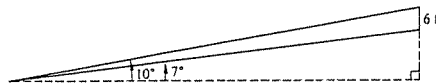


Exercises 5.3

1. Prove the law of sines for $\triangle ABC$ if $\gamma = 90^\circ$.
2. Finish the proof of the law of sines for an obtuse triangle. Figure 5.17 may be helpful.

Solve each of the following triangles, if possible. Consider all the given information to be exact.

3. $\alpha = 47^\circ$, $\beta = 69^\circ$, $b = 26$ ft.
4. $\alpha = 38^\circ$, $\gamma = 75^\circ$, $a = 40$ in.
5. $\beta = 21^\circ 49'$, $\gamma = 71^\circ 28'$, $c = 3.12$ ft.
6. $\alpha = 31^\circ 20'$, $\beta = 59^\circ 50'$, $a = 29$ yds.
7. $a = 35$ in., $b = 28$ in., $\alpha = 36^\circ$.
8. $c = 17$ ft, $b = 28$ ft, $\gamma = 152^\circ 30'$.
9. $a = 23$ yds, $c = 18$ yds, $\gamma = 32^\circ 38'$.
10. $b = 15$ in., $c = 30$ in., $\beta = 30^\circ$.
11. $a = 13$ ft, $b = 30$ ft, $\alpha = 74^\circ 10'$. No solution
12. $a = 48$ yds, $c = 60$ yds, $\alpha = 63^\circ 13'$.
13. $b = 33$ in., $c = 11$ in., $\beta = 37^\circ 50'$.
14. $a = 24$ in., $c = 30$ in., $\alpha = 17^\circ 28'$.
15. Two men, 300 feet apart, observe an airplane that is in the same vertical plane as the two men. The angles of elevation of the plane from the two men are $47^\circ 10'$ and $63^\circ 28'$. If the men are standing on level ground, find the height of the plane above the ground if
- the men are facing each other, and
 - the men are facing in the same direction.
16. Three towns are located in the plains. Town B is 35 miles due north of town A. Town C is 75 miles from town A and is 32° east of north from town B. How far is town C from town B? What direction is town C from town A?
17. A man is looking at a picture hanging on a wall. The picture is 6.0 feet high. The angle of elevation of the top of the picture from the man's line of sight is



- 10° and the angle of elevation of the bottom of the picture is 7° . How far is the man standing from the wall?
18. One diagonal of a parallelogram is 50 inches long. One end of the parallelogram makes angles of 35° and 27° with the two sides. How long are the sides of the parallelogram?
19. Two men shoot at a deer, hitting it in exactly the same spot at the same time. There is an angle of 23° between the paths of the two bullets as they enter the deer. The first man is 150 feet from the deer and 75 feet from the second man. How far is the second man from the deer if he is *behind* the first man?

5.5

The law of cosines

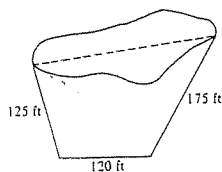
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20. Two men in a building are looking at the top of a second building. The first man is 10 feet above the ground. The second man is 60 feet above the ground and directly above the first man. The angle of elevation of the top of the second building is 65° for the first man, 30° for the second man. How tall is the second building?

Exercises 5.4

Solve the following triangles. Assume the given information is exact.

1. $a = 38$ ft, $b = 27$ ft, $\gamma = 74^\circ$.
2. $a = 123$ in., $b = 75$ in., $\gamma = 39^\circ$.
3. $a = 56$ yd, $b = 83$ yd, $\gamma = 97^\circ$.
4. $a = 23.8$ ft, $c = 29.1$ ft, $\beta = 31^\circ 20'$.
5. $a = 29.5$ in., $c = 28.4$ in., $\beta = 58^\circ 30'$.
6. $a = 94.6$ yd, $c = 29.2$ yd, $\beta = 17^\circ 10'$.
7. $b = 78.4$ ft, $c = 69.2$ ft, $\alpha = 131^\circ 50'$.
8. $b = 15$ in., $c = 8.66$ in., $\alpha = 48^\circ 20'$.
9. $b = 42.7$ yd, $c = 42.7$ yd, $\alpha = 95^\circ 40'$.
10. $a = 38.2$ in., $b = 54.1$ in., $c = 46.3$ in.
11. $b = 835$ ft, $c = 925$ ft, $a = 760$ ft.
12. $c = 500$ yds, $a = 375$ yds, $b = 600$ yds.
13. $a = 3$ yds, $b = 4$ yds, $c = 5$ yds.
14. $b = 73$ in., $c = 94$ in., $a = 128$ in.
15. Tom and Frank want to find the distance across the lake pictured here. They cannot measure across the water, but they did find the information indicated in the sketch. What is the distance across the lake?



16. The quadrilateral $ABCD$ is such that $m(\overline{AB}) = 12$ feet, $m(\overline{BC}) = 15$ feet, $m(\overline{CD}) = 10$ feet, $m(\overline{DA}) = 9.0$ feet, and $m(\angle ABC) = 90^\circ$. Find the measures of the remaining angles of the quadrilateral and the lengths of the two diagonals.
17. The circumference of a regular polygon inscribed in a circle can be found by considering one side of the polygon to be the base of an isosceles triangle which has its third vertex at the center of the circle and proceeding from there. Find the circumference of a regular decagon (10 sides) inscribed in a circle with radius 6.0 feet.
18. The quadrilateral $ABCD$ is such that $m(\overline{AB}) = 25$ feet, $m(\overline{BC}) = 60$ feet, $m(\overline{CD}) = 55$ feet, $m(\overline{DA}) = 20$ feet, and the measure of one of the diagonals is 50 feet. Find the measures of the four angles of the quadrilateral and the length of the other diagonal.
19. Find the circumference of a regular hexagon (6 sides) circumscribed about a circle with radius 8.0 feet.
20. Prove the law of cosines for an obtuse triangle.

