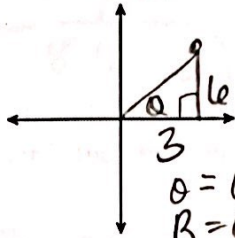


SM2H 8.5 Trigonometry Applications

For each point on the Cartesian plane, find the reference angle AND the standard angle formed by the coordinate point. Round to the hundredths place.

1. (3, 6)

$\tan^{-1}\left(\frac{6}{3}\right)$

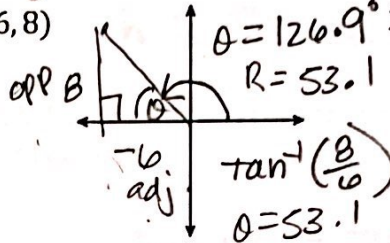


$\theta = 63.43$
 $R = 63.43$

Reference angle: 63.43°

Standard Angle: 63.43°

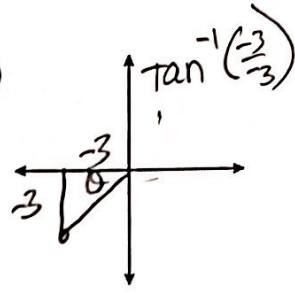
2. (-6, 8)



Reference angle: 53.13°

Standard Angle: 126.87°
 $180 - 53.13$

3. (-3, -3)

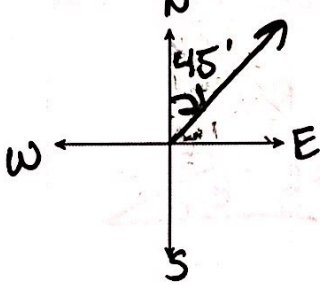


Reference angle: 45°

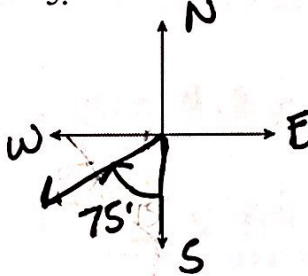
Standard Angle: 225°
 $180 + 45$

For each bearing, draw a picture and label the angle (angle to N or S).

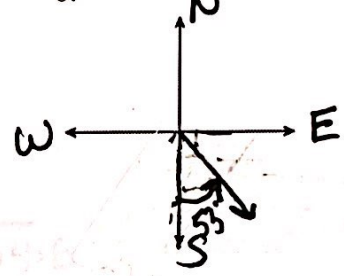
4. N 45° E



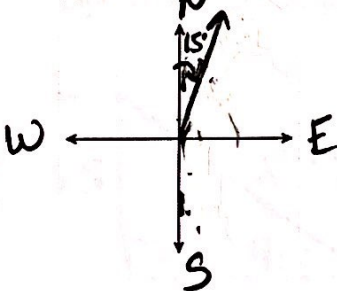
5. S 75° W



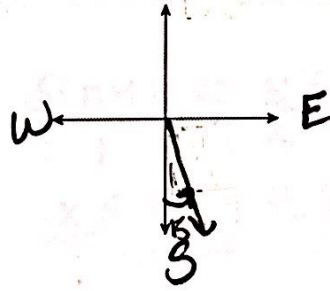
6. S 53° E



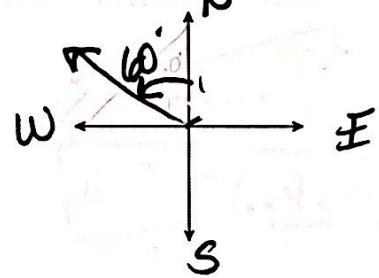
7. N 15° E



8. S 15° E

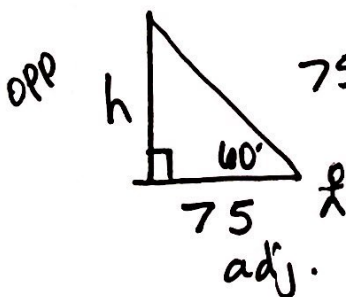


9. N 60° W



Draw and label a diagram for each of the following situations then solve the problem. Show all your work. Round your answers to the hundredths place.

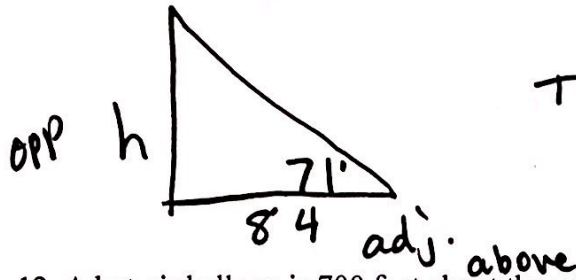
10. A person is 75 feet from the base of a barn. The angle of elevation from the level ground to the top of the barn is 60°. How tall is the barn?



