

Answer Key: Chapter 6 - Co-terminal and Reference Angles

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

1. Answer: 5° <i>Work:</i> Add or subtract multiples of 360°: $725^\circ \equiv 5^\circ \pmod{360^\circ}$.	2. Answer: 250° <i>Work:</i> Add or subtract multiples of 360°: $-110^\circ \equiv 250^\circ \pmod{360^\circ}$.
3. Answer: 30° <i>Work:</i> Add or subtract multiples of 360°: $1110^\circ \equiv 30^\circ \pmod{360^\circ}$.	4. Answer: 315° <i>Work:</i> Add or subtract multiples of 360°: $-765^\circ \equiv 315^\circ \pmod{360^\circ}$.
5. Answer: 135° <i>Work:</i> Add or subtract multiples of 360°: $495^\circ \equiv 135^\circ \pmod{360^\circ}$.	6. Answer: $400^\circ, -320^\circ$ <i>Work:</i> Use $\theta + 360^\circ k$. For example, $40^\circ + 360^\circ = 400^\circ$ and $40^\circ - 360^\circ = -320^\circ$.
7. Answer: $575^\circ, -145^\circ$ <i>Work:</i> Use $\theta + 360^\circ k$. For example, $215^\circ + 360^\circ = 575^\circ$ and $215^\circ - 360^\circ = -145^\circ$.	8. Answer: $325^\circ, -395^\circ$ <i>Work:</i> Use $\theta + 360^\circ k$. For example, $-35^\circ + 360^\circ = 325^\circ$ and $-35^\circ - 360^\circ = -395^\circ$.
9. Answer: $665^\circ, -55^\circ$ <i>Work:</i> Use $\theta + 360^\circ k$. For example, $305^\circ + 360^\circ = 665^\circ$ and $305^\circ - 360^\circ = -55^\circ$.	10. Answer: $110^\circ, -610^\circ$ <i>Work:</i> Use $\theta + 360^\circ k$. For example, $-250^\circ + 360^\circ = 110^\circ$ and $-250^\circ - 360^\circ = -610^\circ$.

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11. Answer: $\theta = 70^\circ + 360^\circ k, \quad k \in \mathbb{Z}$ <i>Work:</i> Coterminal angles differ by an integer multiple of one full rotation.	12. Answer: $\theta = -125^\circ + 360^\circ k, \quad k \in \mathbb{Z}$ <i>Work:</i> Coterminal angles differ by an integer multiple of one full rotation.
13. Answer: $\theta = 240^\circ + 360^\circ k, \quad k \in \mathbb{Z}$ <i>Work:</i> Coterminal angles differ by an integer multiple of one full rotation.	14. Answer: $\theta = 315^\circ + 360^\circ k, \quad k \in \mathbb{Z}$ <i>Work:</i> Coterminal angles differ by an integer multiple of one full rotation.
15. Answer: $\theta = 525^\circ + 360^\circ k, \quad k \in \mathbb{Z}$ <i>Work:</i> Coterminal angles differ by an integer multiple of one full rotation.	16. Answer: $\frac{5\pi}{6}$ <i>Work:</i> Add or subtract multiples of 2π until the result lies in $[0, 2\pi)$.
17. Answer: $\frac{\pi}{4}$ <i>Work:</i> Add or subtract multiples of 2π until the result lies in $[0, 2\pi)$.	18. Answer: $\frac{5\pi}{3}$ <i>Work:</i> Add or subtract multiples of 2π until the result lies in $[0, 2\pi)$.
19. Answer: $\frac{5\pi}{6}$ <i>Work:</i> Add or subtract multiples of 2π until the result lies in $[0, 2\pi)$.	20. Answer: $\frac{5\pi}{4}$ <i>Work:</i> Add or subtract multiples of 2π until the result lies in $[0, 2\pi)$.

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21. Answer: $\frac{7\pi}{3}, -\frac{5\pi}{3}$ <i>Work:</i> Add 2π for a positive coterminal angle and subtract 2π for a negative one.	22. Answer: $\frac{17\pi}{6}, -\frac{7\pi}{6}$ <i>Work:</i> Add 2π for a positive coterminal angle and subtract 2π for a negative one.
23. Answer: $\frac{7\pi}{4}, -\frac{9\pi}{4}$ <i>Work:</i> Add 2π for a positive coterminal angle and subtract 2π for a negative one.	24. Answer: $\frac{17\pi}{5}, -\frac{3\pi}{5}$ <i>Work:</i> Add 2π for a positive coterminal angle and subtract 2π for a negative one.
25. Answer: $\frac{23\pi}{6}, -\frac{\pi}{6}$ <i>Work:</i> Add 2π for a positive coterminal angle and subtract 2π for a negative one.	26. Answer: 50° <i>Work:</i> The angle is in Quadrant II; $\theta_r = 180^\circ - 130^\circ = 50^\circ$.
27. Answer: 45° <i>Work:</i> The angle is in Quadrant III; $\theta_r = 225^\circ - 180^\circ = 45^\circ$.	28. Answer: 50° <i>Work:</i> The angle is in Quadrant IV; $\theta_r = 360^\circ - 310^\circ = 50^\circ$.
29. Answer: 85° <i>Work:</i> The angle is in Quadrant II; $\theta_r = 180^\circ - 95^\circ = 85^\circ$.	30. Answer: 12° <i>Work:</i> The angle is in Quadrant IV; $\theta_r = 360^\circ - 348^\circ = 12^\circ$.

