

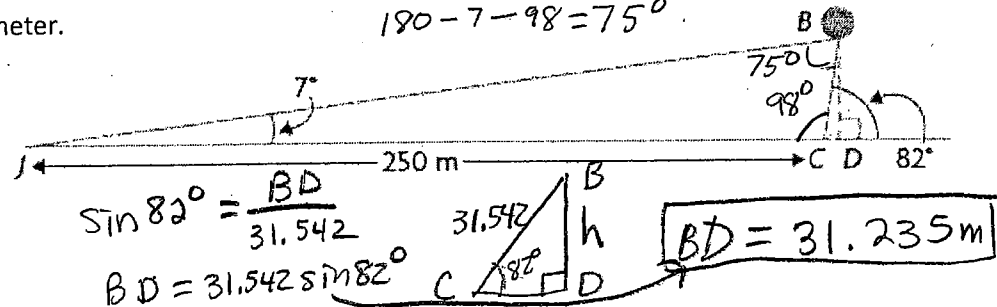
1. Colleen and Jose observed a tethered balloon advertising the opening of a new fitness center. They were 250 meters apart, joined by a line that passed directly below the balloon, and were on the same side of the balloon. Jose observed the balloon at an angle of elevation of 7° while Colleen observed the balloon at an angle of elevation of 82° . Determine the height of the balloon to the nearest meter.

$$180 - 7 - 98 = 75^\circ$$

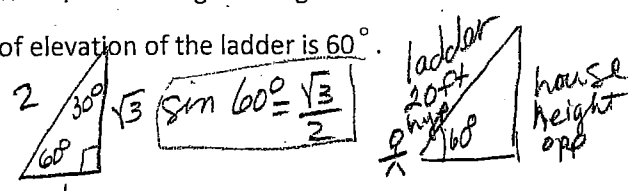
$$\frac{250}{\sin 75^\circ} = \frac{BC}{\sin 7^\circ}$$

$$BC = \frac{250 \sin 7^\circ}{\sin 75^\circ}$$

$$BC = 31.542 \text{ m}$$



2. A ladder 20 feet long leans against the side of a house. Find the height from the top of the ladder to the ground if the angle of elevation of the ladder is 60° .



$$\sin 60^\circ = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 60^\circ = \frac{h}{20}$$

$$h = 20 \sin 60^\circ$$

$$h = 20 \left(\frac{\sqrt{3}}{2} \right)$$

$$h = 10\sqrt{3} = 17.321 \text{ ft}$$

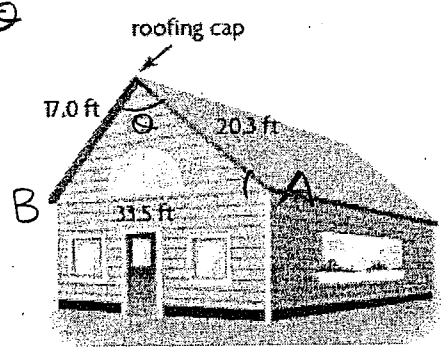
3. The roof of a house consists of two slanted sections, as shown. A roofing cap is being made to fit the crown of the roof, where the two slanted sections meet. Determine the measure of the angle needed for the roofing cap, to the nearest tenth of a degree.

$$33.5^2 = 17^2 + 20.3^2 - 2(17)(20.3) \cos \theta$$

$$1122.25 = 289 + 412.09 - 690.2 \cos \theta$$

$$421.16 = -690.2 \cos \theta$$

$$\boxed{127.6^\circ = \theta}$$



a) Determine the angle of elevation for each roof section, to the nearest tenth of a degree.

$$\frac{17}{\sin A} = \frac{33.5}{\sin 127.6^\circ}$$

$$\sin A = \frac{17 \sin 127.6^\circ}{33.5}$$

$$A = 23.7^\circ \quad B = 28.7^\circ$$

4. Standing on top of a 235 foot tall building, you spot your friend on the ground who is 94 feet away from the building.

