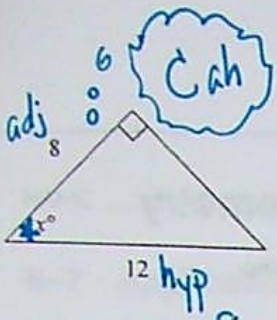
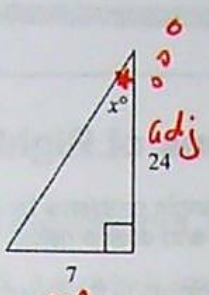
11. 

$\cos x = \frac{8}{12}\ (0.\bar{6})$

$x = \cos^{-1}(0.6666)$

$x \approx 48°$

$\approx 48.2°$

12. 

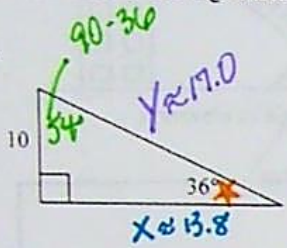
$\tan x = \frac{7}{24}$

$x = \tan^{-1}(7 \div 24)$

$x \approx 16°$

$(16.3°)$

☺13-16: Solve the right triangles **completely** ⇨ find **all** sides and **all** angles.

13. 

T o/a $\tan 36 = \frac{10}{x}$

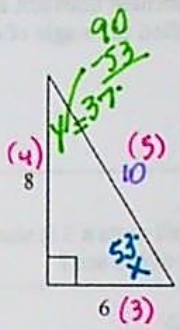
$x = \frac{10}{(\tan 36)}$

$x \approx 13.8$

S o/h $\sin 36 = \frac{10}{y}$

$y = \frac{10}{(\sin 36)}$

$y \approx 17.0$

14. 

$\frac{6}{2} \quad \frac{8}{2} \quad \frac{10}{2}$

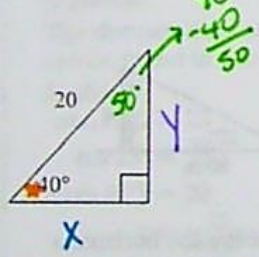
3 - 4 - 5

S o/h $\sin x = \frac{4}{5}$

$\sin x = 0.8$

$x = \sin^{-1}(0.8)$

$x \approx 53°$

15. 

C a/h $20(\cos 40) = \left(\frac{x}{20}\right)20$

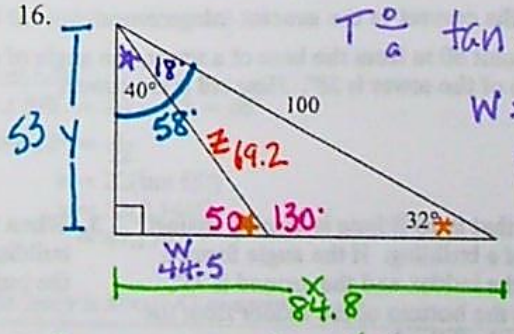
$x = 20(\cos 40)$

$x \approx 15.3u$

S o/h $20(\sin 40) = \left(\frac{y}{20}\right)20$

$y = 20(\sin 40)$

$y \approx 12.9u$

16. 

T o/a $\tan 40 = \frac{w}{53}$

$w = 53(\tan 40)$

$w \approx 44.5$

C a/h $100(\cos 32) = \left(\frac{x}{100}\right)100$

$x = 100(\cos 32)$

$x \approx 84.8$

S o/h $100(\sin 32) = \left(\frac{y}{100}\right)100$

$y = 100(\sin 32)$

$y \approx 53.0$

S o/h $\sin 50 = \frac{53}{z}$

$z = \frac{53}{\sin 50}$

$z \approx 69.2$

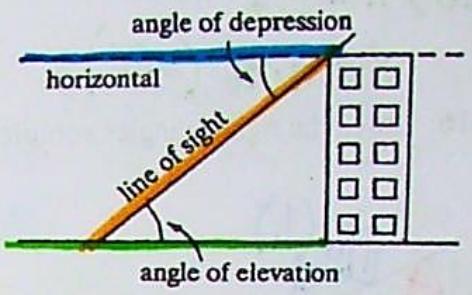
NAME _____

8–7 Applications of Right Triangle Trigonometry

Objective: Solve right triangle problems by correct selection and use of the tangent, sine, and cosine ratios.

