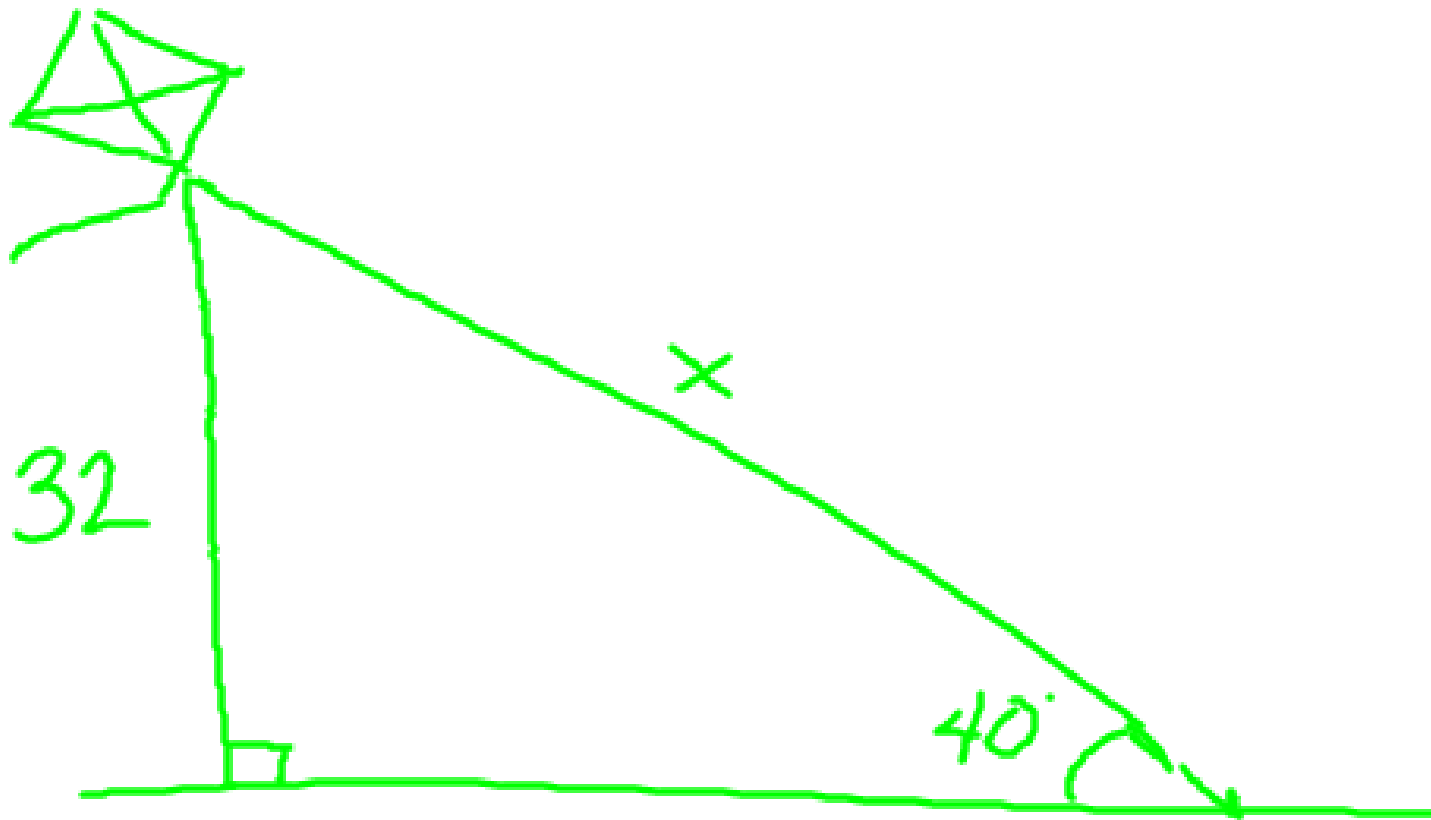


Angle of Elevation:

