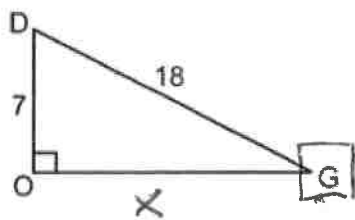


A Quick Rewind:

1. Solve the triangle.



$$\sin G = \frac{7}{18}$$

$$G = \sin^{-1}\left(\frac{7}{18}\right)$$

$$G = 22.89^\circ$$

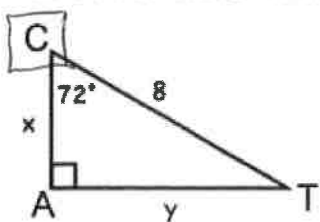
$$\angle D = 90 - 22.89 = 67.115^\circ$$

$$x^2 + 7^2 = 18^2$$

$$x^2 = 275$$

$$x = \sqrt{275} = 5\sqrt{11}$$

2. Solve the triangle.



$$\cos 72 = \frac{x}{8}$$

$$\frac{\cos 72}{1} = \frac{x}{8}$$

$$x = 8 \cos 72$$

$$x = 2.472$$

$$m\angle T = 90 - 72 = 18^\circ$$

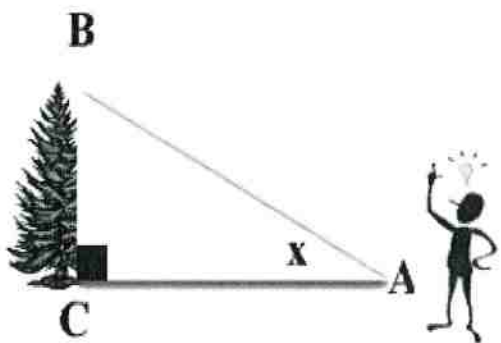
$$x^2 + y^2 = 8^2$$

$$(2.47)^2 + y^2 = 64$$

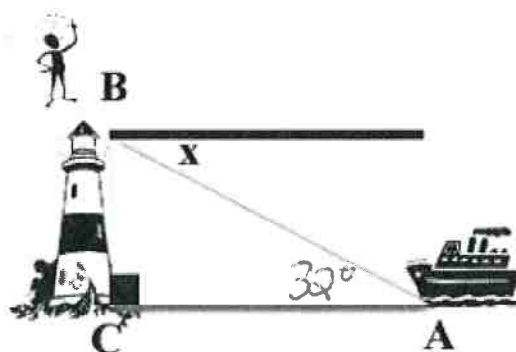
$$y^2 = 57.89$$

$$y = 7.608$$

Trigonometric ratios have many practical real-world examples. Angles of elevation and depression are formed by the horizontal lines that a person's lines of sight to an object form. If a person is looking up, the angle is an elevation angle. If a person is looking down, the angle is a depression angle.

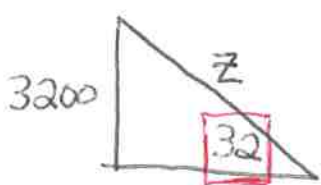


x = angle of elevation from ground to top of tree



x = angle of depression from lighthouse to boat

Example #3: A plane is coming in for a landing with an angle of depression of 32° . The plane is currently 3200 feet in the air. How far does the plane have to travel before it hits the runway?



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

$$\sin 32 = \frac{3200}{z}$$

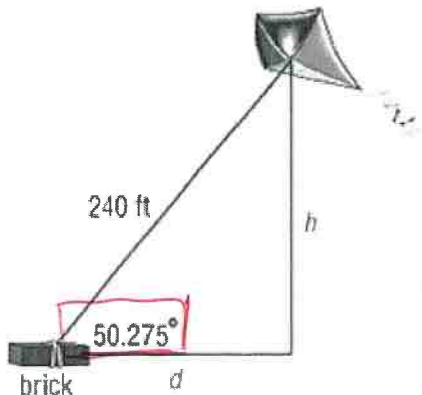
$$\frac{\sin 32}{1} = \frac{3200}{z}$$

$$z \sin 32 = 3200$$

$$z = \frac{3200}{\sin 32}$$

$$z = 6038.66 \text{ ft}$$

Example #4: A child holding on to the string of a kite gets tired and decides to put the string on the ground and secure it with a brick. The length of the string from the brick to the kite is 240 feet.



