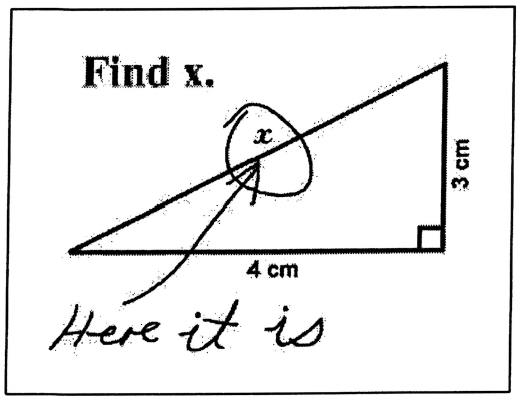
Practice Solving Side Lengths of Right Triangles



Solving equation by

$\frac{1}{n}\sin x = ?$

$\frac{1}{n}\sin x =$

$six = 6$

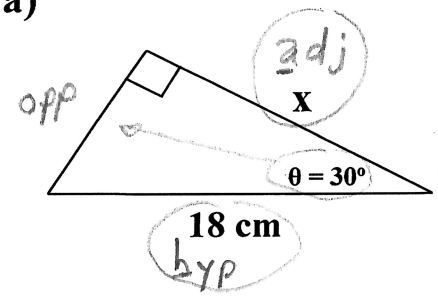
Recall: SOH CAH TOA

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

Examples

Determine the length of the side x in each diagram.

a)



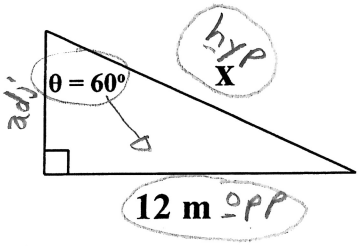
$\cos\theta = \frac{adj}{hyp}$

$\frac{\cos(30°)}{1} = \frac{x}{18}$

$x = 18\cos(30°)$

$x \cong 15.6\text{cm}$

b)



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

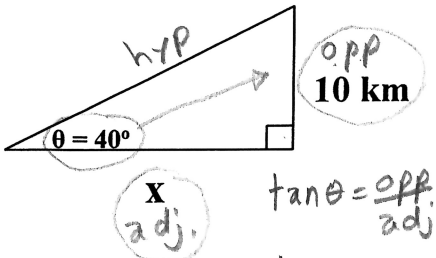
$\frac{\sin(60°)}{1} = \frac{12}{x}$

$x\sin(60°) = 12$

$\frac{x\sin(60°)}{\sin(60°)} = \frac{12}{\sin(60°)}$

$x \cong 13.9\text{m}$

c)



$\tan\theta = \frac{opp}{adj}$

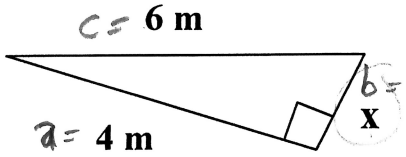
$\frac{\tan(40°)}{1} = \frac{10}{x}$

$x\tan(40°) = 10$

$\frac{x\tan(40°)}{\tan(40°)} = \frac{10}{\tan(40°)}$

$x \cong 11.9\text{ km}$

d)



$a^2 + b^2 = c^2$

$4^2 + x^2 = 6^2$

$16 + x^2 = 36$

$x^2 = 36 - 16$

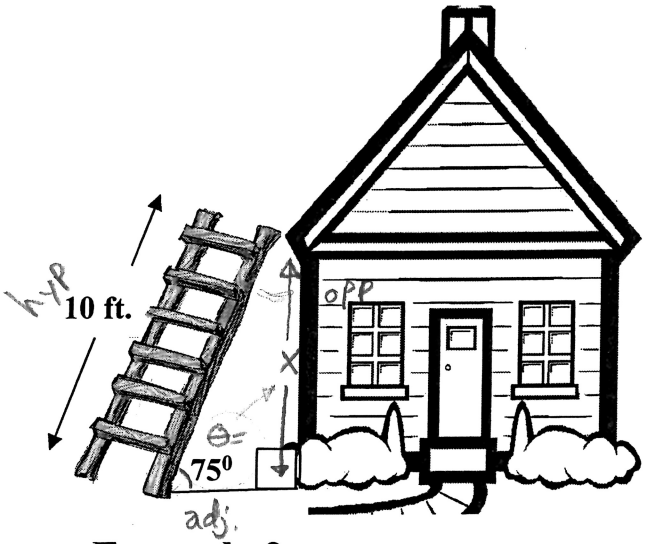
$\sqrt{x^2} = \sqrt{20}$

$x \cong 4.5\text{m}$

Applications of Trigonometry

Example 1

A 10 foot ladder leans against a wall. The angle between the ladder and the ground is 75°. How high up the wall does the ladder reach?



