7.6 Apply the Sine and Cosine Ratios

Before You used the tangent ratio.

Now You will use the sine and cosine ratios.

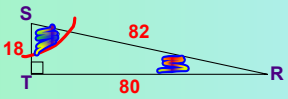
Why? So you can find distances, as in Ex. 39.

Sine and Cosine Ratios: Are ratios of the lengths of a leg and the hypotenuse in a right triangle.

SINE RATIO: $\sin A = \dfrac{\text{length of leg opposite } \angle A}{\text{length of hypotenuse } \angle A}$

EXAMPLE 1: Finding Sine Ratios

Find sin S ~~and sin R.~~

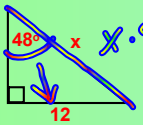


$\sin S = \frac{80}{82}$ (O/H)

$\sin S = \frac{40}{41}$

$\sin^{-1}\frac{40}{41} \approx 77^\circ$

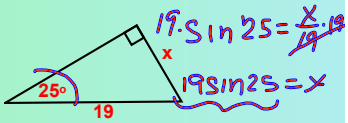
EXAMPLE 2: Find the value of x.



$x \cdot \sin 48 = \frac{12}{x} \cdot x$

$\frac{x \sin 48}{\sin 48} = \frac{12}{\sin 48}$

$x \approx 16.1$



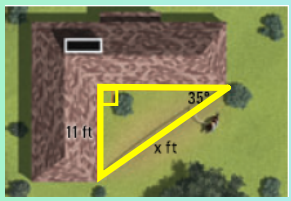
$19 \cdot \sin 25 = \frac{x}{19} \cdot 19$

$19 \sin 25 = x$

$8 \approx x$

EXAMPLE 3: Estimate heights using the tangents.

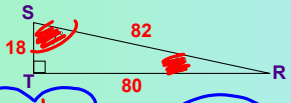
DOG RUN. You want to string cable to make a dog run from two corners of a building, as shown in the diagram. Write and solve a proportion using a trigonometric ratio to approximate the length of cable you will need.



COSINE RATIO: $\cos A = \dfrac{\text{length of leg adjacent } \angle A}{\text{length of hypotenuse } \angle A}$

EXAMPLE 4: Finding Cosine Ratios

Find cos S ~~and cos R.~~

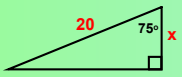


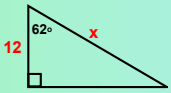
$\cos S = \frac{18}{82}$ (Adj / Hyp)

$\cos S = \frac{9}{41}$

$\cos^{-1}\frac{9}{41} \approx 77^\circ$

EXAMPLE 5: Find the value of x.

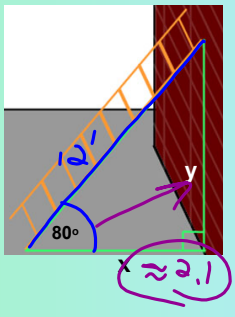




EXAMPLE 6:

A long ladder rests against a building, forming an angle of 80° at the ground. The ladder is 12 feet long.

How far is the ladder from the wall?



$12 \cdot \cos 80 = \frac{x}{12} \cdot 12$

$2.1' \approx x$

$x \approx 2.1$

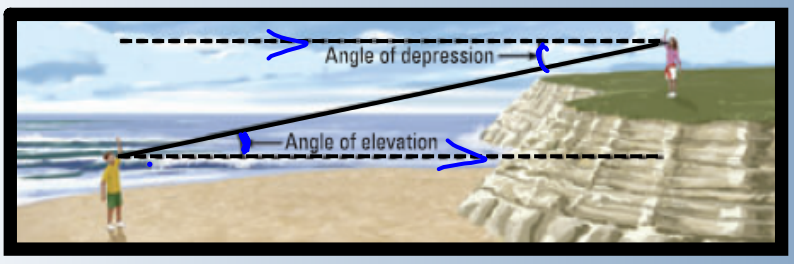
How high up the wall is the ladder?

$12 \cdot \sin 80 = \frac{y}{12} \cdot 12$

$11.8' \approx y$

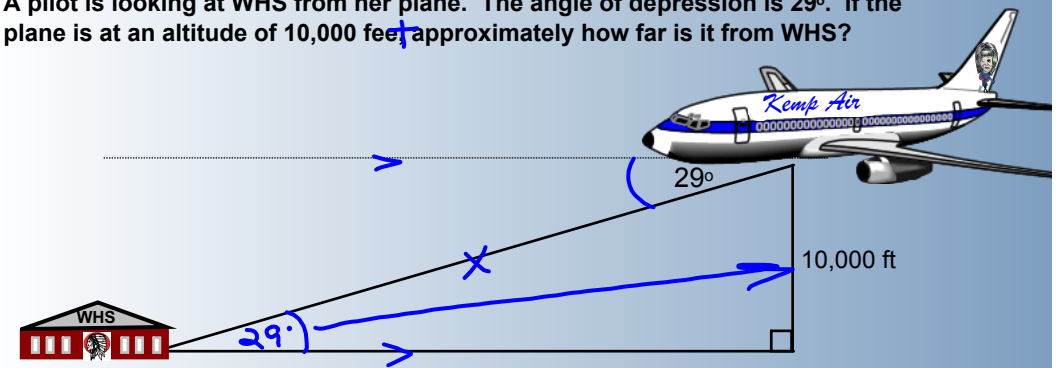
Angle of ELEVATION: When you look UP at an object, the angle your line of sight makes with a horizontal line.

Angle of DEPRESSION: When you look Down at an object, the angle your line of sight makes with a horizontal line.



Example 1:

A pilot is looking at WHS from her plane. The angle of depression is 29°. If the plane is at an altitude of 10,000 feet approximately how far is it from WHS?



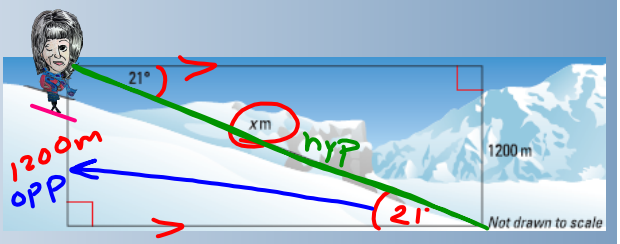
$x \cdot \sin 29 = \frac{10{,}000}{x} \cdot x$

$x \frac{\sin 29}{\sin 29} = \frac{10{,}000}{\sin 29}$

$x \approx 20{,}626.7'$

Example 2:

Snow boarding. Mrs. Kemp is snow boarding on a mountain with an altitude of 1200 meters. The angle of depression is 21°. Barring that she doesn't break a hip, how far does Mrs. Kemp have to travel to reach the bottom of the mountain?



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$x \cdot \sin 21 = \frac{1200}{x} \cdot x$

$x \frac{\sin 21}{\sin 21} = \frac{1200}{\sin 21}$

$x \approx 3348.5\text{m}$