**Please, if necessary, round all answers to the nearest hundredth.**

1. Remus is drawing up plans for new zip line course for his company ZIPitty-do-dah. The anchor point for the zip line on platform A is 80 feet above the ground; while the anchor point for platform B is 45 feet above the ground. The angle of elevation from line of sight at anchor point B is 23°. (image is not to scale)

   Brake Zone 15ft

   17'

   B ∫23°
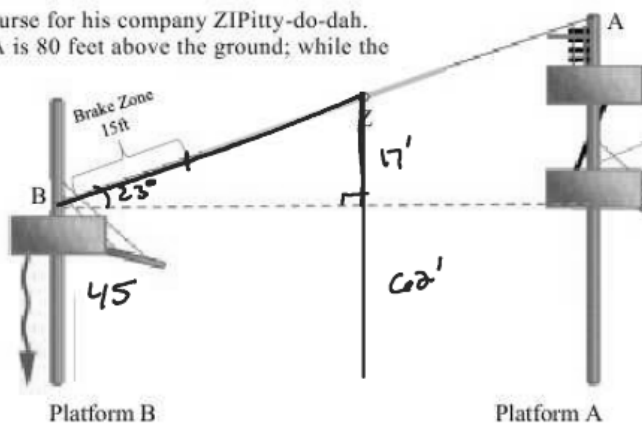
   a. Determine the vertical drop from anchor point A to anchor point B.

      35'

      45   62'

   b. Determine how much wire will be needed to connect anchor point A to anchor point B.
      84.58'

      Platform B   Platform A

   c. Determine how far apart the two platforms are.   82.46'

   d. If a person using the zip line is traveling at 88 fps, and is currently at location Z with a height of 62ft above the ground, how long will it take them to reach the braking zone 15 feet along the line away from platform B?
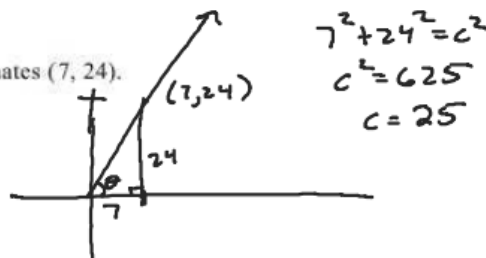
   $\sin 23° = \dfrac{17}{BZ}$ $43.5 - 15$

   $BZ = \dfrac{17}{\sin 23}$ $\dfrac{28.5'}{88} = 0.324$ sec

   $= 43.5$

2. Consider the line that contains the origin and the point with coordinates (7, 24).

   (7,24)

   $7^2 + 24^2 = c^2$
   $c^2 = 625$
   $c = 25$

   a. Sketch this line and find the equation of the line.
      $m = \dfrac{24}{7}$ $y = mx + b$

      $b = 0$ $y = \dfrac{24}{7}x$

      24

      7

   b. Label the angle formed by the line and the positive x-axis θ. Without using your calculator, express the following in ratio form.

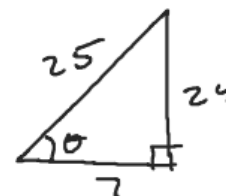 $\tan \theta = \dfrac{24}{7}$ $\cos \theta = \dfrac{7}{25}$ $\sin \theta = \dfrac{24}{25}$

   c. Determine the measure of θ.

      $\theta = \tan^{-1}\left(\dfrac{24}{7}\right) = \cos^{-1}\left(\dfrac{7}{25}\right) = \sin^{-1}\left(\dfrac{24}{25}\right)$

      $= 73.73°$

      25   24

      θ   7

3. Triangle ACB is a right triangle with side $BC = 6$ and hypotenuse $AB = 10$.

a. Compute the length of side AC.

$$a^2 + b^2 = c^2 \qquad b^2 = 64 \qquad 8 = b$$
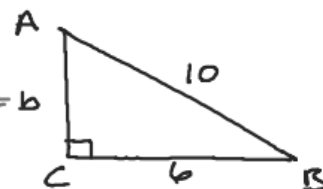$$c^2 + b^2 = 10^2 \qquad b = 8$$
$$36 + b^2 = 100$$

b. Without using your calculator, find the following. Express your answers in <u>ratio form</u>.