$75 \cdot \tan 60 = \frac{h}{75} \cdot 75$

$h = 129.90 \text{ ft}$

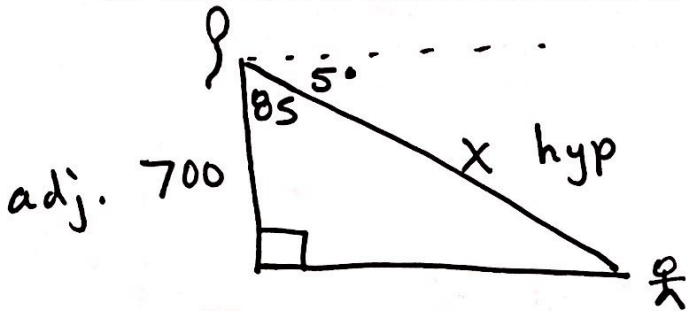
11. A rocket is launched from level ground. A person standing 84 feet from the launch site observes that the angle of elevation is 71° at the rocket's highest point. How high did the rocket reach?



$$\tan 71 = \frac{h}{84}$$

$$h = 84 \tan 71 = \boxed{243.95 \text{ ft}}$$

12. A hot-air balloon is 700 feet above the ground. The angle of depression from the balloon to an observer is 5° . How far is the observer from the hot-air balloon?

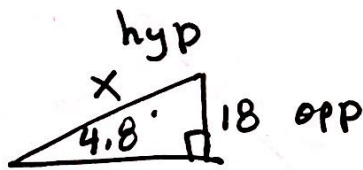


$$\cos 85 = \frac{700}{x}$$

$$\frac{x \cos 85}{\cos 85} = \frac{700}{\cos 85}$$

$$x = \boxed{8031.60 \text{ ft}}$$

13. In order to meet state building codes, a wheelchair access ramp must have an angle of elevation of no more than 4.8° and a rise of 18 inches. How long must the ramp be?

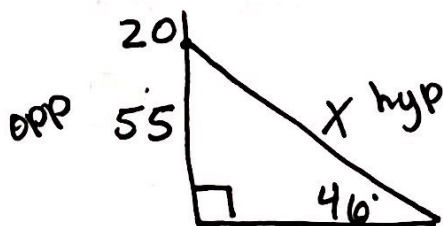


$$\frac{\sin 4.8}{1} = \frac{18}{x}$$

$$\frac{x \sin 4.8}{\sin 4.8} = \frac{18}{\sin 4.8}$$

$$x = \boxed{215.11 \text{ in.}}$$

14. An observation tower is 75 m high. A support wire is attached to the tower 20 m from the top. If the support wire and the ground form an angle of 46° , what is the length of the support wire?

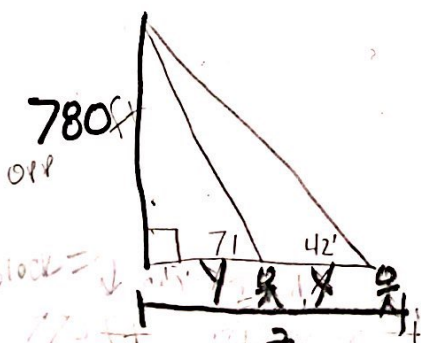


$$\frac{\sin 46}{1} = \frac{55}{x}$$

$$\frac{x \sin 46}{\sin 46} = \frac{55}{\sin 46}$$

$$x = \boxed{76.46 \text{ m}}$$

15. You are a block away from a skyscraper that is 780 ft tall. Your friend is between the skyscraper and yourself. The angle of elevation from your position to the top of the skyscraper is 42° . The angle of elevation from your friend's position to the top of the skyscraper is 71° . To the nearest foot, how far are you from your friend?



