## Math. 1330 - Section 7.1 <br> Solving Right Triangles

Note that a calculator will be needed for most of the problems we will do in class. Test problems will involve angles for which no calculator is needed (e.g. $30^{\circ}, 45^{\circ}, 60^{\circ}, 120^{\circ}$, etc.). So, you will still need those unit circle values.

We'll use right triangle trigonometry to find the lengths of all of the sides and the measures of all of the angles. In some problems, you will be asked to find one or two specific pieces of information, but often you'll be asked to "solve the triangle," i.e. to find all lengths and measures that were not given.

Recall the trigonometry of a right triangle:


$$
\begin{array}{ll}
\sin A=\frac{a}{c} & \sin B=\frac{b}{c} \\
\cos A=\frac{b}{c} & \cos B=\frac{a}{c} \\
\tan A=\frac{a}{b} & \tan B=\frac{b}{a}
\end{array}
$$

We will use these formulas to solve for side-lengths. For example:

$$
\sin A=\frac{a}{c} \quad \rightarrow \quad a=c \cdot \sin A \quad \text { or } \quad c=\frac{a}{\sin A}
$$

Or

$$
\tan A=\frac{a}{b} \quad \rightarrow \quad a=b \cdot \tan A \quad \text { or } \quad b=\frac{a}{\tan A}
$$

Example 1: In the given right triangle below, find x and y .


Example 2: In $\triangle A B C$ with right angle $C, \angle A=40^{\circ}$ and $A C=12$. Find $B C$. Round the answer to the nearest hundredth.

Draw a diagram to represent the following situations, then find the indicated measures to the nearest tenth of a degree.

Example 3: An isosceles triangle has sides measuring $20 \mathrm{in}, 54 \mathrm{in}$ and 54 in . What are the measures of its angles?

Example 4: A 50 foot ladder is leaned against the side of a building. If the ladder forms a $41^{\circ}$ angle with the ground, how high up the side of the building does the ladder reach?

Example 5. In $\triangle A B C, m \angle A=75^{\circ}, m \angle B=45^{\circ}$ and $B C=24$.
a) Find the length of the altitude from $\angle C$ to the side $A B$.
b) Find the length of the side $A C$.

## Angle of Elevation; Angle of Depression:

An angle of elevation is an angle that is formed by a horizontal ray and another ray above the horizontal. For example, in viewing an object at a point above the horizontal, the angle between the line of sight and the horizontal is the angle of elevation as shown in the figure below.


An angle of depression is an angle that is formed by a horizontal ray and another ray below the horizontal. For example, in viewing an object at a point below the horizontal, the angle between the line of sight and the horizontal is the angle of depression as shown in the figure below.


Example 6: The angle of elevation to the top of a building from a point on the ground 120 feet away from the building is $28^{\circ}$. How tall is the building?

Example 7: Dave is at the top of a hill. He looks down and spots his car at a $60^{\circ}$ angle of depression. If the hill is 48 meters high, how far is his car from the base of the hill?

Example 8. A ramp for wheelchair accessibility will be constructed with an angle of elevation of $20^{\circ}$ and a final height of 4 feet. How long is the ramp? How far away is the beginning of the ramp to the wall it is attached to?

