In Exercises 1–4, find the component form of the vector.

1. the vector from the origin to the point $A = (2, 3)$
2. the vector from the point $A = (2, 3)$ to the origin
3. the vector $\overrightarrow{PQ}$, where $P = (1, 3)$ and $Q = (2, -1)$
4. the vector $\overrightarrow{OP}$, where O is the origin and P is the midpoint of the segment RS connecting $R = (2, -1)$ and $S = (-4, 3)$.

In Exercises 5–10, find the magnitude of the vector and the direction angle θ it forms with the positive x-axis ($0 \le \theta < 360°$).

5. $\langle 2, 2\rangle$
6. $\langle -\sqrt{2}, \sqrt{2}\rangle$
7. $\langle \sqrt{3}, 1\rangle$
8. $\langle -2, -2\sqrt{3}\rangle$
9. $\langle -5, 0\rangle$
10. $\langle 0, 4\rangle$

In Exercises 11–16, find the component form of the vector with the given magnitude that forms the given directional angle with the positive x-axis.

11. 4, 180°
12. 6, 270°
13. 5, 100°
14. 13, 200°
15. $3\sqrt{2}$, $\pi/4$ radians
16. $2\sqrt{3}$, $\pi/6$ radians

In Exercises 17–24, let $\mathbf{u} = \langle 3, -2\rangle$ and $\mathbf{v} = \langle -2, 5\rangle$. Find the **(a)** component form and **(b)** magnitude of the vector.

17. $3\mathbf{u}$
18. $-2\mathbf{v}$
19. $\mathbf{u} + \mathbf{v}$
20. $\mathbf{u} - \mathbf{v}$
21. $2\mathbf{u} - 3\mathbf{v}$
22. $-2\mathbf{u} + 5\mathbf{v}$
23. $\frac{3}{5}\mathbf{u} + \frac{4}{5}\mathbf{v}$
24. $-\frac{5}{13}\mathbf{u} + \frac{12}{13}\mathbf{v}$
25. ***Navigation*** An airplane, flying in the direction 20° east of north at 325 mph in still air, encounters a 40-mph tail wind acting in the direction 40° west of north. The airplane maintains its compass heading but, because of the wind, acquires a new ground speed and direction. What are they?
26. A river is flowing due east at 2 mph. A canoeist paddles across the river at 4 mph with his bow aimed directly northwest (a direction angle of 135°). What is the true direction angle of the canoeist's path, and how fast is the canoe going?

In Exercises 27–32, a particle travels in the plane with position vector $\mathbf{r}(t)$. Find **(a)** the velocity vector $\mathbf{v}(t)$ and **(b)** the acceleration vector $\mathbf{a}(t)$.

27. $\mathbf{r}(t) = \langle 3t^2, 2t^3\rangle$
28. $\mathbf{r}(t) = \langle \sin 2t, 2\cos t\rangle$
29. $\mathbf{r}(t) = \langle te^{-t}, e^{-t}\rangle$
30. $\mathbf{r}(t) = \langle 2\cos 3t, 2\sin 4t\rangle$
31. $\mathbf{r}(t) = \langle t^2 + \sin 2t, t^2 - \cos 2t\rangle$
32. $\mathbf{r}(t) = \langle t\sin t, t\cos t\rangle$
33. A particle moves in the plane with position vector $\langle \cos 3t, \sin 2t\rangle$. Find the velocity and acceleration vectors and determine the path of the particle.
34. A particle moves in the plane with position vector $\langle \sin 4t, \cos 3t\rangle$. Find the velocity and acceleration vectors and determine the path of the particle.
35. A particle moves in the plane so that its position at any time $t \ge 0$ is given by $x = \sin 4t \cos t$ and $y = \sin 2t$.

    (a) Find the velocity and speed of the particle when $t = 5\pi/4$.

    (b) Draw the path of the particle and show the velocity vector at $t = 5\pi/4$.

    (c) Is the particle moving to the left or to the right when $t = 5\pi/4$?
36. A particle moves in the plane so that its position at any time $t \ge 0$ is given by $x = e^t + e^{-t}$ and $y = e^t - e^{-t}$.

    (a) Find the velocity vector.

    (b) Find $\lim_{t\to\infty} \frac{dy/dt}{dx/dt}$.

    (c) Show algebraically that the particle moves on the hyperbola $x^2 - y^2 = 4$.

    (d) Sketch the path of the particle, showing the velocity vector at $t = 0$.