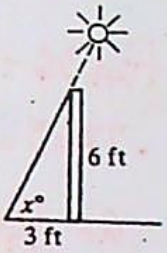
If a person on the ground looks up to the top of a building, the angle formed between the line of sight and the horizontal is called the **angle of elevation.**

If a person standing on the top of a building looks down at a car on the ground, the angle formed between the line of sight and a horizontal line is called the **angle of depression.**



Example 1

At a certain time, a post 6 ft tall casts a 3 ft shadow. What is the angle of elevation of the sun?



Solution

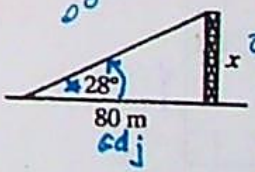
$\tan x^\circ = \frac{6}{3} = 2$

$x \approx 63$

Express lengths correct to the nearest integer.

1. From a point 80 m from the base of a tower, the angle of elevation to the top of the tower is 28°. How tall is the tower?

TOA

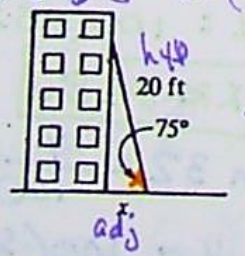


$80(\tan 28) = \left(\frac{x}{80}\right)80$ $\quad x = 80(\tan 28)$

$x \approx 43\text{m}$

2. A ladder that is 20 ft long is leaning against the side of a building. If the angle formed between the ladder and the ground is 75°, how far is the bottom of the ladder from the base of the building?

CAH



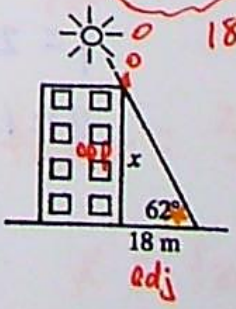
$20(\cos 75) = \left(\frac{x}{20}\right)20$

$x = 20(\cos 75)$

$x \approx 5\text{ft}$

3. When the sun is 62° above the horizon, a building casts a shadow 18 m long. How tall is the building?

TOA



$18(\tan 62) = \left(\frac{x}{18}\right)18$

$x = 18(\tan 62)$

$x \approx 34\text{m}$

NAME _____ DATE _____

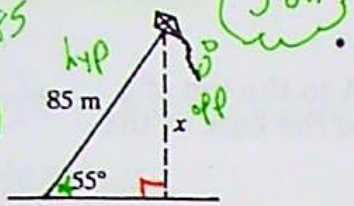
8–7 Applications of Right Triangle Trigonometry *(continued)*

4. A kite is flying at an angle of elevation of about 55°. Ignoring the sag in the string, find the height of the kite if 85 m of string have been let out.

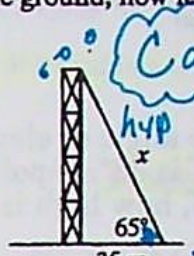
$85(\sin 55) = \left(\frac{x}{85}\right)85$

$x = 85(\sin 55)$

$x \approx 70\text{m}$



5. A guy wire is attached to the top of a tower and to a point on the ground that is 35 m from the base of the tower. If the wire makes a 65° angle with the ground, how long is the wire?



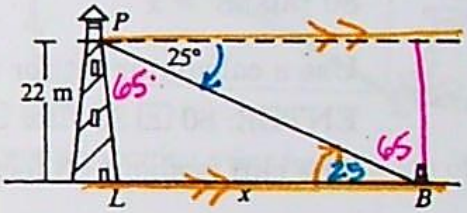
$\cos 65 = \frac{35}{x}$

$x = \frac{35}{(\cos 65)}$

$x \approx 83\text{m}$

Example 2

A person in a lighthouse 22 m above sea level sights a buoy in the water. If the angle of depression to the buoy is 25°, how far from the base of the lighthouse is the buoy?



Solution

The distance between the buoy and the lighthouse can be found in two ways.