$$\tan 71 = \frac{780}{y}$$

$$\frac{y \tan 71}{\tan 71} = \frac{780}{\tan 71}$$

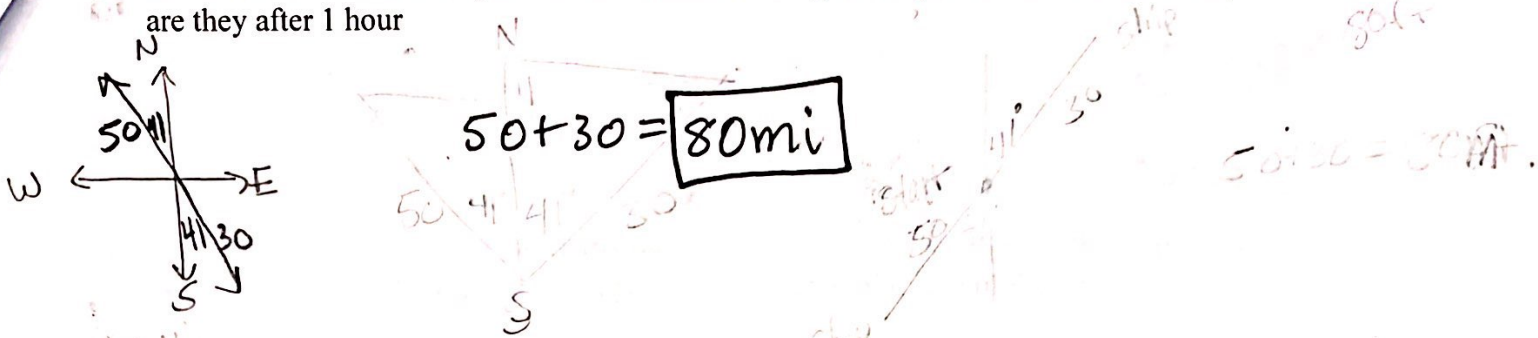
$$y = 268.58$$

$$x = \frac{\tan 42 = \frac{780}{z}}{z} = \frac{866.28}{z}$$

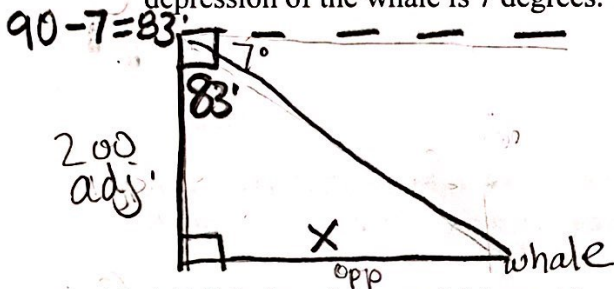
$$\frac{z \tan 42 = 780}{\tan 42} = \frac{597.70}{\tan 42}$$

$$z = 866.28 \quad \boxed{598 \text{ ft}}$$

16. Two ships leave at the same time from the same spot in the Atlantic Ocean. One has a bearing of $S 41^\circ E$ and travels 30 mph. The other has a bearing of $N 41^\circ W$ and travels 50 mph. How far apart are they after 1 hour



17. From a 200 foot observation tower on the beach, a man sights a whale in difficulty. The angle of depression of the whale is 7 degrees. How far is the whale from the shoreline?

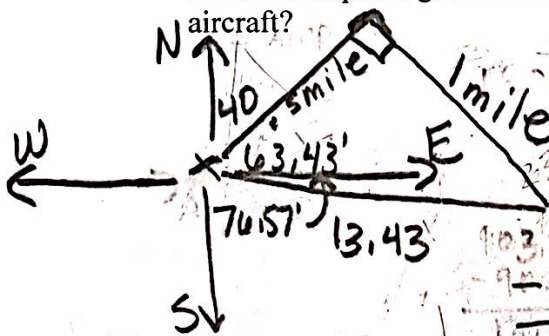


$$\tan 83 = \frac{x}{200} \quad \text{OR}$$

$$x = 200 \tan 83$$

$$x = 1628.87 \text{ ft}$$

18. A DC-9 aircraft leaves Midway Airport from a runway whose bearing is $N 40^\circ E$. After flying for $\frac{1}{2}$ mile, the pilot requests permission to turn 90° and head toward the southeast. The permission is granted. After the airplane goes 1 mile in this direction, what bearing should the control tower use to locate the aircraft?



$$\tan \theta = \frac{1}{0.5}$$

$$\theta = \tan^{-1} \left(\frac{1}{0.5} \right)$$

$$\theta = 63.43^\circ$$

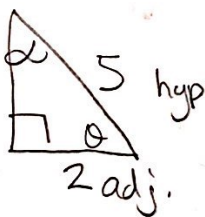
$$40 + 63.43 = 103.43$$

$$N 103.43 E$$

OR

$$S 76.57^\circ E$$

19. The hypotenuse of a right triangle is 5 inches. If one leg is 2 inches, find the degree measure of each angle.



$$\cos \theta = \frac{2}{5}$$

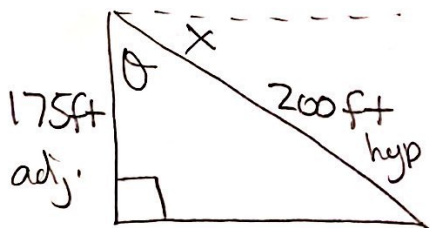
$$\theta = \cos^{-1} \left(\frac{2}{5} \right)$$

$$\theta = 66.42^\circ$$

$$\alpha = 180 - 66.4 - 90$$

$$\alpha = 23.58^\circ$$

20. A straight waterslide starts 175 feet above ground and is 200 feet long. What is the angle of depression from the top to the bottom of the slide?



