

Dilations

- **Plot the points A(-4, 10), B (6, 2) and C (-6, -6). Connect the vertices to make the polygon**
 - What type of polygon did you draw?
- **Multiply each set of coordinates by 2 and graph. Label the new vertices A', B', and C'.**
 - What is the scales factor?
 - What percent of the original figure is the image?
- **Draw a line through the corresponding vertices.**
 - Where do they intersect?
- **Divide each set of original coordinates by 2 and graph. Label the new vertices A'', B'', and C''.**
 - What is the scale factor?
 - What percent of the original figure is the image?
- **Draw a line through the corresponding vertices.**
 - Where do they intersect?
 - What do we call this point of intersection?

What's My Transformation I?

L1	L2	L3	L4

1. How is the second figure like the first figure?
2. What is different about the figures?
3. What do you think caused the figures to be in different locations?
4. How were the coordinates changed from the first to the second figure?
5. Create a new table of values that will maintain the shape and size of the original figure and move it to a different location.
6. Graph the new shape using your graphing calculator.

Activity Sheet 1: Translations

1. Quadrilateral ABCD has coordinates (1,1), (2, 6), (4, 4), and (4, 2). On graph paper, draw Quadrilateral ABCD.
2. Place a sheet of patty paper (tracing paper) over the grid.
3. Trace the quadrilateral and the axes. Label the quadrilateral A'B'C'D'.
4. Translate the quadrilateral five units to the left by sliding the patty paper. Record the vertices of quadrilateral A'B'C'D' in Table 1.

Table 1:

Original Figure	Original Image Translated Horizontally 5 units left
A (,)	A' (,)
B (,)	B' (,)
C (,)	C' (,)
D (,)	D' (,)
(x, y)	(,)

5. What happened to the x-coordinates under the horizontal translation?
6. What happened to the y-coordinates under the horizontal translation?
7. What rule describes your horizontal translation?

8. Find the slopes of the sides of the original quadrilateral and the slopes of the sides of the translated image. Record the slopes in the table below:

	Original Image	Original Image Translated 5 units left
Slope AB		
Slope BC		
Slope CD		
Slope DA		
Any	m	

9. Make a general statement that describes the effect on slope when an image is translated left.

10. Return the quadrilateral to its original position.

11. Translate the quadrilateral three units down by sliding the patty paper. Record the vertices of quadrilateral ABCD and A'B'C'D' in Table 2.

Table 2:

Original Figure	Original Image Translated Vertically 3 units down
A (,)	A' (,)
B (,)	B' (,)
C (,)	C' (,)
D (,)	D' (,)
(x, y)	(,)

12. What happened to the x-coordinates under the vertical translation?

13. What happened to the y-coordinates under the vertical translation?

14. What rule describes your vertical translation?

15. Find the slopes of the sides of the original quadrilateral and the slopes of the sides of the translated image. Record the slopes in the table below:

	Original Image	Original Image Translated vertically 3 units down
Slope AB		
Slope BC		
Slope CD		
Slope DA		
Any	m	

16. Make a general statement that describes the effect on slope when an image is translated vertically 3 units down.

What's My Transformation II?

L1	L2	L3	L4

1. How is the second figure like the first figure?

2. What is different about the figures?

3. What do you think caused the figures to be in different locations?

4. How were the coordinates changed from the first to the second figure?

5. Create a new table of values that will maintain the shape and size of the original figure and move it to a different location.

6. Graph the new shape using your graphing calculator.

Activity Sheet 2: Reflections

1. Quadrilateral ABCD has coordinates (1,1), (2, 6), (4, 4), and (4, 2). On graph paper, draw Quadrilateral ABCD.
2. Place a sheet of patty paper (tracing paper) over the grid.
3. Trace the quadrilateral and the axes. Label the quadrilateral A'B'C'D'.
4. Reflect the quadrilateral across the y-axis by flipping the patty paper. Record the vertices of quadrilateral A'B'C'D' in Table 1.

Table 1:

Original Figure	Original Image Reflected Across the y-axis
A (,)	A' (,)
B (,)	B' (,)
C (,)	C' (,)
D (,)	D' (,)
(x, y)	(,)

5. What happened to the x-coordinates under the reflection across the y-axis?
6. What happened to the y-coordinates under the reflection across the y-axis?
7. What rule describes the reflection across the y-axis?
8. Return the quadrilateral to its original position.

