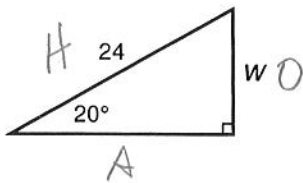


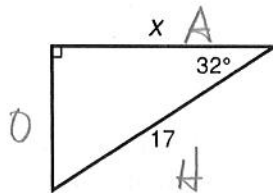
In the following problems, please round lengths to the nearest *hundredth*, and angle measures to the nearest *tenth*.

In problems 1-6, find the value of the missing side or angle measure. All lengths are in centimeters.

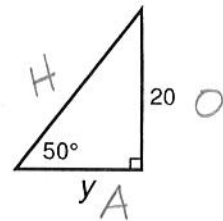
1. 8.21



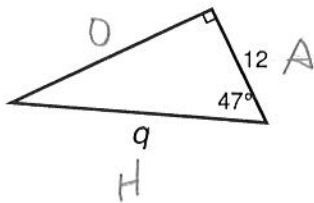
2. 14.42



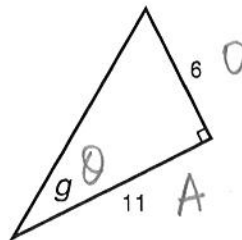
3. 16.81



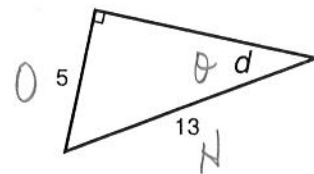
4. 17.60



5. 28.6°

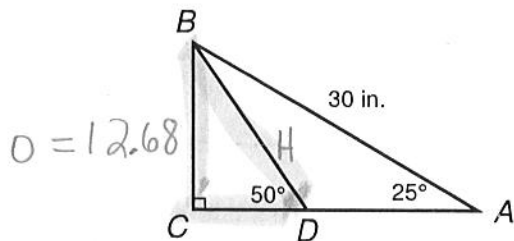


6. 22.6



In problems 7 and 8, find the indicated measures.

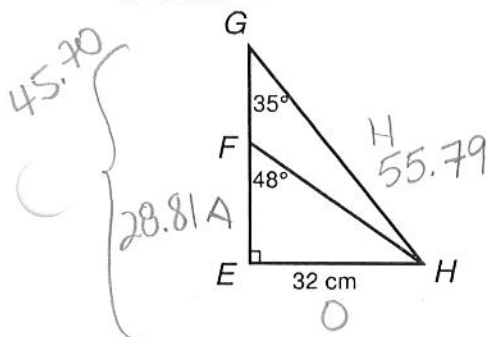
7. Find:



a. $BC =$ 12.68 in

b. $BD =$ 16.55 in

8. Find:



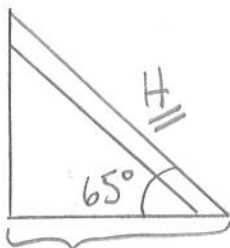
a. $EF =$ 28.81 cm

b. $EG =$ 45.70 cm

c. $FG =$ 16.89 cm

In problems 9-23, solve the problem.

9. A ladder is leaning against the side of a house and forms a 65° angle with the ground. The foot of the ladder is 8 feet from the house. Find the length of the ladder.

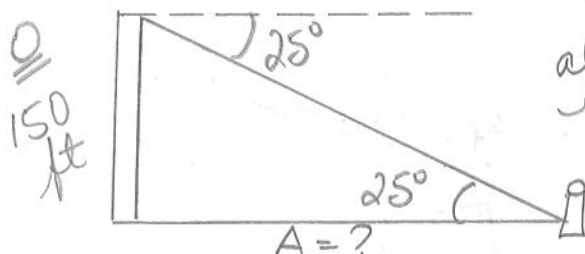


$$\cos \theta = \frac{A}{H}$$

$$H = \frac{A}{\cos \theta} = \frac{8 \text{ ft}}{\cos 65^\circ} = 18.93 \text{ ft}$$

$$l = 18.93 \text{ ft}$$

10. A lighthouse built at sea level is 150 feet high. From its top, the angle of depression of a buoy is 25° . Find the distance from the buoy to the foot of the lighthouse.



