

Welcome to Pre-calculus! Over the summer you must keep your math skills sharp so that when you return in September we may continue where you left off in Algebra 2! Read the summer packet carefully and look up any topics/concepts you are not familiar with. The Internet has wonderful mathematical resources available to you.

Some great mathematical websites that we recommend are:

www.purplemath.com

www.math.com

www.tutorial.math.lamar.edu

We will be starting our pre-calculus course with trigonometry. Below you will find sections on various topics we require you to know before entering pre-calculus. Please read through the topics and examples and complete the exercises that follow.

NUMBER SENSE

Having a grasp on fractions is a difficult thing for many students. Is $\frac{3}{4}$ larger or smaller than $\frac{3}{2}$? If I went $\frac{5}{6}$ of the way around a circle, is that more or less than going $\frac{3}{8}$ of the way around? How can you compare two fractions? You can do it intuitively and think of your movement around a circle, or mathematically with cross multiplication. If you think about $\frac{5}{6}$ of the way around a circle, you are $\frac{1}{6}$ short of completing the circle, whereas with $\frac{3}{8}$ you have not even gone halfway around the circle. So, $\frac{5}{6}$ is clearly larger than $\frac{3}{8}$.

EXERCISES: Compare the two given fractions.

1) $\frac{2}{7}$ and $\frac{5}{6}$

2) $\frac{4}{5}$ and $\frac{3}{7}$

3) $\frac{3}{4}$ and $\frac{5}{6}$

RADIANS

What is a radian? How is it used? A radian is a unit of measurement for angles. Formally, it is defined as the angle measurement that occurs when the radius of a circle is equal to the arc length. We will be using radians as a unit of measurement just as much as we use degrees in pre-calculus.

To convert from radians to degrees:

$\frac{3}{4}\pi$ radians can be converted into degrees. You need to think of your end goal as canceling out the radian unit and inserting a degree unit. If the radian unit is in the denominator, then you want to multiply by a fraction with radians in the denominator to cancel out that unit. In the numerator should be degrees.

$$\pi \text{ radians} = 180^\circ.$$

$$\frac{3\pi}{4} \left(\frac{180^\circ}{\pi} \right) = \frac{3}{4} \left(\frac{180^\circ}{1} \right) = 135^\circ$$

The radian unit cancelled out in the multiplication and you were left with just degrees, which was your goal.

If you were to convert from degrees to radians, your goal would be to cancel the degree unit and thus would multiply by the reciprocal.

EXERCISES: Convert to the unit the angle is not given in

- 4) 135° 5) $\frac{5\pi}{6}$ radians 6) 60° 7) $\frac{2\pi}{3}$ radians

QUADRANTS OF A CIRCLE:

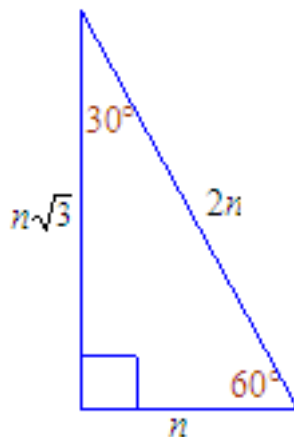
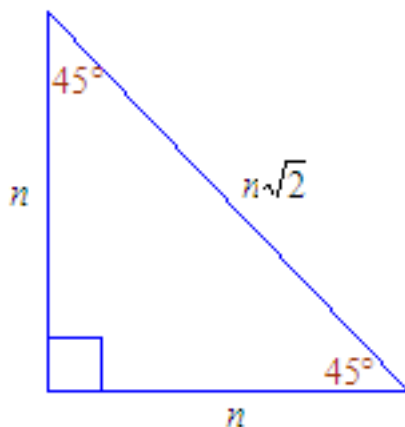
A circle is made up of 4 quadrants starting from 0° (0 radians) and working your way counter-clockwise around to 360° (2π radians).

EXERCISES: Using your knowledge from above about radians and degrees, what quadrant would each angle be in?

- 8) 135° 9) 330° 10) $\frac{5\pi}{6}$ radians 11) $\frac{2\pi}{3}$ radians

SPECIAL RIGHT TRIANGLES:

There are two special right triangles we deal with in pre-calculus. What makes them special is that all their side lengths are in proportion to one another. If you know one side of a special right triangle, then you can find the two missing side lengths using those known proportions and properties.

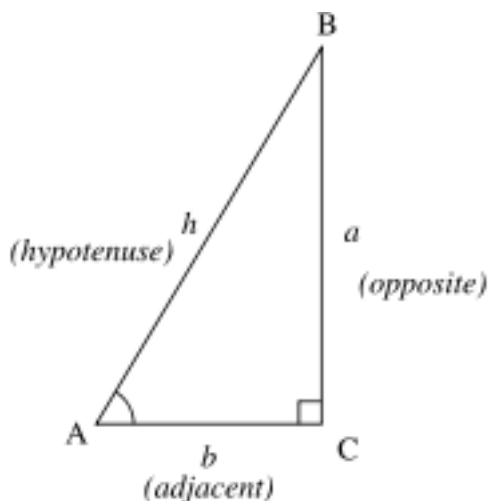


EXERCISES:

- 12) In a 30° - 60° - 90° right triangle, the side opposite the 30° angle is 5 inches. Find the two other sides of the triangle.
- 13) In a 30° - 60° - 90° right triangle, the side opposite the 60° angle is 7 feet. Find the two other sides of the triangle.
- 14) In a 45° - 45° - 90° right triangle the hypotenuse is 2 units long. Find the two other sides of the triangle.
- 15) In a 45° - 45° - 90° right triangle one leg is 2 units long. Find the two other sides of the triangle.

TRIGONOMETRIC FUNCTIONS:

There are three basic trigonometric functions that we begin our work with: $\sin x$, $\cos x$, and $\tan x$.



$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{a}{h} \quad \cos A = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{b}{h} \quad \tan A = \frac{\text{opposite}}{\text{adjacent}} = \frac{a}{b}$$

EXERCISES: In the above triangle, $a=3$, $b=4$, $c=5$.

16) Find $\cos A$

17) Find $\cos B$

18) Find $\tan A$

19) Find $\sin B$

Now using your knowledge of the two special right triangles:

20) Find $\sin(30^\circ)$

21) Find $\tan(30^\circ)$

22) Find $\cos(45^\circ)$

23) Find $\cos(30^\circ)$

24) Find $\cos\left(\frac{\pi}{3}\right)$

25) Find $\sin\left(\frac{\pi}{3}\right)$

BASIC ALGEBRAIC MATERIAL YOU SHOULD NEVER FORGET!

26) $(a+b)^2 =$

27) $(a+b)(a-b) =$

28) Find the slope between the two points: $(-1, 3)$ and $(5, 7)$

29) Find the equation of the line with slope 5 and y-intercept -4.

30) Find the intersection of the two lines: $y = 2x - 1$ and $y = -3x + 2$

31) Simplify: $\sqrt{(x^3 y^6 t^2)}$

32) Find x :

a. $x^2 = 36$

b. $x^3 = 64$

c. $x^{2/3} = 36$

d. $x^{1/3} = 2$

33) $\sqrt{(x^2 + 2xy + y^2)} =$

34) $\sqrt{(x^2 - y^2)} = x - y$. True or false. WHY????

35) Simplify: $3^{-2} =$