Name: _____

Date: _____ Class: Trigonometry, per: _____

Answer Key: Chapter 8 - Sine and Cosine Rule

Objective: Solutions are checked for mathematical accuracy. Equivalent exact forms are acceptable where appropriate.

1. Answer: $b \approx 14.1$

Work: $\dfrac{b}{\sin 45^\circ} = \dfrac{10}{\sin 30^\circ} \Rightarrow b = 10\dfrac{\sin 45^\circ}{\sin 30^\circ} \approx 14.1.$

2. Answer: $b \approx 21.9$

Work: $\dfrac{b}{\sin 70^\circ} = \dfrac{15}{\sin 40^\circ} \Rightarrow b = 15\dfrac{\sin 70^\circ}{\sin 40^\circ} \approx 21.9.$

3. Answer: $c \approx 21.6$

Work: $\dfrac{c}{\sin 80^\circ} = \dfrac{18}{\sin 55^\circ} \Rightarrow c = 18\dfrac{\sin 80^\circ}{\sin 55^\circ} \approx 21.6.$

4. Answer: $c \approx 21.0$

Work: $\dfrac{c}{\sin 100^\circ} = \dfrac{9}{\sin 25^\circ} \Rightarrow c = 9\dfrac{\sin 100^\circ}{\sin 25^\circ} \approx 21.0.$

5. Answer: $b \approx 18.6$

Work: $\dfrac{b}{\sin 50^\circ} = \dfrac{22}{\sin 65^\circ} \Rightarrow b = 22\dfrac{\sin 50^\circ}{\sin 65^\circ} \approx 18.6.$

6. Answer: $c \approx 20.5$

Work: $\dfrac{c}{\sin 72^\circ} = \dfrac{16}{\sin 48^\circ} \Rightarrow c = 16\dfrac{\sin 72^\circ}{\sin 48^\circ} \approx 20.5.$

7. Answer: $b \approx 20.7$

Work: $\dfrac{b}{\sin 88^\circ} = \dfrac{11}{\sin 32^\circ} \Rightarrow b = 11\dfrac{\sin 88^\circ}{\sin 32^\circ} \approx 20.7.$

8. Answer: $c \approx 14.6$

Work: $\dfrac{c}{\sin 45^\circ} = \dfrac{20}{\sin 75^\circ} \Rightarrow c = 20\dfrac{\sin 45^\circ}{\sin 75^\circ} \approx 14.6.$

9. Answer: $b \approx 27.6$

Work: $\dfrac{b}{\sin 112^\circ} = \dfrac{14}{\sin 28^\circ} \Rightarrow b = 14\dfrac{\sin 112^\circ}{\sin 28^\circ} \approx 27.6.$

10. Answer: $c \approx 20.6$

Work: $\dfrac{c}{\sin 73^\circ} = \dfrac{19}{\sin 62^\circ} \Rightarrow c = 19\dfrac{\sin 73^\circ}{\sin 62^\circ} \approx 20.6.$

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11. Answer: $B \approx 46^\circ$

Work: $\sin B = \dfrac{15\sin 35^\circ}{12} \Rightarrow B = \sin^{-1}\left(\dfrac{15\sin 35^\circ}{12}\right) \approx 45.8^\circ$.

12. Answer: $B \approx 31^\circ$

Work: $\sin B = \dfrac{14\sin 42^\circ}{18} \Rightarrow B = \sin^{-1}\left(\dfrac{14\sin 42^\circ}{18}\right) \approx 31.4^\circ$.

13. Answer: $B \approx 38^\circ$

Work: $\sin B = \dfrac{16\sin 50^\circ}{20} \Rightarrow B = \sin^{-1}\left(\dfrac{16\sin 50^\circ}{20}\right) \approx 37.8^\circ$.

14. Answer: $B \approx 43^\circ$

Work: $\sin B = \dfrac{13\sin 28^\circ}{9} \Rightarrow B = \sin^{-1}\left(\dfrac{13\sin 28^\circ}{9}\right) \approx 42.7^\circ$.

15. Answer: $B \approx 39^\circ$

Work: $\sin B = \dfrac{12\sin 63^\circ}{17} \Rightarrow B = \sin^{-1}\left(\dfrac{12\sin 63^\circ}{17}\right) \approx 39.0^\circ$.

16. Answer: $c \approx 9.8$

Work: $c^2 = 8^2 + 11^2 - 2(8)(11)\cos 60^\circ \Rightarrow c \approx 9.8$.

17. Answer: $c \approx 8.2$

Work: $c^2 = 10^2 + 14^2 - 2(10)(14)\cos 35^\circ \Rightarrow c \approx 8.2$.

18. Answer: $c \approx 13.9$

Work: $c^2 = 7^2 + 9^2 - 2(7)(9)\cos 120^\circ \Rightarrow c \approx 13.9$.

19. Answer: $c \approx 11.5$

Work: $c^2 = 13^2 + 15^2 - 2(13)(15)\cos 48^\circ \Rightarrow c \approx 11.5$.

20. Answer: $c \approx 14.3$

Work: $c^2 = 6^2 + 12^2 - 2(6)(12)\cos 100^\circ \Rightarrow c \approx 14.3$.

