EDITED VERSION OF LESSON PREVIOUSLY KNOWN AS:
OPERATIONS AND COORDINATES

GOLD SEAL LESSON

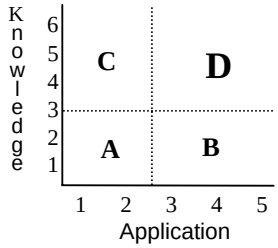
Flip Book Animation

Subject(s)

Mathematics

Grade Level 7

Rigor/Relevance Framework



Instructional Focus	**Number Operation and Concepts:** Students use number, number sense, and number relationships in a problem-solving situation. Students communicate the reasoning used in solving these problems. **Geometry:** Students apply geometric concepts, properties, and relationships in a problem-solving situation. Students communicate the reasoning used in solving these problems. **Problem Solving and Mathematical Reasoning:** Students apply a variety of problem-solving strategies to investigate and solve problems from across the curriculum as well as from practical applications.
Student Learning	• Given a pair of coordinates, students will plot the point in the coordinate plane. • Given a point that is plotted in a coordinate plane, students will identity its coordinates. • Students will be able to translate a point in the coordinate plane. • Students will describe the path of a translated point using function terminology.
Performance Task	**Overview** Students will create a flip book animation. Students will work individually and in pairs to search the internet for animation instructions, use graph paper and teacher generated template. Flip book animations will include the translation of images on a coordinate plane. **Description** Prior to this lesson, students will have a working knowledge of the concept of translation. Now they will extend their thinking to the exploration of translation in the coordinate plane. *(Note: Teachers may want to use the attached worksheet, "Flip Book Animation.")* The lesson begins by giving students the coordinates of a simple picture or shape and asking them to plot it. Then students are directed to add the same number to each x-coordinate and replot the shape on the same set of coordinate axes. Students observe that the shape has been translated horizontally. They are asked to repeat this

Performance Task (con't.)	one more time by adding a different number to each x-coordinate and y-coordinate. Again, students observe that the shape has been translated in a diagonal direction. Student understanding is improved by providing this hands-on investigation prior to formal instruction about how to use function notation to describe translations. To link this lesson to a real-world application, students will be introduced to a real animation technique, making a flip book. There are two Web sites that give a very thorough explanation of the way artists are first taught to animate objects: http://www.idleworm.com/how/anm/01b/bball.shtml (detailed instructions about how to animate a bouncing ball) http://www.cartoonster.com/ (an entertaining, interactive tutorial for making animated cartoons with gives specific directions for making a flip book) The teacher should make many copies of the template shown on the second page of the worksheet. Emphasize to the students that only one point is drawn on each template, but the point is translated to a new location each time. The resulting "flip book" is a fun way to show a valid, real-world application of translation, and it promises to be motivating to your students!
Essential Skills	• Perform operations with signed (positive and negative) numbers, including decimals, ratios, percents, and fractions. (m1) • Understand the use of variables in expressions such as 4x, x+2, and 2x-1, solve for the variable, and know how to represent expressions such as "twice the number" or "four more than the number" using variables. (m7) • Understand the concepts of symmetry and transformations and graphically apply line reflections, rotation, translations, and dilation. (m55) • Apply transformation concepts to understand and create congruent and similar figures. (m49)
Scoring Guide	Attached
Attachments/ Resources	Attached
Standards	**Source of Standards:** Arkansas K–8 Math Framework NO.1.7.5: Compare and represent *integers*, fractions, decimals and mixed numbers and find their approximate location on a number line NO.2.7.4: Model and develop addition, subtraction, multiplication, and division of *integers* G.10.7.1: Plot points in the *coordinate plane* G.10.7.2: Plot points that form the *vertices* of a geometric figure and draw, identify, and classify the figure. G.9.7.2: Perform *translation*s and *reflections* of *two-dimensional* figures using a variety of methods (paper folding, tracing, graph paper).

Submitted by:

Scoring Guide

Score each of the following characteristics on a scale of **4** to **0,** where **4** = surpasses expectations; **3** = high-quality performance; **2** = satisfactory performance; **1** = minimum-quality performance; **0** = does not meet expectations.	
Characteristic	**Score**
The student is able to accurately plot points in the coordinate plane. • Evidence shows that the first wooden shoe was plotted correctly. • Evidence shows that the second and third wooden shoes were plotted correctly.	
The student can describe the relationship between translating a point and the changing coordinates of the point. • Evidence of this is provided in the answer to 1d. • Evidence of this is provided in the answer to 1e	
The student can apply the concept of translation to the procedures used to animate a shape using a flip book. • The flip book is complete and done on time. • The flip book actually does animate the point to simulate a ball rolling off of a table.	

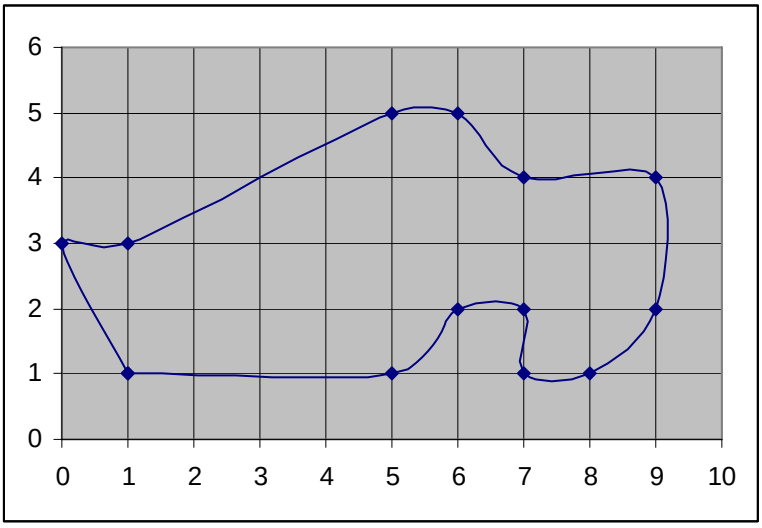
Flip Book Animation

Learn how mathematics can be used to animate cartoon figures. It's all about translation!