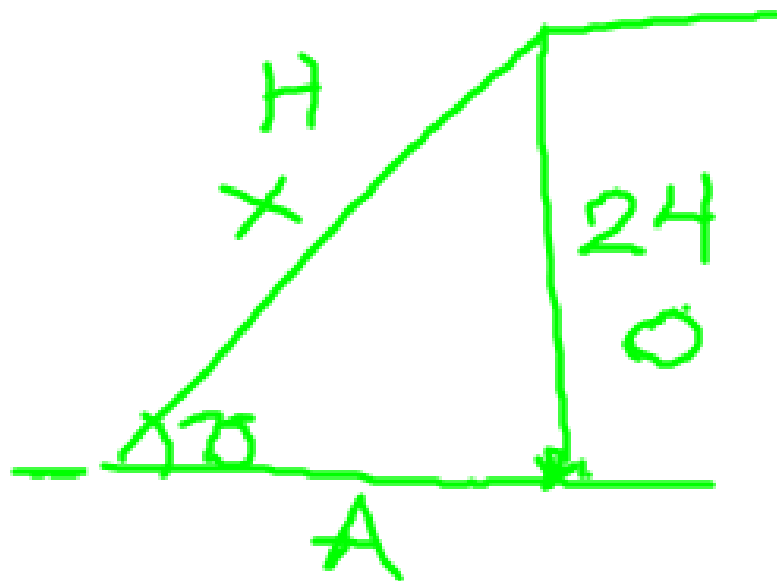
Janie is displaying a kite that she made. The kite is attached to a stake in the ground. The kite is 32 m above the ground, and makes an angle of 40 with the ground. How long is the kite string?



7. Orlando is looking at a flyer for a home-improvement store. He wants to buy a ladder to use around his home. The highest point of his two-storey house is 24 ft. Ladders must have an angle of elevation of 75° to be used safely.



- Which ladder could reach the highest point of Orlando's house safely?
- Orlando's neighbour offers to lend him a 24-ft extension ladder so he does not have to buy one. The neighbour says that Orlando can use this ladder safely to reach the highest point of his house. Is this correct? Why or why not?



$$\sin \theta = \frac{O}{H}$$

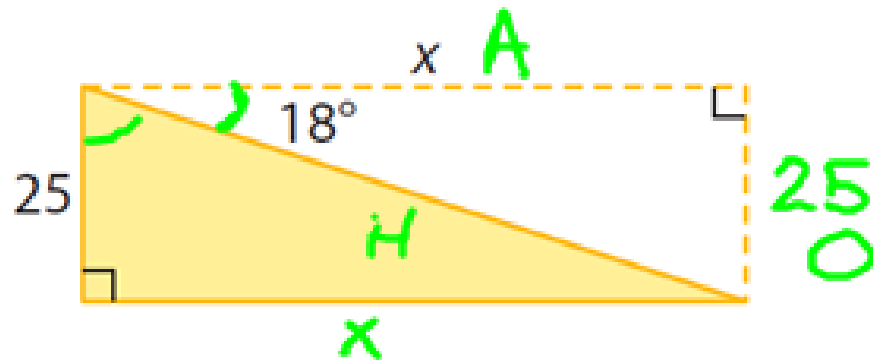
$$\sin 75 = \frac{24}{x}$$

$$x \cdot 0.97 = \frac{24}{0.97} \cdot x$$

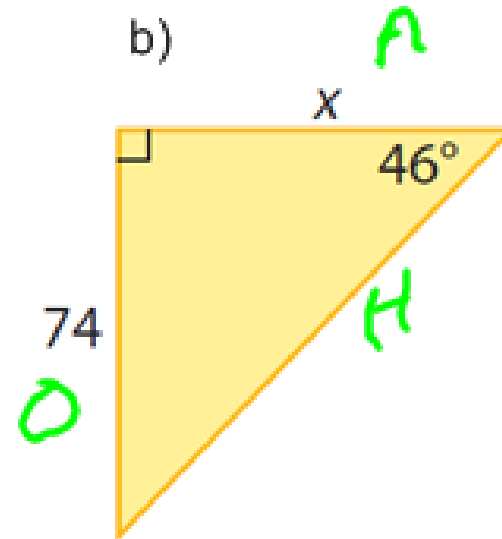
$$\frac{0.97x = 24}{0.97} \quad \frac{24}{0.97}$$

$$x = 24.75$$

1 a)



b)



$$\tan \theta = \frac{O}{A}$$

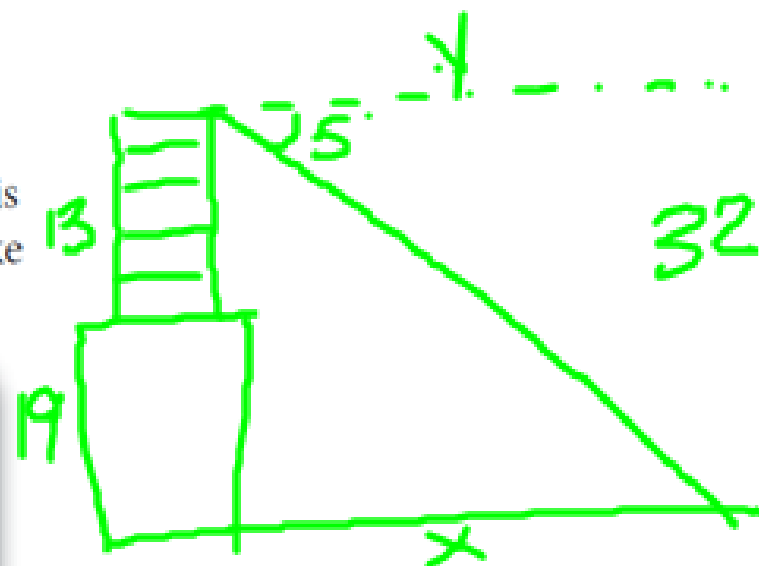
$$\frac{0.325x}{0.325} = \frac{25}{0.325}$$