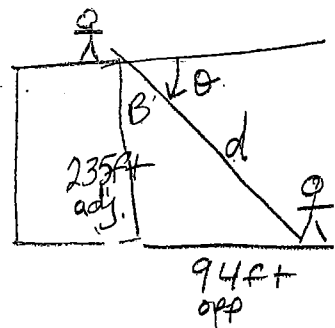
a) What is the angle of depression you had to look to spot your friend?

$$\tan B = \frac{94}{235}$$

$$B = \tan^{-1} \left(\frac{94}{235} \right)$$

$$B = 21.8^\circ$$

$$\theta = 68.2^\circ$$

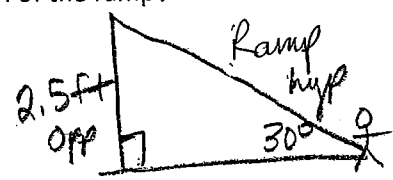


b) What is the distance between you and your friend?

$$\sin 21.8^\circ = \frac{94}{d}$$

$$d = \frac{94}{\sin 21.8^\circ} = \boxed{253.118 \text{ ft}}$$

5. The entrance of the old town library is 2.5 feet above the ground level. A ramp from the ground level to the library entrance is scheduled to be built. The angle of elevation from the base of the ramp to its top is to be 30° . Find the length of the ramp.



$$\sin 30^\circ = \frac{2.5}{R}$$

$$R = \frac{2.5}{\sin 30^\circ}$$

$$R = \frac{2.5}{\frac{1}{2}}$$

$$\boxed{R = 5 \text{ feet}}$$

6. Mark is a landscaper who is creating a triangular planting garden. The homeowner wants the garden to have two equal sides and contain an angle of 135° . Also, the longest side of the garden must be exactly 5 meters.

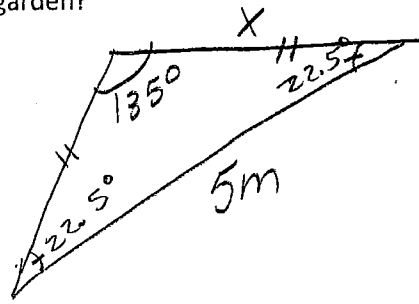
a) How long is the plastic edging that Mark needs to surround the garden?

$$180 - 135 = 45 \div 2 = 22.5^\circ$$

$$\frac{5}{\sin 135^\circ} = \frac{x}{\sin 22.5^\circ}$$

$$x = \frac{5 \sin 22.5^\circ}{\sin 135^\circ}$$

$$x = 2.706 \text{ m}$$



b) Determine the area of the garden.

$$\text{Area} = \frac{1}{2} (2.706)(2.706) \sin 135^\circ$$

$$\text{Area} = 2.589 \text{ m}^2$$

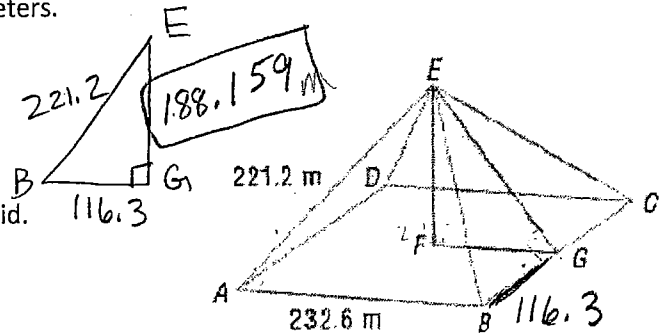
7. The Great Pyramid at Giza in Egypt has a square base with sides of 232.6 meters long. The distance from the top of the pyramid to each corner of the base was originally 221.2 meters.

a) Determine the angle each face makes with the base.

$$\cos G = \frac{116.3}{188.159}$$

$$G = 51.823^\circ$$

b) Determine the size of the apex angle of a face of the pyramid.



8. A steel cable zip-line is being constructed for competition on a reality television show. One end of the zip-line is attached to a platform on top of a 150 foot pole. The other end of the zip-line is attached to the top of a 5 foot stake. The angle of elevation from the top of the stake to the top of the platform is 23° .

a) How long is the zip-line?

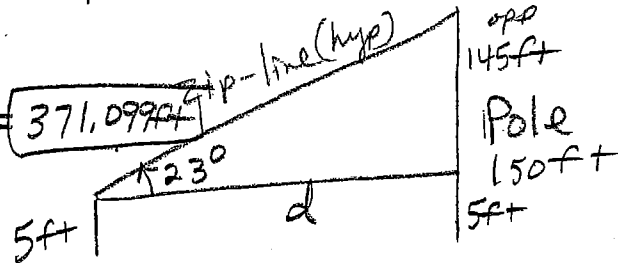
$$\sin 23^\circ = \frac{145}{z}$$

b) How far is the stake from the pole?

$$z = \frac{145}{\sin 23^\circ} = 371.099 \text{ ft}$$

$$\tan 23^\circ = \frac{145}{d}$$

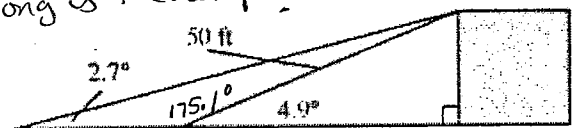
$$d = \frac{145}{\tan 23^\circ} = 341.599 \text{ ft}$$



