

Draw and Construct Triangles Given Side Lengths

I Can determine whether three lengths could be side lengths of a triangle, and, given two side lengths, I can find the range of possible lengths for the third side.

Spark Your Learning



Martina is building a wind chime. She has pieces of metal pipe 2, 3, 4, and 5 inches long that she is going to use to make a triangular top for the wind chime. Which combinations of three lengths will **not** work to make the top?



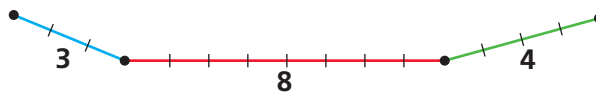
Turn and Talk What do you notice about the set of lengths that did not make a triangle?

Build Understanding



- 1** Can you draw a triangle with side lengths of 3, 4, and 8 units? There are different ways to model the situation and investigate. You can use thin strips of paper cut to the correct lengths, or you can use tools such as a ruler and compass, or geometry software.

- A.** Use the longest side of your model as the possible base. Use your model to view the shorter sides in different positions. Can you draw a triangle? If so, draw one. If not, explain why you cannot.



- B.** Repeat Part A using the shortest segment as the possible base. Can you draw a triangle? If so, draw one. If not, explain why you cannot.

- C.** Complete the statements describing the relationships between the three side lengths that do **not** form a triangle. Use *less than*, *equal to*, or *greater than*.

The sum of the lengths of the two shorter sides is _____ the length of the longer one.

- 2** Can you draw a triangle with side lengths of 3, 4, and 6 units?

- A.** Use the 6-unit segment of your model as the possible base. Can you make a triangle? If so, draw it. If not, explain why you cannot.

- B.** Use the 3-unit segment as the possible base. Can you make a triangle? If so, draw it. If not, explain why you cannot.

- C.** Use the 4-unit segment as the possible base. Can you make a triangle? If so, draw it. If not, explain why you cannot.



- D. How are the triangles you made in Parts A–C alike?

- E. Complete the statements describing the relationships between the three side lengths that form a triangle. Use *less than*, *equal to*, or *greater than*.

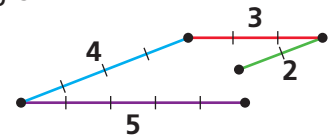
The sum of the lengths of the two shorter sides is _____ the length of the longest side.

- F. Complete the summary of what you have discovered so far for three segments with lengths a , b , and c , where c is the greatest length.

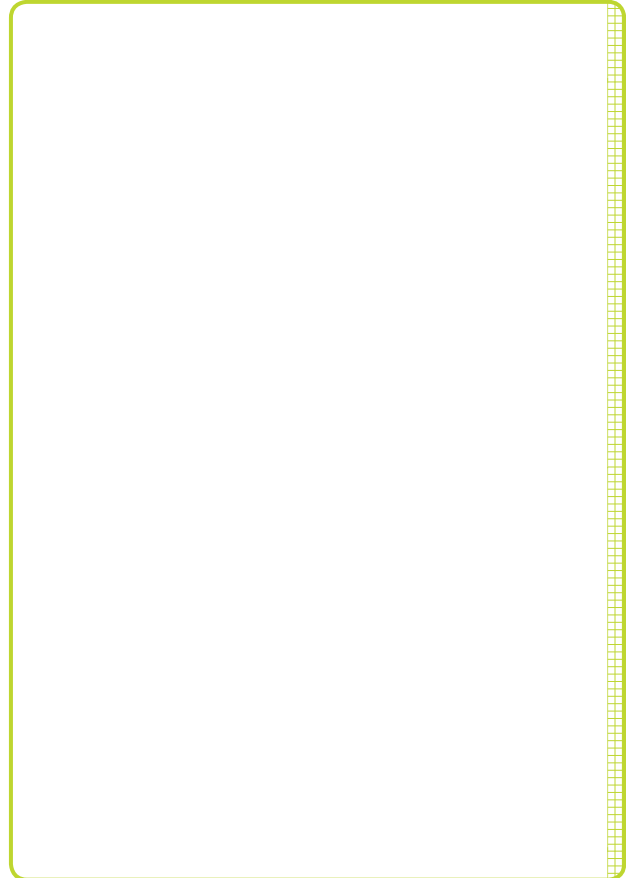
If $a + b$ is _____ than c , the segments cannot form a triangle.

