

## Section 2.2: Trig Ratios of Any Angle

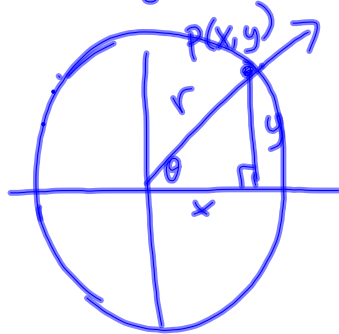
### Trig Ratios

$$\sin = \frac{\text{opposite}}{\text{hypotenuse}} \quad \cos = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan = \frac{\text{opposite}}{\text{adjacent}}$$

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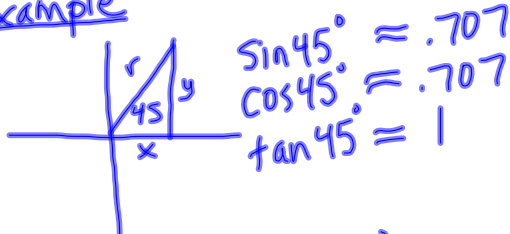
$$0^\circ \leq \theta < 360^\circ \Rightarrow \text{full circle}$$



$$\sin \theta = \frac{y}{r} \quad \tan \theta = \frac{y}{x}$$

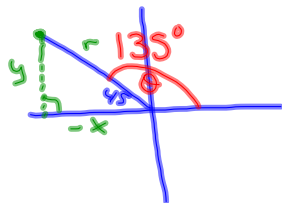
$$\cos \theta = \frac{x}{r}$$

example

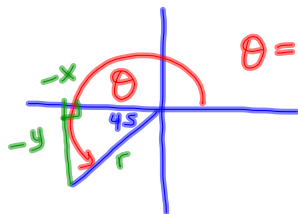


$$\begin{aligned} \sin 45^\circ &\approx .707 \\ \cos 45^\circ &\approx .707 \\ \tan 45^\circ &= 1 \end{aligned}$$

Same ref  $\angle$  of  $45^\circ$



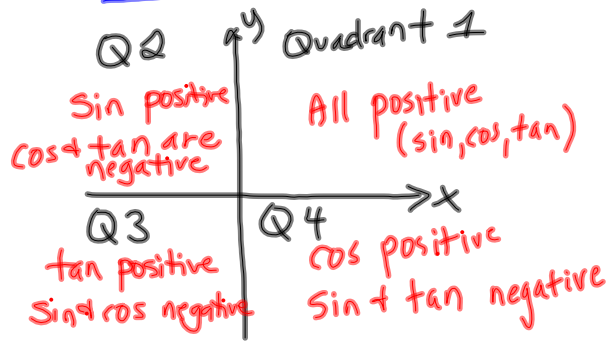
$$\begin{aligned} \sin 135^\circ &= .707 \\ \cos 135^\circ &= -.707 \\ \tan 135^\circ &= -1 \end{aligned}$$



$\theta = 225^\circ$

$$\begin{aligned} \sin 225^\circ &= -.707 \\ \cos 225^\circ &= -.707 \\ \tan 225^\circ &= 1 \end{aligned}$$

# Summary



## pg. 91 Labelling the Ratios for Any Angle in Any Quadrant

The point  $(-8, 15)$  lies on the terminal arm for  $\theta$ . Determine the trig ratios  $\sin\theta, \cos\theta, \tan\theta$ .



By Pythagorean Theorem

$$r^2 = (-8)^2 + (15)^2$$

$$r^2 = 64 + 225$$

$$r^2 = 289$$

$$r = \sqrt{289}$$

$$r = 17$$

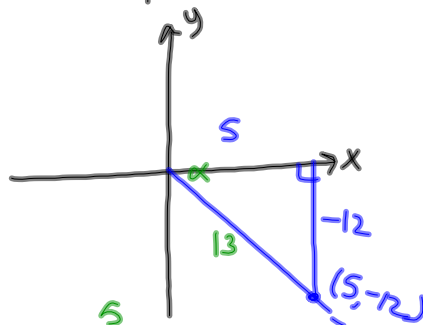
$$\sin\theta = \frac{15}{17}$$

$$\cos\theta = \frac{-8}{17}$$

$$\tan\theta = -\frac{15}{8}$$

One to try:

Point  $(5, -12)$



$$\cos\theta = \frac{5}{13}$$

$$\sin\theta = -\frac{12}{13}$$

$$\tan\theta = -\frac{12}{5}$$

$$r^2 = a^2 + b^2$$

$$r^2 = (5)^2 + (-12)^2$$

$$= 25 + 144$$

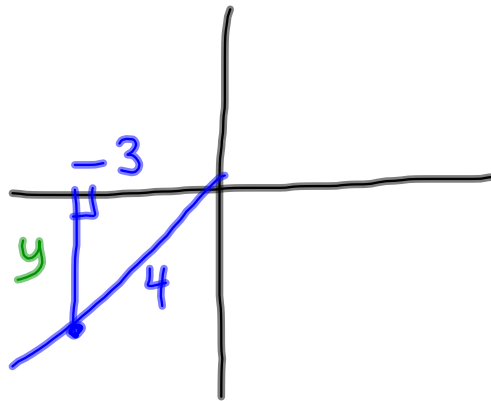
$$r^2 = 169$$

$$r = 13$$

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Suppose  $\theta$  is an angle in standard position with terminal arm in Quadrant III and  $\cos \theta = -\frac{3}{4}$ .

What are the EXACT values of  $\sin \theta$ ,  $\tan \theta$ ?



EXACT.  
 → no decimals  
 → no rounding  
 → simplify radical

$$c^2 = a^2 + b^2$$

$$4^2 = (-3)^2 + y^2$$

$$16 = 9 + y^2$$

$$16 - 9 = y^2$$

$$7 = y^2$$

$$\sqrt{7} = y \quad \times \text{negative } y \text{ in QIII}$$

$$\sin \theta = \frac{-\sqrt{7}}{4}$$

$$\tan \theta = \frac{-\sqrt{7}}{-3} \Rightarrow \frac{\sqrt{7}}{3}$$

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