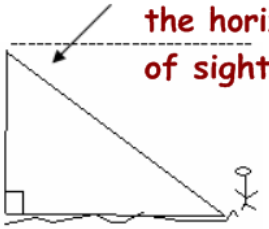
Applications of Right Angle Trigonometry

ANGLE OF ELEVATION/DEPRESSION

Angle of elevation – is the angle between the ground and the line of sight. (angle of inclination)

Always from the GROUND up

Angle of Depression – is the angle between the horizon and the line of sight.



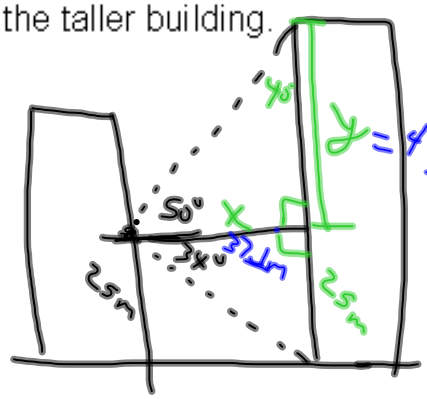
Always outside the triangle

Example 1:

Two trees are 100m apart. From a point on midway between them, the angles of elevation to their tops are 8° and 13°. How much taller is one tree than the other?

Example 2:

The 8th floor of an apartment building is 25m above the ground. From the 8th floor, the angle of elevation to the top of the other building is 50°. The angle of depression to the base of the taller building is 34°. Determine the height of the taller building.



$\tan 34° = \frac{25}{x}$

$x = \frac{25}{\tan 34°}$

$x = 37.1\text{m}$

$\tan 50° = \frac{y}{37.1}$

$y = 44.17\text{m}$

$\text{Height} = 44.2\text{m} + 25\text{m}$

$= 69.2\text{m}$

ANGLE OF ELEVATION/DEPRESSION

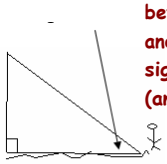
!eview:

OH CAH TOA stands for:

hese trig ratios will only work with _____ triangles.

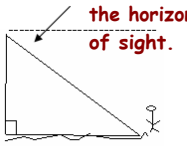
ı each ratio we have _____ angle(s) and _____ side(s).

Angle of elevation - is the angle between the ground and the line of sight. (angle of inclination)



Always from the GROUND up

Angle of Depression - is the angle between the horizon and the line of sight.



Always outside the triangle

lso, note that the angle of elevation = angle of depression

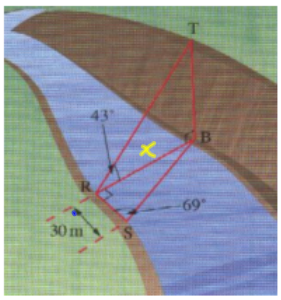
ometimes we don't have enough information to solve a triangle, by using just one triangle. However, if we ave another associated right triangle, we may be able to solve one by using the provided data from the other.

Example: **#1.**

wo trees are 100m apart. From a point on midway between them, the angles of levation to their tops are 8° and 13°. How much taller is one tree than the other?

2. The 8th floor of an apartment building is 25m above the ground. From the 8th floor, the angle of elevation to the top of the other building is 50°. The angle of depression to the base of the taller building is 34°. Determine the height of the taller building.

3. A climbing club plans to scale a cliff overlooking a river. To prepare for the climb, a surveyor visited the site and took some measurements to calculate the height of the cliff. From point R on the shore directly across the river, the angle of elevation to the top of the cliff is $\angle TRB = 43^\circ$. From a point S, 30m down the river, $\angle BSR = 69^\circ$. How high is the cliff?



