19. Given: $B = 101°, a = 10, c = 22$ — an SAS case. $b = \sqrt{a^2 + c^2 - 2ac\cos B} \approx \sqrt{667.955} \approx 25.845$, so Area $\approx \sqrt{11659.462} \approx 107.98$ cm^2 (using Heron's formula). Or, use $A = \frac{1}{2}ac\sin B$.

20. Given: $C = 112°, a = 1.8, b = 5.1$ — an SAS case. $c = \sqrt{a^2 + b^2 - 2ab\cos C} \approx \sqrt{36.128} \approx 6.011$, so Area $\approx \sqrt{18.111} \approx 4.26$ in.^{2} (using Heron's formula). Or, use $A = \frac{1}{2}ab\sin C$.

For #21–28, a triangle can be formed if $a + b < c, a + c < b$, and $b + c < a$.

21. $s = \frac{17}{2}$; Area $= \sqrt{66.9375} \approx 8.18$

22. $s = \frac{21}{2}$; Area $= \sqrt{303.1875} \approx 17.41$

23. No triangle is formed ($a + b = c$).

24. $s = 27$; Area $= \sqrt{12{,}960} = 36\sqrt{10} \approx 113.84$

25. $a = 36.4$; Area $= \sqrt{46{,}720.3464} \approx 216.15$

26. No triangle is formed ($a + b < c$)

27. $s = 42.1$; Area $= \sqrt{98{,}629.1856} \approx 314.05$

28. $s = 23.8$; Area $\sqrt{10{,}269.224} \approx 101.34$

29. Let $a = 4, b = 5$, and $c = 6$. The largest angle is opposite the largest side, so we call it C. Since $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$, $C = \cos^{-1}\left(\frac{1}{8}\right) \approx 82.819°$ ≈ 1.445 radians.

30. The shorter diagonal splits the parallelogram into two (congruent) triangles with $a = 26, B = 39°$, and $c = 18$. The diagonal has length $b = \sqrt{a^2 + c^2 - 2ac\cos B}$ $\approx \sqrt{272.591} \approx 16.5$ ft.

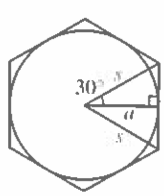
31. Following the method of Example 3, divide the hexagon into 6 triangles. Each has two 12-inch sides that form a 60° angle.

$6 \times \frac{1}{2}(12)(12)\sin 60° = 216\sqrt{3} \approx 374.1$ square inches

32. Following the method of Example 3, divide the nonagon into 9 triangles. Each has two 10-inch sides that form a 40° angle.

$9 \times \frac{1}{2}(10)(10)\sin 40° \approx 289.3$ square inches

33.

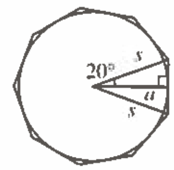


In the figure, $a = 12$ and so $s = 12\sec 30° = 8\sqrt{3}$. The area of the hexagon is

$6 \times \frac{1}{2}(8\sqrt{3})(8\sqrt{3})\sin 60° = 288\sqrt{3}$

≈ 498.8 square inches.

34.



In the figure, $a = 10$ and so $s = 10\sec 20°$. The area of the nonagon is

$9 \times \frac{1}{2}(10\sec 20°)(10\sec 20°)\sin 40°$

≈ 327.6 square inches.

35. Given: $C = 54°, BC = a = 160, AC = b = 110$ — an SAS case. $AB = c = \sqrt{a^2 + b^2 - 2ab\cos C}$ $\approx \sqrt{17{,}009.959} \approx 130.42$ ft.

36. **(a)** The home-to-second segment is the hypotenuse of a right triangle, so the distance from the pitcher's rubber to second base is $90\sqrt{2} - 60.5 \approx 66.8$ ft. This is a bit more than

$c = \sqrt{60.5^2 + 90^2 - 2(60.5)(90)\cos 45°}$
$\approx \sqrt{4059.857} \approx 63.7$ ft.

(b) $B = \cos^{-1}\left(\frac{a^2 + c^2 - b^2}{2ac}\right) \approx \cos^{-1}(-0.049)$
$\approx 92.8°$.

37. **(a)** $c = \sqrt{40^2 + 60^2 - 2(40)(60)\cos 45°}$
$\approx \sqrt{1805.887} \approx 42.5$ ft.

(b) The home-to-second segment is the hypotenuse of a right triangle, so the distance from the pitcher's rubber to second base is $60\sqrt{2} - 40 \approx 44.9$ ft.

(c) $B = \cos^{-1}\left(\frac{a^2 + c^2 - b^2}{2ac}\right) \approx \cos^{-1}(-0.057)$
$\approx 93.3°$.

38. Given: $a = 175, b = 860$, and $C = 78°$. An SAS case, so $AB = c = \sqrt{a^2 + b^2 - 2ab\cos C} \approx \sqrt{707{,}643.581}$ ≈ 841.2 ft.

39. **(a)** Using right ΔACE, $m\angle CAE = \tan^{-1}\left(\frac{6}{18}\right)$
$= \tan^{-1}\left(\frac{1}{3}\right) \approx 18.435°$.

(b) Using $A \approx 18.435°$, we have an SAS case, so $DF = \sqrt{9^2 + 12^2 - 2(9)(12)\cos A} \approx \sqrt{20.084}$ ≈ 4.5 ft.

(c) $EF = \sqrt{18^2 + 12^2 - 2(18)(12)\cos A} \approx \sqrt{58.168}$ ≈ 7.6 ft.

40. After two hours, the planes have traveled 700 and 760 miles, and the angle between them is 22.5°, so the distance is $\sqrt{700^2 + 760^2 - 2(700)(760)\cos 22.5°}$ $\approx \sqrt{84{,}592.177} \approx 290.8$ mi.

41. $AB = \sqrt{73^2 + 65^2 - 2(73)(65)\cos 8°}$
$\approx \sqrt{156.356} \approx 12.5$ yd.