If $a + b$ is _____ than c , the segments form one triangle.

- 3** Can you draw a quadrilateral with side lengths of 2, 3, 4, and 5 units?



- A. Make and use a model. Can you connect the endpoints to form a quadrilateral? If so, draw a quadrilateral. If not, explain why you cannot.
- B. Using the same side lengths, can you make a quadrilateral that is different than the one you drew in Part A? If so, draw it. If not, explain why you cannot.
- C. Make a conjecture about the number of quadrilaterals that can be made using four different segment lengths. Support your conclusion.



Turn and Talk Is it possible that four segments cannot form a quadrilateral?

Step It Out

- 4** In Parts A–C, let a and b be the shorter lengths and c be the longest length. Compare $a + b$ to c to determine if a triangle can be made. Write $<$, $=$, or $>$.

- A.** Nia wants to make a triangular picture frame from strips of wood that are 9 centimeters, 11 centimeters, and 15 centimeters long.

$$9 + 11 \boxed{} 15$$

Since the sum of the lengths of two shorter strips is _____ the length of the longest strip, Nia **can / cannot** make a triangle.

- B.** Gerard has pieces of string 6 inches, 5 inches, and 11 inches in length that he plans to use as a border for a collage.

$$6 + 5 \boxed{} 11$$

Since the sum of the lengths of two shorter pieces is _____ the length of the longest piece, Gerard **can / cannot** make a triangle.

- C.** Olivia gives her niece leftover pipe cleaners from her art supplies. They are 12 centimeters, 10 centimeters, and 24 centimeters long.

$$12 + 10 \boxed{} 24$$

Since the sum of the lengths of two shorter pipe cleaners is _____ the length of the longest, Olivia's niece **can / cannot** make a triangle.

- D.** Amil is making a bamboo trivet. Given the side lengths shown for the first two sides, what is one possible side length that will form a triangular trivet?

$5 + 8 = \underline{\hspace{2cm}}$, so one side length that will make a triangle is _____ inches.



Check Understanding

- 1.** Max has three pieces of oak trim that are 7 inches, 11 inches, and 18 inches long. He wants to use them to make a triangular base for a candleholder. Will the pieces make a triangle? Explain your answer.

- 2.** Bella is making a sculpture. She has pieces of copper pipe that are 4 centimeters long and 13 centimeters long. What is a possible third length of copper pipe that will make a triangle? Justify your answer.

On Your Own

3. Horace is making a shadow box in the shape of a triangle to hold his homerun baseballs. He has pieces of wood 12 inches, 12 inches, and 26 inches long. Show whether these pieces will make a triangle.

4. **Art** An artist is going to make triangle earrings from glass rods with the lengths shown. Show whether these rods will make a triangle.

5. Alan makes triangular potholders and sews edging around the outside. He has pieces of edging 5 inches, 5 inches, and 10 inches long. Show whether these pieces will make a triangle.



Pieces to use:
1 cm
2 cm
2.5 cm

6. **Open Ended** The volleyball team is making a triangular banner for their last home game. They want two of the sides to be 4 feet long each. Determine one possible length for the third side. Justify your answer.

7. **MP Reason** Dante is constructing a quadrilateral with four sides, each 2 inches long. How many different quadrilaterals can he make? Explain.

Determine whether each set of numbers could be lengths of the sides of a triangle.

8. 17, 13, 11 _____ 9. 11, 19, 35 _____ 10. 6, 7, 13 _____

Two side lengths of a triangle are given. Find a possible third length.

11. 5 meters, 12 meters 12. 3 feet, 9 feet 13. 23 miles, 31 miles

14. A craftsman makes stained glass crafts. He has metal strips of lengths 5 inches, 8 inches, and 11 inches. Show whether these strips will make a triangle.

