

# Angles, Unit Circle, and Trig Graphs – The Unit Circle and Exact Value

- **unit circle** → a circle with a radius of 1 centered at the (0, 0) and has equation  $x^2 + y^2 = 1$
- terminal point → pt that falls on the UC
- cosine function → X-coordinate of termpt
- reference number → shortest distance b/w termpt and x-axis (aka-reference angle)
- sine function → y-coordinate of termpt

Refer to **TRIG CHART / UNIT CIRCLE SHEET** to label parts of the Unit Circle:

- 1.) Complete the TRIG CHART → Use the 45 – 45 – right  $\Delta$  and the 30 – 60 – right  $\Delta$   
For quadrant angles ( $0^\circ$  and  $90^\circ$ ), use your calculator

(Make sure to rationalize the denominator → EXAMPLE:  $\frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$ )

- 2.) Label the degree measure ABOVE each pt on the Unit Circle (only use increments of  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ )
- 3.) Label the radian measure BELOW each pt on the Unit Circle (convert degree measure to radians)
- 4.) Draw diagonal lines through pairs of points that have the same reference number (angle):

a.)  $30^\circ$  and  $210^\circ$   
 $150^\circ$  and  $330^\circ$  } **Red**  
Ref Angle =  $30^\circ$

b.)  $45^\circ$  and  $225^\circ$   
 $135^\circ$  and  $315^\circ$  } **Blue**  
Ref Angle =  $45^\circ$

c.)  $60^\circ$  and  $240^\circ$   
 $120^\circ$  and  $300^\circ$  } **Green**  
Ref Angle =  $60^\circ$

- 5.) Label the terminal point (x, y) of each degree/radian measure → ( $x = \cos \theta$ ,  $y = \sin \theta$ )
- 6.) Also add the following to your sheet: Quadrant #'s and where sin, cos, tan are positive and negative.

**Steps to Find Exact Value of an Angle:** Some answers contain radicals (**NO decimal answers**)

- 1.) Find the reference angle B – Use the “Coloring Coding key” to help determine this.
  - 2.) Use Trig Chart to look up value using reference angle B.
  - 3.) Use “Signs” Diagram of Trigonometric Functions to determine if value is positive or negative
- \* If finding the exact value of a quadrant angle ( $90^\circ$ ,  $180^\circ$ ,  $270^\circ$ , or  $360^\circ$ ) → use values in terminal points.

**Examples:** Using your TC/UC Sheet, find the exact value. Remember – **NO DECIMALS!!!!**

1.) $\sin 135^\circ = \frac{\sqrt{2}}{2}$ $45^\circ, \text{II}, +$	2.) $\cos 210^\circ = -\frac{\sqrt{3}}{2}$ $30^\circ, \text{III}, -$	3.) $\cos 300^\circ = 1$ termpt $(1, 0)$ $x$ $y$	4.) $\tan 780^\circ = -\sqrt{3}$ $60^\circ, \text{IV}, -$
5.) $\sin 30^\circ = \frac{1}{2}$ $30^\circ, \text{I}, +$	6.) $\tan 270^\circ = \text{undefined}$ termpt $(0, -1) \rightarrow -\frac{1}{0}$ $x$ $y$	7.) $\tan 150^\circ = -\frac{\sqrt{3}}{3}$ $30^\circ, \text{II}, -$	8.) $\cos 315^\circ = \frac{\sqrt{2}}{2}$ $45^\circ, \text{IV}, +$
9.) $\tan\left(\frac{7\pi}{6}\right) = -\frac{\sqrt{3}}{3}$ $30^\circ, \text{III}, +$	10.) $\cos\left(\frac{2\pi}{3}\right) = -\frac{1}{2}$ $60^\circ, \text{II}, -$	11.) $\sin\left(-\frac{3\pi}{2}\right) = 1$ $-90^\circ \rightarrow 180^\circ$ termpt $(-1, 0)$ $x$ $y$	12.) $\tan\left(\frac{15\pi}{4}\right) = -1$ $675^\circ \rightarrow 315^\circ$ $45^\circ, \text{IV}, -$