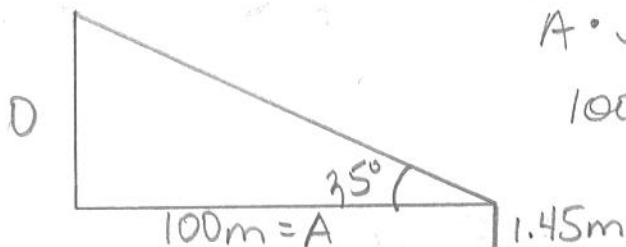
alternate interior

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

$$A = \frac{150 \text{ ft}}{\tan 25^\circ} =$$

$$d = 321.68 \text{ ft}$$

11. A surveyor is 100 meters from a bridge. The angle of elevation to the top of the bridge is 35° . The surveyor's instrument is 1.45 meters above the ground. Find the height of the bridge.



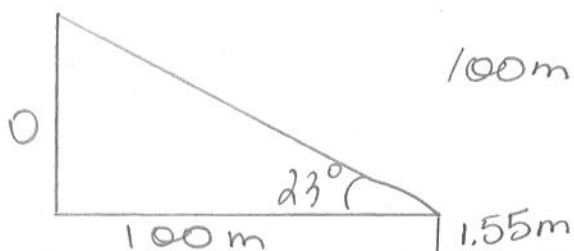
$$A \cdot \tan \theta = \frac{O}{A} \cdot A$$

$$100 \text{ m} \cdot \tan 35^\circ = O$$

$$h = 70.02 + \frac{1.45}{\tan 35^\circ}$$

$$71.47 \text{ m} = h$$

12. A surveyor is 100 meters from a building. The angle of elevation to the top of the building is 23° . The surveyor's instrument is 1.55 meters above the ground. Find the height of the building.

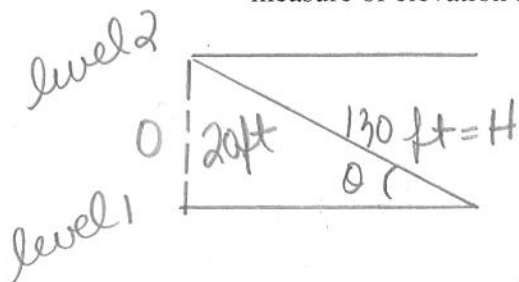


$$100 \text{ m} \cdot \tan 23^\circ = O$$

$$42.45 \text{ m} + 1.55 \text{ m} = 44 \text{ m}$$

$$h = 44.00 \text{ m}$$

13. In a parking garage, each level is 20 feet apart. Each ramp to a level is 130 feet long. Find the measure of elevation for each ramp.



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

$$\theta = \sin^{-1} \left(\frac{O}{H} \right)$$

$$= \sin^{-1} \left(\frac{20 \text{ ft}}{130 \text{ ft}} \right)$$

$$\theta = 8.85^\circ$$

$$\theta = 8.85^\circ$$

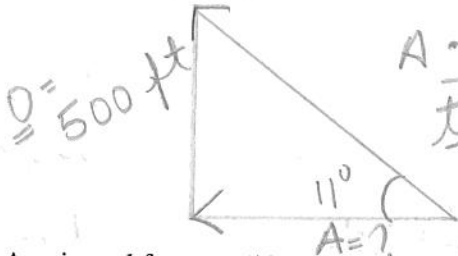
14. A train in the mountains rises 10 feet for every 250 feet it moves along the track. Find the angle of elevation of the track.