9. Reflect the quadrilateral across the x-axis by flipping the patty paper. Record the vertices of quadrilateral ABCD and A'B'C'D' in Table 2.

Table 2:

Original Figure	Original Image Reflected Across the x-axis
A (,)	A' (,)
B (,)	B' (,)
C (,)	C' (,)
D (,)	D' (,)
(x, y)	(,)

10. What happened to the x-coordinates under the reflection across the x-axis?

11. What happened to the y-coordinates under the reflection across the x-axis?

12. What rule describes the reflection across the x-axis?

13. Find the slopes of the sides of the original quadrilateral and the slopes of the sides of the reflected image. Record the slopes in the table below:

	Original Image	Original Image Reflected Across the x-axis	Original Image Reflected Across the y-axis
Slope AB			
Slope BC			
Slope CD			
Slope DA			
Any	m		

14. Make a general statement that describes the effect on slope when an image is reflected across the x-axis.

15. Make a general statement that describes the effect on slope when an image is reflected across the y-axis.

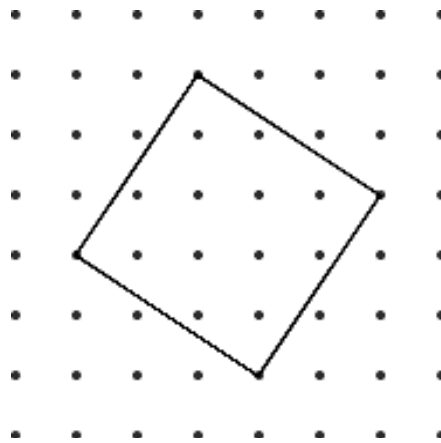
Visualizing

- How many blocks did I need to build this tower?
- What is the height of this tower?
- If you could fly over this tower, what would it look like from the air?
- What does it look like from the front?
- What does it look like from the right side?
- What do you call the number of unit cubes that a tower contains?

The Pythagorean Theorem

Calculating Area: Problem A1. Come up with a method to find the exact area of the square in square units. You can either use calculations or count the square units.

Here is a square drawn on dot paper:



Squares Around a Right Triangle: Each of the three figures in **Problem A2** shows a right triangle with squares built on the sides. Determine the exact area of all three squares for each figure.

Figure 1:

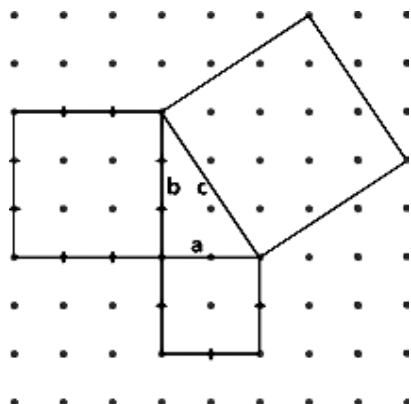


Figure 2:

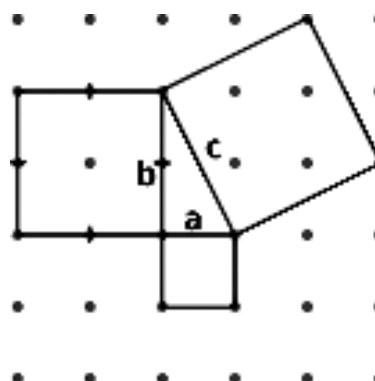
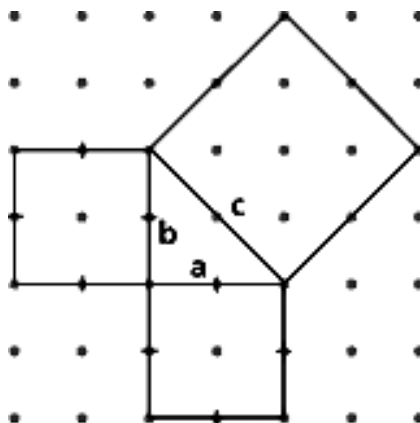
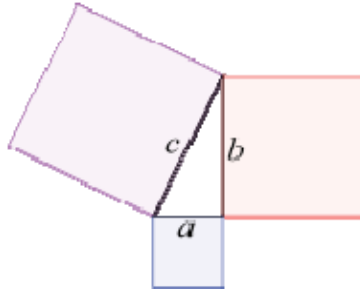


Figure 3:



Is it Right?

