MAT-222-840

Activities for Chapter 10

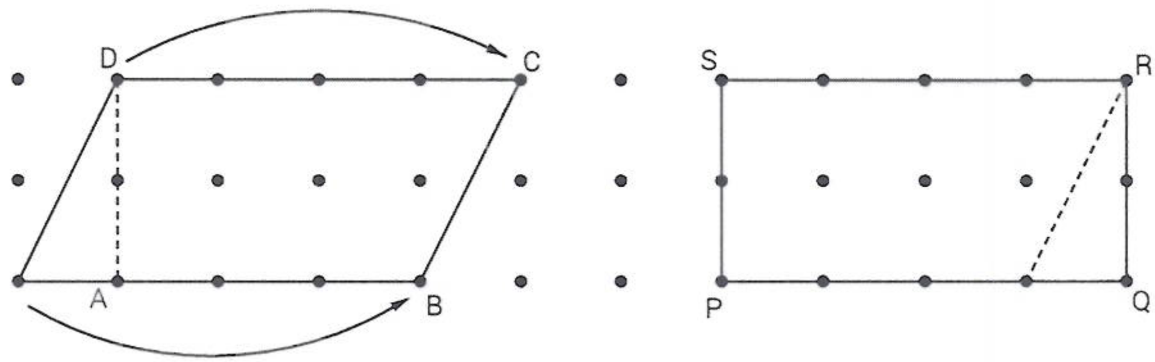
Name: Solutions

Date: ____________________

Activity 1: Area—From Rectangles to Parallelograms

For this activity, you will need dot paper and a centimeter ruler.

1. Construct a parallelogram on your dot paper. Construct the altitude from one vertex of the upper base as shown. Sketch the parallelogram again, moving the triangle to the other end of the figure (by sketching, as the arrows show below) and match the vertices as shown.



2. What kind of polygon is the new figure? Justify your answer with properties of the new polygon.

   Rectangle. Since the angles of the new quadrilateral all come from altitudes, I know each is 90°.

3. What is the relationship between the base and altitude of the original parallelogram and those of the new polygon?

   Same base & altitude.

4. What is the area of the new polygon?

   $A = bh = 4(2) = 8$ square units (8 cm^2)

5. What is the relationship between the area of the original parallelogram and the area of the new polygon?

   Same area

6. What is the area of the original parallelogram?

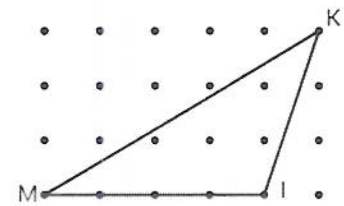
   Must also be 8 cm^2

7. What is the rule for determining the area of a parallelogram with base *b* and height *h*?

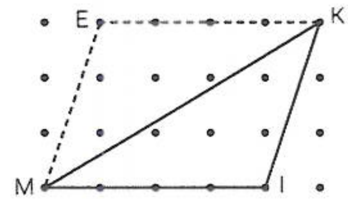
   $\boxed{A = bh}$ (same as rectangle!)

Activity 2: Area—From Parallelograms to Triangles

For this activity you will need dot paper and a centimeter ruler.



1. Construct ΔKIM on your dot paper. Construct a segment $\overline{KE}$ that is parallel to $\overline{MI}$ and has length equal to the length of $\overline{MI}$ as shown. Draw the segment $\overline{EM}$.



2. What type of quadrilateral is *MIKE*? Justify your answer with properties of *MIKE*.

Parallelogram : I know opposite angles are congruent. (because the triangles ΔMEK and ΔKIM are congruent.)

3. What is the area of quadrilateral *MIKE*?

$A = bh = 4(3) = 12 \text{ cm}^2$

4. What is the relationship between the base and the height of the quadrilateral *MIKE* and the base and the height of ΔKIM?

Same height & base.

5. Given the area of quadrilateral *MIKE*, how can you find the area of ΔKIM? What is that area?

Area of ΔKIM is half of area of MIKE.

$\frac{1}{2}(12 \text{ cm}^2) = 6 \text{ cm}^2$

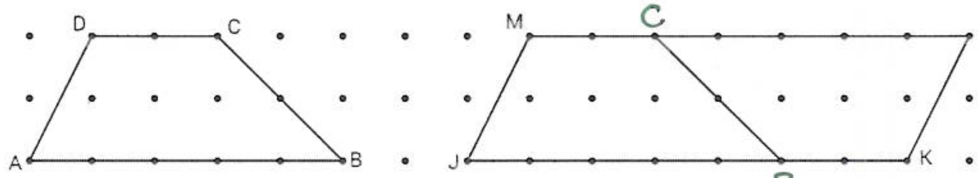
6. What is the rule for determining the area of a triangle with base b and height h?

