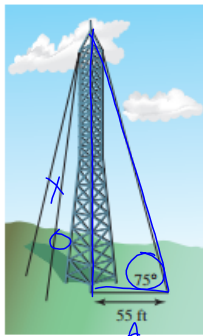smaller.

61. Height   A guy wire from the top of the transmission tower at WJBC forms a 75° angle with the ground at a 55-foot distance from the base of the tower. How tall is the tower?
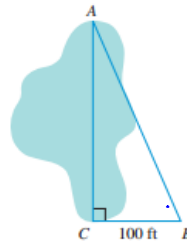
$$\tan 75 = \frac{x}{55}$$

75°

55 ft

62. Height   Kirsten places her surveyor's telescope on the top of a tripod 5 feet above the ground. She measures an 8° elevation above the horizontal to the top of a tree that is 120 feet away. How tall is the tree?
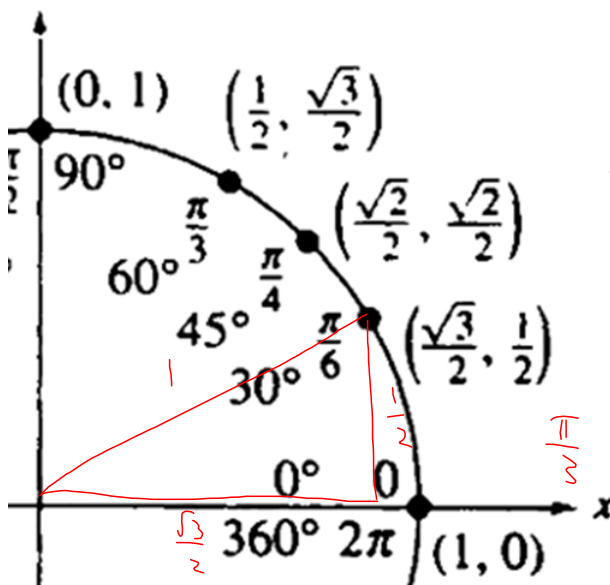
8°
120 ft   5 ft
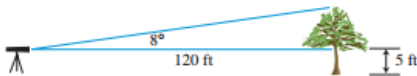
65. Distance   DaShanda's team of surveyors had to find the distance AC across the lake at Montgomery County Park. Field assistants positioned themselves at points A and C while DaShanda set up an angle-measuring instrument at point B, 100 feet from C in a perpendicular direction. DaShanda measured $\angle ABC$ as 75°12′42″. What is the distance AC?

