The following facts from your previous math training are good to have at your fingertips for this course. You will be reminded of these concepts as we encounter them, but you may wish to refresh your memory now.

Equation of a Line: Equations of lines can always be expressed in the form

$$Ax + By + C = 0$$

where A, B and C are real numbers, and at least one of A and B is not zero.

If $B \neq 0$, the equation of the line can be written in the more familiar form

$$y = mx + b$$

where m is the ***slope*** and b is the ***y-intercept*** of the line.

If $B = 0$ while $A \neq 0$, the line is vertical and may be expressed

$$x = k$$

where k is the constant value of x.

Slope of Line: A line passing through the points (x_1, y_1) and (x_2, y_2) has slope

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}\ .$$

If $y_1 = y_2$ then the line is horizontal and $m = 0$.

If $x_1 = x_2$ then the line is vertical and the slope m is not defined.

Quadratic Equations and the Quadratic Formula: a quadratic equation is an equation of the form

$$ax^2 + bx + c = 0$$

where a, b and c are real numbers and $a \neq 0$. The solutions (or roots) of the equation are given by

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}\ .$$

This is normally written as the single expression

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

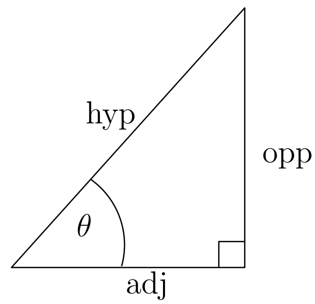
called the ***quadratic formula***.

The term $b^2 - 4ac$ is called the ***discriminant*** and the number of solutions of the quadratic equation can be determined as follows:

- If $b^2 - 4ac > 0$ there are two distinct (different) real roots;
- If $b^2 - 4ac = 0$ there is only one real root (that is, a single repeated root);
- If $b^2 - 4ac < 0$ there are no real roots (roots are complex numbers).

If the quadratic equation $ax^2 + bx + c = 0$ has roots $x = p$ and $x = q$, then the left hand side can be factored as $ax^2 + bx + c = a(x - p)(x - q)$.

Basic Trig Ratios: Referring to the triangle



the basic trigonometric ratios are defined as

$$\sin\theta = \frac{\text{opp}}{\text{hyp}}, \qquad \cos\theta = \frac{\text{adj}}{\text{hyp}}, \qquad \tan\theta = \frac{\text{opp}}{\text{adj}} \ .$$

Note also that $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$.

Converting Between Radians and Degrees: Radians and degrees are simply two different units for measuring angle size (in the same way that inches and centimetres are two different units for measuring length).

To convert from degrees to radians, multiply by $\pi/180$:

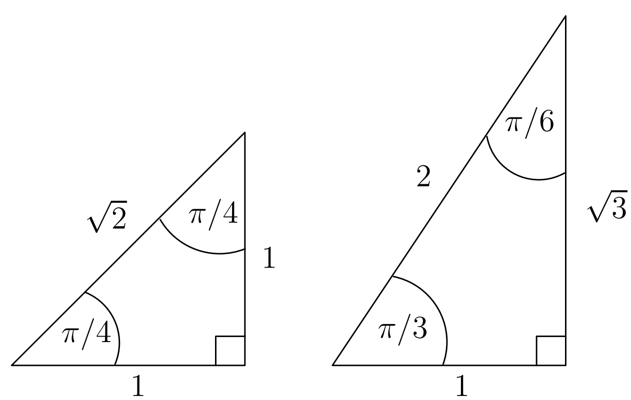
$$x \text{ degrees} = \frac{\pi x}{180} \text{ radians} \ .$$

To convert from radians to degrees, multiply by $180/\pi$:

$$x \text{ radians} = \frac{180x}{\pi} \text{ degrees} \ .$$

In calculus, you most always work in radians.

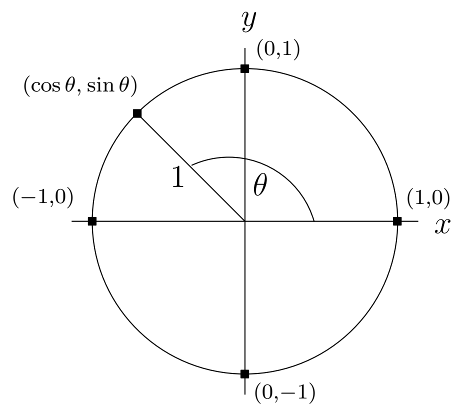
Special Triangles: The following triangles and the trig ratios above can be used to easily find the sin, cos and tan of $\pi/4$, $\pi/3$, $\pi/6$:



For example, $\sin\pi/3 = \text{opp}/\text{hyp} = \sqrt{3}/2$.

Note that $\pi/4 = 45°$, $\pi/3 = 60°$, $\pi/6 = 30°$.

Unit Circle and Trig: Along with the special triangles, the unit circle (circle of radius 1 centered at $(0,0)$) is useful for evaluating trig functions at integer multiples of $\pi/3$, $\pi/4$, $\pi/6$, and also $\pi/2$:



As the figure shows, the (x,y) coordinate of the endpoint of the ray which has swept out the angle θ is $(\cos\theta,\, \sin\theta)$.

Standard Trig Graphs: Here are the graphs of $y = \cos x$ and $y = \sin x$. Knowing what these look like often makes for easy answers: