Determining Values For Triangles:

A. On number sense tests, there are 3 different ways of finding specific values for triangles:

1. Find the largest/smallest integral value to make a triangle.

2. Find the largest/smallest integral value to make an acute triangle.

3. Find the largest/smallest integral value to make an obtuse triangle.

B. Steps

1. For the first type, we know from geometry that each leg MUST be less than the sum of the other two legs. For this reason, the 3rd side, c, must be between the values: $a - b < c < a + b$, where a is the larger of the two sides.

2. For the second type, to force a triangle to be acute the 3rd side, c, must be between the values: $\sqrt{a^2 - b^2} < c < \sqrt{a^2 + b^2}$, where a is the larger of the two sides.

3. For the third type, to force a triangle to be obtuse the 3rd side, c, must be between the values: $a - b < c < \sqrt{a^2 - b^2}$ or $\sqrt{a^2 + b^2} < c < a + b$. Either one of these two values work.

    a. It follows that the smallest/largest value for the 3rd side is the same as the type of problem found in number 1. above. So actually, this type and the 1st type yield the same answers.

C. Examples

Ex [1] A triangle has sides of 3, 7, and x. Then x < _____.

a. According to number 1. above, x < 3+7 or x < 10.

b. The answer is 10.

c. If the problem had asked for the largest integral value of x, the answer would be 9 not 10, since it must be less than 10.

Ex [2] An acute triangle has sides of 3, 7, and x. The largest integral value of x is _____.

a. According to number 2. above, $\sqrt{7^2-3^2} < x < \sqrt{7^2+3^2}$ or $\sqrt{40} < x < \sqrt{58}$. The only possible integral value is 7.

b. The answer is 7.

Ex [3] An obtuse triangle has sides of 3, 7, and x. The smallest integral value of x is _____.

a. According to number 3. above, 7 - 3 < x or 4 < x. The next highest integral number over 4 is 5.

b. The answer is 5.