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Unit 7, Lesson 7: Building Polygons (Part 2)

Let's build more triangles.

7.1: Where Is Lin?

m.openup.org/1/7-7-7-1

At a park, the slide is 5 meters east of the swings. Lin is standing 3 meters away from the slide.

1. How far away from the swings is Lin?

2. Draw a diagram of the situation including where Lin could be.

3. Is there anywhere else Lin could be?

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7.2: How Long Is the Third Side?

m.openup.org/1/7-7-7-2

Your teacher will give you some strips of different lengths and fasteners you can use to attach the corners.

1. Build as many different triangles as you can that have one side length of 5 inches and one of 4 inches. Record the side lengths of each triangle you build.

2. Are there any other lengths that could be used for the third side of the triangle but weren't in your set?

3. Are there any lengths that were in your set but could not be used as the third side of the triangle?

Are you ready for more?

Assuming you had access to strips of any length, and you used the 9-inch and 5-inch strips as the first two sides, complete the sentences:

1. The third side can't be _____ inches or longer.

2. The third side can't be _____ inches or shorter.

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7.3: Swinging the Sides Around

m.openup.org/1/7-7-7-3

We'll explore a method for drawing a triangle that has three specific side lengths. Your teacher will give you a piece of paper showing a 4-inch segment as well as some instructions for which strips to use and how to connect them.

1. Follow these instructions to mark the possible endpoints of one side:

   a. Put your 4-inch strip directly on top of the 4-inch segment on the piece of paper. Hold it in place.

   b. For now, ignore the 3-inch strip on the left side. Rotate it so that it is out of the way.

   c. In the 3-inch strip on the *right* side, put the tip of your pencil in the hole on the end that is not connected to anything. Use the pencil to move the strip around its hinge, drawing all the places where a 3-inch side could end.

   d. Remove the connected strips from your paper.

2. What shape have you drawn while moving the 3-inch strip around? Why? Which tool in your geometry toolkit that can do something similar?

3. Use your drawing to create two unique triangles, each with a base of length 4 inches and a side of length 3 inches. Use a different color to draw each triangle.

4. Reposition the strips on the paper so that the 4-inch strip is on top of the 4-inch segment again. In the 3-inch strip on the *left* side, put the tip of your pencil in the hole on the end that is not connected to anything. Use the pencil to move the strip around its hinge, drawing all the places where another 3-inch side could end.

5. Using a third color, draw a point where the two marks intersect. Using this third color, draw a triangle with side lengths of 4 inches, 3 inches, and 3 inches.

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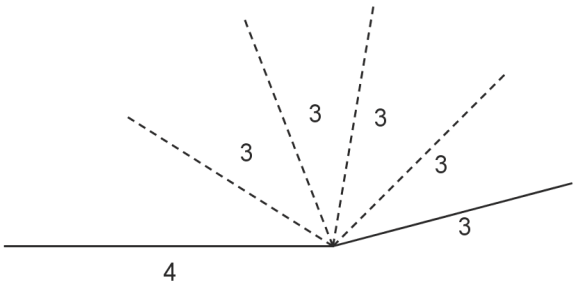
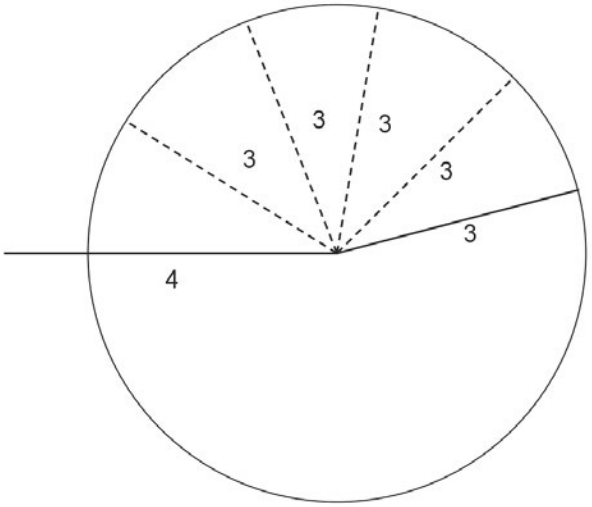
Lesson 7 Summary

If we want to build a polygon with two given side lengths that share a vertex, we can think of them as being connected by a hinge that can be opened or closed:



All of the possible positions of the endpoint of the moving side form a circle:



You may have noticed that sometimes it is not possible to build a polygon given a set of lengths. For example, if we have one really, really long segment and a bunch of short segments, we may not be able to connect them all up. Here's what happens if you try to make a triangle with side lengths 21, 4, and 2:

The short sides don't seem like they can meet up because they are too far away from each other.

