Measure each of the angles above as closely as possible.
Activity 2: Triangle Properties—Angles

**PURPOSE** Reinforce the theorem on the angle sum of a triangle and reinforce the construction of a triangle using a protractor and ruler.

**MATERIALS** A centimeter ruler and a protractor

**GROUPING** Work in pairs.

**GETTING STARTED** Make all constructions on a separate piece of paper. As you construct the triangles in each section, compare your triangle with your partner’s triangle.

Use a ruler and a protractor to construct a triangle that has two angles with the indicated measures. Record your results in the table.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Sum of the Given Angles</th>
<th>Is a Triangle Possible?</th>
<th>If Yes, What Is the Measure of the Third Angle?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. In each Exercise 1–6 that did result in a triangle, what is true about the sum of the measures of the two given angles?

2. In each Exercise 1–6 that did not result in a triangle, what is true about the sum of the measures of the two given angles?

3. List the measures for three pairs of angles that can be used to construct a triangle.
   a. __________   b. __________   c. __________

4. List the measures for three pairs of angles that cannot be used to construct a triangle.
   a. __________   b. __________   c. __________

5. What can you conclude about the sum of the measures of the three angles of a triangle?

6. For each exercise that resulted in a triangle, list the angle pair and identify the type of triangle that was constructed.
Activity 3: Inside or Outside?

**PURPOSE**
Explore the relationship among points in the interior or exterior of a simple closed curve.

**GROUPING**
Work individually.

**GETTING STARTED**
The following examples illustrate various curves.

**Examples:**
- **Exterior**
  - Simple closed
- **Interior**
  - Simple not closed
- **Not simple closed**

Some *simple* curves may not appear to be so simple. In the curve shown, point $K$ is clearly outside the curve.

1. Do you think point $M$ is inside the curve or outside?

2. What about point $D$?
For each of the following curves, point M and point B are either both inside or both outside the curve. Without crossing a boundary, draw a curve from M to B. Then draw a segment from M to B and count the number of times the segment crosses the boundary. (A crossing means that the segment goes from inside the curve to the outside, or from outside the curve to the inside.) Enter the number of times the segment crosses the boundary in the table below.

Example:

Where are points M and B? ______

<table>
<thead>
<tr>
<th>Figure</th>
<th>Number of Crossings</th>
<th>Is the Number of Crossings Odd or Even?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. What conjecture can you make concerning the number of crossings when a segment is drawn between two points that are either both inside or both outside a simple closed curve?
In each of the curves, point T is inside the curve and point B is outside. Draw a segment from T to B; count the number of times the segment crosses the boundary and complete the table.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Number of Crossings</th>
<th>Is the Number of Crossings Odd or Even?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. What conjecture can you make concerning the number of crossings when a segment is drawn between two points where one is inside and one is outside a simple closed curve?

2. Look back at the curve at the beginning of this activity. Explain how you can use the results of the activity to determine the correct location of points M and D.

3. If you were given a random point like point M at the beginning of the activity, explain how you could determine whether the point is inside the curve or outside.
Activity 4: Angles on Pattern Blocks

**PURPOSE**
Determine the sum of the measures of the interior angles of a polygon and the measure of each angle of a regular polygon.

**MATERIALS**
One set of Pattern Blocks (page A-1, A-3, A-5)

**GROUPING**
Work individually.

Determine the measure of each interior angle of each pattern block. You may use only the fact that the square has four right angles. **HINT**: You may place combinations of blocks on top of a block to assist in determining the measures of the angles.

**Example:**
Indicate the measure of each angle inside the pattern blocks as shown in the example. For each pattern block, explain the method you used to determine the measure of each angle. Draw a sketch of the blocks you used to illustrate your explanations. The measures you find on one block may be used to determine the measures of the angles on other blocks.

1. 

2. 

3. 

4. 

5. 

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1. Use pattern blocks to construct a convex pentagon. Determine the measure of each interior angle of the pentagon. Sketch your pentagon and indicate the measure of each angle.

2. Use pattern blocks to construct a convex heptagon (seven sides). Determine the measure of each interior angle of the heptagon. Sketch your heptagon and indicate the measure of each angle.

3. Use the measures of each of the interior angles of the pattern blocks and the polygons you constructed to complete the following table:

<table>
<thead>
<tr>
<th>Number of Sides</th>
<th>Sum of the Measures of the Angles</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td></td>
</tr>
</tbody>
</table>

4. How is the increase in the sum of the measures of the interior angles related to the increase in the number of sides?

5. Given the number of sides of a polygon, $n$, how would you determine the sum of the measures of the interior angles of the polygon?

6. If a polygon is regular, how would you determine the measure of each interior angle?
MATERIALS CARD 12.8

- Equilateral Triangle 12.8
- Regular Quadrilateral (Square) 12.8
- Regular Pentagon 12.8
- Regular Octagon 12.8
- Regular Decagon 12.8
- Regular Hexagon 12.8
- Regular Dodecagon 12.8
Each net in the left column will fold into a polyhedron. Use Y or N to indicate which of the nets to the right will also fold into the same polyhedron. If necessary, make the net with Polydrons or make copies of the nets on pages A-39 and A-40 and cut them out. Then check your conjecture by folding the net into the polyhedron.

1.

2.

3.

4.

5.

6.
Activity 9: A View from the Top

PURPOSE  Develop spatial perception by using various views to construct models of buildings.

MATERIALS  Cubes, at least 16 per person or pair

GROUPING  Work individually or in pairs.

GETTING STARTED  Architectural plans may include various views of a building: top, front, back, left, and right. By viewing a building from the top and sides, you can determine its shape. Each number on a building mat tells you the number of stories (cubes) in that section of the building.

1. Use the numbers on this mat to construct the building with your cubes.

```
  2
left 1 3
1 1 2
```

2. Determine which views below represent the

<table>
<thead>
<tr>
<th>front</th>
<th>back</th>
<th>right</th>
<th>left</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>B.</td>
<td>C.</td>
<td></td>
</tr>
<tr>
<td>D.</td>
<td>E.</td>
<td>F.</td>
<td></td>
</tr>
<tr>
<td>G.</td>
<td>H.</td>
<td>I.</td>
<td></td>
</tr>
</tbody>
</table>

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1. Use your cubes to construct the building represented by the following mats:

a. 

\[
\begin{array}{ccc}
1 & 2 & 1 \\
3 \\
1 & 2 & 1
\end{array}
\]

Front

b. 

\[
\begin{array}{ccc}
4 & 2 & 1 \\
2 & 3 \\
4
\end{array}
\]

Front

c. 

\[
\begin{array}{ccc}
3 & 2 & 1 \\
4 & 3 & 2 \\
1 \\
1
\end{array}
\]

Front

2. On centimeter grid paper, draw the architectural plans for each building. Label the top, front, back, left, and right view for each.

3. What is the relationship between the front and back views? Between the left and right views?

---

Use the plans below to construct each building. Record the height of each section of the building on the mat.

**BUILDING VIEWS**

**Example:**

<table>
<thead>
<tr>
<th>TOP</th>
<th>FRONT</th>
<th>RIGHT</th>
<th>MAT</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Top View" /></td>
<td><img src="image2" alt="Front View" /></td>
<td><img src="image3" alt="Right View" /></td>
<td><img src="image4" alt="Mat View" /></td>
</tr>
</tbody>
</table>

**Example:**

1. 

2. 

3. 

**EXTENSION**

Draw a set of plans for a building showing the top, front, and one side view. The building can use no more than 20 cubes. Give the plans to a classmate to construct.
Exploring the Area of a Circle