

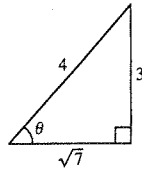
93. $\sin \theta = \frac{3}{4}$

Adjacent side: $\sqrt{16 - 9} = \sqrt{7}$

$$\cos \theta = \frac{\sqrt{7}}{4} \quad \tan \theta = \frac{3}{\sqrt{7}} = \frac{3\sqrt{7}}{7}$$

$$\csc \theta = \frac{4}{3} \quad \sec \theta = \frac{4}{\sqrt{7}} = \frac{4\sqrt{7}}{7}$$

$$\cot \theta = \frac{\sqrt{7}}{3}$$



Section 5.7 Applications and Models

- You should be able to solve right triangles.
- You should be able to solve right triangle applications.
- You should be able to solve applications of simple harmonic motion: $d = a \sin wt$ or $d = a \cos wt$.

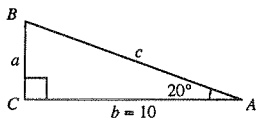
Solutions to Odd-Numbered Exercises

1. Given: $A = 20^\circ, b = 10$

$$B = 90^\circ - 20^\circ = 70^\circ$$

$$\tan A = \frac{a}{b} \Rightarrow a = b \tan A = 10 \tan 20^\circ \approx 3.64$$

$$\cos A = \frac{b}{c} \Rightarrow c = \frac{b}{\cos A} = \frac{10}{\cos 20^\circ} \approx 10.64$$

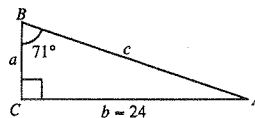


3. Given: $B = 71^\circ, b = 24$

$$\tan B = \frac{b}{a} \Rightarrow a = \frac{b}{\tan B} = \frac{24}{\tan 71^\circ} \approx 8.26$$

$$\sin B = \frac{b}{c} \Rightarrow c = \frac{b}{\sin B} = \frac{24}{\sin 71^\circ} \approx 25.38$$

$$A = 90^\circ - 71^\circ = 19^\circ$$

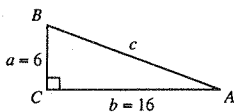


5. Given: $a = 6, b = 16$

$$c^2 = a^2 + b^2 \Rightarrow c = \sqrt{292} \approx 17.09$$

$$\tan A = \frac{a}{b} = \frac{6}{16} \Rightarrow A = \arctan\left(\frac{3}{8}\right) \approx 20.56^\circ$$

$$B = 90^\circ - 20.56^\circ = 69.44^\circ$$

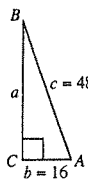


7. Given: $b = 16, c = 48$

$$a = \sqrt{c^2 - b^2} = \sqrt{2048} \approx 45.25$$

$$\cos A = \frac{b}{c} = \frac{16}{48} = \frac{1}{3} \Rightarrow A = \arccos\left(\frac{1}{3}\right) \approx 70.53^\circ$$

$$B \approx 90^\circ - 70.53^\circ = 19.47^\circ$$



9. $A = 12^\circ 15'$, $c = 430.5$

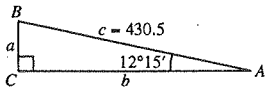
$$B = 90^\circ - 12^\circ 15' = 77^\circ 45'$$

$$\sin 12^\circ 15' = \frac{a}{430.5}$$

$$a = 430.5 \sin 12^\circ 15' \approx 91.34$$

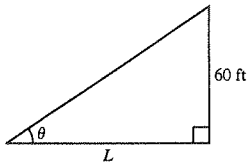
$$\cos 12^\circ 15' = \frac{b}{430.5}$$

$$b = 430.5 \cos 12^\circ 15' \approx 420.70$$



13. $\tan \theta = \frac{h}{(1/2)b} \Rightarrow h = \frac{1}{2}b \tan \theta = \frac{1}{2}(14.2) \tan(41.6^\circ) \approx 6.30$ feet

15. (a)



(b) $\tan \theta = \frac{60}{L}$

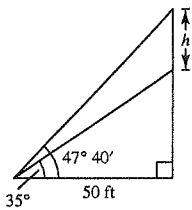
$$L = \frac{60}{\tan \theta} = 60 \cot \theta$$

(c)

θ	10°	20°	30°	40°	50°
L	340	165	104	72	50

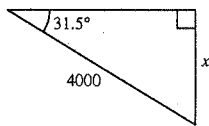
(d) No, the shadow lengths do not increase in equal increments. The cotangent function is not linear.

