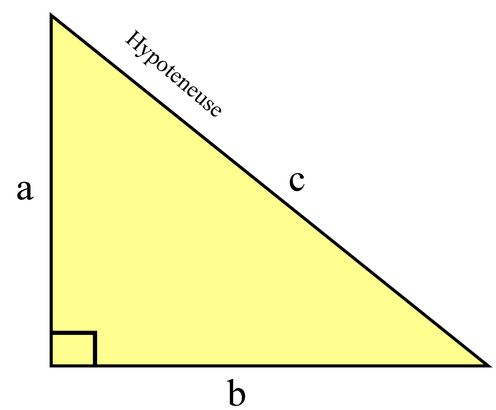
Unit 6 Trigonometry Application

Review of Trig Ratios in a Right ▲

Terms to Know:

Congruence: any objects that have the same size and same shape ($\cong$). This means that all the sides have the same length and all the angles have the same measure.
Similarity: when two objects have the same shape but different sizes. Any two similar shapes will have a constant ratio of sides. All the angles in similar objects are the same as their corresponding ones.
Vector: an arrow that shows both direction and distance
Bearing: the angle of direction, measured from due north
adjacent side: the leg closest to the angle you are using in the trig problem
opposite side: the leg that is across from the angle you are using in the trib problem
hypotenuse: it is always the side directly opposite the right angle in the triangle

The Pythagorean Theorem



For any right triangle

$$a^2 + b^2 = c^2$$

with this formula you can find the third side of a right triangle as long as you have the other two sides

Pythagorean triples: a set of three whole numbers that make the pythagorean equation work
Example: $3^2 + 4^2 = 5^2$

Trigonometry Ratios

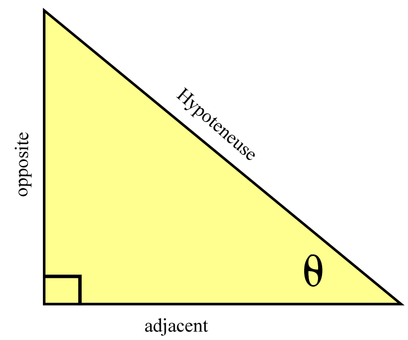
Trigonometry can help us when we don't know two sides of the right triangle. Trigonometry relates the lengths of the sides of a right triangle to the size of the angles, so we can now solve a triangle with any two pieces of information. Trigonometry is based on the fact that the comparison (ratio) of any two sides in the similar right triangles is always the same.

Here are the Basic Trig Ratios - Tangent, Sine and Cosine

$$\tan\theta = \frac{opp}{adj}$$

$$\sin\theta = \frac{opp}{hyp}$$

$$\cos\theta = \frac{adj}{hyp}$$



To Use trigonometry, follow these steps

- ✓ make and label a diagram for the problem
- ✓ identify which information that you are given and what you want to find out
- ✓ choose the right Trig Ratio based on what you need to know
- ✓ Solve the equation.

There are only three ways for the equation to work out, so there are only 3 ways to solve it.....

1. You are missing the top of the fraction.

$$\tan 35^\circ = \frac{x}{20}$$

$$20\tan 35^\circ = x$$

Solve by MULTIPLYING both sides by the bottom number in the fraction.

2. You are missing the bottom of the fraction

$$\sin 26^\circ = \frac{62}{x}$$

$$x = \frac{62}{\sin 26^\circ}$$

Solve by SWITCHING the unknown with the trig ratio on the other side

3. You are missing the angle in the equation

$$\cos\theta = \frac{23}{30}$$

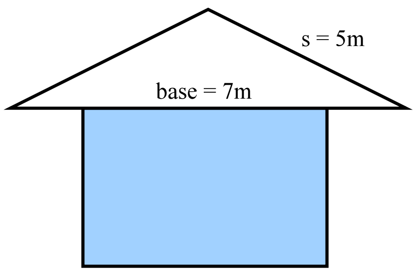
$$\cos^{-1}\left(\frac{23}{30}\right) = \theta$$

Solve by getting the INVERSE value of the whole fraction

6.1 Area of a Triangle

$$Area = \frac{1}{2}bc\sin A$$

Example: You want to rebuild the roof of your house and have to replace the wood under the triangular side ends of the roof. The slope of the roof is 30 degrees. Find the area of the two end sections you have to replace and how much it would cost to do this if one square meter of plywood costs $15.50.



Solution:

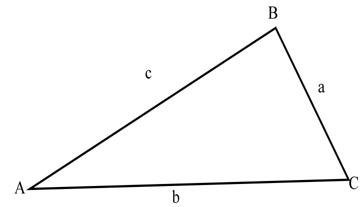
$$A = \tfrac{1}{2}bc\sin A$$
$$A = \tfrac{1}{2}(5m)(7m)\sin 30^{\circ}$$
$$A = 8.75m^2$$

$$Cost = (8.75m^2)(15.50\ \$/m^2)$$
$$Cost = \$135.63$$

Question: You own a property in the country outside of Goose Bay. The property is in the shape of a triangle with dimensions as shown below. You are being assessed for property taxes this year at a rate of $230 per square meter of your property. What would be the assessed value of your property?

6.2 Law of Sines and Law of Cosines

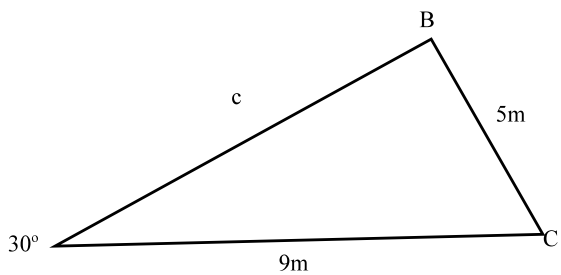
Solving non-right angle triangles



The Law of Sines

$$\frac{SinA}{a} = \frac{SinB}{b} = \frac{SinC}{c}$$

when to use:
- when you have at least one full pair of angle and its opposite side, and any other piece of information.

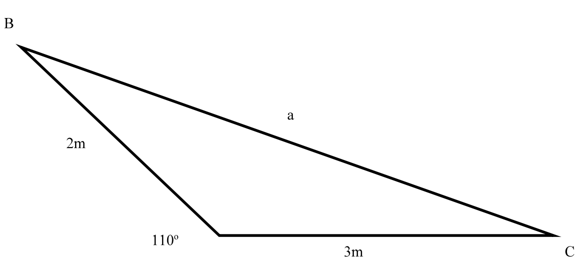


$$\frac{\sin 30^\circ}{5} = \frac{SinB}{9}$$
$$9\sin 30^\circ = 5SinB$$
$$\frac{9\sin 30^\circ}{5} = SinB$$
$$0.9 = SinB$$
$$B = Sin^{-1}(0.9)$$
$$B = 64^\circ$$

The Cosine Law

$$a^2 = b^2 + c^2 - 2bcCosA$$

when to use:
- when you have two sides of a triangle and their **included angle**.
- when you have all three sides and no angles of the triangle



$$a^2 = 3^2 + 2^2 - 2(3)(2)Cos110^\circ$$
$$a^2 = 13 - 12Cos110^\circ$$
$$a^2 = 13 - (-4.10)$$
$$a^2 = 17.1$$
$$a = \sqrt{17.1}$$
$$a = 4.13$$