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

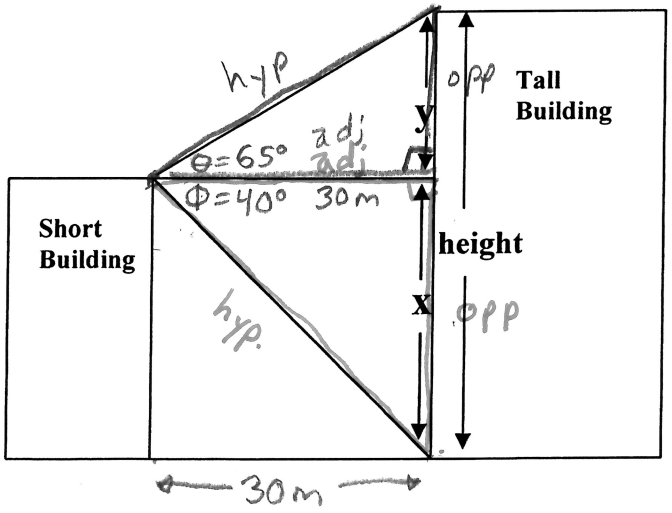
$\frac{\sin(75°)}{1} = \frac{x}{10}$

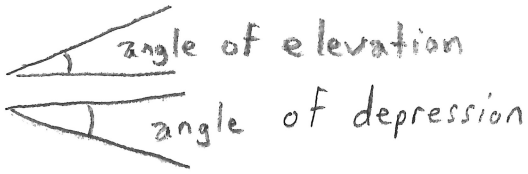
$x = 10\sin(75°)$

$x \cong 9.7$ feet

Example 2

Two buildings are 30 metres apart. From the top of the short building, the angle of elevation to the top of the tall building is 65°. From the top of the short building, the angle of depression to the bottom of the tall building is 40°. What is the height of the tall building?





$\tan\Phi = \frac{opp}{adj}$

$\frac{\tan(40°)}{1} = \frac{x}{30}$

$x = 30\tan(40°)$

$x \cong 25.2$ m

$\tan\theta = \frac{opp}{adj}$

$\frac{\tan(65°)}{1} = \frac{y}{30}$

$y = 30\tan(65°)$

$y \cong 64.3$m

$height = x + y$

$= 25.2 + 64.3$

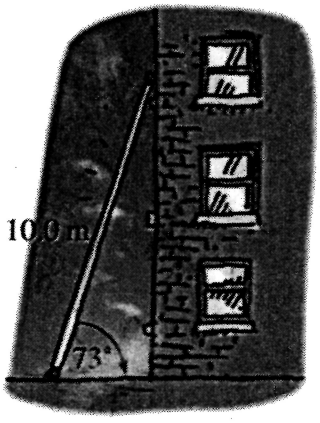
$\cong 89.5$m

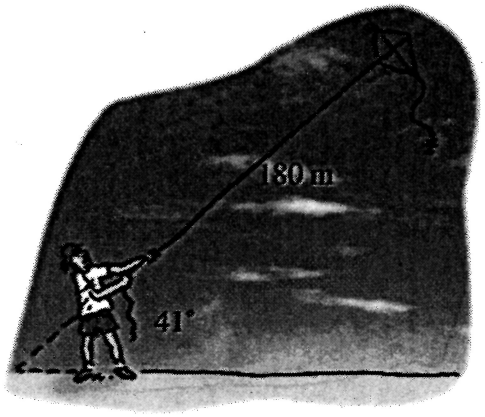
Applications of Trigonometry – Solving Side Lengths

1. A 10.0-m ladder leans against a vertical wall at an angle of 73° (below left).

a) Calculate the height the ladder reaches up the wall.

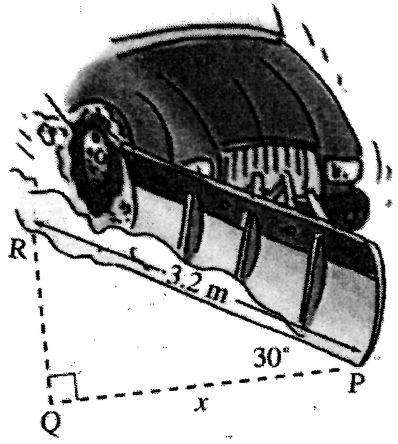
b) Calculate the distance from the foot of the ladder to the wall.