Using grid paper, cut out squares with areas of 9, 16, 25, 36, 81, 100, 121, 144, 169. Use three of the squares to construct a triangle as shown below. Tape the squares in position.



Complete the chart below with possible side lengths of a triangle. Let side “a” always be the shortest side and “c” the longest side. Determine if the triangle formed is acute, right, or obtuse.

Triangle side lengths a, b, c	Area of a^2	Area of b^2	Area of c^2	$a^2 + b^2$	Acute, Right, or Obtuse

1. For what kind of triangle is $c^2 < a^2 + b^2$?
2. For what kind of triangle is $c^2 > a^2 + b^2$?
3. For what kind of triangle is $c^2 = a^2 + b^2$?

Surface Area and Volume: Make It

Create a net for each of the following solids. Fold the net into the solid figure.

- 1. A cube with edges of 8cm.**
- 2. A cylinder with a base diameter of 10cm and a height of 8.7cm**
- 3. A rectangular prism with length 8cm, width 3cm and height 11cm.**
- 4. A cone by constructing a circle with radius 5 cm and a semicircle with radius 10cm.**

What's My Surface Area and Volume?

Complete the following for each of your solids.

1. Cube

Sketch the net and the solid

Each edge of the cube is 8cm.

- A. Shape of the Base: _____
- B. Formula for Area of Base: _____
- C. Area of Base (B): _____
- D. Height of Solid (h): _____
- E. Formula for Surface Area: _____
- F. Surface Area: _____
- G. Formula for Volume: _____
- H. Volume of Solid: _____

2. Rectangular Prism

Sketch the net and the solid

Rectangular prism has length 8cm,
width 3cm, and height 11cm.

- A. Shape of the Base: _____
- B. Formula for Area of Base: _____
- C. Area of Base (B): _____
- D. Height of Solid (h): _____
- E. Formula for Surface Area: _____
- F. Surface Area: _____
- G. Formula for Volume: _____
- H. Volume of Solid: _____

3. Cylinder

Cylinder has a base diameter of 10cm and a height of 8.7cm.

Sketch the net and the solid

- A. Shape of the Base: _____
- B. Formula for Area of Base: _____
- C. Area of Base (B): _____
- D. Height of Solid (h): _____
- E. Formula for Surface Area: _____
- F. Surface Area: _____
- G. Formula for Volume: _____
- H. Volume of Solid: _____

4. Cone

Cone has a circle with radius 5cm, and a semicircle with radius 10cm.

Sketch the net and the solid

- A. Shape of the Base: _____
- B. Formula for Area of Base: _____
- C. Area of Base (B): _____
- D. Height of Solid (h): _____
- E. Formula for Surface Area: _____
- F. Surface Area: _____
- G. Formula for Volume: _____
- H. Volume of Solid: _____

5. Pyramid

Each edge of square is 3cm and the height of the solid is 8cm.

Sketch the net and the solid

- A. Shape of the Base: _____
- B. Formula for Area of Base: _____
- C. Area of Base (B): _____
- D. Height of Solid (h): _____
- E. Formula for Surface Area: _____
- F. Surface Area: _____
- G. Formula for Volume: _____
- H. Volume of Solid: _____

Area and Volume: Changing Dimensions

1. On a sheet of centimeter grid paper, draw a 3cm by 5cm rectangle. Find the perimeter of the rectangle.

2. On a sheet of centimeter grid paper, draw a rectangle with dimensions twice as large as the rectangle in problem 1. Find the perimeter. Are the rectangles from problems 1 and 2 similar? Justify your answer.

3. On the centimeter grid paper, draw a rectangle with dimensions three times as large as the rectangle in problem 1. Find the perimeter. Are the rectangles from problems 2 and 3 similar? Justify your answer.

4. On the centimeter grid paper, draw a rectangle with dimensions half as large as the rectangle in problem 1. Find the perimeter.

5. Using the four rectangles from problems 1 through 4, fill in the table.

Rectangle	Dimensions multiplied by	Perimeter	Perimeter multiplied by

6. If you multiply the dimensions of a figure by a constant, c , what do you think happens to the perimeter?

7. Draw and cut out the net for each of the two rectangular prisms shown below on centimeter paper. You may need to tape two sheets of paper together to make the net for the larger prism.