$\tan A = \dfrac{6}{8}$ $\qquad\qquad$ $\cos A = \dfrac{8}{10}$ $\qquad\qquad$ $\sin A = \dfrac{6}{10}$

$\tan B = \dfrac{8}{6}$ $\qquad\qquad$ $\cos B = \dfrac{6}{10}$ $\qquad\qquad$ $\sin B = \dfrac{8}{10}$

4. Demetri leans a 35-ft ladder against a wall. The base of the ladder is 5 feet from the wall.

a. What angle does the ladder make with the ground? Show your work.

b. How high up the wall does the ladder reach? Show your work.

5. You are standing 25 feet away from a tree, and you measure the angle of elevation (from your eyes which are 5 feet off the ground) to be 35°. How tall is the tree?
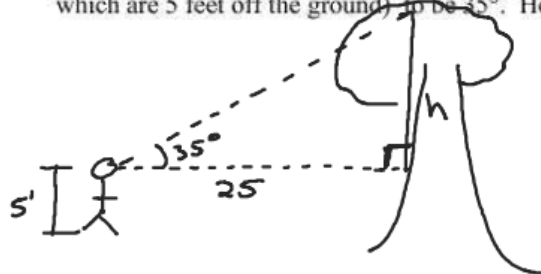
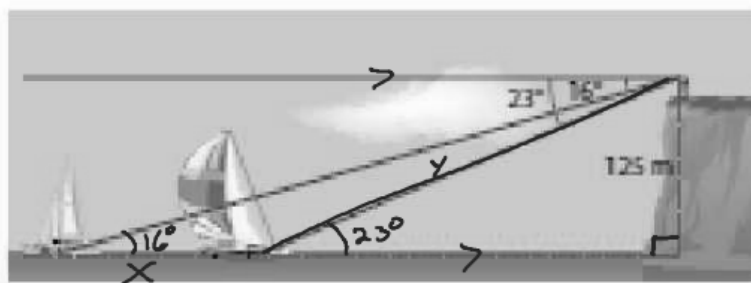$$\tan 35° = \frac{h}{25}$$
$$h = 25 \tan 35°$$
$$h = 17.5 + 5$$
$$= 22.5 \text{ ft}$$

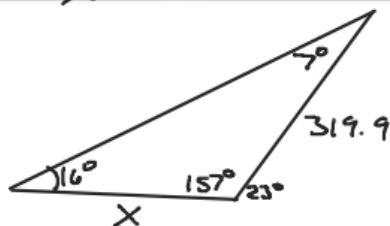**6.** From the eye of an observer at the top of a cliff 125 m from the surface of the water, the angles of depression to two sailboats, both due west of the observer, are 16° and 23°. Calculate the distance between the sailboats.

$$\sin 23° = \frac{125}{y}$$
$$y = \frac{125}{\sin 23}$$
$$= 319.9$$
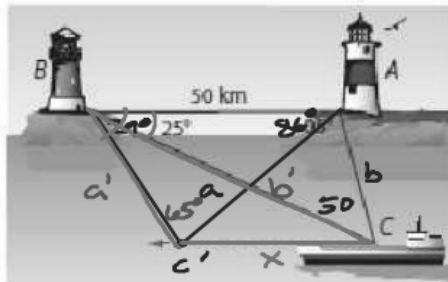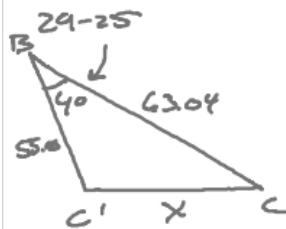
$$\frac{x}{\sin 7°} = \frac{319.9}{\sin 16}$$
$$x = \frac{319.9 \sin 7}{\sin 16}$$
$$x = 141.43 \text{ m}$$

7. Two lighthouses A and B are 50 km apart. At 2 A.M., a freighter moving parallel to line AB is sighted at point C as shown in the diagram below.

a) From lighthouse A

$$\frac{50}{\sin 50} = \frac{b}{\sin 25}$$

$$b = \frac{50 \sin 25}{\sin 50}$$

$$= 27.58$$

From LH B

$$\frac{50}{\sin 50} = \frac{a}{\sin 105}$$

$$a = \frac{50 \sin 105}{\sin 50}$$

$$= 63.04$$

[handwritten triangle: 29-25, B, 40°, 63.04, 55.0, c', x, C]

a. How far is the freighter from lighthouse B? From lighthouse A?