19. (a)


 (c) $h \approx 19.9$ feet

21. $\sin 31.5^\circ = \frac{x}{4000}$

$$x = 4000 \sin 31.5^\circ \approx 2089.99 \text{ feet}$$



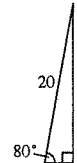
11. $\tan \theta = \frac{h}{(1/2)b}$

$$h = \frac{1}{2}b \tan \theta$$

$$h = \frac{1}{2}(4) \tan 52^\circ \approx 2.56 \text{ in.}$$

17. $\sin 80^\circ = \frac{h}{20}$

$$h = 20 \sin 80^\circ \approx 19.70 \text{ feet}$$


 (b) Let the height of the church = x and the height of the church and steeple = y . Then:

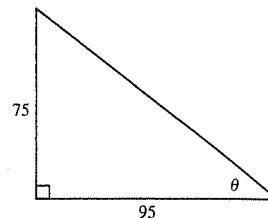
$$\tan 35^\circ = \frac{x}{50} \text{ and } \tan 47^\circ 40' = \frac{y}{50}$$

$$x = 50 \tan 35^\circ \text{ and } y = 50 \tan 47^\circ 40'$$

$$h = y - x = 50(\tan 47^\circ 40' - \tan 35^\circ)$$

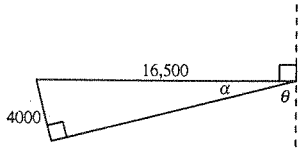
23. $\tan \theta = \frac{75}{95}$

$$\theta = \arctan \frac{15}{19} \approx 38.29^\circ$$



25. $\sin \alpha = \frac{4000}{16,500} \Rightarrow \alpha \approx 14.03^\circ$

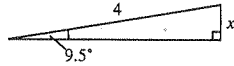
Hence, $\theta \approx 90^\circ - \alpha \approx 75.97^\circ$.



29. $\sin 9.5^\circ = \frac{x}{4}$

$x = 4 \sin 9.5^\circ$

≈ 0.66 mile

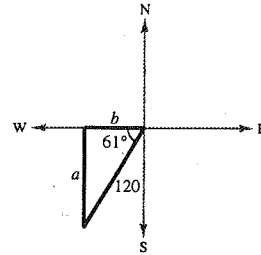


31. $90^\circ - 29^\circ = 61^\circ$

$(20)(6) = 120$ nautical miles

$\sin 61^\circ = \frac{a}{120} \Rightarrow a = 120 \sin 61^\circ \approx 104.95$ nautical miles

$\cos 61^\circ = \frac{b}{120} \Rightarrow b = 120 \cos 61^\circ \approx 58.18$ nautical miles



33. $\theta = 32^\circ, \phi = 68^\circ$ Note: ABC form a right triangle.

(a) $\alpha = 90^\circ - 32^\circ = 58^\circ$

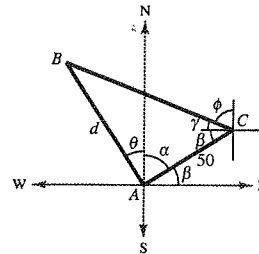
Bearing from A to C : N 58° E

(b) $\beta = \theta = 32^\circ$

$\gamma = 90^\circ - \phi = 22^\circ$

$C = \beta + \gamma = 54^\circ$

$\tan C = \frac{d}{50} \Rightarrow \tan 54^\circ = \frac{d}{50} \Rightarrow d \approx 68.82$ m



27. Since the airplane speed is

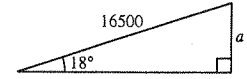
$\left(275 \frac{\text{ft}}{\text{sec}}\right)\left(60 \frac{\text{sec}}{\text{min}}\right) = 16,500 \frac{\text{ft}}{\text{min}}$,

after one minute its distance travelled is 16,500 feet.

$\sin 18^\circ = \frac{a}{16,500}$

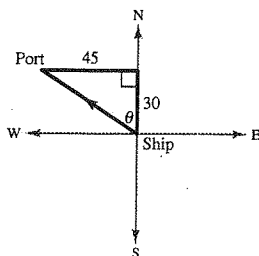
$a = 16,500 \sin 18^\circ$

≈ 5099 ft



35. $\tan \theta = \frac{45}{30} = \frac{3}{2} \Rightarrow \theta \approx 56.31^\circ$

Bearing: N 56.31° W



37. $\tan 6.5^\circ = \frac{350}{d} \Rightarrow d \approx 3071.91$ ft

$\tan 4^\circ = \frac{350}{D} \Rightarrow D \approx 5005.23$ ft

Distance between ships: $D - d \approx 1933.3$ ft

