# 5.3 The Triangle Inequality Theorem

Bell Work:
Jan claims that she can look at the lengths of the 3 sides of a triangle and then classify them as right, acute, or obtuse without measuring the angles. Which triangles do you think are right? Acute? Obtuse? Do you know how Jan did it?

1. 3, 4, 5
2. 6, 7, 8
3. 6, 8, 11
4. 4, 6, 7

You can tell whether the triangle is a right triangle by checking to see if the side measures work in the Pythagorean Theorem.
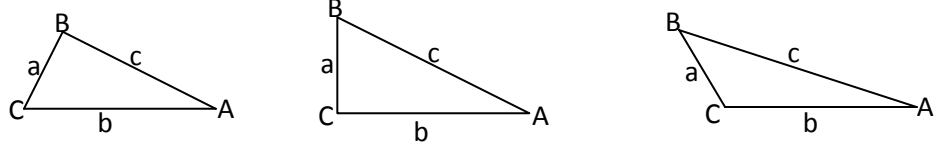
<C is the right angle. If we make <C smaller (acute now) then c becomes smaller and $a^2 + b^2 > c^2$.
<C is the right angle. If we make <C larger (obtuse now) then c becomes larger and $a^2 + b^2 < c^2$.

1. **3, 4, 5: $3^2 + 4^2 = 9 + 16 = 25 = 5^2$ Since this works in the Pythagorean Theorem, the triangle is a right triangle.**
2. **6, 7, 8: $6^2 + 7^2 = 36 + 49 = 85$ and $8^2 = 64$ Since 85 > 64 c is smaller than a right angle and the triangle is acute.**
3. **6, 8, 11: $6^2 + 8^2 = 36 + 64 = 100$ and $11^2 = 121$ Since 100 < 64 c is larger than a right angle and the triangle is obtuse.**
4. **4, 6, 7: $4^2 + 6^2 = 16 + 36 = 52$ and $7^2 = 49$ Since 52 > 49 c is smaller than a right angle and the triangle is obtuse.**

Experiment:
Each student will receive a piece of raw spaghetti. They are to break it into 3 pieces, measure each piece with a ruler and then try to form a triangle with the pieces. A table of results will be compiled on the board. **Answers here will vary with the class. Below are some examples.**

Piece 1 (cm)	Piece 2 (cm)	Piece 3 (cm)	Triangle (yes or no)
3	3	3	Yes
4	5	7	Yes
5	7	12	No
9	2	14	No

Instruction:
Triangle Inequality Theorem
The sum of the lengths of any two sides of a triangle is greater than the length of the third side.
A good strategy is to compare the sum of the lengths of the two smallest sides to the length of the largest side.

Which of the following can be the lengths of the 3 sides of a triangle?
1. 2 cm, 5.1 cm, 2.4 cm   **2 + 2.4 = 4.4 which is not > than 5.1 so NO**
2. 9.2 cm, 7 cm, 1.9 cm   **1.9 + 7 = 8.9 which is not > than 9.2 so NO**

Application Problem:
David's father drives him to school in the morning and then drives from the school to work. The school is 4 miles from David's house and his father's job is 7 miles from the house. How far is the job from the school?

There are possibilities:
1. The school is on the way to the job. So school to job would be 7 - 4 = 3 miles
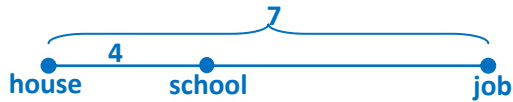
2. The job is the opposite direction from the school. So school to job would be 4 + 7 = 11 miles

3. The house, school, and job form a triangle.   3 < distance < 11