$\tan 69^\circ = \frac{x}{30}$

$x = 30 \tan 69^\circ$

$x = 78.15\text{m}$

$\tan 43^\circ = \frac{h}{78.15\text{m}}$

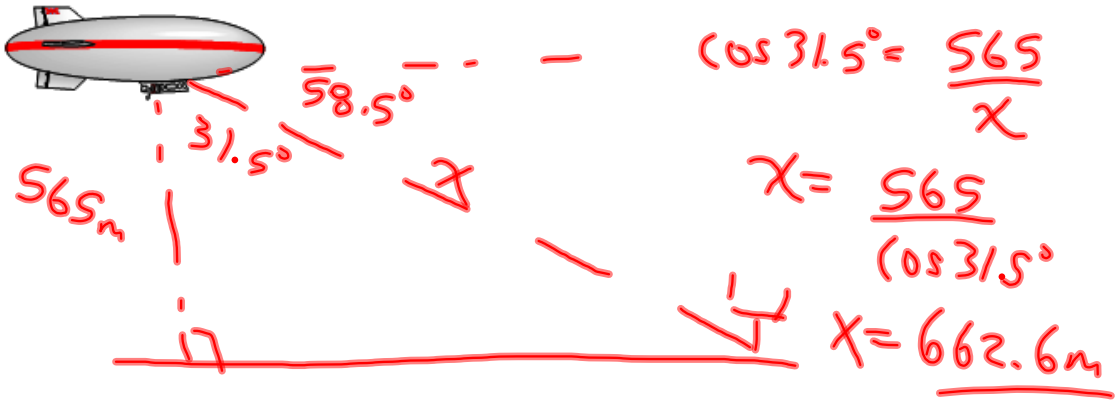
$h = 78.15(\tan 43^\circ)$

$h = 72.9\text{m}$

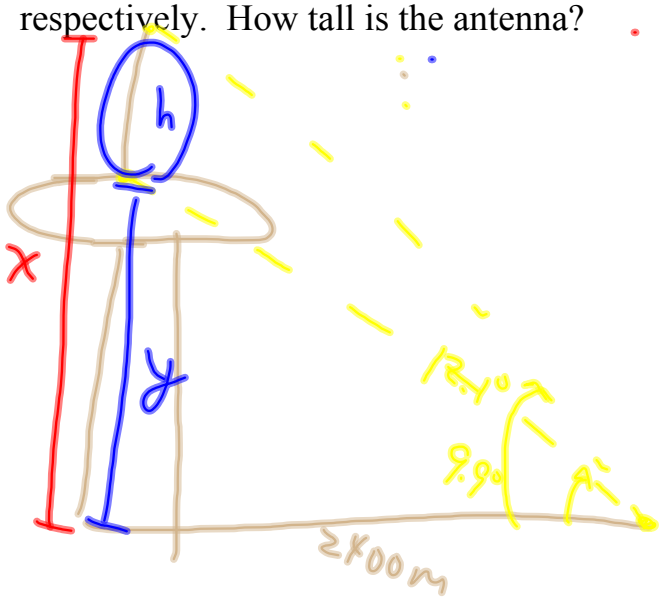
Applications of Trig Ratios

Examples...

#1. The Goodyear Blimp is 565 m above the ground during a Super Bowl game. The angle of depression of the north goal line from the blimp is 58.5°. How far is the observer in the blimp from the goal line?



#2. An antenna is on the top of the CN Tower in Toronto. From a point 2400 m away, the angles of elevation to the top and bottom of the antenna are 12.1° and 9.9° respectively. How tall is the antenna?



tan 12.1° = x/2400

x = 514.52m

tan 9.9° = y/2400

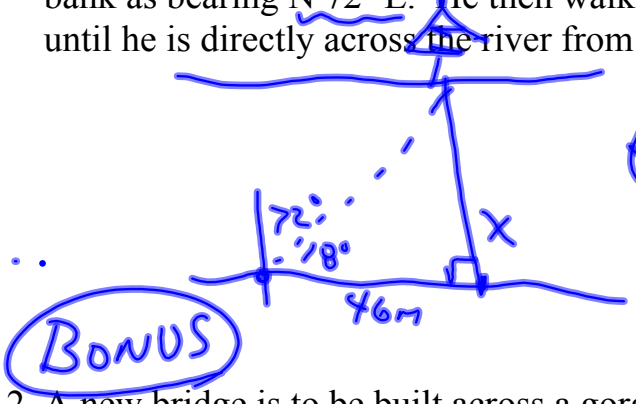
y = 418.87m

h = 514.52 − 418.87

= 95.6m

Warm Up

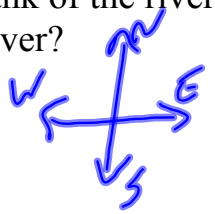
1. A surveyor who wishes to know the width of a river sights a tree on the opposite bank as bearing N 72° E. He then walks 46 m due east along the bank of the river until he is directly across the river from the tree. How wide is the river?



$\tan 18° = \frac{x}{46}$

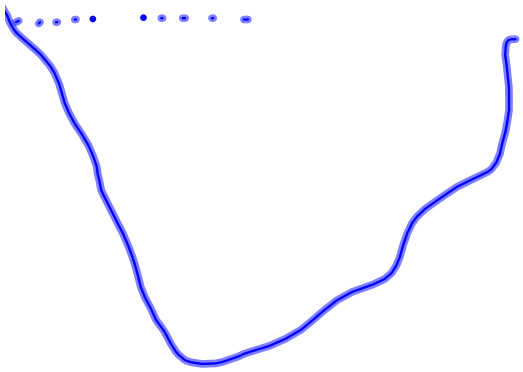
$x = 46 \tan 18°$

$x = 14.9\text{ m}$



BONUS

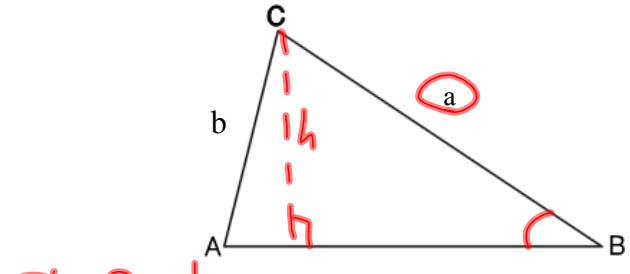
2. A new bridge is to be built across a gorge which is known to be 15 m wide. A support pier is to be built at the deepest point of the gorge. If the angles of depression to that point are 39° and 58° from the two ends of the bridge, what must the height of this support pier be?



Law of Sines

** Used when the triangle does not contain 90^o angle (Oblique Triangle)
** In order to use you must be given 1)an angle and an opposite side
AND
2) any other side or angle
Lower case letters "a,b,c" represent side lengths
Upper case letters "A,B,C" represent angle measures

Let's derive the Law of Sines...



$\sin B = \frac{h}{a}$

$h = a \sin B$

$\sin A = \frac{h}{b}$

$h = b \sin A$

$\therefore a \sin B = b \sin A$

$\frac{a \sin B}{\sin B \sin A} = \frac{b \sin A}{\sin A \sin B}$

$\frac{a}{\sin A} = \frac{b}{\sin B}$

Law of Sines

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

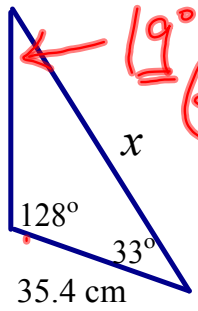
OR

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

"when looking for a side"

"when looking for an angle"

EXAMPLE #1 - Finding a side.



19°

$\frac{35.4}{\sin 19^\circ} = \frac{x}{\sin 128^\circ}$ ($\sin 128^\circ$)

$x = 85.7\text{ cm}$

EXAMPLE #2 - Finding an angle.