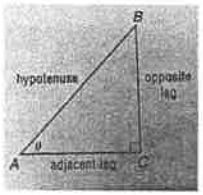
Right Triangle Trigonometry Review

SOH - CAH - TOA

Trigonometry- the study of the relationships among angles and sides of a right triangle

- Sine $\sin\theta = \frac{opp}{hyp}$
- Cosine $\cos\theta = \frac{adj}{hyp}$
- Tangent $\tan\theta = \frac{opp}{adj}$



New Trig Functions! *Notice these are reciprocals of first 3*

- Cosecant (opposite of sine) $\csc\theta = \frac{hyp}{opp}$ or $\csc\theta = \frac{1}{\sin\theta}$
- Secant (opp. of cosine) $\sec\theta = \frac{hyp}{adj}$ or $\sec\theta = \frac{1}{\cos\theta}$
- Cotangent (opp of tangent) $\cot\theta = \frac{adj}{opp}$ or $\cot\theta = \frac{1}{\tan\theta}$

Example 1: Find the values of the six trigonometric functions for angle θ

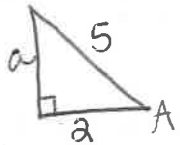
$\sin\theta = \frac{opp}{hyp} = \frac{4}{5}$ $\quad \csc\theta = \frac{hyp}{opp} = \frac{5}{4}$

$\cos\theta = \frac{adj}{hyp} = \frac{3}{5}$ $\quad \sec\theta = \frac{hyp}{adj} = \frac{5}{3}$

$\tan\theta = \frac{opp}{adj} = \frac{4}{3}$ $\quad \cot\theta = \frac{adj}{opp} = \frac{3}{4}$

Example 2: If $\cos A = \frac{2}{5}$, find the value of tan A

Draw a right triangle. Label an angle A.



cos. $A = \frac{2}{5}$ $\cos = \frac{adj}{hyp}$ Label!

tan $A = \frac{opp}{adj}$ - need opposite side - use Pyth. Thm.

$a^2 + 2^2 = 5^2$

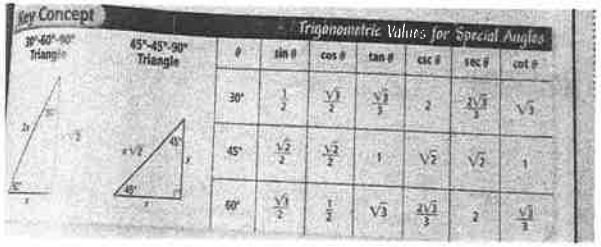
$a^2 + 4 = 25$

$a^2 = 21$

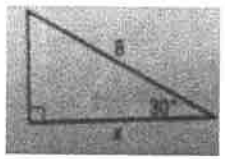
$a = \sqrt{21}$

$\tan A = \frac{\sqrt{21}}{2}$

Trigonometric Values for Special Angles



Example 3: Write an equation involving sin, cos, or tan that can be used to find the value of x. Then solve. Round to the nearest tenth.



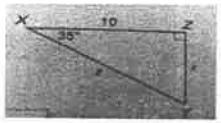
x is adjacent, given hypotenuse. Use cosine.

$\cos\theta = \frac{adj}{hyp}$ $\cos 30 = \frac{x}{8}$

$\cos 30 = \frac{\sqrt{3}}{2}$ so $\frac{\sqrt{3}}{2} = \frac{x}{8} \rightarrow 2x = 8\sqrt{3}$

$x = 4\sqrt{3} \approx 6.9$

Example 4: Solve. Round measures of sides to the nearest tenth and angles to the nearest degree.



x: $\tan 35 = \frac{x}{10}$ $x = 10\tan 35 = 7.0$

z: $\sec 35 = \frac{z}{10}$ $\frac{1}{\cos 35} = \frac{z}{10}$

$\frac{10}{\cos 35} = z = 12.2$

x + y are complementary b/c it is a right triangle.

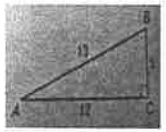
$x + y = 90$

$35 + y = 90$

$y = 55°$

Example 5: Solve. Round measures of sides to the nearest tenth and measures of angles to the nearest degree.

finding measures of angles A+B



$\sin A = \frac{5}{13}$ $\sin^{-1}(5/13) = A$

$A = 22.6 \approx \boxed{23°}$

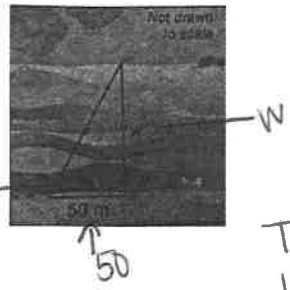
$A + B + 90 = 180$

$A + B = 90$

$23 + B = 90$

$\boxed{B \approx 67°}$

Example 6: In order to construct a bridge across a river, the width of the river at that location must be determined. Suppose a stake is planted on one side of the river directly across from a second stake on the opposite side. At a distance 50 meters to the left of the stake, an angle of 82° is measured between the two stakes. Find the width of the river.



$\tan 82 = \frac{W}{50}$

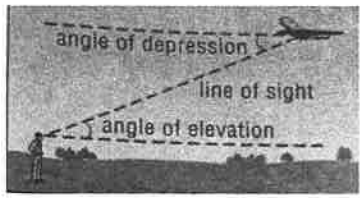
$50 \tan 82 = W$

$\boxed{W \approx 355.8}$

The width of the river is about 355.8 meters.

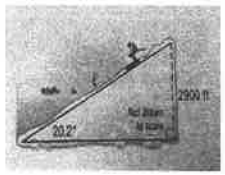
Angles of Elevation and Depression

- Angles formed from the line of sight to a line parallel to the ground.



*remember it's always the distance from the horizontal!

Example 7: The Aerial run in Snowbird, Utah has an angle of elevation of 20.2°. Its vertical drop is 2900 feet. Estimate the length of the run.



have the opposite, looking for hypotenuse. use sine.

$\sin 20.2 = \frac{2900}{\ell}$

$\ell \sin 20.2 = 2900$

$\ell = \frac{2900}{\sin 20.2}$

$\boxed{\ell = 8398.5 \text{ ft}}$

The length of the run is about 8399 feet.