$$\tan 18 = \frac{25}{x}$$

$$x = 76.92$$

$$x \cdot 0.325 = \frac{25}{x} \cdot x$$

Emily is touring historical lighthouses in Nova Scotia. While she is at the top of the Peter Island lighthouse, she notices that she can see Sweetcake Cove across the water to the southwest. The lighthouse is 13 m high and its base is 19 m above the water. Emily estimates that she looks down at the cove with an **angle of depression** of 5° . What is the approximate horizontal distance from the lighthouse to Sweetcake Cove, to the nearest metre?



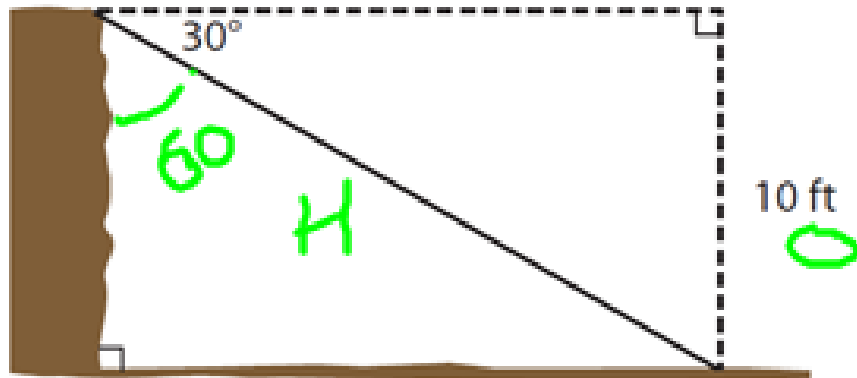
$$13 + 19 = 32$$



$$\tan 5 = \frac{32}{x}$$

$$0.0874 = \frac{32}{x}$$

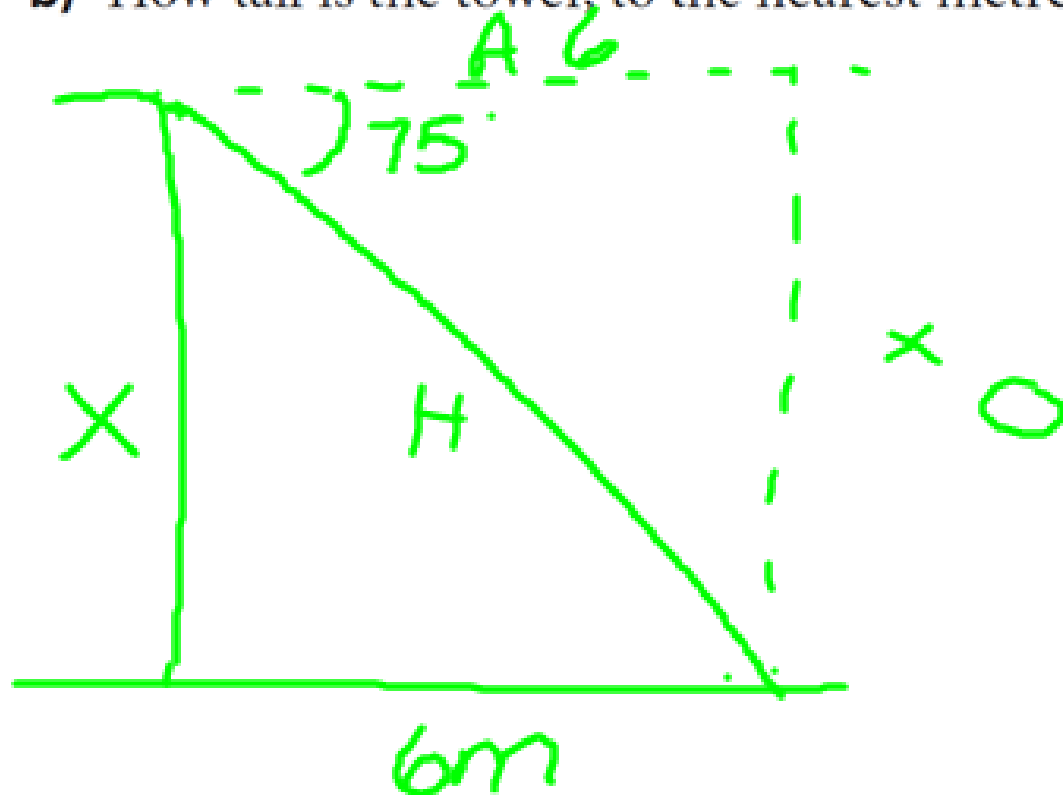
Ben drives an excavator. His job is to dig holes in the ground for basements or swimming pools. He uses a sloped ramp leading down into the excavation area to get his machine safely into and out of the hole. This angle of depression is 30° . The excavation is 10 feet deep.