A

C   100 ft   B

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4.2 Extension

(0, 1) $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

90°

$\frac{\pi}{3}$ $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$

60°

45° $\frac{\pi}{4}$ $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

30° $\frac{\pi}{6}$

0°   0

360° 2π   (1, 0)
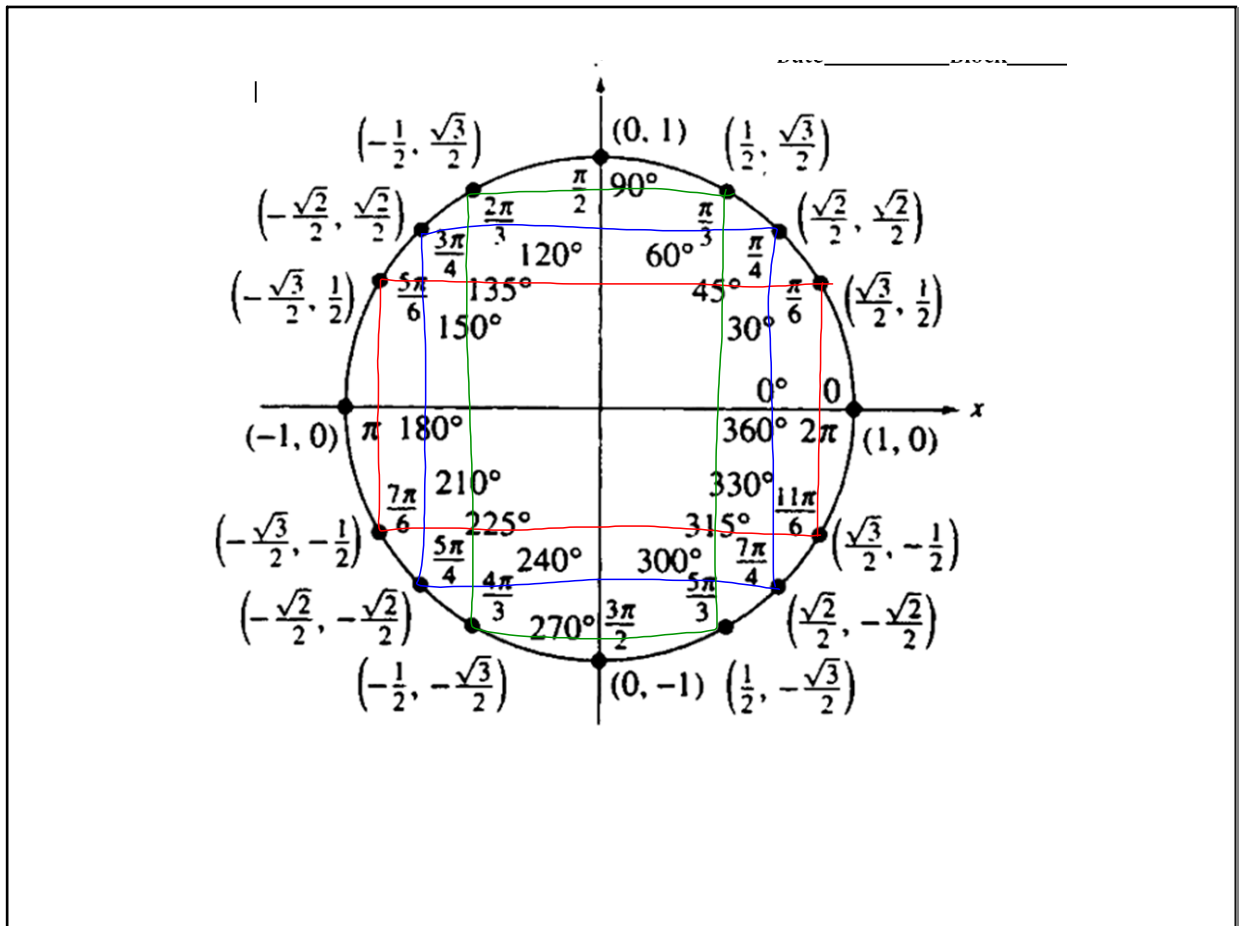
$\frac{\sqrt{3}}{2}$

$\sin \frac{\pi}{6} = \frac{O}{H} = \frac{\frac{1}{2}}{1} = \frac{1}{2} = y$

$\cos \frac{\pi}{6} = \frac{A}{H} = \frac{\sqrt{3}}{2} = x$

$\tan \frac{\pi}{6} = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} = \frac{y}{x}$

$\frac{1}{2} \cdot \frac{2}{\sqrt{3}} = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$

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Unit Circle Trig Functions

$\sin\theta = y$	$\cos\theta = x$	$\tan\theta = \dfrac{\sin\theta}{\cos\theta} = \dfrac{y}{x}$
$\csc\theta = \dfrac{1}{\sin\theta} = \dfrac{1}{y}$	$\sec\theta = \dfrac{1}{\cos\theta} = \dfrac{1}{x}$	$\cot\theta = \dfrac{\cos\theta}{\sin\theta} = \dfrac{x}{y}$

Find the acute angle that satisfies the given equation.

1.) $\sin\theta = \dfrac{1}{2}$

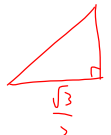$\dfrac{\pi}{6}, 30$

2.) $\tan\theta = 1$

$\dfrac{y}{x} = 1$

$45, \dfrac{\pi}{4}$

3.) $\tan\theta = \dfrac{\sqrt{3}}{3}$

$\dfrac{\pi}{6}, 30$

4.) $\cos\theta = \dfrac{\sqrt{3}}{2}$ $\dfrac{\pi}{6}, 30$

$\dfrac{\sqrt{3}}{2}$

5.) $\csc\theta = 2$

$\dfrac{1}{\frac{1}{2}} = 2$

$\dfrac{\pi}{6}, 30$

6.) $\sin\theta = \dfrac{\sqrt{3}}{2}$

$\dfrac{\pi}{3}, 60$

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2

7.) $\cot\theta = 1$

$45, \dfrac{\pi}{4}$

8.) $\cos\theta = \dfrac{\sqrt{2}}{2}$
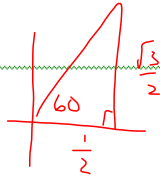
$45, \dfrac{\pi}{4}$

Find the exact value.

