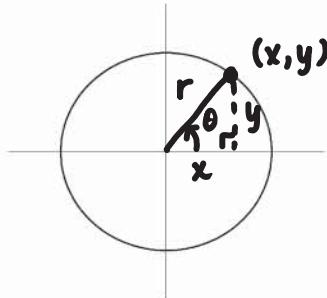


4.3 Trigonometric Ratios

If (x, y) is a point on the terminal arm of a circle then the following ratios can be determined:



Same as grade 11

$$\sin \theta = \frac{y}{r}$$

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

$$\tan \theta = \frac{y}{x}$$

Sine	All
+	+
Tangent	Cosine
+	+

C-A-S-T rule

Reciprocal Trig Ratios

Cosecant is the reciprocal of sine

$$\csc \theta = \frac{1}{\sin \theta} \quad \text{or} \quad \csc \theta = \frac{r}{y}$$

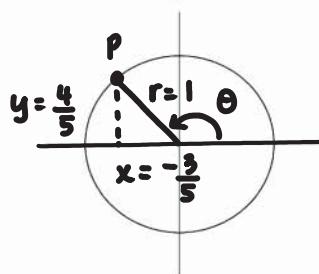
Secant is the reciprocal of cosine

$$\sec \theta = \frac{1}{\cos \theta} \quad \text{or} \quad \sec \theta = \frac{r}{x}$$

Cotangent is the reciprocal of tangent

$$\cot \theta = \frac{1}{\tan \theta} \quad \text{or} \quad \cot \theta = \frac{x}{y}$$

Example 1: The point $(-\frac{3}{5}, \frac{4}{5})$ is on the **unit circle** and the terminal arm of angle θ . Find the value of all six trig ratios.



$$\sin \theta = \frac{\frac{4}{5}}{1} = \frac{4}{5}$$

$$\csc \theta = \frac{5}{4}$$

$$\cos \theta = \frac{-\frac{3}{5}}{1} = -\frac{3}{5}$$

$$\sec \theta = -\frac{5}{3}$$

$$\tan \theta = \frac{\frac{4}{5}}{-\frac{3}{5}} = \frac{4}{5} \cdot \frac{5}{-3} = -\frac{4}{3}$$

$$\cot \theta = -\frac{3}{4}$$

Example 2: The point $(-3, -8)$ is on the terminal arm of angle θ . Find the value of all six trig ratios.

x y

not a unit circle!

find r

$$(-3)^2 + (-8)^2 = r^2$$

$$9 + 64 = r^2$$

$$73 = r^2$$

$$\sqrt{73} = r$$

$$\sin \theta = \frac{-8}{\sqrt{73}}$$

$$\csc \theta = -\frac{\sqrt{73}}{8}$$

$$\cos \theta = \frac{-3}{\sqrt{73}}$$

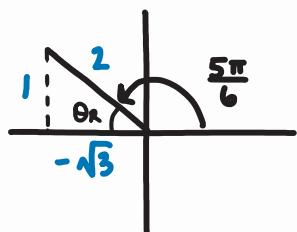
$$\sec \theta = -\frac{\sqrt{73}}{3}$$

$$\tan \theta = \frac{-8}{-3} = \frac{8}{3}$$

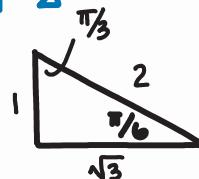
$$\cot \theta = \frac{3}{8}$$

Example 3: Find the exact trig ratio:

- a) $\sin \frac{5\pi}{6}$
- locate angle (which quadrant)
 - find ref. angle
 - use special Δ

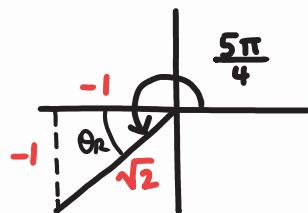


$$\theta_R = \pi - \frac{5\pi}{6} = \frac{\pi}{6}$$

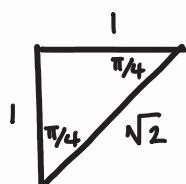


$$\sin \frac{5\pi}{6} = \frac{1}{2}$$

b) $\cos \frac{5\pi}{4}$

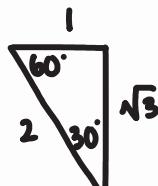
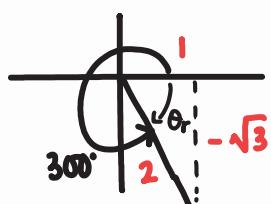


$$\theta_R = \frac{5\pi}{4} - \pi = \frac{\pi}{4}$$



$$\cos \frac{5\pi}{4} = -\frac{1}{\sqrt{2}}$$

c) $\csc 300^\circ$



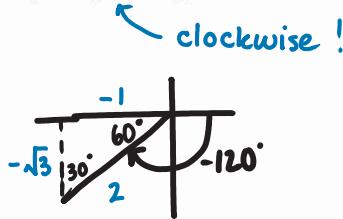
$$\sin 300^\circ = -\frac{\sqrt{3}}{2}$$

$$\csc 300^\circ = \frac{-2}{\sqrt{3}}$$

$$\theta_R = 360^\circ - 300^\circ$$

$$\theta_R = 60^\circ$$

d) $\cot(-120^\circ)$



$$\tan(-120^\circ) = \frac{-\sqrt{3}}{-1} = \frac{\sqrt{3}}{1}$$

$$\cot(-120^\circ) = \frac{1}{\sqrt{3}}$$

Example 4: Use a calculator to find the trig ratios (to the nearest thousandth)

a) $\sin 50^\circ = 0.7660$

b) $\sec 100^\circ = \frac{1}{\cos 100^\circ} = \frac{1}{-0.1736} = -5.7588$

c) $\tan \frac{5\pi}{7} = -1.2540$

↑
radian
mode!

Practice: p.201 #1d – h, 3, 4ace, 6, 8, 12

Mrs. Donnelly

PC 12