$\boxed{A = \frac{1}{2}bh}$ (Half of parallelograms area)

Activity 3: Area—From Parallelograms to Trapezoids

For this activity you will need dot paper and a centimeter ruler.

1. Construct a trapezoid *ABCD* on your dot paper as shown. Construct a rotated copy of trapezoid *ABCD*, and match the vertices with the original trapezoid as shown.



2. Polygon *JKLM* is what type of quadrilateral? Justify your answer with properties of *JKLM*.

JKLM is a parallelogram, because JMCB $\cong$ LKBC, so opposite angles of JKLM are congruent.

3. What is the area of quadrilateral *JKLM*?

$A = bh = 7(2) = 14 \text{ cm}^2$

4. How can you use the area of *JKLM* to find the area of *ABCD*?

Area of ABCD is ½ of JKLM $= 7 \text{ cm}^2$

5. If the length of the bases of *ABCD* are $AB = b_1$ and $CD = b_2$, what is the length of each base of *JKLM*?

$b_1 + b_2$

6. What is the relationship between the height of *ABCD* and the height of *JKLM*?

Same height

7. What is the rule for determining the area of a trapezoid with bases b_1, b_2 and height h?

$A = \frac{1}{2}(b_1 + b_2)h$

Activity 4: Pattern Block Similarity

For this activity, you will need a set of pattern blocks.

1. First, follow this example to get the idea of this activity.

Using squares, we can construct larger squares that are **similar** to the original one.

The original square, Figure 1, uses one pattern block. The next larger similar square, Figure 2, uses 4 pattern blocks. The next larger similar square, Figure 3, uses 9 pattern blocks.

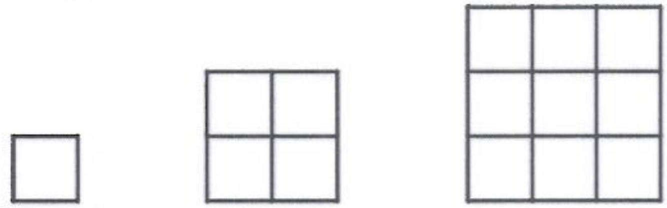
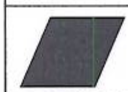
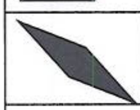
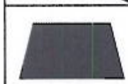


Figure 1 Figure 2 Figure 3

2. Use pattern blocks to construct Figure 4, the next larger similar square after Figure 3. How many blocks are needed to construct it?

16

3. Complete the table below for each of the following pattern block shapes. If you don't have enough pattern blocks to make Figure 5, or 6, or 7 (etc) make a conjecture based upon the pattern that you see in Figures 1-4.

	Number of Blocks in...								
Shape	Figure 1	Figure 2	Figure 3	Figure 4	Figure 5	Figure 6	Figure 7	...	Figure n
	1	4	9	16	25	36	49	...	n^2
	1	4	9	16	25	36	49	...	n^2
	1	4	9	16	25	36	49	...	n^2
	1	4	9	16	25	36	49	...	n^2
	1	4	9	16	25	36	49	...	n^2

4. How does this activity demonstrate the Theorem from Section 10.4 about Perimeters and Areas of Similar Figures?

If the perimeter of the figure is n times as long as the original, the area of the figure is n^2 as large as the original.

Activity 5: Diameters to Circumferences

You will need a piece of paper, a compass, and scissors for this activity.

1. On a blank piece of paper, use your compass to draw a circle with a radius between 1 and 1 ¾ inches.
2. Cut a strip of paper from the long edge of your sheet. We will use this as a flexible ruler.
3. Use your strip of paper to measure the circumference of your circle (that is, around your circle). Cut the strip of paper to this length.
4. Use the strip of paper to measure the diameter of the circle. (You may want to use an actual ruler as a straight edge to draw the diameter of the circle before measuring it.)
5. Fold your strip of paper into parts that are as long as the diameter.

This activity shows that a circle's circumference is about $3\frac{1}{4}$ times as long as its diameter. (Round any fractional part to a reasonable approximation)

How does this relate to the value of π?

π is defined as the ratio of a circle's circumference to its diameter: $\pi = \frac{c}{d}$

this is true NO MATTER WHAT SIZE circle we use!