$\theta = 2.29^\circ$

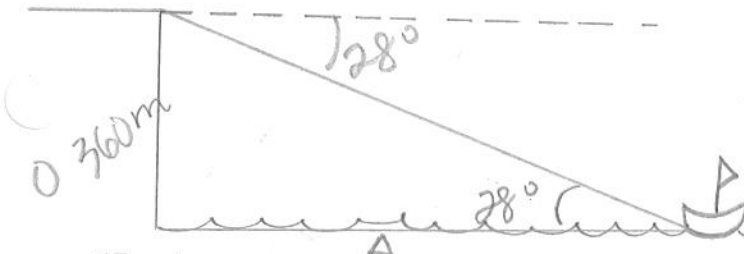
$\tan \theta = \frac{O}{A}$ $\theta = \text{inv tan} \left(\frac{O}{A} \right)$

15. A plane rose from take-off and flew at an angle of 11° with the ground. When it reached an altitude of 500 feet, what was the horizontal distance the plane had flown?



$A \cdot \frac{\tan \theta}{\tan \theta} = \frac{O \cdot A}{A \tan \theta}$
 $= \frac{500 \text{ ft}}{\tan 11^\circ} = 2572.28 \text{ ft}$

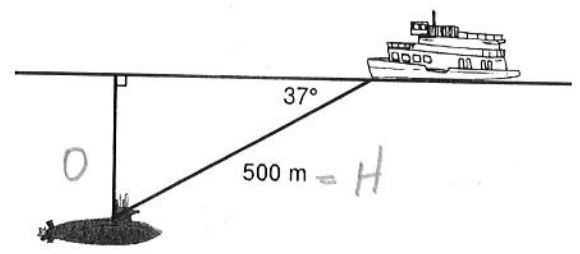
16. As viewed from a cliff 360 m above sea level, the angle of depression of a ship is 28° . How far is the ship from the shore?



$A \cdot \frac{\tan \theta}{\tan \theta} = \frac{O \cdot A}{A \tan \theta}$
 $A = \frac{360 \text{ m}}{\tan 28^\circ} = 677.06 \text{ m}$

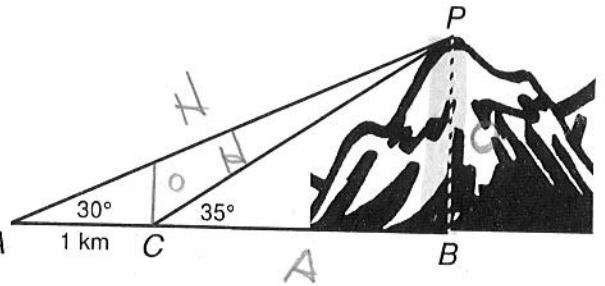
17. A sonar operator on a cruiser detects a submarine at a distance of 500 m and an angle of depression of 37° . How deep is the submarine?

$H \cdot \frac{\sin \theta}{\sin \theta} = \frac{O}{H} \cdot H$
 $500 \text{ m} \cdot \sin 37^\circ = O$
 300.91 m



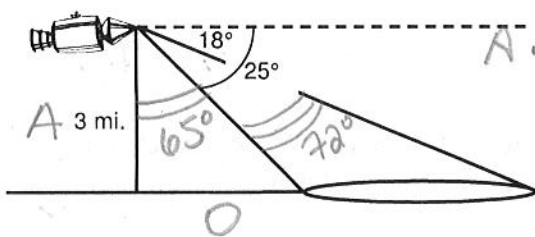
18. A mountain has a base and peak that are inaccessible. At point A, the angle of elevation of the peak is 30° . One kilometer closer to the mountain, at point C, the angle of elevation of 35° . Find the height PB of the mountain.

