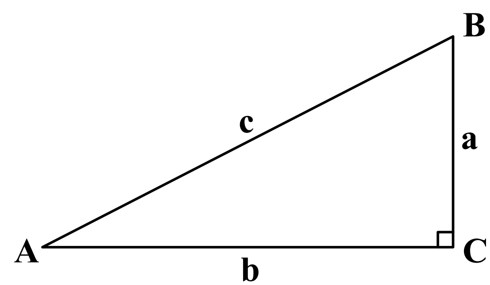
General Algebra II Right Triangle Activity Unit 13 page 1 ______________________________

Some important relationships involving right triangles are between the angles and sides. Every right triangle has two acute angles. These <u>acute angles</u> determine the relative lengths of the sides of the triangle. These relationships can best be observed by drawing right triangles with given angle measures and carefully measuring and comparing their sides.

Directions for Table I: Each row of the table I (on page 2) corresponds to a different right triangle. You are to draw a triangle that has the given angle measures. (You will be drawing nine different right triangles.) Then fill out table I for each triangle that you drew. Measure angle B (in degrees) and the length of each side (in millimeters). Be as accurate as you can.

Now that you have some data, you can explore relationships dealing with the <u>relative lengths</u> of the sides. This involves calculating certain ratios. These ratios are named the <u>sine ratio</u>, the <u>cosine ratio</u>, and the <u>tangent ratio</u>. Refer to the diagram below as you read the following definitions.



For either of the <u>acute angles</u> in the triangle above, the sine ratio, the cosine ratio, and the tangent ratio are defined as follows.

The <u>sine of the angle</u> is the ratio of the length of the <u>leg opposite the angle</u> to the length of the <u>hypotenuse</u>.

The <u>cosine of the angle</u> is the ratio of the length of the <u>leg adjacent to the angle</u> to the length of the <u>hypotenuse</u>.

The <u>tangent of the angle</u> is the ratio of the length of the <u>leg opposite the angle</u> to the length of the <u>leg adjacent to the angle</u>.

Note each of the following:

The length of the <u>leg opposite angle A</u> is <u>a</u>. The length of the <u>leg opposite angle B</u> is <u>b</u>.

The length of the <u>leg adjacent to angle A</u> is <u>b</u>. The length of the <u>leg adjacent to angle B</u> is <u>a</u>.

Table II summarizes the sine, cosine, and tangent ratios for angles A and B in the right triangle (page 1). Sin(A) is read the sine of angle A. Cos(A) is read the cosine of angle A. Tan(A) is read the tangent of angle A.

$$\text{Sin(A)} = \frac{a}{c} \qquad \text{Cos(A)} = \frac{b}{c} \qquad \text{Tan(A)} = \frac{a}{b}$$

$$\text{Sin(B)} = \frac{b}{c} \qquad \text{Cos(B)} = \frac{a}{c} \qquad \text{Tan(B)} = \frac{b}{a}$$

Directions for Table II. Use the data that you collected in table I, along with the definitions of the sine ratio, the cosine ratio, and the tangent ratio, to fill out Table II. All of your ratios should be expressed as decimals rounded to the nearest hundredth. Once you have finished filling out table II, you will be comparing your results in table II with the results of other students.

Table I: degrees			Table I: millimeters			Table II					
Angle A	Angle B	Angle C	a	b	c	Sin(A)	Cos(A)	Tan (A)	Sin(B)	Cos(B)	Tan (B)
15		90									
25		90									
30		90									
40		90									
45		90									
50		90									
60		90									
65		90									
75		90									

The acute angles of a right triangle are complementary. Discuss what this means. Do your measurements confirm this?

According to the Pythagorean Theorem, $a^2 + b^2 = c^2$. Check and see how close your measured distances come to confirming this. The table on page 3 can be used to check your sine, cosine and tangent ratios as well.

The following table gives the values of the sine, the cosine, and the tangent ratios for 9 different acute angles. (A calculator was used for these. Most have been rounded to the nearest thousandth. Three are exact values.) Compare these values to the values you got in table II.

Angle Measure	15°	25°	30°	40°	45°	50°	60°	65°	75°
Sine of the Angle	0.259	0.423	0.5	0.643	0.707	0.766	0.866	0.906	0.966
Cosine of the Angle	0.966	0.906	0.866	0.766	0.707	0.643	0.5	0.423	0.259
Tangent of the Angle	0.268	0.466	0.577	0.839	1	1.192	1.732	2.145	3.732

Discussion questions:

1. Why are the sine and the cosine ratios for the acute angles in the right triangle always less than 1?

2. Why is the tangent of 45° equal to 1.

3. Explain why the tangent of angles less than 45° is less than 1, while the tangent of angles greater than 45° is greater than 1.

4. What other patterns can you observe and <u>explain</u> in the table?

The Pythagorean Theorem and the three ratios, sine, cosine and tangent, are very useful in solving problems involving right triangles. Class worksheet #1 will be used to give you practice in using these relationships to calculate specific measurements in given right triangles. Class worksheet #2 is used to give you practice in using these relationships in problem solving. Good luck.