2. A kite has a string 180 m long (above right). The string makes an angle of 41° with the ground. Determine the height of the kite.

3. A snow plow has a 3.2-m blade set at an angle of 30°. How wide a path will the snow plow clear?

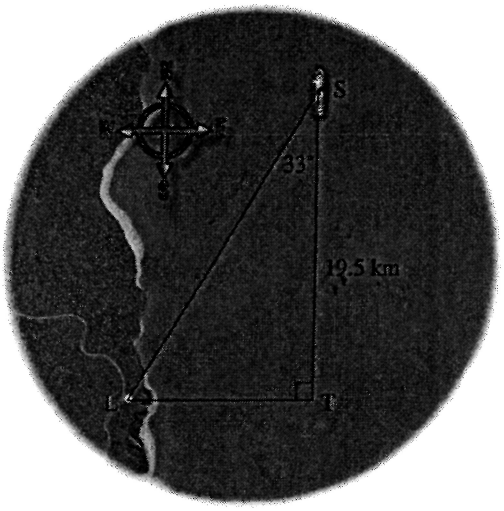


4. A storm causes some 14.0-m hydro poles to lean over. One pole leans at an angle of 72° to the ground. How high is the top of the pole from the ground?

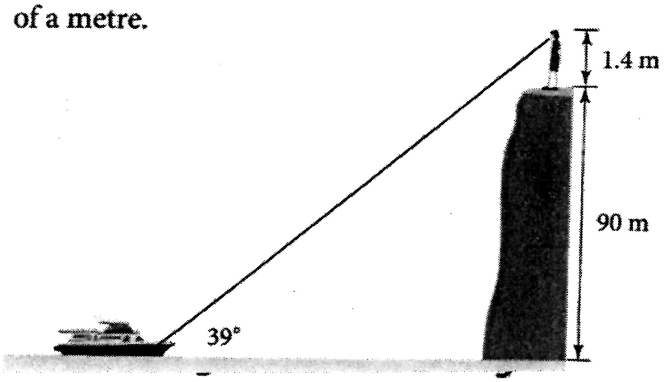
5. When a ship is at T, the navigator observes a lighthouse L due west on the shore. The ship sails 19.5 km north to point S. The navigator measures ∠TSL and finds that it is 33°.

a) How far is the ship from the lighthouse now?

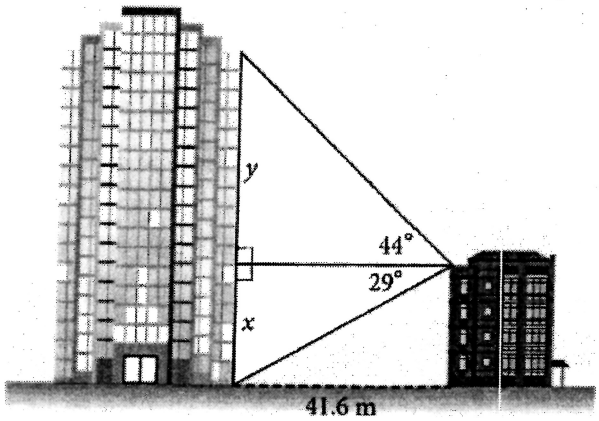
b) Use the Pythagorean Theorem to calculate the distance LT.



6. The Cathedral Bluffs in Toronto, Ontario, are eroded sandstone cliffs that rise 90 m above Lake Ontario. Natalie is 1.4 m tall. From her position at the top of the cliffs, the angle between the surface of the lake and her line of sight to a boat is 39°. Find the distance between the boat and the base of the cliffs to the nearest tenth of a metre.



7. Two buildings are 41.6 m apart. From the roof of the shorter building, the angle of elevation to the top of the taller building is 44° and the angle of depression to the base of the taller building is 29°. Find the heights of the buildings to the nearest tenth of a metre.



Answers:

1. a) 9.6m b) 2.9 m
2. 118.1 m
3. 2.8 m
4. 13.3 m
5. a) 23.3 km b) 12.7 km
6. 111.1 m
7. short building = 23.1 m, tall building = 63.2 m