Method 1

$m\angle PBL = 25$

$\tan 25° = \frac{22}{x}$

$x(\tan 25°) = 22$

$x = \frac{22}{\tan 25°}$

$\approx \frac{22}{0.4663}$

≈ 47.1799

Method 2

$m\angle BPL = 90 - 25 = 65$

$\tan 65° = \frac{x}{22}$

$x = 22(\tan 65°)$

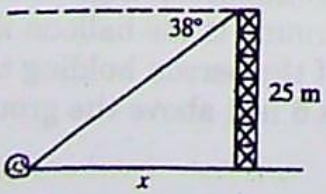
$x \approx 22(2.1445)$

≈ 47.1792

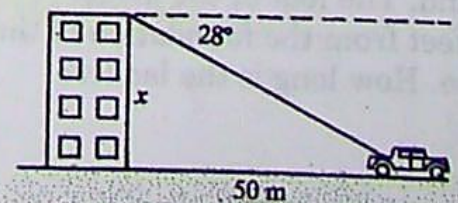
The buoy is about 47 m away.

Express lengths correct to the nearest integer.

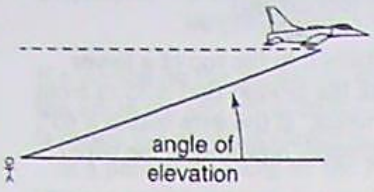
6. The angle of depression from the top of a tower to a boulder on the ground is 38°. If the tower is 25 m high, how far from the base of the tower is the boulder?

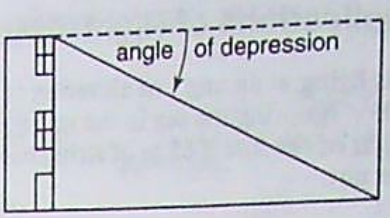


7. An observer at the top of a building sees a car on the road below. The angle of depression to the car is 28°. If the car is about 50 m from the building when it is seen, how tall is the building?

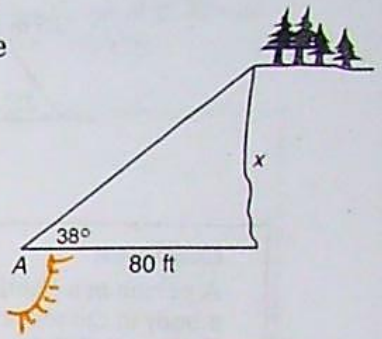


of depression.



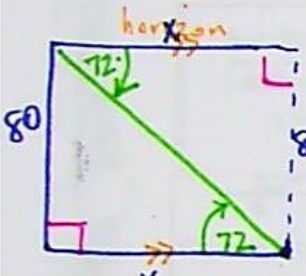


Example: The angle of elevation from point A to the top of a cliff is 38°. If point A is 80 feet from the base of the cliff, how high is the cliff?



Let x represent the height of the cliff.
Then $\tan 38° = \frac{x}{80}$.

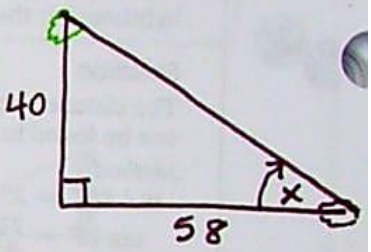
$80 \tan 38° = x$



Use a calculator set for the degree mode to find x.

ENTER: 80 × 38 TAN = 62.502850

The cliff is about 63 feet high.



Solve each problem. Round measures of segments to the nearest hundredth and measures of angles to the nearest degree.

1. From the top of a tower, the angle of depression to a stake on the ground is 72°. The top of the tower is 80 feet above ground. How far is the stake from the foot of the tower?

TOA

$\tan 72 = \frac{80}{x}$

$x = \frac{80}{\tan 72}$

$x \approx 25.99$ ft

2. A tree 40 feet high casts a shadow 58 feet long. Find the measure of the angle of elevation of the sun.

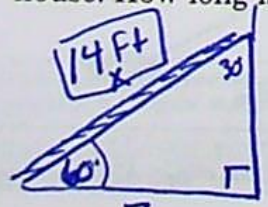
TOA

$\tan x = \frac{40}{58}$

$x = \tan^{-1}(40 \div 58)$

$x \approx 35°$

3. A ladder leaning against a house makes an angle of 60° with the ground. The foot of the ladder is 7 feet from the foundation of the house. How long is the ladder?



$\cos 60 = \frac{7}{x}$

$x = \frac{7}{(\cos 60)}$

$x = 14$ ft

4. A balloon on a 40-foot string makes an angle of 50° with the ground. How high above the ground is the balloon if the hand of the person holding the balloon is 6 feet above the ground?

SOH

$\sin 50 = \frac{x}{40}$

$x = 40(\sin 50)(+6)$

$= 30.6 + 6$