b. At 3 A.M., the angle at A is 86°. The angle at B is 29°. How far is the freighter from lighthouse B? From lighthouse A?

b) From LH A

$$\frac{50}{\sin 65} = \frac{b'}{\sin 29}$$

$$b' = \frac{50 \sin 29}{\sin 65}$$

$$a' = 55.03$$

From LH B

$$\frac{50}{\sin 65} = \frac{a'}{\sin 86}$$

$$a' = \frac{50 \sin 86}{\sin 65}$$

$$b' = 26.74$$

c. How far has the freighter moved in the hour between 2 A.M. and 3 A.M.?

$$x^2 = 63.04^2 + 55.03^2 - 2(63.04)(55.03)\cos 4°$$

$$x = 9 \text{ km}$$

8. The ninth hole at Duffy's Golf Club is 325 yards down a straight fairway. In his first round of golf for the season, Andy tees off and hooks the ball 20° to the left of the line from the tee to the hole. The ball stops 205 yards from the tee at point P, as shown in the figure.
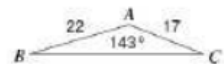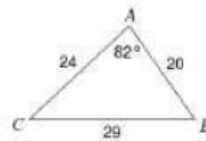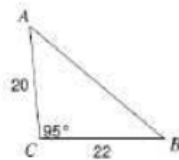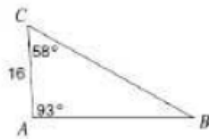
$$d^2 = 205^2 + 325^2 - 2(205)(325)\cos 20°$$

[figure: golf course with 205 yards, 325, 20°, P, Tee]
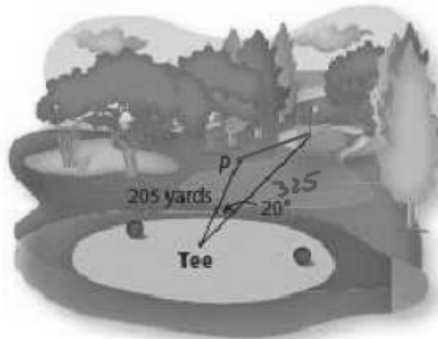
a. How far is his ball from the hole (marked by the flag)?

b. To decide which club to use on his next shot, Andy knows he hits an average of 135–145 yards with a five iron; with a four iron, he hits 145–155 yards; and with a three iron, he hits 155–165 yards. Which of these clubs would be his best choice?

9. Solve the triangles displayed below.

[three triangles: first with M, 5, H, 10, K right angle; second with 8, 73°; third with 28°, 12]
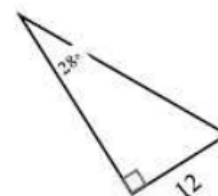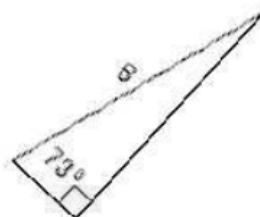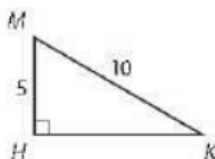
10. Solve the following triangles.
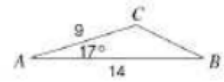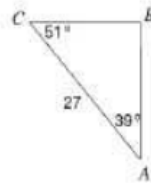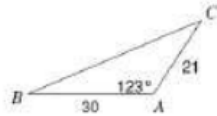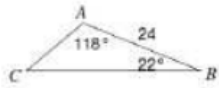
Finding the Height of the Bridge over the Royal Gorge:

The highest bridge in the world is the bridge over the Royal Gorge of the Arkansas River in Colorado. Sightings to the same point at water level is directly under the bridge are taken from each side of the 880 foot-long bridge, as indicated in the figure. How high is the bridge?

$$\frac{880}{\sin 45.3} = \frac{x}{\sin 65.5} \quad \text{or} \quad \frac{880}{\sin 45.3} = \frac{y}{\sin 69.2}$$

$$x = 1126.57 \quad \text{or} \quad y = 1157.35$$

$$\sin 69.2 = \frac{h}{1126.57} \qquad \sin 65.5 = \frac{h}{1157.35}$$

$$1053.14 \text{ ft}$$