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31. Answer: 1° <i>Work:</i> The angle is in Quadrant III; $\theta_r = 181^\circ - 180^\circ = 1^\circ$.	32. Answer: 58° <i>Work:</i> The angle is in Quadrant III; $\theta_r = 238^\circ - 180^\circ = 58^\circ$.
33. Answer: 78° <i>Work:</i> The angle is in Quadrant II; $\theta_r = 180^\circ - 102^\circ = 78^\circ$.	34. Answer: 27° <i>Work:</i> The angle is in Quadrant IV; $\theta_r = 360^\circ - 333^\circ = 27^\circ$.
35. Answer: 34° <i>Work:</i> The angle is in Quadrant II; $\theta_r = 180^\circ - 146^\circ = 34^\circ$.	36. Answer: $\frac{\pi}{3}$ <i>Work:</i> Quadrant II: $\theta_r = \pi - \frac{2\pi}{3} = \frac{\pi}{3}$.
37. Answer: $\frac{\pi}{4}$ <i>Work:</i> Quadrant III: $\theta_r = \frac{5\pi}{4} - \pi = \frac{\pi}{4}$.	38. Answer: $\frac{\pi}{6}$ <i>Work:</i> Quadrant IV: $\theta_r = 2\pi - \frac{11\pi}{6} = \frac{\pi}{6}$.
39. Answer: $\frac{5\pi}{12}$ <i>Work:</i> Quadrant II: $\theta_r = \pi - \frac{7\pi}{12} = \frac{5\pi}{12}$.	40. Answer: $\frac{4\pi}{9}$ <i>Work:</i> Quadrant III: $\theta_r = \frac{13\pi}{9} - \pi = \frac{4\pi}{9}$.

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41. Answer: $\frac{3\pi}{10}$ <i>Work:</i> Quadrant IV: $\theta_r = 2\pi - \frac{17\pi}{10} = \frac{3\pi}{10}$.	42. Answer: $\frac{5\pi}{12}$ <i>Work:</i> Quadrant IV: $\theta_r = 2\pi - \frac{19\pi}{12} = \frac{5\pi}{12}$.
43. Answer: $\frac{2\pi}{5}$ <i>Work:</i> Quadrant IV: $\theta_r = 2\pi - \frac{8\pi}{5} = \frac{2\pi}{5}$.	44. Answer: $\frac{3\pi}{8}$ <i>Work:</i> Quadrant III: $\theta_r = \frac{11\pi}{8} - \pi = \frac{3\pi}{8}$.
45. Answer: $\frac{2\pi}{5}$ <i>Work:</i> Quadrant III: $\theta_r = \frac{7\pi}{5} - \pi = \frac{2\pi}{5}$.	46. Answer: Terminal angle 125°; Quadrant II; reference angle 55°. <i>Work:</i> $845^\circ - 720^\circ = 125^\circ$, then use the quadrant reference-angle rule.
47. Answer: Terminal angle 220°; Quadrant III; reference angle 40°. <i>Work:</i> $-500^\circ + 720^\circ = 220^\circ$, then use the quadrant reference-angle rule.	48. Answer: Terminal angle $\frac{\pi}{6}$; Quadrant I; reference angle $\frac{\pi}{6}$. <i>Work:</i> $\frac{25\pi}{6} - 4\pi = \frac{\pi}{6}$, then use the quadrant reference-angle rule.
49. Answer: Terminal angle $\frac{3\pi}{4}$; Quadrant II; reference angle $\frac{\pi}{4}$. <i>Work:</i> $-\frac{13\pi}{4} + 4\pi = \frac{3\pi}{4}$, then use the quadrant reference-angle rule.	50. Answer: Terminal angle $\frac{11\pi}{9}$; Quadrant III; reference angle $\frac{2\pi}{9}$. <i>Work:</i> $\frac{47\pi}{9} - 4\pi = \frac{11\pi}{9}$, then use the quadrant reference-angle rule.