You may even want to go around and triple-check their work for this step; having a rocket too tight can make it almost impossible to launch.
3. Next, slide the rocket's body so the top is even with the top of the PVC pipe. Tape the top of the rocket's body so that when you blow air into the other side of the PVC pipe it will start to launch your rocket. Make sure there are no leaks. Be careful not to tape the rocket to the pipe! You eventually want the pipe gone from your rocket!
4. Get another piece of paper and draw a fin shape of your choosing, we recommend a polygon. Remind your students that they want their fins to be congruent shapes. Cut out the first fin and use it as a template to draw 1-3 more congruent figures. Cut these out.
5. Pick a side of your polygon fin to make a small fold. Fold the same side of each fin the same amount. Use a small amount of tape to tape the small folded bit of your fin onto the rocket's body.
6. Have your students name their rocket. This is especially important if you are launching multiple rockets at once; your students should be able to distinguish data obtained from each other's rockets.

Now it's time to launch the rockets. Make sure to test out which fixed launch angle and PSI values work well within your launching space.
Before the students actually launch their rockets, it is important to go over safety with the students. Kids can get VERY worked up over this activity. Explain to them that everyone needs to stay behind the launchers when they are pressurized, and only let the students whose rockets have been shot go retrieve them AFTER you've given the all clear signal.
When your students are actually launching their rockets, remind them to note the distance that their rocket travelled, and record them in the table on their worksheet. If necessary, remind them of beginning concepts of linear functions (how to tell whether or not a graph is a function, calculating slope or y-intercept from a graph). In addition, go over how to find an equation of the line of best fit from a collection of data points (though the methods may vary depending on the technology used, instructions for how to do so using a TI-83 calculator can be found at `http://cstl-csm.semo.edu/ltansil/134/Handouts/bestfit.pdf`).

Rockets and Functions Worksheet

Name:_____

Here are some things to think about while building your rocket:

- Is the paper rolled around the pipe tightly, yet loose enough to slide off? Your rocket shouldn't fall right off the tube, but should slide easily along it.
- Is your rocket taped up enough to withstand being shot?
- Have you made sure your rocket is not taped to the pipe? Remember that you want the rocket to shoot off the pipe!
- Have you added 3 fins to your rocket? Are all of your fins congruent (in other words, are they all the same shape)?
- Did you name your rocket?

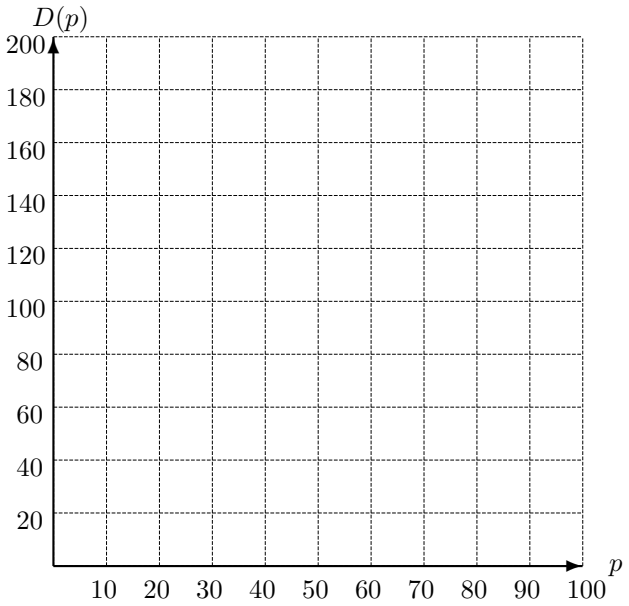
Rocket Name:_____

Rocket Launch Table

Make a table for the distance, D, based on the air pressure p.

p	$D(p)$
20 psi	
30 psi	
40 psi	
50 psi	
60 psi	
70 psi	
80 psi	

Plot the points from the table on the graph paper below.
After you plot the points, on the graphing paper above, sketch your line of best fit.



Discussion Questions:

1. Does your data represent a function? Justify your response.

2. What pressure is required for the rocket to travel a distance of 60 feet? 160 feet?

3. Describe the association (positive, negative, or no association). Justify your answer.

4. (a) Look at your line of best fit. What is the slope of the line?
Hint: Pick two points on the line and use the slope formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

(b) What is the y-intercept of the line?

(c) Write the equation of the line of best fit in slope-intercept form.

(d) Use your equation to predict how far the rocket will travel if you apply 100 psi.

(e) Use your equation to predict how much pressure you would need to launch the rocket 200 feet.