$\tan 30^\circ = \frac{O}{A}$ $\tan 35^\circ = \frac{O}{A}$
 $A \tan 30^\circ = A \tan 35^\circ$
 $x \tan 30^\circ = (x - 1 \text{ km}) \tan 35^\circ$
 $0.58x = x \tan 35^\circ - \tan 35^\circ$
 $0.58x = 0.70x - 0.70$
 $0.20 = 0.70x - 0.58x$



$\frac{0.70}{0.12} = \frac{0.12x}{0.12}$
 $5.83 \text{ km} = x$

19. Before Apollo 11 descended to the surface of the moon, it made one orbit at a distance of 3 miles above the surface of the moon. At one point in its orbit, the onboard guidance system measured the angles of depression to the near and far sides of a huge crater. The angles measured 25° to the near side of the crater, and 18° to the far side of the crater. Find the distance across the crater.

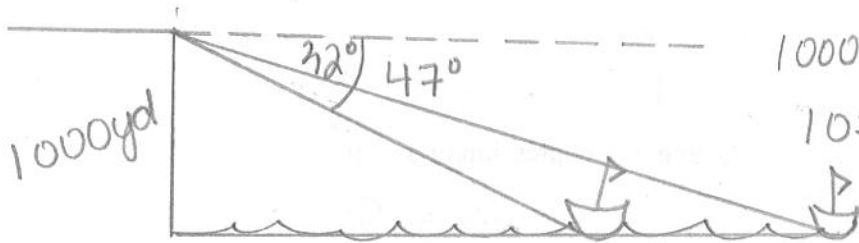


$A \cdot \tan \theta = \frac{O}{A} \cdot A$

$3 \text{ mi} \cdot \tan 72^\circ - 3 \text{ mi} \cdot \tan 65^\circ = \text{dia}$
 $9.23 \text{ mi} - 6.43 \text{ mi} = 2.8 \text{ mi}$

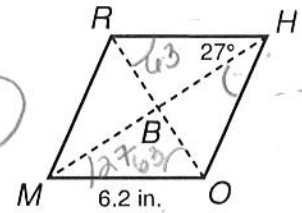
same

20. An observer on a cliff 1000 yards above sea level sights two ships due east. The angles of depression of the ships are 47° and 32° . Find the distance between the two ships.



$1000 \text{ yd} \tan 47^\circ - 1000 \text{ yd} \tan 32^\circ =$
 $1072 \text{ yd} - 625 \text{ yd} = 447 \text{ yd apart}$

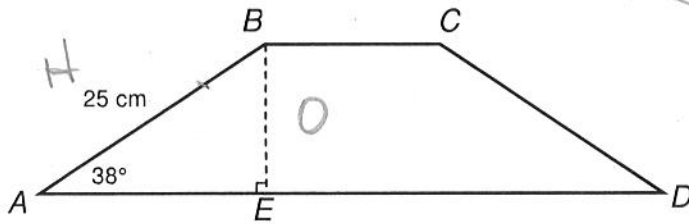
21. One diagonal of a rhombus makes an angle of 27° with a side of the rhombus. If each side of the rhombus has a length of 6.2 inches, find the length of each diagonal.



$H \cdot \sin \theta = \frac{O}{H} \cdot H = (6.2 \text{ in}) \sin 63^\circ = 5.52 \text{ in} \times 2 = 11.04 \text{ in}$

$H \sin \theta = O$
 $6.2 \text{ in} \sin 27^\circ = 2.81 \text{ in} \times 2 = 5.62 \text{ in}$

22. Find the height of isosceles trapezoid ABCD as marked.



$H \sin \theta = O$
 $25 \text{ cm} \sin 38^\circ = 15.39 \text{ cm}$

23. The legs of an isosceles triangle are each 18 cm. The base is 14 cm. Find:

- a) the measure of the base angles, and
- b) the exact length of the altitude to the base.

a) $\cos \theta = \frac{A}{H}$
 $\theta = \cos^{-1} \frac{A}{H}$
 $= \cos^{-1} \left(\frac{7 \text{ cm}}{18 \text{ cm}} \right) = 67^\circ$

b) $H \sin \theta = O$
 $18 \text{ cm} \sin 67^\circ = O$
 16.57 cm