1. First you must learn a little about the mathematics involved. On a sheet of graph paper, draw a large set of coordinate axes. Label the x and y-axes and label some points.

   a) Plot the following points on your coordinate system. Remember that the first coordinate of the pair names a position going right or left in the horizontal direction, and the second coordinate names a position going up or down in the vertical direction. Connect the points in the order shown. You should see a picture of a wooden shoe.

   (1,1) (5,1) (6,2) (7,2) (7,1) (8,1) (9,2) (9,4) (7,4) (6,5) (5,5) (1,3) (0,3) (1,1)



   b) Add -10 to the first coordinate of each point in the list shown in a. Write the coordinates and then plot the figure on the same set of axes as used for "a." Use a different colored pencil.

   ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

   Write a sentence or two to describe what happened to the wooden shoe image:

_____

_____

_____

_____

_____

c) Add 2 to the first coordinate and add -5 to the second coordinate of each point. Write the new coordinates on the lines below and then plot the points on the same set of axes, using a third colored pencil.

____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

Write a sentence or two to describe what happened to the original wooden shoe image:

d) How should the coordinates be changed if you want to move the drawing up three units and to the right five units? (Explain in a sentence or two.)

e) Work with a partner to write a set of just three clear rules that a person could use to translate a figure vertically, horizontally, or diagonally.

a) Now you will be making a flip book to animate a point. The point will look like it is rolling across a table and falling off of the edge onto the floor. Once you learn how to animate a simple shape like a point, you will be able to use this technique to animate more complicated figures. There are two Web sites that do a good job of explaining the first lesson that a beginning animator is taught. Visit these Web sites before you begin your own animation experiment in 2b:

- http://www.idleworm.com/how/anm/01b/bball.shtml
- http://www.cartoonster.com/

We will be using translation to animate our "ball." The Web sites referenced above did not use our strict mathematical definition of translation to animate their balls. Write two reasons that the previous sentence is a true statement.

_____

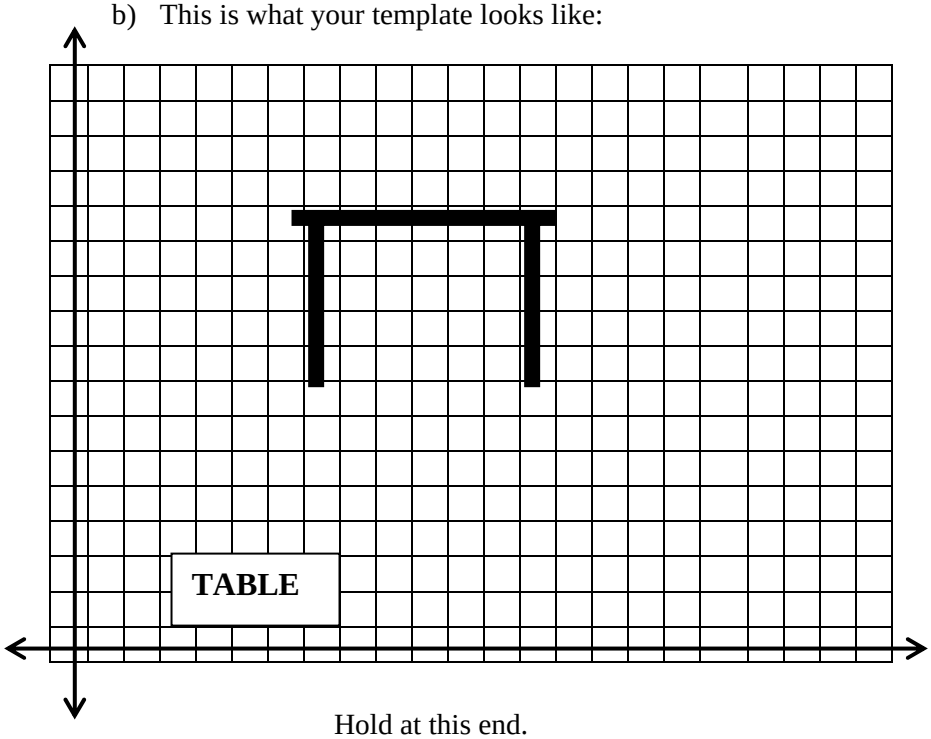
_____

_____

_____

_____

b) This is what your template looks like:



Hold at this end.

You will be plotting a point on the table—or really just above the table, beginning at (7, 13). You can make the point a large "dot" to simulate a ball.

To place the ball in its next location, what mathematical process would have to happen?

_____

_____

_____

_____

How will this change when the ball begins to fall?

_____

_____

_____

_____

c) Your teacher will provide you with as many templates as you need to complete the animation. Make sure that you only plot one point on each template sheet! When you hold the templates together as indicated and flip, you should see the ball roll across the table and drop to the floor!