

NAME _____ DATE _____ PERIOD _____

12-3 Study Guide and Intervention (continued)

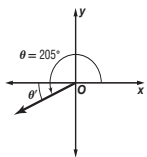
Trigonometric Functions of General Angles

Trigonometric Functions with Reference Angles If θ is a nonquadrantal angle in standard position, its **reference angle** θ' is defined as the acute angle formed by the terminal side of θ and the x-axis.

Reference Angle Rule	Quadrant I	Quadrant II	Quadrant III	Quadrant IV
	$\theta' = \theta$	$\theta' = 180^\circ - \theta$ ($\theta' = \pi - \theta$)	$\theta' = \theta - 180^\circ$ ($\theta' = \theta - \pi$)	$\theta' = 360^\circ - \theta$ ($\theta' = 2\pi - \theta$)

Example 1 Sketch an angle of measure 205° . Then find its reference angle.

Because the terminal side of 205° lies in Quadrant III, the reference angle θ' is $205^\circ - 180^\circ$ or 25° .



Example 2 Use a reference angle to find the exact value of $\cos \frac{3\pi}{4}$.

Because the terminal side of $\frac{3\pi}{4}$ lies in Quadrant II, the reference angle θ' is $\pi - \frac{3\pi}{4}$ or $\frac{\pi}{4}$.

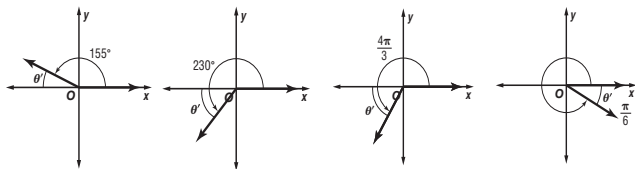
The cosine function is negative in Quadrant II.

$$\cos \frac{3\pi}{4} = -\cos \frac{\pi}{4} = -\frac{\sqrt{2}}{2}$$

Exercises

Sketch each angle. Then find its reference angle.

1. 155° 25° 2. 230° 50° 3. $\frac{4\pi}{3}$ $\frac{\pi}{3}$ 4. $-\frac{\pi}{6}$ $\frac{\pi}{6}$



Find the exact value of each trigonometric function.

5. $\tan 330^\circ = -\frac{\sqrt{3}}{3}$ 6. $\cos \frac{11\pi}{4} = \frac{\sqrt{2}}{2}$ 7. $\cot 30^\circ = \sqrt{3}$ 8. $\csc \frac{\pi}{4} = \sqrt{2}$

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12-3 Skills Practice

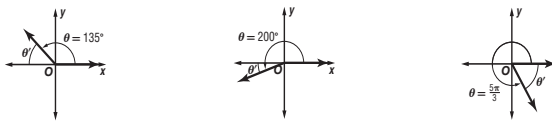
Trigonometric Functions of General Angles

The terminal side of θ in standard position contains each point. Find the exact values of the six trigonometric functions of θ .

- | | |
|---|---|
| 1. (5, 12) | 2. (3, 4) |
| $\sin \theta = \frac{12}{13}, \cos \theta = \frac{5}{13}, \tan \theta = \frac{12}{5}$ | $\sin \theta = \frac{4}{5}, \cos \theta = \frac{3}{5}, \tan \theta = \frac{4}{3}$ |
| $\csc \theta = \frac{13}{12}, \sec \theta = \frac{13}{5}, \cot \theta = \frac{5}{12}$ | $\csc \theta = \frac{5}{4}, \sec \theta = \frac{5}{3}, \cot \theta = \frac{3}{4}$ |
| 3. (8, -15) | 4. (-4, 3) |
| $\sin \theta = -\frac{15}{17}, \cos \theta = \frac{8}{17}, \tan \theta = -\frac{15}{8}$ | $\sin \theta = \frac{3}{5}, \cos \theta = -\frac{4}{5}, \tan \theta = -\frac{3}{4}$ |
| $\csc \theta = -\frac{17}{15}, \sec \theta = \frac{17}{8}, \cot \theta = -\frac{8}{15}$ | $\csc \theta = \frac{5}{3}, \sec \theta = -\frac{5}{4}, \cot \theta = -\frac{4}{3}$ |
| 5. (-9, -40) | 6. (1, 2) |
| $\sin \theta = -\frac{40}{41}, \cos \theta = -\frac{9}{41}, \tan \theta = \frac{40}{9}$ | $\sin \theta = \frac{2\sqrt{5}}{5}, \cos \theta = \frac{\sqrt{5}}{5}, \tan \theta = 2$ |
| $\csc \theta = -\frac{41}{40}, \sec \theta = -\frac{41}{9}, \cot \theta = \frac{9}{40}$ | $\csc \theta = \frac{\sqrt{5}}{2}, \sec \theta = \sqrt{5}, \cot \theta = \frac{1}{2}$ |
| 7. (3, -9) | 8. (-8, 12) |
| $\sin \theta = -\frac{3\sqrt{10}}{10}, \cos \theta = \frac{\sqrt{10}}{10}, \tan \theta = -3$ | $\sin \theta = \frac{3\sqrt{13}}{13}, \cos \theta = -\frac{2\sqrt{13}}{13}, \tan \theta = -\frac{3}{2}$ |
| $\csc \theta = -\frac{\sqrt{10}}{3}, \sec \theta = \frac{\sqrt{10}}{1}, \cot \theta = -\frac{1}{3}$ | $\csc \theta = \frac{\sqrt{13}}{3}, \sec \theta = -\frac{\sqrt{13}}{2}, \cot \theta = -\frac{2}{3}$ |

Sketch each angle. Then find its reference angle.

9. 135° 45° 10. 200° 20° 11. $\frac{5\pi}{3}$ $\frac{\pi}{3}$



Find the exact value of each trigonometric function.

12. $\sin 150^\circ = \frac{1}{2}$ 13. $\cos 270^\circ = 0$ 14. $\cot 135^\circ = -1$ 15. $\tan (-30^\circ) = -\frac{\sqrt{3}}{3}$
 16. $\tan \frac{\pi}{4} = 1$ 17. $\cos \frac{4\pi}{3} = -\frac{1}{2}$ 18. $\cot (-\pi)$ 19. $\sin \left(-\frac{3\pi}{4}\right) = -\frac{\sqrt{2}}{2}$
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