The Asimov Museum has contracted with a company that provides Robotic Security Squads to guard the exhibits during the hours the museum is closed. The robots are designed to patrol the hallways around the exhibits and are equipped with cameras and sensors that detect motion.

Each robot is assigned to patrol the area around a specific exhibit. They are designed to maintain a consistent distance from the wall of the exhibits. Since the shape of the exhibits change over time, the museum staff must program the robots to turn the corners of the exhibit.

Below, you will find a map of the museum's current exhibits and the path to be followed by the robot. One robot is assigned to patrol each exhibit.

When a robot reaches a corner, it will stop, turn through a programmed angle, and then continue its patrol. Your job is to determine the angles that R1, R2, R3, and R4 will need to turn as they patrol their area. Keep in mind the direction in which the robot is traveling and make sure it always faces forward as it moves around the exhibits.

Try measuring the angles on the following pages using a protractor or using the Geometer’s Sketchpad animation found at

http://gwinnett.k12.ga.us/PhoenixHS/math/grade09/unit03/Unit%203%20-%20Robot%20Task.gsp
1. What angles will Robot 1 need to turn? What is the total of these turns?

Exterior Angle at Vertex 'A': 

Exterior Angle at Vertex 'B': 

Exterior Angle at Vertex 'C': 

Exterior Angle at Vertex 'D': 

TOTAL: 

2. What angles will Robot 2 need to turn? What is the total of these turns?

Exterior Angle at Vertex 'E': 

Exterior Angle at Vertex 'F': 

Exterior Angle at Vertex 'G': 

Exterior Angle at Vertex 'H': 

Exterior Angle at Vertex 'I': 

TOTAL: 
3. What angles will Robot 3 need to turn? What is the total of these turns?

Exterior Angle at Vertex 'J':
Exterior Angle at Vertex 'K':
Exterior Angle at Vertex 'L':
Exterior Angle at Vertex 'M':
Exterior Angle at Vertex 'N':
Exterior Angle at Vertex 'O':

TOTAL: 

4. What angles will Robot 4 need to turn? What is the total of these turns?

Exterior Angle at Vertex 'P':
Exterior Angle at Vertex 'Q':
Exterior Angle at Vertex 'R':
Exterior Angle at Vertex 'S':
Exterior Angle at Vertex 'T':
Exterior Angle at Vertex 'U':
Exterior Angle at Vertex 'V':

TOTAL: 
5. What do you notice about the sum of the angles? Do you think this will always be true? (please explain using complete sentences)

6. The museum also requested a captain robot, CR, to patrol the entire exhibit area. What angles will CR need to turn? What is the total of these turns?
7. What makes Captain Robot’s path different from the other robot’s paths (other than the number of sides being different)? (please explain using complete sentences)

(RECALL FROM EARLIER IN THIS UNIT)
8. a. Create a random triangle on a piece of patty papers.
   b. Write a number inside each interior angle
   c. Cut out the triangle
   d. Tear off or cut each of the angles from the triangle
   e. Paste all 3 angles next to one another so that they all have the same vertex and the edges are touching but they aren’t overlapping

9. What is the measure of a straight angle or the angle that creates a line by using two opposite rays from a common vertex?

10. Collectively does the sum of your 3 interior angles of a triangle form a straight angle? What about others in your class?

11. Make a conjecture about the sum of the interior angles of a triangle. Do you think your conjecture will always be true? (please explain using complete sentences)
12. Determine the measure of the interior angles of the polygons of the polygons formed by Exhibits A through D. 

Look at the sum of the angles in the polygons. Do you notice a pattern?

Exhibit A (Quadrilateral)   Exhibit B (Pentagon)   Exhibit C (Hexagon)     Exhibit D (Heptagon)

<table>
<thead>
<tr>
<th>Interior Angle at Vertex 'A:'</th>
<th>Interior Angle at Vertex 'E:'</th>
<th>Interior Angle at Vertex 'J:'</th>
<th>Interior Angle at Vertex 'P:'</th>
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<tr>
<td>Interior Angle at Vertex 'B:'</td>
<td>Interior Angle at Vertex 'F:'</td>
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<td>Interior Angle at Vertex 'G:'</td>
<td>Interior Angle at Vertex 'L:'</td>
<td>Interior Angle at Vertex 'R:'</td>
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<tr>
<td>Interior Angle at Vertex 'D:'</td>
<td>Interior Angle at Vertex 'H:'</td>
<td>Interior Angle at Vertex 'M:'</td>
<td>Interior Angle at Vertex 'S:'</td>
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<td>Interior Angle at Vertex 'I:'</td>
<td>Interior Angle at Vertex 'O:'</td>
<td>Interior Angle at Vertex 'N:'</td>
<td>Interior Angle at Vertex 'T:'</td>
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TOTAL: + TOTAL: + TOTAL: + TOTAL:

13. Look at the sums of the angles in each of the polygons, do you notice a pattern? Can you briefly describe the pattern?
14. Using your hypothesis from the previous problem can you determine the sum of the interior angles of the following:
   A. Octagon (8-Sides)     B. Dodecagon (12-sides)     C. Icosagon (20 sides)     D. A polygon with n-sides

15. Using the information from above what would be the measure of a single interior angle each were regular polygons?
   A. Regular Octagon      B. Regular Dodecagon             C. Regular Icosagon             D. A regular polygon with n-sides

16. The museum intends to create regular polygons for its 6th exhibition. For regular polygons the robot will make the same ‘turn’ at each vertex. Can you determine the angle of each turn for the robot for a regular Pentagon?
   a. A regular Pentagon?
   b. A regular Hexagon?
   c. A regular Nonagon?

17. A sixth exhibit was added to the museum. The robot patrolling this exhibit will make 15º turns at each vertex. How many sides must the exhibit have and what is the name of the polygon?

   What makes it possible for the robot to make the same turn each time (what type of polygon must the exhibit be)?

18. Find the value of \( x \) in each diagram below.
   a.
   b.
   c.