Name: KEY Hour: ____________ Date: ____________

NOTES: Section 13.4 – Evaluate Trigonometric Functions of Any Angle

Goals: #1 - I can evaluate inverse trig functions.

#2 - I can solve for an angle when given its trig ratio and what quadrant it lies in.

#3 - I can find the measure of an angle when given two sides of a right triangle.

Homework: Lesson 13.4 Worksheet

Exploration #1: Work with a partner and answer the following questions.

1. Could you find an angle, θ whose $\sin\theta = \frac{1}{2}$?

   30°

   a. Is there another possible angle?

   150°, 390°, 510°, ...

2. Could you find an angle, θ whose $\cos\theta = -\frac{\sqrt{2}}{2}$?

   135°

   a. Is there another possible angle?

   225°, 495°, 585°, ...

3. Could you find an angle, θ whose $\tan\theta = 0$?

   0°

   a. Is there another possible angle?

   360°, 180°, 540°, ...

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Notes:

Finding an angle that corresponds to a given value, is called evaluating inverse trigonometric functions.

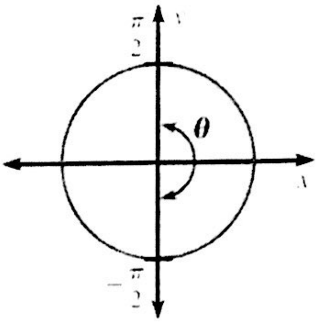
To obtain a unique angle θ, we must restrict the domain of the trig function.

- Inverse Sine:

If $-1 \le a \le 1$, then the **inverse sine** of a is an angle θ, written $\theta = \sin^{-1} a$, where:

(1) $\sin \theta = a$

(2) $-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$, $-90° \le \theta \le 90°$

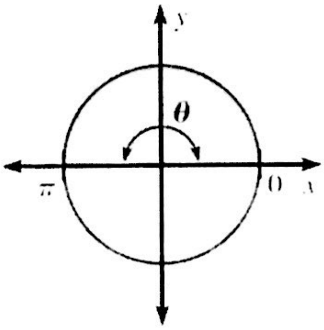


- Inverse Cosine:

If $-1 \le a \le 1$, then the **inverse cosine** of a is an angle θ, written $\theta = \cos^{-1} a$, where:

(1) $\cos \theta = a$

(2) $0 \le \theta \le \pi$, $0° \le \theta \le 180°$

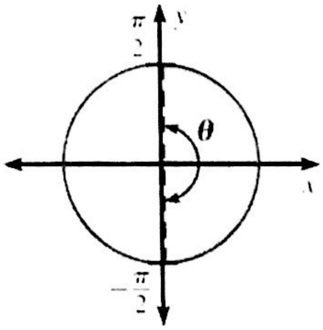


- Inverse Tangent:

If a is any real number, then the **inverse tangent** of a is an angle θ, written $\theta = \tan^{-1} a$, where:

(1) $\tan \theta = a$

(2) $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$, $-90° < \theta < 90°$



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Example #1: Evaluate the expression in both radians and degrees.

$\frac{y}{x} \quad -\frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \frac{\sqrt{3}}{2} \cdot \frac{2}{1} = -\sqrt{3}$

$0 < \theta < 180°$

1. $\cos^{-1}\frac{\sqrt{3}}{2}$

$\boxed{\theta = 30°, \frac{\pi}{6}}$

$-90° < \theta < 90°$

2. $\sin^{-1} 2$

$\boxed{\text{undefined}}$

$-90° < \theta < 90°$ 300°

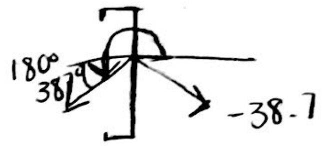
3. $\tan^{-1}(-\sqrt{3})$

$\boxed{\theta = -60°, -\frac{\pi}{3}}$

Example #2: Solve the equation $\sin\theta = -\frac{5}{8}$ where $180° < \theta < 270°$.

$\theta = \sin^{-1}(-\frac{5}{8})$

$\theta \approx -38.7°$



$38.7° + 180°$

$\boxed{\theta \approx 218.7°}$

$\sin\theta = -\frac{5}{8}$ ✓

You practice:

1. Evaluate the expression in both radions and degrees.

$0 < \theta < 180°$ a. $\cos^{-1}\frac{1}{2}$

$\boxed{\theta = 60°, \frac{\pi}{3}}$

315°

$-90° < \theta < 90°$ $\frac{y}{x} \quad -\frac{\frac{\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}}$

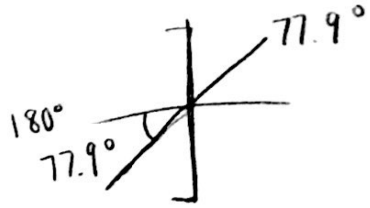
b. $\tan^{-1}(-1)$

$\boxed{\theta = -45°, -\frac{\pi}{2}}$

2. Solve the equation $\tan\theta = 4.7$ where $180° < \theta < 270°$.

$\theta = \tan^{-1}(4.7)$

$\theta \approx 77.9$



$180° + 77.9$

$\boxed{\theta \approx 258°}$

$\tan\theta = 4.7$ ✓

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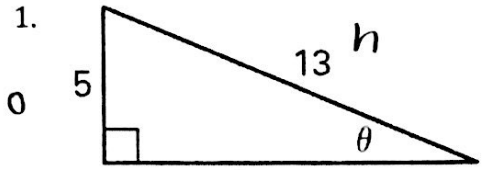
Example #3: Find the measure of the angle θ.

1.

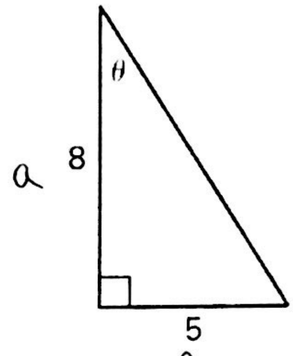


$\sin\theta = \frac{5}{13}$

$\theta = \sin^{-1}\left(\frac{5}{13}\right)$

$\boxed{\theta \approx 22.6^\circ}$

2.



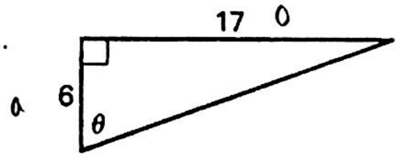
$\tan\theta = \frac{5}{8}$

$\theta = \tan^{-1}\left(\frac{5}{8}\right)$

$\boxed{\theta \approx 32^\circ}$

You practice: Find the measure of the angle θ.

1.

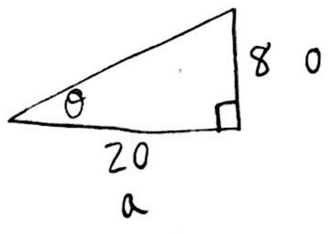


$\tan\theta = \frac{17}{6}$

$\theta = \tan^{-1}\left(\frac{17}{6}\right)$

$\boxed{\theta = 70.6^\circ}$

Example #4: A monster truck drives off a ramp in order to jump onto a row of cars. The ramp has a height of 8 feet and a horizontal length of 20 feet. What is the angle θ of the ramp?



$\tan\theta = \frac{8}{12}$

$\theta = \tan^{-1}\left(\frac{8}{12}\right)$

$\boxed{\theta \approx 33.7^\circ}$