- a. If the angle formed by the string and the ground is 50.275° , how high is the kite?

$$\sin 50.275 = \frac{h}{240}$$

$$h = 240 \sin 50.275$$

$$h = 184.59 \text{ ft}$$

- b. What is the horizontal distance between the kite and the brick?

$$\cos 50.275 = \frac{d}{240}$$

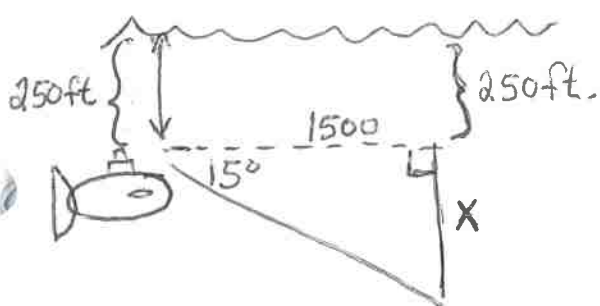
$$d = 240 \cos 50.275 = 153.39 \text{ ft}$$

$$\text{OR } h^2 + d^2 = 240^2$$

$$184.59^2 + d^2 = 240^2$$

$$d = 153.39 \text{ ft}$$

Example #5: A submersible traveling at a depth of 250 feet dives at an angle of 15° with respect to a line parallel to the water's surface. It travels a horizontal distance of 1500 feet during the dive. What is the depth of the submersible after the dive?



$$\tan 15 = \frac{x}{1500}$$

$$x = 1500 \tan 15$$

$$x = 401.924$$

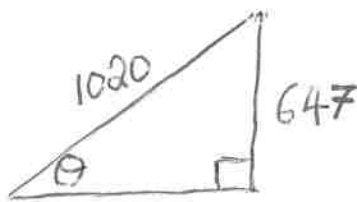
$$\text{Total depth} = 250 + 401.92$$

$$= 651.923 \text{ ft}$$

below the water surface.

Example #6: The steepest railway in the world is the Katoomba Scenic Railway in Australia. The passenger car is pulled up the mountain by twin steel cables. It travels along the tract 1020 feet to obtain a change in altitude of 647 feet.

- a. Find the angle of elevation of the railway.

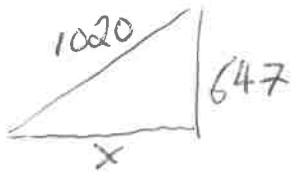


$$\sin \theta = \frac{647}{1020}$$

$$\theta = \sin^{-1} \left(\frac{647}{1020} \right)$$

$$\theta = 39.369^\circ$$

- b. How far does the car travel in a horizontal direction?



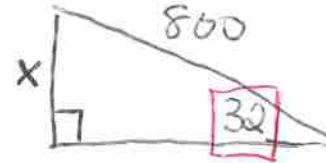
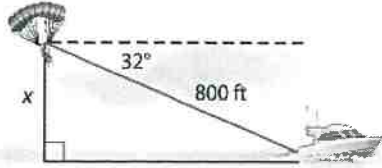
$$x^2 + 647^2 = 1020^2$$

$$x = 788.537 \text{ ft.}$$

1.04 Practice Trig Applications

Date: _____

39. **PARASAILING** Kayla decided to try parasailing. She was strapped into a parachute towed by a boat. An 800-foot line connected her parachute to the boat, which was at a 32° angle of depression below her. How high above the water was Kayla? (Example 6)



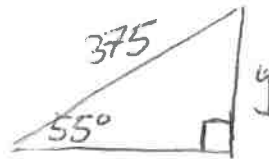
$$\sin 32 = \frac{x}{800}$$

$$x = 800 \sin 32$$

$$x = 423.935 \text{ ft}$$

41. **ROLLER COASTER** On a roller coaster, 375 feet of track ascend at a 55° angle of elevation to the top before the first and highest drop. (Example 6)

- Draw a diagram to represent the situation.
- Determine the height of the roller coaster.

