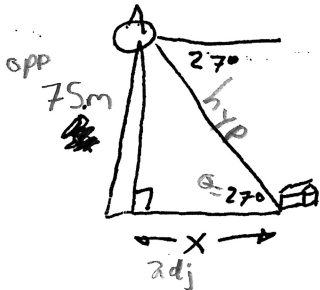


PROBLEM SOLVING WITH TRIGONOMETRY

For the following word problems, include a **diagram** of a triangle with all information labeled, show **all steps** neatly, and write a final **concluding statement**. Round all answers to **one decimal place**.

1. A fire tower is 75 m high. From the top of the tower, the angle of depression to a cabin is 27° . Find the distance from the cabin to the tower.



$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

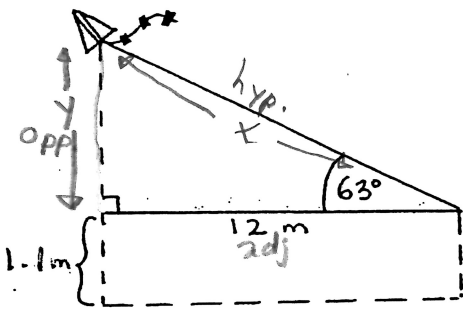
$$\tan(27^\circ) = \frac{75}{x}$$

$$\frac{75}{\tan(27^\circ)} = \frac{75}{\tan(27^\circ)} \times x$$

$$x \tan(27^\circ) = \frac{75}{\tan(27^\circ)}$$

$$x \approx 147.2 \text{ m}$$

2.



- a) Find the length of string attached to the kite.

$$\cos \theta = \frac{\text{adj}}{\text{hyp}}$$

$$\cos(63^\circ) = \frac{12}{x}$$

$$\frac{x \cos(63^\circ)}{\cos(63^\circ)} = \frac{12}{\cos(63^\circ)}$$

$$x \approx 26.4 \text{ m}$$

- b) How high is the kite?

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\tan(63^\circ) = \frac{y}{12}$$

$$y = 12 \tan(63^\circ)$$

$$y = 23.6 \text{ m}$$

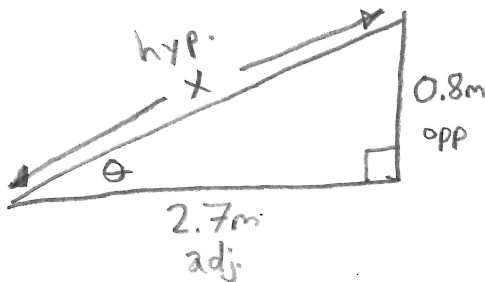
$$\text{height} = 1.1 + y$$

$$= 1.1 + 23.6$$

$$\approx 24.7 \text{ m}$$

3. A wheelchair ramp at the entrance to a public library rises 0.8 metres over a horizontal distance of 2.7 m. $\approx 24.7 \text{ m}$

Diagram



- (a) At what angle is the ramp to the ground?

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\tan \theta = \frac{0.8}{2.7}$$

$$\theta = \tan^{-1}\left(\frac{0.8}{2.7}\right)$$

$$\theta \approx 16.5^\circ$$

- (b) How long is the ramp?

$$c^2 = a^2 + b^2$$

$$x^2 = 0.8^2 + 2.7^2$$

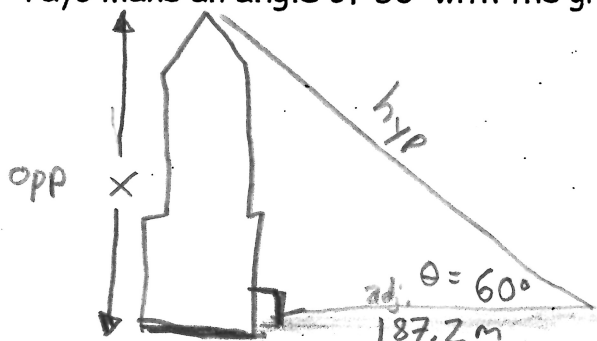
$$x^2 = 0.64 + 7.29$$

$$\sqrt{x^2} = \sqrt{7.93}$$

$$x \approx 2.8 \text{ m}$$

Answers: (1) 147.2 m (2) a) 26.4 m b) ~~15.3 m~~ 24.7 m (3) a) 16.5° b) 2.8 m (4) 324.2 m
 (5) 9.0° (6) 25.1 m (7) 67.4° , 22.6° (8) 4.6 m

4. The Chrysler Building in New York casts a shadow that is 187.2 m long when the sun's rays make an angle of 60° with the ground. How high is the Chrysler Building?