- What trigonometric ratio would you use to find the length of the ramp?
- Calculate the length of the ramp, to the nearest foot.

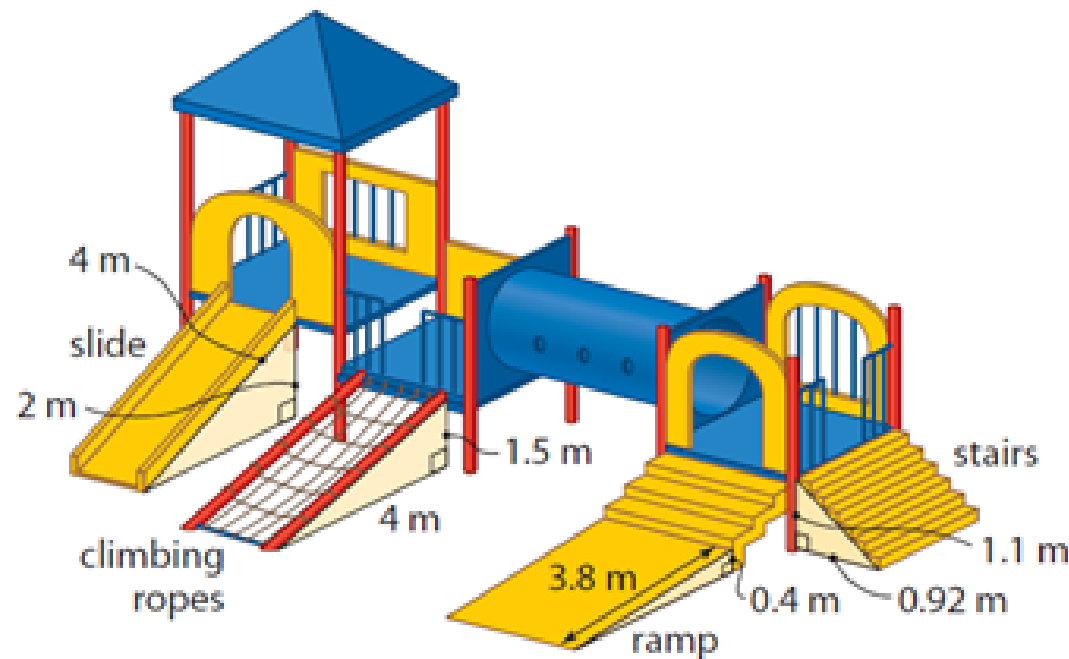
A guy wire supporting a tower must be attached to the tower at an angle of depression of 75° . The guy wire is anchored to the ground 6 m from the base of the tower.

- a) What angle does the wire make with the tower? How do you know?
- b) How tall is the tower, to the nearest metre?



$$\begin{aligned}\tan \theta &= \frac{O}{A} \\ \tan 75 &= \frac{x}{6} \\ 6 \cdot 3.73 &= \frac{x}{6} \cdot 6 \\ 22.38 &= x\end{aligned}$$

Alan and Amy are part of a charity that builds playgrounds for young children. They are studying the playground designs to make sure they meet safety specifications before building starts. They use a table to organize their findings.



Playground Part	Safe Angle	Actual Angle (°)	Safe? (Yes/No)
Slide	Angle of depression of 50° or less		
Staircase to bridge	Angle of elevation of 35° or less		
Ramp	Angle of elevation of 7° or less		
Climbing ropes	Angle of depression of 75° or less		

A security camera is installed on an 8-m pole above a parking lot to watch the entrance to a convenience store. The pole is 20 m from the entrance. The camera operates properly at an angle of depression of 25° .

- a)** At the correct operating angle, how far, horizontally, can the camera's view reach?
- b)** Can the camera's view reach the entrance? If not, what height of pole should the camera be installed on to monitor the entrance?

From the top of a bridge over the Victoria River in Newfoundland and Labrador, Maria looks down at a sailboat at an angle of depression of 13° . The bridge is 22 m above the water.

- a)** Estimate the horizontal distance from the bridge to the sailboat.
- b)** Calculate the horizontal distance from the bridge to the sailboat. Express your answer to the nearest metre.
- c)** How does your calculation compare to your estimate? Explain.

Practice:

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1, 2, 5, 6