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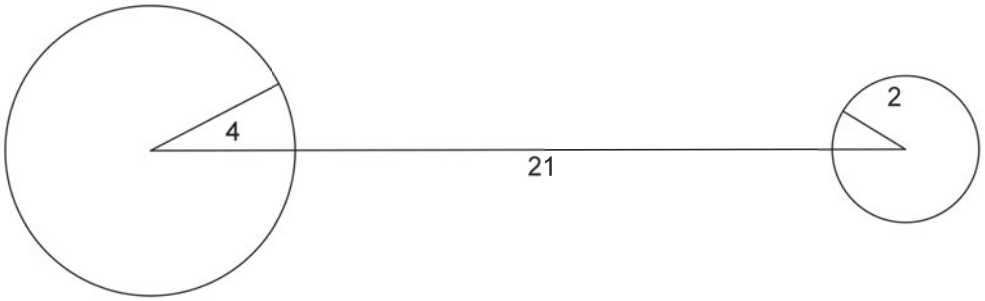

If we draw circles of radius 4 and 2 on the endpoints of the side of length 21 to represent positions for the shorter sides, we can see that there are no places for the short sides that would allow them to meet up and form a triangle.

In general, the longest side length must be less than the sum of the other two side lengths. If not, we can't make a triangle!

If we *can* make a triangle with three given side lengths, it turns out that the measures of the corresponding angles will *always* be the same. For example, if two triangles have side lengths 3, 4, and 5, they will have the same corresponding angle measures.

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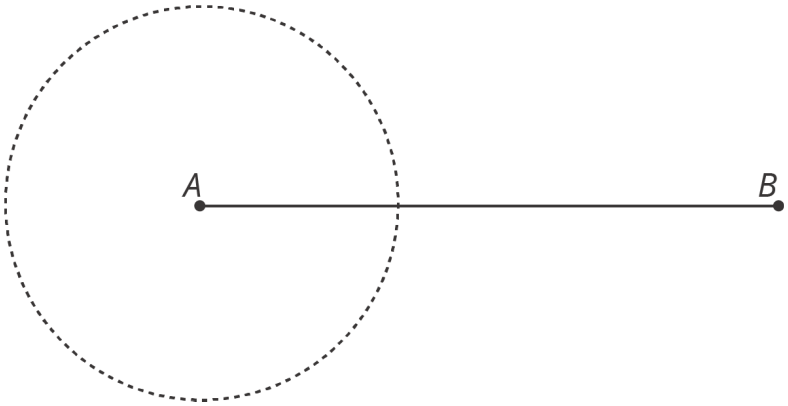
Unit 7, Lesson 7: Building Polygons (Part 2)

1. In the diagram, the length of segment AB is 10 units and the radius of the circle centered at A is 4 units. Use this to create two unique triangles, each with a side of length 10 and a side of length 4. Label the sides that have length 10 and 4.



2. Select **all** the sets of three side lengths that will make a triangle.

   A. 3, 4, 8
   B. 7, 6, 12
   C. 5, 11, 13
   D. 4, 6, 12
   E. 4, 6, 10

3. Based on signal strength, a person knows their lost phone is exactly 47 feet from the nearest cell tower. The person is currently standing 23 feet from the same cell tower. What is the closest the phone could be to the person? What is the furthest their phone could be from them?

4. Each row contains the degree measures of two complementary angles. Complete the table.

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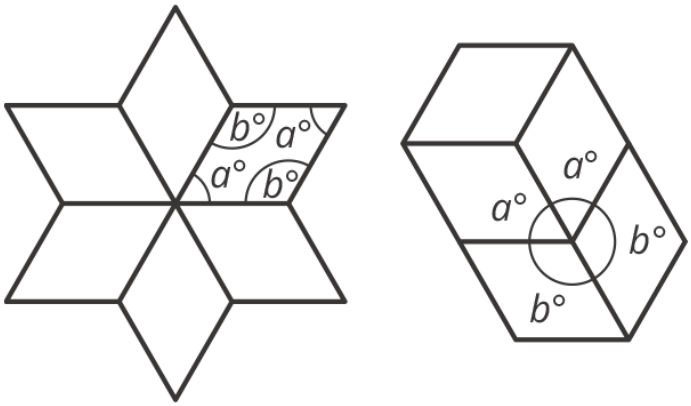
measure of an angle	measure of its complement
80°	
25°	
54°	
x	

(from Unit 7, Lesson 2)

5. Here are two patterns made using identical rhombuses. Without using a protractor, determine the value of a and b. Explain or show your reasoning.



(from Unit 7, Lesson 1)

6. Mai's family is traveling in a car at a constant speed of 65 miles per hour.

   a. At that speed, how long will it take them to travel 200 miles?

   b. How far do they travel in 25 minutes?

(from Unit 4, Lesson 3)