

$$\cos\left(\frac{7\pi}{6}\right) = -\frac{\sqrt{3}}{2}$$

$$\sin\left(\frac{7\pi}{6}\right) = -\frac{1}{2}$$

Now we can calculate the (x, y) coordinates using the identities $x = \cos \theta$ and $y = \sin \theta$.

The coordinates of the point are $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$ on the unit circle.

TRY IT #7 Find the coordinates of the point on the unit circle at an angle of $\frac{5\pi}{3}$.

MEDIA

Access these online resources for additional instruction and practice with sine and cosine functions.

[Trigonometric Functions Using the Unit Circle \(http://openstax.org//trigunitcir\)](http://openstax.org//trigunitcir)

[Sine and Cosine from the Unit Circle \(http://openstax.org//sincosuc\)](http://openstax.org//sincosuc)

[Sine and Cosine from the Unit Circle and Multiples of Pi Divided by Six \(http://openstax.org//sincosmult\)](http://openstax.org//sincosmult)

[Sine and Cosine from the Unit Circle and Multiples of Pi Divided by Four \(http://openstax.org//sincosmult4\)](http://openstax.org//sincosmult4)

[Trigonometric Functions Using Reference Angles \(http://openstax.org//trigrefang\)](http://openstax.org//trigrefang)



5.2 SECTION EXERCISES

Verbal

- Describe the unit circle.
- What do the x - and y -coordinates of the points on the unit circle represent?
- Discuss the difference between a coterminal angle and a reference angle.
- Explain how the cosine of an angle in the second quadrant differs from the cosine of its reference angle in the unit circle.
- Explain how the sine of an angle in the second quadrant differs from the sine of its reference angle in the unit circle.

Algebraic

1 For the following exercises, use the given sign of the sine and cosine functions to find the quadrant in which the terminal point determined by t lies.

- $\sin(t) < 0$ and $\cos(t) < 0$
- $\sin(t) > 0$ and $\cos(t) > 0$
- $\sin(t) > 0$ and $\cos(t) < 0$
- $\sin(t) < 0$ and $\cos(t) > 0$

2 For the following exercises, find the exact value of each trigonometric function.

- $\sin \frac{\pi}{2}$
- $\sin \frac{\pi}{3}$
- $\cos \frac{\pi}{2}$
- $\cos \frac{\pi}{3}$
- $\sin \frac{\pi}{4}$
- $\cos \frac{\pi}{4}$

16. $\sin \frac{\pi}{6}$

19. $\cos \pi$

22. $\sin 0$

17. $\sin \pi$

20. $\cos 0$

18. $\sin \frac{3\pi}{2}$

21. $\cos \frac{\pi}{6}$

Numeric

For the following exercises, state the reference angle for the given angle.

23. 240°

26. -315°

29. $\frac{2\pi}{3}$

32. $-\frac{7\pi}{4}$

24. -170°

27. 135°

30. $\frac{5\pi}{6}$

33. $-\frac{\pi}{8}$

25. 100°

28. $\frac{5\pi}{4}$

31. $-\frac{11\pi}{3}$

For the following exercises, find the reference angle, the quadrant of the terminal side, and the sine and cosine of each angle. If the angle is not one of the special angles on the unit circle, ~~use a calculator and round to three decimal places.~~

34. 225°

37. 135°

40. 250°

43. $\frac{7\pi}{6}$

46. $\frac{4\pi}{3}$

49. $\frac{7\pi}{4}$

35. 300°

38. 210°

41. 150°

44. $\frac{5\pi}{3}$

47. $\frac{2\pi}{3}$

36. 320°

39. 120°

42. $\frac{5\pi}{4}$

45. $\frac{3\pi}{4}$

48. $\frac{5\pi}{6}$

leave it unevaluated.

For the following exercises, find the requested value.

50. If $\cos(t) = \frac{1}{7}$ and t is in the 4th quadrant, find $\sin(t)$.

53. If $\sin(t) = -\frac{1}{4}$ and t is in the 3rd quadrant, find $\cos(t)$.

51. If $\cos(t) = \frac{2}{9}$ and t is in the 1st quadrant, find $\sin(t)$.

54. Find the coordinates of the point on a circle with radius 15 corresponding to an angle of 220° .

52. If $\sin(t) = \frac{3}{8}$ and t is in the 2nd quadrant, find $\cos(t)$.

55. Find the coordinates of the point on a circle with radius 20 corresponding to an angle of 120° .



Algebraic

X5 For the following exercises, find the exact value of each expression.

6. $\tan \frac{\pi}{6}$

7. $\sec \frac{\pi}{6}$

8. $\csc \frac{\pi}{6}$

9. $\cot \frac{\pi}{6}$

10. $\tan \frac{\pi}{4}$

11. $\sec \frac{\pi}{4}$

12. $\csc \frac{\pi}{4}$

13. $\cot \frac{\pi}{4}$

14. $\tan \frac{\pi}{3}$

15. $\sec \frac{\pi}{3}$

16. $\csc \frac{\pi}{3}$

17. $\cot \frac{\pi}{3}$

X6 For the following exercises, use reference angles to evaluate the expression.

18. $\tan \frac{5\pi}{6}$

19. $\sec \frac{7\pi}{6}$

20. $\csc \frac{11\pi}{6}$

21. $\cot \frac{13\pi}{6}$

22. $\tan \frac{7\pi}{4}$

23. $\sec \frac{3\pi}{4}$

24. $\csc \frac{5\pi}{4}$

25. $\cot \frac{11\pi}{4}$

26. $\tan \frac{8\pi}{3}$

27. $\sec \frac{4\pi}{3}$

28. $\csc \frac{2\pi}{3}$

29. $\cot \frac{5\pi}{3}$

30. $\tan 225^\circ$

31. $\sec 300^\circ$

32. $\csc 150^\circ$

33. $\cot 240^\circ$

34. $\tan 330^\circ$

35. $\sec 120^\circ$

36. $\csc 210^\circ$

37. $\cot 315^\circ$

38. If $\sin t = \frac{3}{4}$, and t is in quadrant II, find $\cos t$, $\sec t$, $\csc t$, $\tan t$, $\cot t$.

39. If $\cos t = -\frac{1}{3}$, and t is in quadrant III, find $\sin t$, $\sec t$, $\csc t$, $\tan t$, $\cot t$.

40. If $\tan t = \frac{12}{5}$, and $0 \leq t < \frac{\pi}{2}$, find $\sin t$, $\cos t$, $\sec t$, $\csc t$, and $\cot t$.

41. If $\sin t = \frac{\sqrt{3}}{2}$ and $\cos t = \frac{1}{2}$, find $\sec t$, $\csc t$, $\tan t$, and $\cot t$.

42. If $\sin 40^\circ \approx 0.643$ and $\cos 40^\circ \approx 0.766$ find $\sec 40^\circ$, $\csc 40^\circ$, $\tan 40^\circ$, and $\cot 40^\circ$.

43. If $\sin t = \frac{\sqrt{2}}{2}$, what is the $\sin(-t)$?

44. If $\cos t = \frac{1}{2}$, what is the $\cos(-t)$?

45. If $\sec t = 3.1$, what is the $\sec(-t)$?

46. If $\csc t = 0.34$, what is the $\csc(-t)$?

47. If $\tan t = -1.4$, what is the $\tan(-t)$?

48. If $\cot t = 9.23$, what is the $\cot(-t)$?

X7