9.) $\sec\left(\dfrac{\pi}{3}\right)$

$\dfrac{1}{\cos\frac{\pi}{3}}$

$\dfrac{1}{\frac{1}{2}} = 2$

60, $\dfrac{\sqrt{3}}{2}$, $\dfrac{1}{2}$

10.) $\tan\left(\dfrac{\pi}{4}\right)$

1

11.) $\csc\left(\dfrac{\pi}{3}\right)$

$\dfrac{1}{\sin\frac{\pi}{3}}$

$\dfrac{1}{\frac{\sqrt{3}}{2}} = \dfrac{2}{\sqrt{3}} \cdot \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{2\sqrt{3}}{3}$
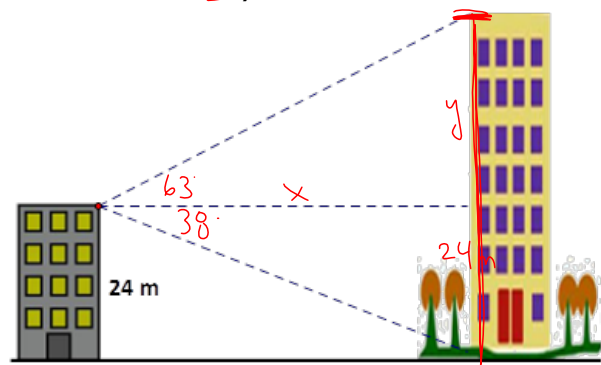
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11.) From an apartment window 24 m above the ground, the angle of depression of the base of a nearby building is 38 degrees and the angle of elevation of the top is 63 degrees. Find the height of the nearby building (to the nearest foot).
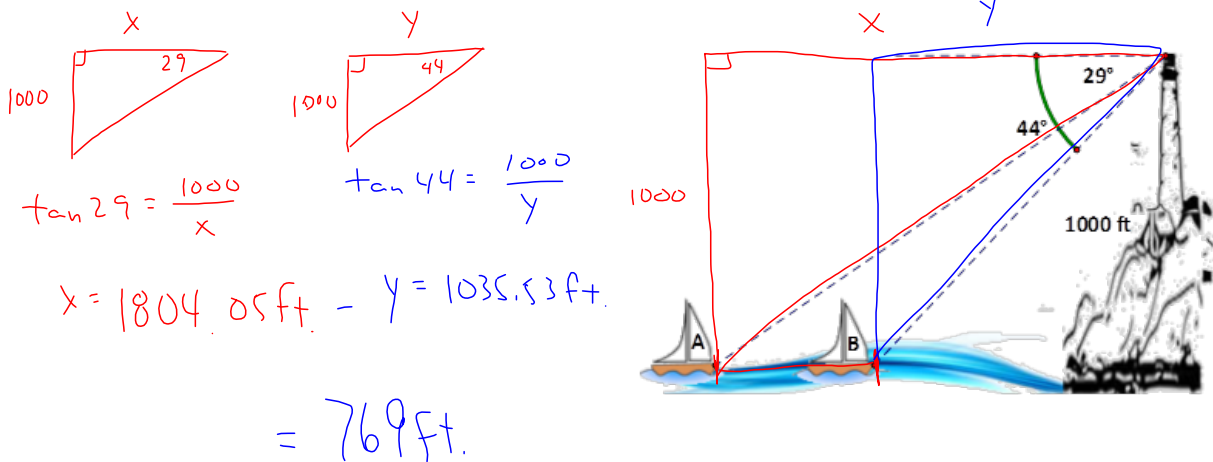
$\tan 38 = \dfrac{24}{x}$

$x = 30.72\,m$

$\tan 63 = \dfrac{y}{ANS}$

$y = 60.29\,m + 24 =$

$+24$

$= 84\,m$

24 m

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3

12.) From a lighthouse 1000 ft above sea level, the angle of depression to a boat (A) is 29 degrees. A little bit later the boat has moved closer to the shore (B) and the angle of depression measures 44 degrees. How far (to the nearest foot) has the boat moved in that time?

x

y

29

44

1000

1000

$$\tan 29 = \frac{1000}{x}$$

$$\tan 44 = \frac{1000}{y}$$

1000

$x = 1804.05 \text{ ft.} - y = 1035.53 \text{ ft.}$

$= 769 \text{ ft.}$

29°

44°

1000 ft

A

B

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