Pre-Calculus Name: Date: Period:

7C: The Unit Circle

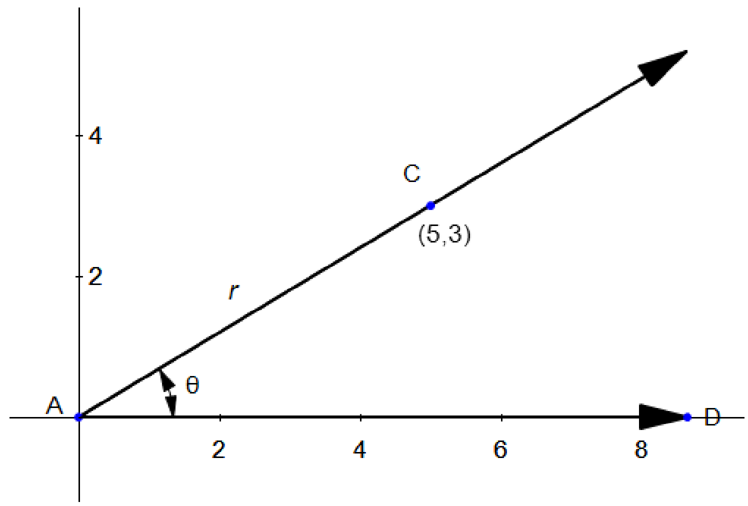
We have now learned about finding the values of the trig. functions in a right triangle. Now, we will place these angles in the coordinate plane and expand the concept of trigonometric functions to larger angles.

Functions from Coordinates

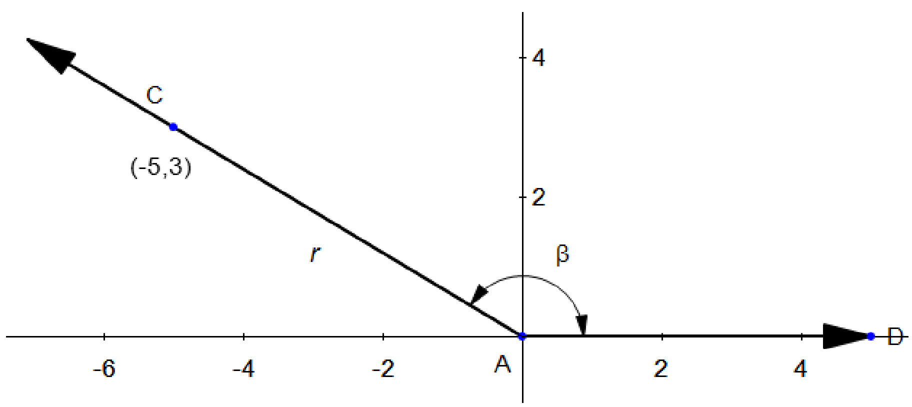
Consider This

a) Find the value of r to the right.

b) Find the 6 trig. functions for the angle θ shown to the right.



c) Now find the value of the 6 trig functions for the angle β below.



Trigonometric functions of any angle

If θ is an angle in standard position and $P(x, y)$ is any point on the terminal side of the angle, then $r = \sqrt{x^2 + y^2}$ is the distance from P to the origin and

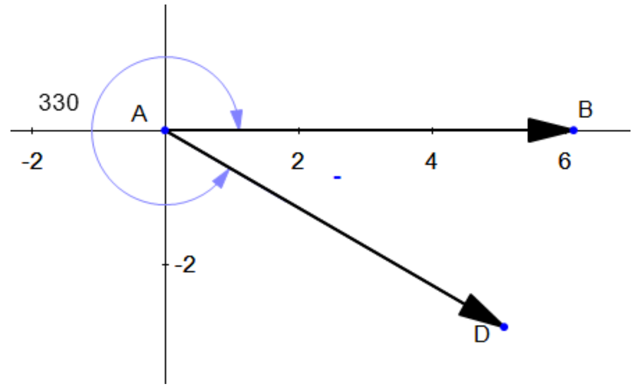
$$\sin\theta = \frac{y}{r} \qquad \csc\theta = \frac{r}{y}, \quad (y \neq 0)$$

$$\cos\theta = \frac{x}{r} \qquad \sec\theta = \frac{r}{x}, \quad (x \neq 0)$$

$$\tan\theta = \frac{y}{x}, \quad (x \neq 0) \qquad \cot\theta = \frac{x}{y}, \quad (x \neq 0)$$

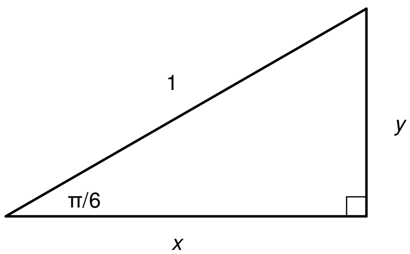
Special Angles (from special triangles)

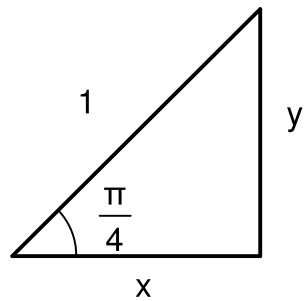
Find the value of the 6 trig functions for a 330° angle.



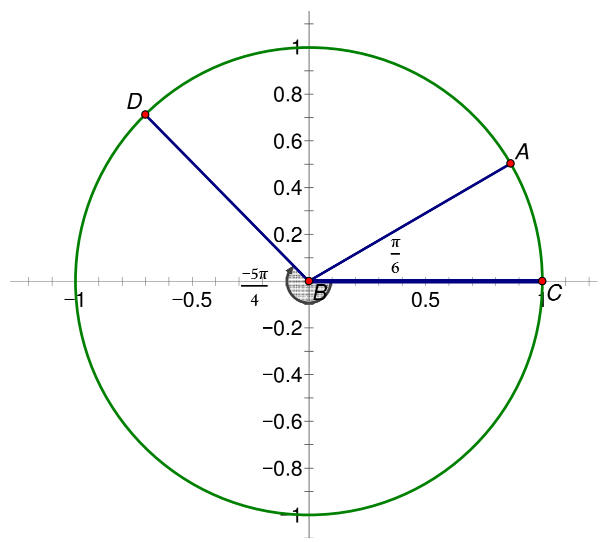
Explore

1) Find the exact and approximate value of each variable.





2) Find the exact coordinates of A and D if $C(1,0)$



3) Find the following ratios (exactly):
   a. $\cos\frac{\pi}{6} =$
   b. $\sin\frac{\pi}{6} =$
   c. $\sin -\frac{5\pi}{4} =$
   d. $\cos -\frac{5\pi}{4} =$

The circle in #2 above is called the *Unit Circle* because the radius is 1 unit.

Points on the Unit Circle
If $P(x, y)$ is a point on the unit circle, then

$$\sin\theta = y \qquad \csc\theta = \frac{1}{y}, \quad (y \neq 0)$$

$$\cos\theta = x \qquad \sec\theta = \frac{1}{x}, \quad (x \neq 0)$$

$$\tan\theta = \frac{y}{x}, \quad (x \neq 0) \qquad \cot\theta = \frac{x}{y}, \quad (x \neq 0)$$

Complete the Unit Circle
Use reference triangles to fill in all the angles (in degrees and radian) and coordinates on the unit circle. Then decide which of the 6 trig functions are positive or negative in each quadrant.