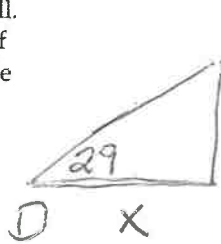
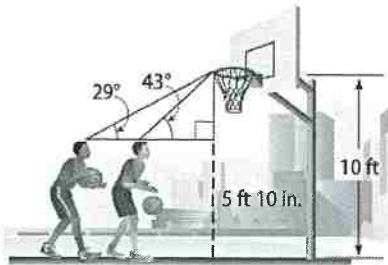


$$\sin 55 = \frac{y}{375}$$

$$y = 375 \sin 55$$

$$y = 307.182 \text{ ft}$$

43. **BASKETBALL** Both Derek and Sam are 5 feet 10 inches tall. Derek looks at a 10-foot basketball goal with an angle of elevation of 29° , and Sam looks at the goal with an angle of elevation of 43° . If Sam is directly in front of Derek, how far apart are the boys standing? (Example 7)

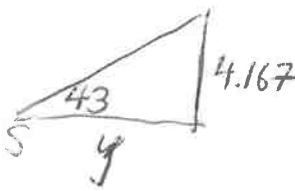


$$10 - 5.833 = 4.167$$

$$\tan 29 = \frac{4.167}{x}$$

$$x \tan 29 = 4.167$$

$$x = 7.517$$



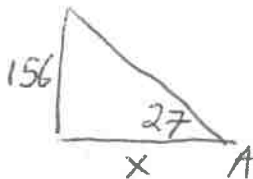
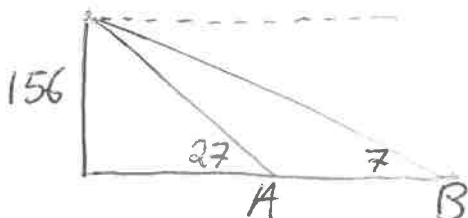
$$\tan 43 = \frac{4.167}{y}$$

$$y = \frac{4.167}{\tan 43} = 4.469$$

$$7.517 - 4.469 = 3.048 \text{ ft}$$

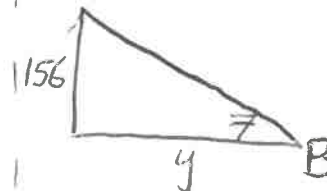
45. **LIGHTHOUSE** Two ships are spotted from the top of a 156-foot lighthouse. The first ship is at a 27° angle of depression, and the second ship is directly behind the first at a 7° angle of depression. (Example 7)

- Draw a diagram to represent the situation.
- Determine the distance between the two ships.



$$\tan 27 = \frac{156}{x}$$

$$x = \frac{156}{\tan 27} = 306.167$$



$$\tan 7 = \frac{156}{y}$$

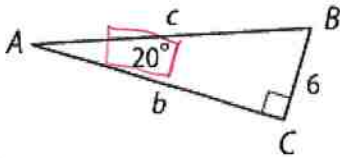
$$y = \frac{156}{\tan 7}$$

$$y = 1270.518$$

$$1270.518 - 306.167 = 964.351 \text{ ft. apart}$$

Solve each triangle. Round side lengths to the nearest tenth and angle measures to the nearest degree. (Example 8)

47.