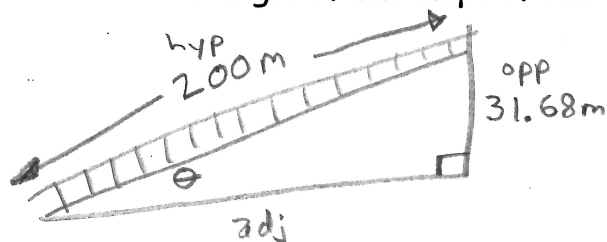
$$\tan \theta = \frac{\text{opp.}}{\text{adj.}}$$

$$\tan(60^\circ) = \frac{x}{187.2}$$

$$x = 187.2 \tan(60^\circ)$$

$$x \approx 324.2 \text{ m}$$

5. A mountain railway track in B.C. rises 31.68 metres in 200 metres of track length. Calculate the angle of the slope of the track.



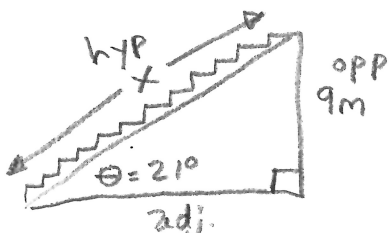
$$\sin \theta = \frac{\text{opp}}{\text{hyp}}$$

$$\sin \theta = \frac{31.68}{200}$$

$$\theta = \sin^{-1}\left(\frac{31.68}{200}\right)$$

$$\theta \approx 9.1^\circ$$

6. An escalator rises 9 metres vertically and makes an angle of 21° with the horizontal. What is the length of the sloping escalator?



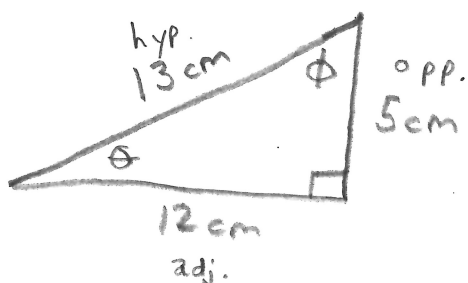
$$\sin \theta = \frac{\text{opp}}{\text{hyp}}$$

$$\frac{\sin(21^\circ)}{1} = \frac{9}{x}$$

$$x \frac{\sin(21^\circ)}{\sin(21^\circ)} = \frac{9}{\sin(21^\circ)}$$

$$x \approx 25.1 \text{ m}$$

7. Find the size of the angles of a right angle triangle with sides 5 cm, 12 cm, and 13 cm. (Hint: Which side has to be the hypotenuse and which angle has to be 90° ?)



$$\tan \theta = \frac{\text{opp.}}{\text{adj.}}$$

$$\tan \theta = \frac{5}{12}$$

$$\theta = \tan^{-1}\left(\frac{5}{12}\right)$$

$$\theta \approx 22.6^\circ$$

$$\phi = 180^\circ - 90^\circ - \theta$$

$$= 180^\circ - 90^\circ - 22.6^\circ$$

$$\phi \approx 67.4^\circ$$

8. The angle of elevation of the top of a flagpole, from a point 10 m from the base of the flagpole and 1 m above the ground, is 70° . Find the height of the flagpole.

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\frac{\tan(70^\circ)}{1} = \frac{x}{10}$$

$$x = 10 \tan(70^\circ)$$

$$x \approx 27.5 \text{ m}$$

$$\text{height} = x + 1$$

$$= 27.5 + 1$$

$$\approx 28.5 \text{ m}$$

