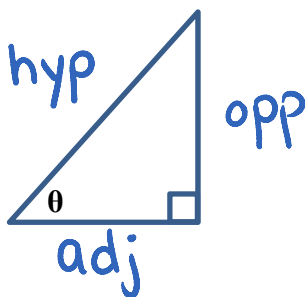## 2.3 Sine and Cosine Ratios

### A. Primary Trigonometric Ratios

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} \qquad \cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} \qquad \tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

A trick to remember:

SOH CAH TOA

$$S\frac{O}{H} \quad C\frac{A}{H} \quad T\frac{O}{A}$$

- Sine and Cosine relate the **hypotenuse** to another side.
- We use the same steps as when using the Tangent ratio.

### Examples:

1) Calculate the following the four decimal places.

   a) $\sin(65°) =$ **0.9063**   b) $\cos(12°) =$ **0.9781**   c) $\tan(33°) =$ **0.6494**

2) Solve for $\theta$ to the nearest degree.

   a) $\sin(\theta) = 0.1965$   b) $\cos(\theta) = 0.2397$   c) $\tan(\theta) = 2.6209$

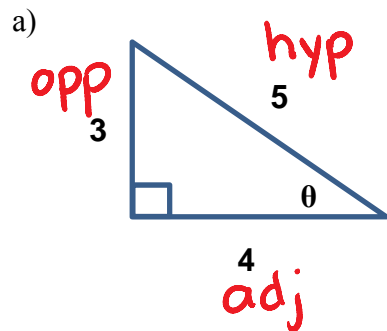$$\theta = \sin^{-1}(0.1965) \qquad \theta = \cos^{-1}(0.2397) \qquad \theta = \tan^{-1}(2.6209)$$

$$\theta = 11° \qquad\qquad\qquad \theta = 76° \qquad\qquad\qquad \theta = 69°$$

# SOH CAH TOA

3) Write the primary trig ratios for the following triangles.

a)

opp hyp
3     5
□     θ
4
adj

$\sin\theta = \dfrac{3}{5}$

$\cos\theta = \dfrac{4}{5}$

$\tan\theta = \dfrac{3}{4}$

b)

15 opp
adj
8
θ   17  hyp
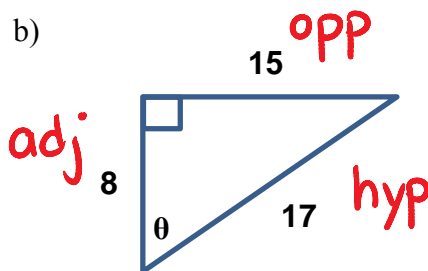
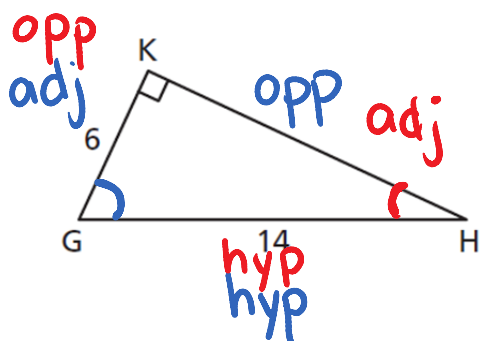$\sin\theta = \dfrac{15}{17}$

$\cos\theta = \dfrac{8}{17}$

$\tan\theta = \dfrac{15}{8}$

4) Determine the value of *each* angle to the nearest degree.

a) ∠G and ∠H

opp
adj  K
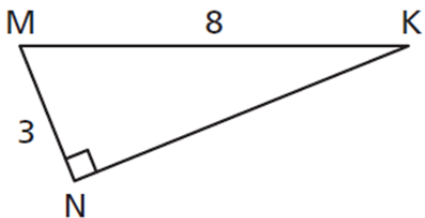6    opp  adj
G    14   H
hyp
hyp

∠G   $\cos G = \dfrac{6}{14}$

$G = \cos^{-1}\left(\dfrac{6}{14}\right)$

$G = 65°$

∠H
$\sin H = \dfrac{6}{14}$

$H = \sin^{-1}\left(\dfrac{6}{14}\right)$

$H = 25°$

b)  ∠K and ∠M

M _____ 8 _____ K
3
N

$\angle K = 22°$         $\angle M = 68°$

## B. Angles of Inclination and Depression

Angle of Inclination (or elevation): ___an angle going up from a___ horizontal.
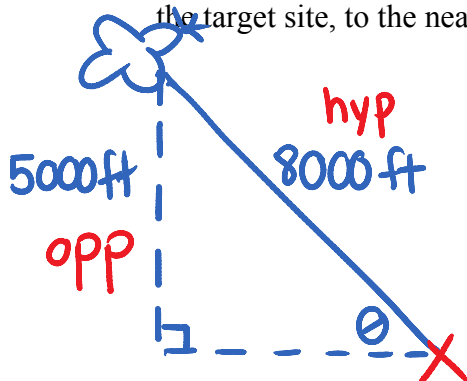
$\angle \theta$ _ _ _

Angle of Depression: ___an angle going down from a___ horizontal

_ _ _ $\theta$

**Examples:**

5)  A water bomber is flying at an altitude of 5000 ft. The plane's radar shows that it is 8000 ft from the target site. What is the angle of elevation of the plane measured from the target site, to the nearest degree?
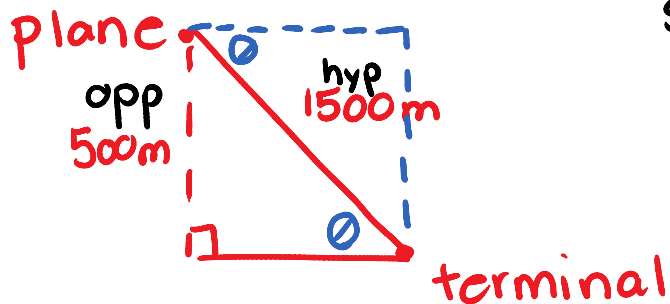
5000ft   hyp 8000 ft
opp
θ
X

$\sin\theta = \dfrac{opp}{hyp}$

$\sin\theta = \dfrac{5000}{8000}$

$\theta = \sin^{-1}\left(\dfrac{5000}{8000}\right)$

$\theta = 39°$

6) An airplane is approaching an airport. The pilot knows the plane is 500 m above the landing strip and 1500 m away from the terminal by line of sight. What is the angle of depression of the pilot's view of the terminal to the nearest degree?

Plane

opp 500m

hyp 1500m

terminal

$$\sin\theta = \frac{opp}{hyp}$$

$$\sin\theta = \frac{500}{1500}$$

$$\theta = \sin^{-1}\left(\frac{500}{1500}\right)$$

$$\theta = 19°$$

*pg. 95 #4-6,7-9ab,12-14*