$$\sin 20 = \frac{6}{c}$$

$$c \sin 20 = 6$$

$$c = \frac{6}{\sin 20}$$

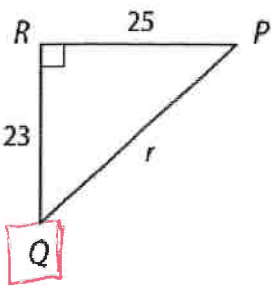
$$c = 17.543$$

$$b^2 + 6^2 = 17.543^2$$

$$b = 16.485$$

$$m\angle B = 90 - 20 = 70^\circ$$

49.



$$\tan Q = \frac{25}{23}$$

$$Q = \tan^{-1}\left(\frac{25}{23}\right)$$

$$Q = 47.386^\circ$$

$$23^2 + 25^2 = r^2$$

$$r = 33.971$$

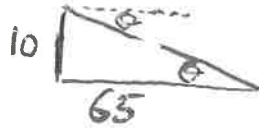
$$m\angle P = 90 - 47.386$$

$$m\angle P = 42.614^\circ$$

55. **BASEBALL** Michael's seat at a game is 65 feet behind home plate. His line of vision is 10 feet above the field.

a. Draw a diagram to represent the situation.

b. What is the angle of depression to home plate? 9°



$$\tan \theta = \frac{10}{65}$$

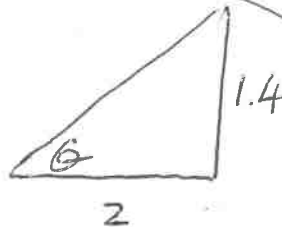
$$\theta = \tan^{-1}\left(\frac{10}{65}\right)$$

$$\theta = 8.746^\circ$$

56. **HIKING** Jessica is standing 2 miles from the center of the base of Pikes Peak and looking at the summit of the mountain, which is 1.4 miles from the base.

a. Draw a diagram to represent the situation.

b. With what angle of elevation is Jessica looking at the summit of the mountain?

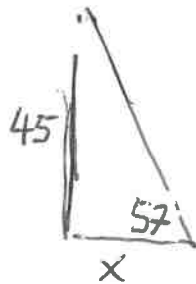
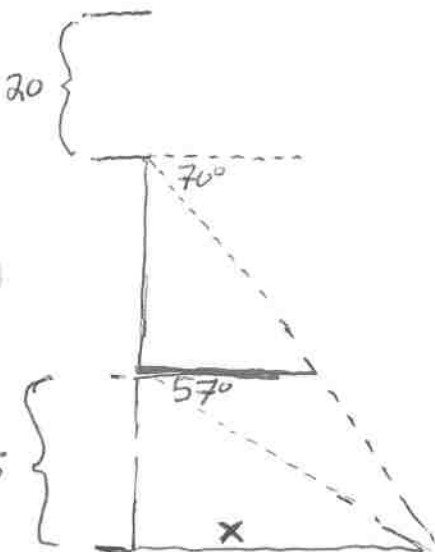


$$\tan \theta = \frac{1.4}{2}$$

$$\theta = \tan^{-1}\left(\frac{1.4}{2}\right)$$

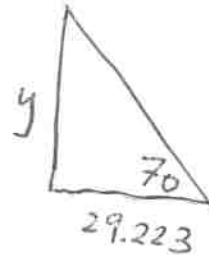
$$\theta = 35^\circ$$

71. **SCUBA DIVING** A scuba diver located 20 feet below the surface of the water spots a shipwreck at a 70° angle of depression. After descending to a point 45 feet above the ocean floor, the diver sees the shipwreck at a 57° angle of depression. Draw a diagram to represent the situation, and determine the depth of the shipwreck. 100 ft



$$\tan 57 = \frac{45}{x}$$

$$x = 29.223 \text{ ft}$$



$$\tan 70 = \frac{y}{29.223}$$

$$y = 29.223 \tan 70$$

$$y = 80.290 \text{ ft}$$

depth of shipwreck is 20 ft + 80.290 ft

$$= 100.290 \text{ ft}$$