15. Karissa is building a triangular landscape border around her mailbox. She has logs 4 feet, 5 feet, and 10 feet long. Show whether these logs will make a triangle.

16. Pierce is developing his own board game. The border of the board is going to be 3 pieces of cardboard, each 17 inches long. Show whether these lengths will make a triangle.

17. **(MP) Construct Arguments** Risa has four sticks measuring 2 inches, 2.5 inches, 3 inches, and 8 inches. She wants to connect the sticks end to end to make a quadrilateral. Can she do it? Explain why or why not.

Determine whether each set of numbers could be lengths of the sides of a triangle.

18. 8.5, 6, 10 _____ 19. 2.5, 2.5, 4 _____ 20. 5, 12, 18 _____

Two side lengths of a triangle are given. Find a possible third length.

21. 5 inches, 10 inches _____ 22. 6 yards, 18 yards _____ 23. 9 meters, 21 meters _____



I'm in a **Learning Mindset!**


Did I find a different or unique way to determine whether a set of side lengths could form a triangle? What is it?



Draw and Construct Triangles Given Side Lengths

1. Haley is making a triangle-shaped box garden. She has wooden pieces of lengths 6 feet, 8 feet, and 13 feet. Show whether these pieces will make a triangle.

2. Students are making shapes with string in an art class. Ben has pieces of string measuring 4 inches, 2 inches, and 1.5 inches long. Show whether these lengths will make a triangle.

3.  **Construct Arguments** The Culinary Club is making a triangle-shaped sign showing a piece of pie for their pie-eating competition. Two of the sides measure as shown. Determine a possible length for the third side. Justify your answer.



4. Seth wants to make a quadrilateral charm for a necklace. He has wire pieces with lengths 1 centimeter, 2 centimeters, 4 centimeters, and 5 centimeters. How many possible quadrilaterals are there with those side lengths?

Determine whether each set of numbers could be lengths of the sides of a triangle.

5. 2, 4, 6 _____ 6. 16, 21, 33 _____ 7. 1, 3, 3 _____

Two side lengths of a triangle are given. Find a possible third length.

8. 6 meters, 8 meters _____ 9. 4 feet, 5 feet _____ 10. 4.5 yards, 7 yards _____

Test Prep

- 11.** Lorelei is making decorative boxes in the shape of triangles. Which of the following could be the lengths of the sides of the boxes?
- (A) 12 cm, 13 cm, 24 cm
 - (B) 12 cm, 13 cm, 25 cm
 - (C) 10 cm, 10 cm, 24 cm
 - (D) 10 cm, 10 cm, 22 cm
- 12.** Lhu builds dollhouses with triangle-shaped roofs. Which of the following could be lengths of the edges of the roof of a dollhouse?
- (A) 10 in., 10 in., 20 in.
 - (B) 10 in., 12 in., 24 in.
 - (C) 11 in., 12 in., 24 in.
 - (D) 11 in., 11 in., 20 in.
- 13.** Select all the sets of numbers that could be lengths of the sides of a triangle.
- | | |
|---------------|---------------|
| (A) 2, 7, 9 | (D) 6, 6, 14 |
| (B) 4, 11, 13 | (E) 8, 15, 21 |
| (C) 6, 9, 12 | (F) 9, 17, 27 |
- 14.** An artist gets strips of metal from a salvage yard to make decorative wall art. He finds strips that are 2.5 feet and 3.5 feet long. Determine one possible length for the third strip if the artist wants to make a triangle.
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Spiral Review

- 15.** Kevin bought a video game for \$45. He also wants to buy 2 game controllers. He has a total of \$120 to spend. Write and solve an inequality to find how much Kevin can spend on each controller.
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- 16.** Sofia has 16 hours to paint a living room and 2 bedrooms. She spends 7 hours painting the living room. Write and solve an inequality to find how much time she can spend on each bedroom if she splits her time equally.
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