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21. Answer: $c \approx 23.1$

Work: $c^2 = 18^2 + 21^2 - 2(18)(21)\cos 72^\circ \Rightarrow c \approx 23.1.$

22. Answer: $c \approx 23.3$

Work: $c^2 = 9^2 + 16^2 - 2(9)(16)\cos 135^\circ \Rightarrow c \approx 23.3.$

23. Answer: $c \approx 8.4$

Work: $c^2 = 11^2 + 17^2 - 2(11)(17)\cos 25^\circ \Rightarrow c \approx 8.4.$

24. Answer: $C \approx 82^\circ$

Work: $\cos C = \dfrac{5^2 + 7^2 - 8^2}{2(5)(7)} \Rightarrow C \approx 81.8^\circ.$

25. Answer: $C \approx 90^\circ$

Work: $\cos C = \dfrac{9^2 + 12^2 - 15^2}{2(9)(12)} \Rightarrow C \approx 90.0^\circ.$

26. Answer: $C \approx 98^\circ$

Work: $\cos C = \dfrac{7^2 + 10^2 - 13^2}{2(7)(10)} \Rightarrow C \approx 98.2^\circ.$

27. Answer: $C \approx 88^\circ$

Work: $\cos C = \dfrac{8^2 + 13^2 - 15^2}{2(8)(13)} \Rightarrow C \approx 87.8^\circ.$

28. Answer: $C \approx 74^\circ$

Work: $\cos C = \dfrac{10^2 + 10^2 - 12^2}{2(10)(10)} \Rightarrow C \approx 73.7^\circ.$

29. Answer: $C \approx 103^\circ$

Work: $\cos C = \dfrac{6^2 + 8^2 - 11^2}{2(6)(8)} \Rightarrow C \approx 102.6^\circ.$

30. Answer: $C \approx 87^\circ$

Work: $\cos C = \dfrac{14^2 + 15^2 - 20^2}{2(14)(15)} \Rightarrow C \approx 87.1^\circ.$

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31. Answer: $C = 70^\circ$, $b \approx 20.8$, $c \approx 21.1$

Work: $C = 180^\circ - 42^\circ - 68^\circ = 70^\circ$. Then use $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.

32. Answer: $C = 80^\circ$, $b \approx 15.5$, $c \approx 21.6$

Work: $C = 180^\circ - 55^\circ - 45^\circ = 80^\circ$. Then use $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.

33. Answer: $C = 70^\circ$, $b \approx 23.6$, $c \approx 22.6$

Work: $C = 180^\circ - 30^\circ - 80^\circ = 70^\circ$. Then use $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.

34. Answer: $C = 70^\circ$, $b \approx 12.9$, $c \approx 19.8$

Work: $C = 180^\circ - 72^\circ - 38^\circ = 70^\circ$. Then use $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.

35. Answer: $C = 70^\circ$, $b \approx 17.1$, $c \approx 18.0$

Work: $C = 180^\circ - 47^\circ - 63^\circ = 70^\circ$. Then use $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.

36. Answer: $c \approx 10.0$, $A \approx 44^\circ$, $B \approx 86^\circ$

Work: Cosine Rule gives $c \approx 10.0$. Then use the Sine/Cosine Rule for an angle and $A + B + C = 180^\circ$.

37. Answer: $c \approx 17.3$, $A \approx 42^\circ$, $B \approx 63^\circ$

Work: Cosine Rule gives $c \approx 17.3$. Then use the Sine/Cosine Rule for an angle and $A + B + C = 180^\circ$.

38. Answer: $c \approx 14.9$, $A \approx 26^\circ$, $B \approx 44^\circ$

Work: Cosine Rule gives $c \approx 14.9$. Then use the Sine/Cosine Rule for an angle and $A + B + C = 180^\circ$.

39. Answer: $c \approx 12.2$, $A \approx 56^\circ$, $B \approx 82^\circ$

Work: Cosine Rule gives $c \approx 12.2$. Then use the Sine/Cosine Rule for an angle and $A + B + C = 180^\circ$.

40. Answer: $c \approx 17.9$, $A \approx 34^\circ$, $B \approx 51^\circ$

Work: Cosine Rule gives $c \approx 17.9$. Then use the Sine/Cosine Rule for an angle and $A + B + C = 180^\circ$.

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41. Answer: 6.5 km *Work:* Cosine Rule: $d^2 = 6.4^2 + 8.1^2 - 2(6.4)(8.1)\cos 52^\circ$, so $d \approx 6.5$ km.	**42. Answer:** 116.9 m *Work:* Cosine Rule gives $c = \sqrt{120^2 + 85^2 - 2(120)(85)\cos 67^\circ} \approx 116.9$ m.
43. Answer: 63.2 km *Work:* By the Cosine Rule, $d \approx 63.2$ km.	**44. Answer:** $AC \approx 96.4$ m *Work:* $C = 70^\circ$ and $\dfrac{AC}{\sin 65^\circ} = \dfrac{100}{\sin 70^\circ}$, so $AC \approx 96.4$ m.
45. Answer: 73.7° *Work:* $\cos C = \dfrac{50^2 + 65^2 - 70^2}{2(50)(65)}$, so $C \approx 73.7^\circ$.	**46. Answer:** 80.3° *Work:* The 30 m side is opposite the required angle. Cosine Rule gives $C \approx 80.3^\circ$.
47. Answer: $b \approx 154.4$ m *Work:* $b = 120\dfrac{\sin 73^\circ}{\sin 48^\circ} \approx 154.4$ m.	**48. Answer:** $C = 67^\circ$, $a \approx 102.3$ m, $c \approx 106.6$ m *Work:* $C = 180^\circ - 62^\circ - 51^\circ = 67^\circ$; then apply the Sine Rule.
49. Answer: 14.8 m *Work:* Cosine Rule: $d = \sqrt{18^2 + 24^2 - 2(18)(24)\cos 38^\circ} \approx 14.8$ m.	**50. Answer:** 82.8° *Work:* $\cos C = \dfrac{140^2 + 175^2 - 210^2}{2(140)(175)}$, hence $C \approx 82.8^\circ$.