Geometry
7.3 Triangle Inequalities

TI-Nspire Investigation - fill in the table with class results

Side 1	Side 2	Base	Success? Y/N
4	4	4	Y/N
0	0	0	N
5	5	7	Y
3	3	8	N
4	6	10	N
4	6	7	Y
5	8	12	Y
4	4	7	Y
5	12	13	Y

Use the lengths from your table to make the following comparisons using <, >, or =.

Side 1 + Side 2 ___ Base

5+5 > 7
4+6 > 7
5+8 > 12
4+4 > 4

Side 2 + Base ___ Side 1

5+7 > 5
6+7 > 4
8+12 > 5
4+4 > 4

Base + Side 1 ___ Side 2

7+5 > 5
7+4 > 6
12+5 > 8
4+4 > 4

Jesse has 3 pieces of wood. The pieces measure 7 inches, 10 inches, and 14 inches. Tyrone has 3 pieces of wood that measure 6 inches, 11 inches, and 3 inches. Will they each be able to create a triangle? Why or why not?

Jesse
7, 10, 14
7+10 > 14 ✓
10+14 > 7 ✓
7+14 > 10 ✓
yes

Tyrone
6, 11, 3
6+11 > 3 ✓
11+3 > 6 ✓
3+6 < 11 X
NO

5. Make a conjecture about the relationship of the measures of the sides of a triangle.

2 sides added together must always be greater than the 3rd side

6. Given a triangle with side lengths x, y, and z, which of the following is true? Justify your reasoning.

a. $x + y > z$ yes b/c of

b. $x + z > y$ yes

c. $z + y > x$ yes

Triangle Inequality Theorem

The sum of any two side lengths of a triangle is greater than the third side length.

$AB + BC > AC$
$BC + AC > AB$
$AC + AB > BC$

Example 1 Use the Triangle Inequality Theorem to tell whether a triangle can have sides with the given lengths. Explain.

(A) 4, 8, 10

4+8 > 10 ✓
8+10 > 4 ✓
4+10 > 8 ✓
So yes

(B) 7, 9, 18

7+9 < 18 X
9+18 7
18+7 9
NO

7. Given the lengths of 2 sides of a triangle, what are the possible measures for the length of the third side? Let's plug them into the inequalities from #6.

$x + y > z$ $x + z > y$ $z + y > x$

a. 4 inches and 7 inches

$4+7>z$ $4+z>7$ $z+7>4$

$11>z$ $z>3$ $z>-3$

$z<11$ $3<z<11$

b. 10 centimeters and 10 centimeters $0<y<20$

$10+y>10$ $10+10>y$ $10+y>10$

$y>0$ $y<20$ $y>0$

c. 11 inches and 12 inches

$11+12>x$ $11+x>12$ $12+x>11$

$x<23$ $x>1$ $x>-1$ $1<x<23$

d. 0.5 centimeter and 2.5 centimeters

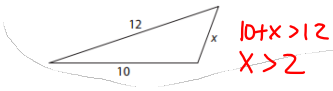
$.5+2.5>x$ $.5+x>2.5$ $2.5+x>.5$

$3>x$ $x>2$ $x>-2$

$x<3$ $2<x<3$

Example 2 **Find the range of values for x using the Triangle Inequality Theorem.**

(A) Find possible values for the length of the third side using the Triangle Inequality Theorem.



$10+x>12$

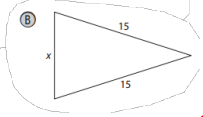
$x>2$

$12+10>x$ $12+x>10$

$x<22$ $x>-2$

$2<x<22$

(B)



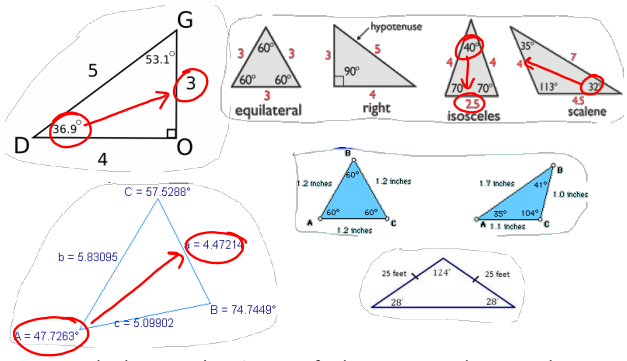
$x+15>15$ $15+x>15$

$x>0$ $x>0$

$15+15>x$

$x<30$

$0<x<30$



Study the triangles above to find a pattern and answer the questions below:

Where is the smallest angle in relation to the shortest side?

directly opposite of each other

Where is the largest angle in relation to the longest side?

directly opposite of each other

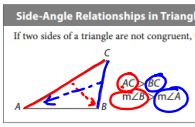
How does your answer to the previous questions relate to isosceles and equilateral triangles?

Isosceles - If 2 ∠'s are ≅ then the 2 sides opp of them are ≅

Equil - If all sides are ≅ then all ∠'s are ≅

Side-Angle Relationships in Triangles

If two sides of a triangle are not congruent, then the larger angle is opposite the longer side.

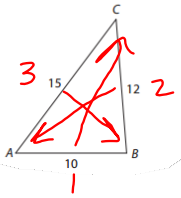


Angle-Side Relationships in Triangles

If two angles of a triangle are not congruent, then the longer side is opposite the larger angle.

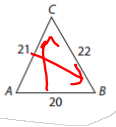
Example 3 **For each triangle, order its angle measures from least to greatest.**

(A)



∠C, ∠A, ∠B

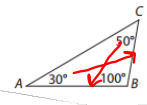
(B)



∠C, ∠B, ∠A

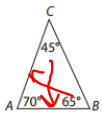
Example 4 For each triangle, order the side lengths from least to greatest.

Ⓐ



$\overline{CB}, \overline{AB}, \overline{AC}$

Ⓑ



$\overline{AB}, \overline{AC}, \overline{CB}$

Try This:

Determine if a triangle can be formed with the given side lengths. Explain your reasoning.

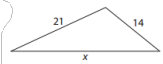
12 units, 4 units, 17 units

$12+4 \not> 17$ No

$4+17 > 12$

$12+17 > 4$

Find the range of values for x using the Triangle Inequality Theorem.



$21+19 > x$

~~$21+x > 14$~~

$14+x > 21$

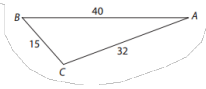
$-14 \quad -14$

$x < 35$

$x > 7$

$7 < x < 35$

For each triangle, order its angle measures from least to greatest.



$\measuredangle A, \measuredangle B, \measuredangle C$

For each triangle, order the side lengths from least to greatest.

$\overline{CB}, \overline{AC}, \overline{AB}$

Homework

pg 299; 5-11, 13, 14, 16-22
ec: 12, 24