$$\cos \theta = \frac{175}{200}$$

$$\theta = \cos^{-1} \left(\frac{175}{200} \right) = 28.96^\circ$$

$$x = 90 - 28.96 = 61.04^\circ$$

21. A battleship is 100 miles East and 110 miles South of its home port. What bearing should it take in order to get home quickest?

Bearing from ship to port

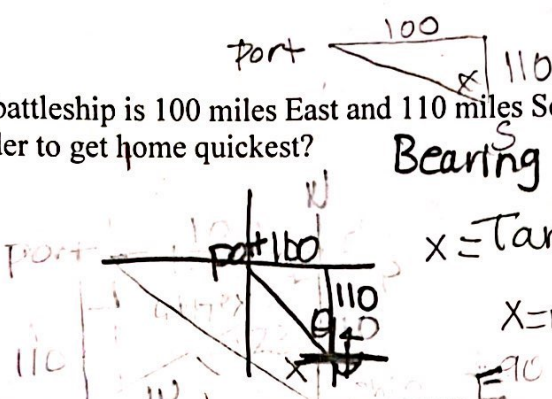
N 42.27° W

N 42.27° W

$$x = \tan^{-1}\left(\frac{100}{110}\right)$$

$$x = 42.27^\circ$$

$$= 90 - 47.7$$



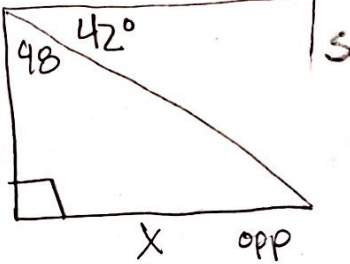
22. Kelly is standing on top of a cliff 305 feet above a lake. The measure of the angle of depression to a boat on the lake is 42 degrees. How far is the boat from the base of the cliff?

305
adj.

$$\tan 48 = \frac{x}{305}$$

$$x = 305 \tan 48$$

$$x = 338.74 \text{ ft}$$

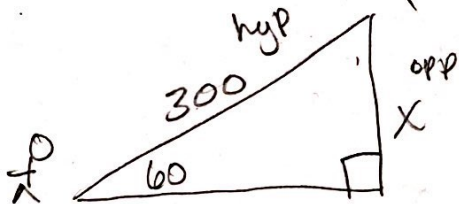


23. A boy who is flying a kite lets out 300 ft of string, which makes an angle of 60 degrees with the ground. Assuming that the string is taut, find how high the kite is above the ground.

$$\sin 60 = \frac{x}{300}$$

$$x = 300 \sin 60$$

$$x = 259.81 \text{ ft}$$



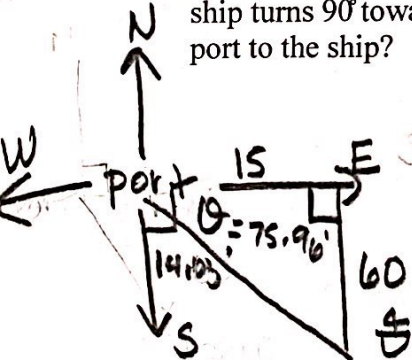
24. A ship leaves the port of Miami with a bearing of S 90° E and a speed of 15 knots. After 1 hour, the ship turns 90° toward the south. After 4 hours, maintaining the same speed, what is the bearing from the port to the ship?

$$\tan \theta = \frac{60}{15}$$

$$\theta = \tan^{-1}\left(\frac{60}{15}\right) = 75.96$$

$$90 - 75.96 = 14.03$$

S 14.03° E



25. One of the most amazing things that happens in nature is the ability of bees to make a honeycomb. Each cell of the honeycomb is a regular hexagon. If the side of one of these honeycomb cells is 2 mm, then what is its area? Use the equation $A = .5ap$ for the area of a regular polygon where A = area, a = distance center to midpoint of a side, and p = perimeter



$$p = 2 \cdot 6 = 12$$



$$a^2 + 1^2 = 2^2$$

$$a^2 + 1 = 4$$

$$a^2 = 3$$

$$a = \sqrt{3}$$

$$A = .5 \sqrt{3} \cdot 12$$

$$A = 6\sqrt{3} \text{ mm}^2$$

$$A = 10.39 \text{ mm}^2$$