

Lesson 11: Conditions on Measurements that Determine a Triangle

Classwork

Exploratory Challenge 1

- a. Can any three side lengths form a triangle? Why or why not?
- b. Draw a triangle according to these instructions:
- ✓ Draw segment \overline{AB} of length 3 cm in your notebook.
 - ✓ Draw segment \overline{AC} of length 4 cm on one piece of patty paper.
 - ✓ Draw segment \overline{BC} of length 5 cm on the other piece of patty paper.
 - ✓ Line up the appropriate endpoint on each piece of patty paper with the matching endpoint on \overline{AB} .
 - ✓ Use your pencil point to hold each patty paper in place, and adjust the paper to form $\triangle ABC$.
- c. What do you notice?
- d. What must be true about the sum of the lengths of \overline{AB} and \overline{AC} if the two segments were to just meet? Use your patty paper to verify your answer.
- e. Based on your conclusion for part (c), what if \overline{AC} is 3 cm as you originally had, but \overline{BC} is 4 cm in length. Could you form $\triangle ABC$?
- f. What must be true about the sum of the lengths of \overline{AB} and \overline{BC} if the two segments were to meet and form a triangle?

Exercise 1

Two sides of _____ have lengths of _____ cm and _____ cm. What are all the possible whole-number lengths for the remaining side?

Exploratory Challenge 2

- a. Which of the following conditions determine a triangle? Follow the instructions to try and draw _____. Segment _____ has been drawn for you as a starting point in each case.
- i. Choose measurements of _____ and _____ for _____ so that the sum of measurements is greater than _____. Label your diagram.
Your chosen angle measurements: _____
Were you able to form a triangle? Why or why not?

A _____ B

- ii. Choose measurements of _____ and _____ for _____ so that the measurement of _____ is supplementary to the measurement of _____. Label your diagram.
Your chosen angle measurements: _____
Were you able to form a triangle? Why or why not?

A _____ B

- iii. Choose measurements of $\angle A$ and $\angle B$ for $\triangle ABC$ so that the sum of measurements is less than 180° . Label your diagram.

Your chosen angle measurements:

Were you able to form a triangle? Why or why not?



- b. Which condition must be true regarding angle measurements in order to determine a triangle?
- c. Measure and label the formed triangle in part (b) with all three side lengths and the angle measurement for $\angle C$. Now, use a protractor, ruler, and compass to draw $\triangle ABC$ with the same angle measurements, but side lengths that are half as long.
- d. Do the three angle measurements of a triangle determine a unique triangle? Why or why not?

Exercise 2

Which of the following sets of angle measurements determines a triangle?

a. $30^\circ, 40^\circ, 50^\circ$

b. $30^\circ, 40^\circ, 110^\circ$

c. $30^\circ, 40^\circ, 130^\circ$

d. $30^\circ, 40^\circ, 180^\circ$

e. $30^\circ, 40^\circ, 20^\circ$

Choose one example from above that does determine a triangle and one that does not. For each, explain why it does or does not determine a triangle using words and a diagram.

Problem Set

- Decide whether each set of three given lengths determines a triangle. For any set of lengths that does determine a triangle, use a ruler and compass to draw the triangle. Label all side lengths. For sets of lengths that do not determine a triangle, write “Does not determine a triangle,” and justify your response.
 - cm, cm, cm
 - cm, cm, cm
- For each angle measurement below, provide one angle measurement that will determine a triangle and one that will not determine a triangle. Provide a brief justification for the angle measurements that will not form a triangle. Assume that the angles are being drawn to a horizontal segment ; describe the position of the non-horizontal rays of angles and .

	: A Measurement that Determines a Triangle	: A Measurement that Doesn't Determine a Triangle	Justification for No Triangle

- For the given side lengths, provide the minimum and maximum whole-number side lengths that determine a triangle.

Given Side Lengths	Minimum Whole Number Third Side Length	Maximum Whole Number Third Side Length
cm, cm		
cm, cm		
cm, cm		
cm, cm		