

1. A penny dropped from the top of the Leaning Tower of Pisa falls to a point 14 feet from its base. If the tower is 182 feet, at what angle does it lean at the ground?

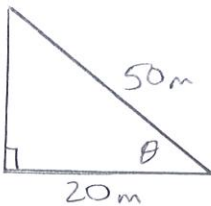


$$\cos \theta = \frac{14}{182}$$

$$\cos^{-1}\left(\frac{14}{182}\right) = \theta$$

$$\theta \approx 86^\circ$$

2. Beyoncé is on stage at her concert and you are standing 20 meters away from the base of her stage. If she goes down a 50 meter slide off of her stage and knocks you over, what is the angle the slide makes with the floor?

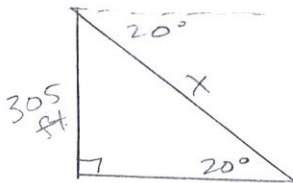


$$\cos \theta = \frac{20}{50}$$

$$\cos^{-1}\left(\frac{20}{50}\right) = \theta$$

$$\theta \approx 66^\circ$$

3. You are at the top of the Statue of Liberty and see a boat in the Hudson River. The Statue of Liberty is 305 feet and the angle of depression to the boat is  $20^\circ$ . What is the direct distance from you to the boat?

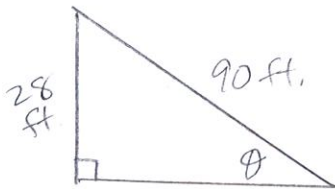


$$\sin 20 = \frac{305}{x}$$

$$x = \frac{305}{\sin 20}$$

$$x \approx 891.76 \text{ ft.}$$

4. A 90-foot escalator rises 28 feet vertically. What is the angle that the escalator makes with the floor?

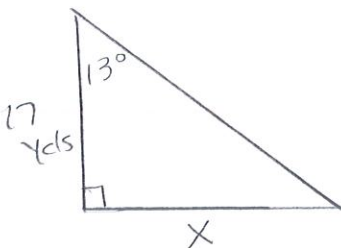


$$\sin \theta = \frac{28}{90}$$

$$\sin^{-1}\left(\frac{28}{90}\right) = \theta$$

$$\theta \approx 18^\circ$$

5. A guy wire supports a telephone pole. If the pole is 17 yards tall and the angle between the wire and the pole is  $13^\circ$ , how far is the base of the wire from the base of the pole?

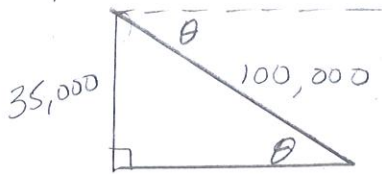


$$\tan 13 = \frac{x}{17}$$

$$17 \tan 13 = x$$

$$x \approx 3.92 \text{ yds}$$

6. A plane is flying at an altitude of 35,000 feet. The direct distance between the plane and the runway is 100,000 feet. What angle of descent must the pilot fly so that he lands at the beginning of the runway?

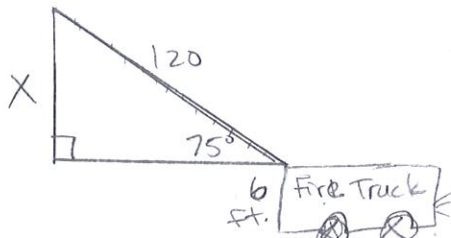


$$\sin \theta = \frac{35,000}{100,000}$$

$$\sin^{-1}\left(\frac{35,000}{100,000}\right) = \theta$$

$$\theta \approx 20^\circ$$

7. A ladder is mounted on a fire truck, six feet above the ground. If the maximum length of the ladder is 120 feet and the maximum angle to which it can be raised is  $75^\circ$ , how high up will it reach?



$$\sin 75 = \frac{X}{120}$$

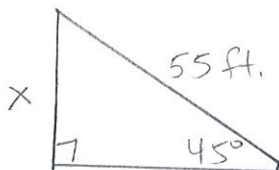
$$120 \sin 75 = X$$

$$X \approx 115.91$$

$$115.91 + 6$$

$$\approx 121.91 \text{ ft.}$$

8. A 55-foot line is attached to a kite. When the kite has pulled the line taut (tight), the angle of elevation to the kite is approximately  $45^\circ$ . Approximate the height of the kite.

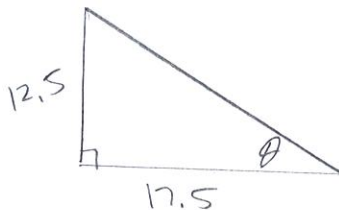


$$\sin 45 = \frac{X}{55}$$

$$X = 55 \sin 45$$

$$X \approx 38.89 \text{ ft.}$$

9. The height of an outdoor basketball backboard is  $12 \frac{1}{2}$  feet, and the backboard casts a shadow  $17 \frac{1}{2}$  feet long. Approximate the angle of elevation of the sun.

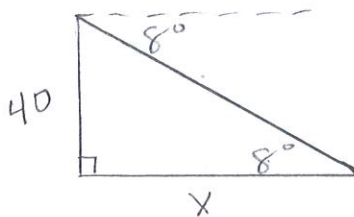


$$\tan \theta = \frac{12.5}{17.5}$$

$$\tan^{-1}\left(\frac{12.5}{17.5}\right) = \theta$$

$$\theta \approx 36^\circ$$

10. From a 40-foot observation tower on the coast, a Coast Guard officer sights a boat in difficulty. The angle of depression of the boat is  $8^\circ$ . How far is the boat from the shoreline?

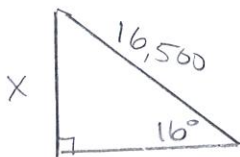


$$\tan 8 = \frac{40}{X}$$

$$X = \frac{40}{\tan 8}$$

$$X \approx 284.61 \text{ ft.}$$

11. During takeoff, an airplane's angle of climb is  $16^\circ$  and its speed is 275 feet per second. Approximate the plane's altitude after 1 minute.



$$\sin 16 = \frac{X}{16,500}$$

$$16,500 \sin 16 = X$$

$$X \approx 4548.02 \text{ feet}$$

$$\frac{275 \text{ ft}}{1 \text{ sec}} \cdot \frac{60 \text{ sec}}{1 \text{ minute}} = 16,500 \text{ ft/min}$$