Splash! into Proportions – Middle School (Grades 6-8)

Introduction	In these activities, students will explore the data that they gathered with Splash! and apply it to various mathematical tasks.
Time	1 class period
Grade	6-8
Lesson Preparation	Students will have visited the Tsongas Industrial History Center to participate in the Power to Production program. Students gathered data from the waterwheel test on the Splash! app. For this activity, teachers can download the class's data at www.tihcsplash.org. Provide each student one of the eight sets of speed data from the field trip and a copy of the Spinning the Day Away worksheet. Provide graph paper and rulers. For this activity, students will be graphing from 0-60 along the x-axis, so it is best to have 8.5"x11" graph paper sheets.
Vocabulary	Ratio Proportion Coordinate Plane Proportional Relationship
Anticipated Student Preconceptions/ Misconceptions	Students may forget that 60 seconds = 1 minute, and 60 minutes = 1 hour

Frameworks	Massachusetts Math Standards
	
	 7.RP.2.Recognize and represent proportional relationships between quantities.
	    a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table, or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
	    b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
	    c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.*
	    d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate

Guiding Question	How can we use ratio and proportion to predict how many times a given wheel/base combination will turn in a given amount of time? How can we display and interpret this data on the coordinate plane?
Objectives	Students will be able to: • Create a table to determine the numbers of rotations completed in a given period of time. • Create a graph that displays the data from the table. • Use the graph to determine the number of rotations completed for times not given on the table. • Create an equation or use equivalent fractions to determine how many rotations would be completed in a time that is not visible on the graph.
Activity	1. Students may work individually or in pairs 2. Display data from the field trip on the board. There should be speed data for wheels A through D, each with a bucket or paddle option. Students should pick one of the wheels to use. Remind students which letter corresponds to which base. 3. Provide students with a copy of the worksheet "Spinning the Day Away" and graph paper.
Assessment	Completed worksheet and graphs
Differentiated Suggestions	Graphic organizer, such as t-chart, for organizing ordered pairs. Anchor charts to remind students how to graph ordered pairs Leave reminder 60 seconds = 1 minute on the board or on student papers.
Adapting the Activity for Other Grades	For grade six, the lesson can be adapted to use equivalent fractions and used as a review of equivalent fractions. The teacher may also choose to have students create the data table and plot the resulting points in the coordinate plane, and then ask if negative numbers, rational numbers, etc. could be part of the set of points. For Grade Eight, students can investigate the different wheel rotation rates as forming a system of equations that has one solution (at the origin). The teacher can extend this investigation by asking the students to consider where the solution would be located if one wheel begins rotating prior to the other wheel.

Spinning the Day Away Worksheet

Write down the wheel and base combination whose rotations you are counting.

  _____

How many rotations did the wheel/ base combination complete in 15 seconds?

  _____

Complete the table below.

Time	Number of Rotations
0 seconds	0
15 seconds	
30 seconds	
1 minute	
5 minutes	
30 minutes	
60 minutes	

Use the information from your table to create a graph using the x,y axes. Your graph must have
- A title
- Labeled axes
- An appropriate scale

Use your graph to determine how many rotations the will be completed after:

    a. 2 minutes   _____

    b. 10 minutes   _____

    c. 45 minutes   _____

Justify each of your answers using the graph.

If t represents the time in minutes and r represents the number of rotations completed, determine the number of rotations the wheel will complete in

    a. 2 hours   _____

    b. 5 hours   _____

    c. 1 day   _____

Show your work or justify your answer