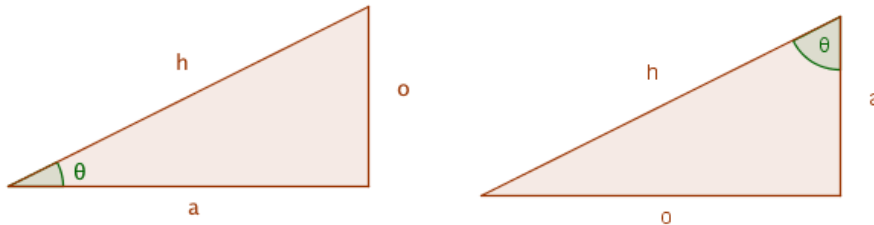


Trigonometry is about the relationships between an acute angle in a right triangle and the ratios of sides in the triangle. For example, given a right triangle with a 30° angle, the ratio of the side opposite the 30° angle to the hypotenuse is always 0.5. Increasing the angle increases the ratio and decreasing the angle decreases the ratio. The relationship between the angle and the ratio of the opposite side to the hypotenuse is called the **sine**.



a = side adjacent to θ , o = side opposite θ , h = hypotenuse of the right triangle.
The position of the angle determines which side is opposite and which is adjacent.

$$\sin(\theta) = \frac{o}{h} \quad (1)$$

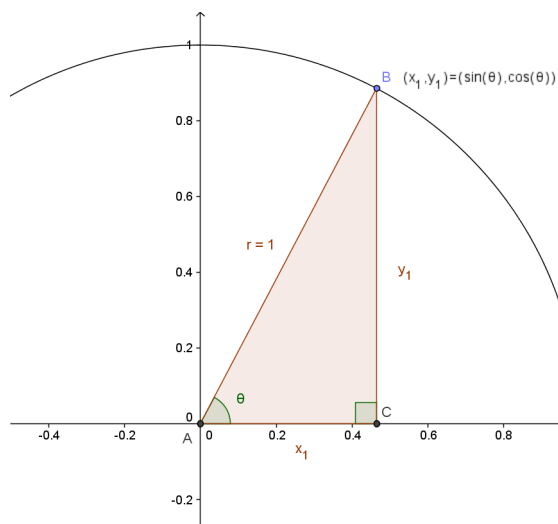
Other important relationships are
Cosine:

$$\cos(\theta) = \frac{a}{h} \quad (2)$$

Tangent(slope):

$$\tan(\theta) = \frac{o}{a} \quad (3)$$

The Unit Circle



The sine and the cosine can be extended by defining them as the y and x coordinates of the unit circle, respectively.

Given our original definition of sine, (1), then for any circle centered at the origin:

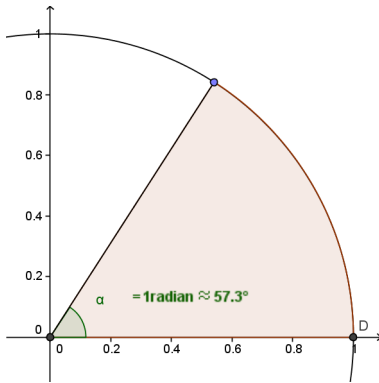
$$\sin(\theta) = \frac{y}{r} \quad (4)$$

$$\cos(\theta) = \frac{x}{r} \quad (5)$$

$$\tan(\theta) = \frac{y}{x} \quad (6)$$

Note that in either case the tangent of the angle is the slope.

Angle Measures



A common angle measure is degrees. A degree is $\frac{1}{360}$ of a revolution. Why one out of three-hundred sixty? Well, 360 is *about* the number of days in a year and it has 24 factors. Otherwise, it is no more special than any other number.

An alternative unit of angle measure is found by using the circumference of a circle. For any circle, 1 *revolution* is also 2π times the radius. Physically, if a wheel rolls once then the distance covered is always 2π radii on the ground. If the radius is 1 meter then about 6.28 meters are covered. If the radius is 1 foot then about 6.28 feet are covered. So we say, if one revolution is made then an angle of about 6.28 *radians* is covered.

$$1 \text{ revolution} = 360^\circ = 2\pi \text{ radians}$$