8. Find the total surface area of each prism by finding the area of each face and adding the areas together.

Prism 1

Face	Area
Top	
Bottom	
Front	
Back	
Right	
Left	
Total	

Prism 2

Face	Area
Top	
Bottom	
Front	
Back	
Right	
Left	
Total	

9. When you add the areas of all six faces together, you are finding the surface area of the prism. The dimensions of Prism 2 are _____ as large as the dimensions of Prism 1. The total surface area of Prism 2 is _____ as large as the total surface area of Prism 1.

10. Draw and cut out a net for Prism 3 with dimensions 3 times as large as the dimensions of Prism 1. You may need to tape together four sheets of centimeter grid paper.

11. Find the total surface area of Prism 3 by finding the area of each face and adding the areas together.

Prism 3

Face	Area
Top	
Bottom	
Front	
Back	
Right	
Left	
Total	

12. The dimensions of Prism 3 are _____ as large as the dimensions of Prism 1.
The total surface area of Prism 3 is _____ as large as the total surface area of Prism 1.

13. If you multiply the dimensions of a rectangular prism by a constant, c , what do you think happens to the surface area?

14. Draw a net for Prism 4 with dimensions half as large as the dimensions of Prism 1.
What do you think will happen to the surface area?

15. Find the total surface area of Prism 4 by finding the area of each face and adding the areas together.

Prism 4

Face	Area
Top	
Bottom	
Front	
Back	
Right	
Left	
Total	

16. The dimensions of Prism 4 are _____ as large as the dimensions of Prism 1. The total surface area of Prism 4 is _____ as large as the total surface area of Prism 1. Did you predict what would happen to the surface area correctly? Why or why not?

17. Fill in the table.

Dimensions multiplied by	2	3	4	5	10	20	.5	.25	Surface area multiplied by
by <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 10 <input type="checkbox"/> 20 <input type="checkbox"/> .5 <input type="checkbox"/> .25									<input type="checkbox"/> Surface area multiplied by
2									by
Surface area multiplied by									Surface area multiplied by

When the dimensions of a prism are multiplied by c , the surface area is multiplied by _____.

18. Using tape, shape each net into a rectangular prism.

19. Find the volume of each rectangular prism. Remember to use the formula $V = Bh$, where B is the area of the base, and h is the height of the prism.

	Dimensions multiplied by	l	w	h	$B = lw$	$V = Bh$	Volume multiplied by
Prism 1							
Prism 2							
Prism 3							
Prism 4							

If you multiply the dimensions of a rectangular prism by a constant, c , what happens to the volume?

Underlying Processes and Mathematical Tools

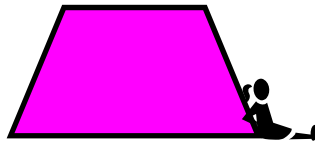
Performance Task

A brick company manufactures decorative bricks in the shape of isosceles trapezoids. The longer base of the smallest trapezoid is 20cm. The legs of this trapezoid are 4cm long each, and the trapezoid has a perimeter of 43cm.

The next larger trapezoid has the same base lengths as the first, and has a perimeter of 51cm.

The third trapezoid in the series has the same base lengths as the other two, and a perimeter of 67cm.

If this pattern continues, find the area of the tenth brick. Justify your answer.



This task is an example of assessing multiple concepts and processes within one problem. In this problem, students use, at the least, the concepts of area of a trapezoid, applications of the Pythagorean Theorem, functional relationships, and properties and attributes of functions. Geometric relationships, including the area of a polygon, and patterns and algebraic relationships are concepts addressed in different strands of the 8th grade and Algebra I TEKS as well as Objectives 1, 2, 6, 8, and 10 of the Grade 9 Texas Assessment of Knowledge and Skills (TAKS).

Resources Used

Region IV: Accelerated Curriculum for Mathematics Grade 11 Exit TAKS (2006). Region 4 Education Service Center, Houston, TX 77092

Region IV: TAKS Mathematics Preparation Guide (2003). Region 4 Education Service Center, Houston, TX 77092

www.learner.org

www.tea.state.tx.us

