Data & Math are Everywhere *Activity Alice in Wonder"Space"land on Mars*

SpaceMath NASA and Data (Please see attached for Projects and Data Collection Examples)**:**

- Project #491 Curiosity Rover on the Move! http://spacemath.gsfc.nasa.gov
- Project #536 Exploring a Possible Landing Area on Mars http://spacemath.gsfc.nasa.gov
- Data Collection: Transformations of Ordered Pairs

Essential Questions:

- How does knowledge of mathematical skills correlate to real-life experiences?
- How do people use data to influence others?
- How can the relationship among lines, angles, and polygons be used to solve problems?
- How do transformations play a part in your life?

Objective with Enduring Understanding:

- Students will be able to see transformations occur everywhere around us.
- Students will be able to independently use their learning to make predictions and decisions on real world events.
- Students will be able to independently use their learning to accurately describe and model transformations.
- Students will be able to reinforce prior knowledge of the plotting of points in a two dimensional Cartesian coordinate system and the area of an object.
- Students will be able to understand that transformations change the figures orientation, coordinates or size; changing certain properties while preserving others.

Common Core Standards include:

CC.8.G.1 - Verify experimentally the properties of rotations, reflections, and translations:
CC.8.G.1.a - Lines are taken to lines, and line segments to line segments of the same length.
CC.8.G.1.b - Angles are taken to angles of the same measure.
CC.8.G.1.c - Parallel lines are taken to parallel lines.
CC.8.G.2 - Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
CC.8.G.3 - Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
CC.8.G.4 - Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
ELA-Literacy.W.8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
ELA-Literacy.8.RI.4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.

Prior Knowledge: CC.7.G.B.6 Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Evidence (Please see attached for two graded data collection examples of ordered pairs with graphs, conclusion questions and rubric)**:**

Transformations occur everywhere around us and this activity will take my students from earth to Mars with a fun twist using Alice in Wonder"Space"land. In the movie Alice fell into Wonderland where she grew, shrunk, spun, and looked in the mirror – all things that we do in the geometry unit for transformations using a coordinate plane. Taking my students from London to Wonder"Space"land on Mars where a coordinate plane will be the landing area on Mars using a low-image map (#536) where Alice will reflect, rotate and dilate/scale. We will also incorporate the path the Curiosity Rover took in space for Alice to translate (#491).

To gain momentum and be sure all the students are aware of the story of Alice in Wonderland, I have several copies of the book available. I also show a three minute clip of Alice shrinking and growing. We will then explore the mosaic map by Mars Curiosity Rover to engage and excite them for the activity.
Alice: https://www.youtube.com/watch?v=qtwNtBp0n4o
Mars:
https://mars.nasa.gov/msl/multimedia/mosaics/?order=pub_date+desc&per_page=50&page=0&search=&filter_categories%5B0%5D%5B%5D=238%3A176&fs=&fc=&ft=&dp=&category=238%3A176

The data given and created serves to engage the math concept by providing ordered pair (x,y) locations for points on Mars with the Curiosity Rover movement for translation. The reflection, rotation and dilation transformation on the graph will provide a visual of the change in properties on Mars. The pre-image ordered pairs will be given. The data collected will be ordered pairs of the new image for each transformation. All transformations will be based off the pre-image ordered pairs. The graphing will take place for the ordered pairs with color coding for each transformation. The graph paper needs to be augmented with the map of Mars.

I added transformation conclusion questions to enhance the understanding of the concept. These will focus on vocabulary (see key vocabulary list below) and incorporate prior knowledge questions about the area of the pre-image trapezoid and the area of the dilated image with a scaling factor calculation.

1. What vocabulary terms can be used to describe Alice's reflection, translation, and rotation compared to her pre-image?
2. Where would an image be located if the pre-image was rotated 180 degrees clockwise?
3. What is the area of the pre-image? What is the area of the dilated image?
4. Briefly describe the difference in areas based on the scale factor you found.

This activity will have a point rubric established to help clarify student expectations in an easy-to-follow format as seen in the attachment. We are moving to portfolio based grading and this activity is more aligned with our new direction for project based learning.

	Steps to complete	Points Earned	Points Possible
1	Original (Pre-image) is graphed correctly.	1	1
2	Alice is reflected correctly, neat and colored. Coordinates are filled in correctly.	2	2
3	Alice is translated correctly, neat and colored. Coordinates are filled in correctly.	2	2
4	Alice is rotated correctly, neat and colored. Coordinates are filled in correctly.	2	2
5	Alice is dilated correctly, neat and colored. Coordinates are filled in correctly.	2	2
6	Questions answered thoroughly. Complete sentences are used or work is shown to support your answers.	2	2
	TOTAL POINTS	11	11

An idea for an extension activity is the discussion around Global Positioning Systems (GPS) which is often brought up by my students as they further explore the coordinate plane to find the distance between two points on Mars, in London or on Earth.

KEY VOCABULARY

congruence:	when two figures are the same size and same shape
dilation:	a transformation that enlarges or reduces a figure
image:	a shape or figure after a transformation; the new figure
orientation of a figure:	the direction in which a figure is placed on a coordinate plane
pre-image	a shape or figure before a transformation; the original figure
reflection:	a transformation that produces a mirror image of the original figure over a line of reflection
rotation:	a transformation that turns a figure around a center of rotation
scale factor:	the ratio of corresponding sides in similar figures; the multiplier used to create a dilation
similarity:	when two figures are the same shape and have proportional sides and congruent angles
translation:	a transformation that moves each point of a figure the same distance and same direction