Exercises 5.5

Find the area of $\triangle ABC$ if the following is known. (Assume the given information is exact.)

1. $a = 25$ ft, $b = 32$ ft, $\gamma = 29^\circ$.
2. $b = 84$ in., $c = 73$ in., $\alpha = 42^\circ$.
3. $c = 65$ yds, $a = 128$ yds, $\beta = 104^\circ$.
4. $a = 30$ ft, $b = 15$ ft, $\gamma = 60^\circ$.
5. $a = 32$ in., $b = 48$ in., $c = 29$ in.
6. $a = 53$ yds, $b = 53$ yds, $c = 53$ yds.
7. $a = 74$ ft, $b = 29$ ft, $c = 58$ ft.
8. $a = 86$ in., $b = 93$ in., $c = 47$ in.
9. $\alpha = 35^\circ$, $\beta = 64^\circ$, $a = 28$ ft.
10. $\gamma = 64^\circ$, $\beta = 57^\circ$, $c = 16$ yds.
11. $\gamma = 103^\circ$, $\alpha = 47^\circ$, $a = 29$ in. ZS: 2
12. $\alpha = 37^\circ$, $\beta = 83^\circ$, $c = 329$ ft.
13. $\beta = 75^\circ$, $\gamma = 35^\circ$, $a = 806$ yds.
14. $\gamma = 75^\circ$, $\alpha = 83^\circ$, $b = 3$ in.
15. $a = 16$ ft, $b = 32$ ft, $\alpha = 28^\circ$.
16. $b = 63$ in., $c = 87$ in., $\gamma = 69^\circ$.
17. $c = 45$ yds, $a = 55$ yds, $\gamma = 58^\circ$.

Exercises 5.3

3. $\gamma = 64^\circ$, $a = 20.37$ ft, $c = 25.03$ ft.
 5. $\alpha = 86^\circ 43'$, $a = 3.282$ ft, $b = 1.223$ ft.
 7. $\beta = 28^\circ 3'$, $\gamma = 115^\circ 57'$, $c = 53.57$ in.

9. $\alpha = 43^\circ 18'$, $\beta = 104^\circ 14'$, $b = 32.51$ yds or $\alpha = 136^\circ 42'$, $\beta = 10^\circ 40'$,
 $b = 6.207$ yds.
 11. No solution
 13. $\alpha = 130^\circ 22'$, $\gamma = 11^\circ 48'$, $a = 41.0$ in.
 15. a. 210 ft b. 703 ft 17. 110 ft 19. 180 ft

Exercises 5.4

1. $\alpha = 65^\circ 40'$, $\beta = 40^\circ 20'$, $c = 40.09$ ft.
 3. $\alpha = 31^\circ 45'$, $\beta = 51^\circ 15'$, $c = 105.6$ yds.
 5. $\alpha = 62^\circ 42'$, $\gamma = 58^\circ 48'$, $b = 28.31$ in.
 7. $\beta = 25^\circ 41'$, $\gamma = 22^\circ 29'$, $a = 134.8$ ft.
 9. $\beta = 42^\circ 10'$, $\gamma = 42^\circ 10'$, $a = 63.30$ yds.
 11. $\alpha = 50^\circ 51'$, $\gamma = 70^\circ 43'$, $\beta = 58^\circ 26'$.
 13. $\alpha = 36^\circ 52'$, $\beta = 53^\circ 8'$, $\gamma = 90^\circ$.
 15. 240 ft 17. 37 ft 19. $32\sqrt{3}$ ft

Exercises 5.5

1. 193.9 sq ft 3. 4036 sq yds 5. 450.8 sq in.
 7. 778.6 sq ft 9. 606.7 sq ft 11. 280.2 sq in.
 13. 191,500 sq yds 15. 170.9 sq ft or 253.6 sq ft
 17. No solution 19. 105.8 sq ft 21. $128\sqrt{3}$ sq ft

Review Exercises

1. $\beta = 70^\circ$, $a = 218.7$ in., $c = 266.4$ in.
 3. $\alpha = 40^\circ 32'$, $\beta = 49^\circ 28'$, $a = 2\sqrt{66}$ ft = 16.25 ft.
 5. $\alpha = 64^\circ 59'$, $\gamma = 40^\circ 38'$, $a = 26.92$ ft.
 7. a. 10° c. -828° 9. 414.1 ft
 11. a. $\frac{2\pi}{9}$ radians c. $-\frac{9\pi}{10}$ radians
 13. $\alpha = 35^\circ 26'$, $\beta = 48^\circ 11'$, $\gamma = 96^\circ 23'$ 15. No solution
 17. $b = 46.84$ yds, $\alpha = 26^\circ 58'$, $\gamma = 103^\circ 42'$.

Chapter 6

Exercises 6.1

1. a. $7, -1, 7 + i$ c. $2, 5, 2 - 5i$ e. $0, -4, 4i$
 g. $9, -2, 9 + 2i$ i. $\sqrt{3}, \sqrt{2}, \sqrt{3} - \sqrt{2}i$ k. $3, 0, 3$
 3. $-2\pi - i$ 5. $6i$ 7. $4\pi + 7i$
 9. $1 + 2i$ 11. $(3e^2 + 2b) + 37$ 13. $-6 - 17i$
 15. $\frac{1}{13} + \frac{5}{13}i$ 17. $\frac{c}{c^2 + d^2} - \frac{d}{c^2 + d^2}$ 19. $\frac{88}{26} - \frac{41}{26}i$
 21. $39 - 21i$ 23. $-\frac{79}{125} - \frac{122}{125}i$ 25. $-\frac{60}{289} - \frac{32}{289}i$