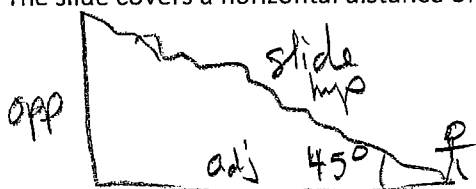
9. A 50-foot ramp makes an angle of 4.9° with the horizontal. To meet new accessibility guidelines, a new ramp must be built so it makes an angle of 2.7° with the horizontal. How long is the ramp?

$$\frac{50}{\sin 2.7^\circ} = \frac{\text{ramp}}{\sin 175.1^\circ}$$

$$\text{ramp} = \frac{50 \sin 175.1^\circ}{\sin 2.7^\circ} = 90.664 \text{ ft}$$



10. The angle of elevation from the bottom of the world's longest slide, located in Peru, Vermont, is approximately 45° . The slide covers a horizontal distance of 821 feet. Find the length of the slide.



$$\cos 45^\circ = \frac{821}{\text{slide}}$$

$$\text{slide} = \frac{821}{\cos 45^\circ} = \frac{821}{\frac{\sqrt{2}}{2}} = 1161.069 \text{ ft}$$

11. The roof of a house is being reconstructed to accommodate heavy snows. The current 32-foot roofline makes an 18.2° angle with the horizontal. The owner has decided to construct the new roof so that it makes a 50° angle with the horizontal.

a) What will be the length of the new roofline?

$$\frac{\text{roofline}}{\sin 108.2^\circ} = \frac{32}{\sin 40^\circ}$$

$$\text{roofline} = \frac{32 \sin 108.2}{\sin 40^\circ}$$

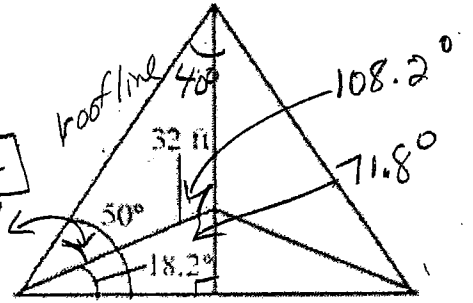
$$\boxed{\text{roofline} = 47.293 \text{ ft}}$$

b) How much higher will the new roof be?

$$\frac{\text{height}}{\sin 31.8^\circ} = \frac{32}{\sin 40^\circ}$$

$$\text{height} = \frac{32 \sin 31.8^\circ}{\sin 40^\circ}$$

$$\boxed{\text{height} = 26.234 \text{ ft}}$$



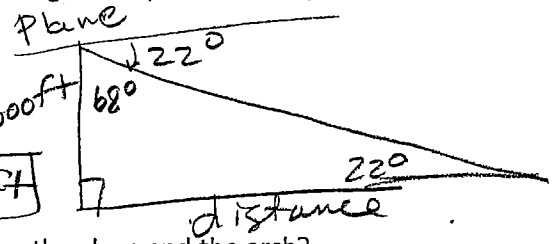
12. A plane is flying at an elevation of 35,000 feet within sight of the Gateway Arch in St. Louis, Missouri. The pilot would like to estimate her distance from the Arch. She finds that the angle of depression to a point on the ground below the arch is 22° .

a) What is the distance between the plane and the arch?

$$\tan 22^\circ = \frac{35000}{d}$$

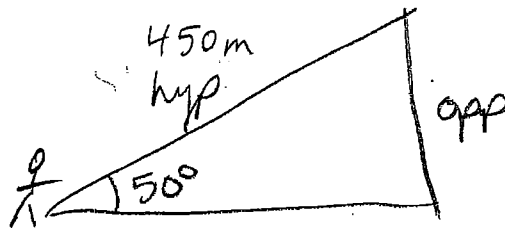
$$d = \frac{35000}{\tan 22^\circ}$$

$$d = \boxed{86,628.040 \text{ ft}}$$



b) What is the distance between a point on the ground directly below the plane and the arch? (along the ground)

13. A man is lying on the beach, flying a kite. He holds the end of the kite string at ground level and estimates the angle of elevation of the kite to be 50° . If the string is 450 feet long, how high is the kite above the ground?



$$\sin 50^\circ = \frac{\text{opp}}{450}$$

$$\text{opp} = 450 \sin 50^\circ$$

$$\boxed{= 344.720 \text{ m}}$$

