1/27/2015

What is inverse trigonometric function? Where do we use them?

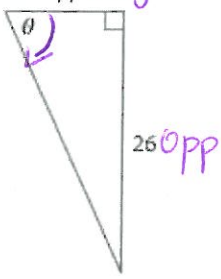
Inverse trig functions are "opposite" of trig functions and when a trigonometric value of an acute angle is given, they are used to find missing angle measure.

KeyConcept Inverse Trigonometric Functions

Inverse Sine	If θ is an acute angle and the sine of θ is x, then the **inverse sine** of x is the measure of angle θ. That is, if $\sin \theta = x$, then $\sin^{-1} x = \theta$.
Inverse Cosine	If θ is an acute angle and the cosine of θ is x, then the **inverse cosine** of x is the measure of angle θ. That is, if $\cos \theta = x$, then $\cos^{-1} x = \theta$.
Inverse Tangent	If θ is an acute angle and the tangent of θ is x, then the **inverse tangent** of x is the measure of angle θ. That is, if $\tan \theta = x$, then $\tan^{-1} x = \theta$.

Examples: Find the value of θ. Round it to nearest degree if necessary.

1.



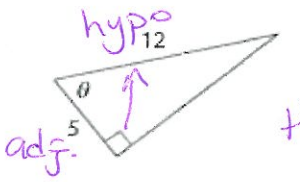
Since opposite and adjacent side measures are given, we have to use tanθ or cotθ

$\tan\theta = \frac{26}{11}$, then take $\tan^{-1}$ of both sides

$\tan^{-1}(\tan\theta) = \tan^{-1}\left(\frac{26}{11}\right)$

$= \theta$ $\quad \theta = \tan^{-1}\left(\frac{26}{11}\right) \rightarrow \boxed{\theta = 67^\circ}$

2.



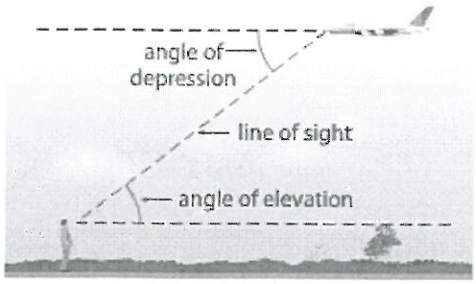
Hypotenuse and adjacent sides are given, so, we have to use cosθ

$\cos\theta = \frac{5}{12}$, then take $\cos^{-1}$ of both sides

$\cos^{-1}(\cos\theta) = \cos^{-1}\left(\frac{5}{12}\right)$

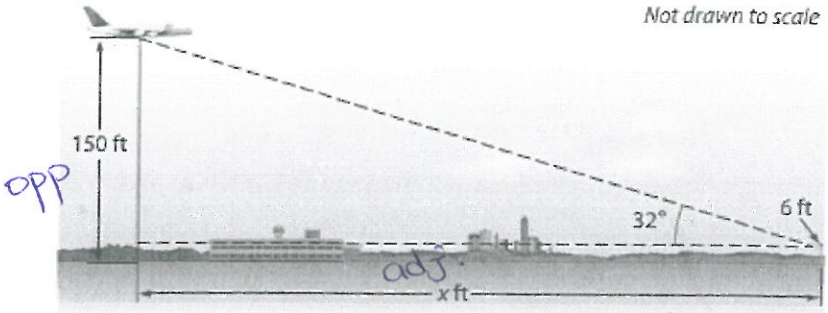
$\boxed{\theta = 65^\circ}$

Angle of Elevation vs. Angle of Depression



Real-World Examples:

1. **AIRPLANES** **A ground crew worker who is 6 feet tall is directing a plane on a runway. If the worker sights the plane at an angle of elevation of 32°, what is the horizontal distance from the worker to the plane?**



Angle of elevation is given, $\theta = 32°$

$\frac{\tan 32°}{1} = \frac{150ft}{x}$

$x \cdot \tan 32° = 150ft$

$x = \frac{150ft}{\tan 32°}$

$x = 240.4ft$

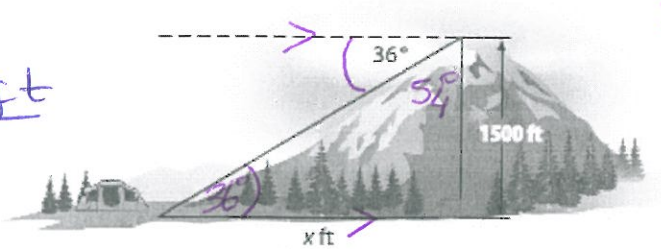
① When we disregard the height of the person, which is 6ft

② Take the height of the person into account, then, opposite side is $150ft - 6ft = 144ft$

$\tan 32° = \frac{144ft}{x}$

$x = \frac{144ft}{\tan 32°} \approx 230.4ft$

2. **CAMPING** A group of hikers on a camping trip climb to the top of a 1500-foot mountain. When the hikers look down at an angle of depression of 36°, they can see the campsite in the distance. What is the horizontal distance between the campsite and the group to the nearest foot?



1st way

$\tan 36° = \frac{1500ft}{x}$

$x = \frac{1500ft}{\tan 36°}$

$x \approx 2065ft$

2nd way

$\tan 54° = \frac{x}{1500ft}$

$x = (\tan 54°)(1500ft)$

$x \approx 2065ft$

* Wait until the last step of your solution to round. OR take at least 4 digits, i.e, $\tan 36° = 0.7265$ when you divide/multiply.