19–22 Describe the motion of a particle with position (x, y) as t varies in the given interval.

19. $x = 3 + 2 \cos t$, $\quad y = 1 + 2 \sin t$, $\quad \pi/2 \le t \le 3\pi/2$
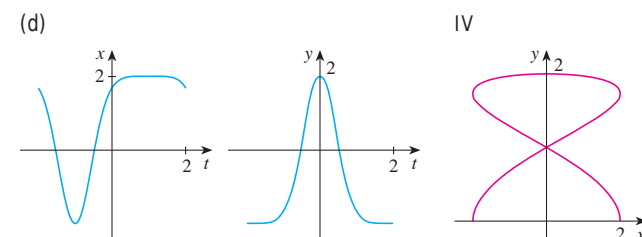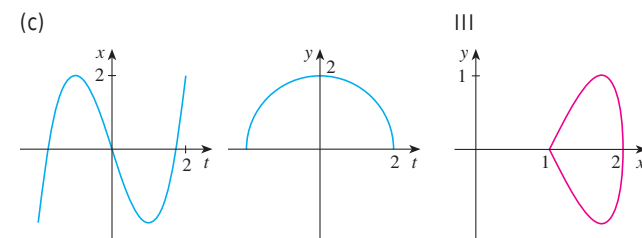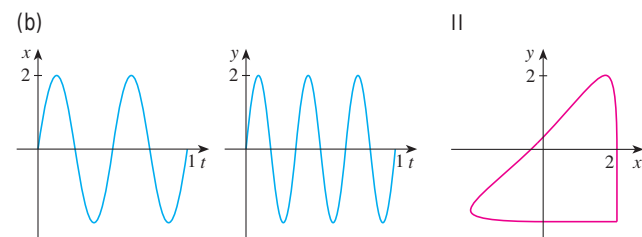
20. $x = 2 \sin t$, $\quad y = 4 + \cos t$, $\quad 0 \le t \le 3\pi/2$

**21.** $x = 5 \sin t$, $\quad y = 2 \cos t$, $\quad -\pi \le t \le 5\pi$

22. $x = \sin t$, $\quad y = \cos^2 t$, $\quad -2\pi \le t \le 2\pi$

23. Suppose a curve is given by the parametric equations $x = f(t)$, $y = g(t)$, where the range of f is $[1, 4]$ and the range of g is $[2, 3]$. What can you say about the curve?

24. Match the graphs of the parametric equations $x = f(t)$ and $y = g(t)$ in (a)–(d) with the parametric curves labeled I–IV. Give reasons for your choices.

(a)

I

(b)

II

(c)

III

(d)

IV
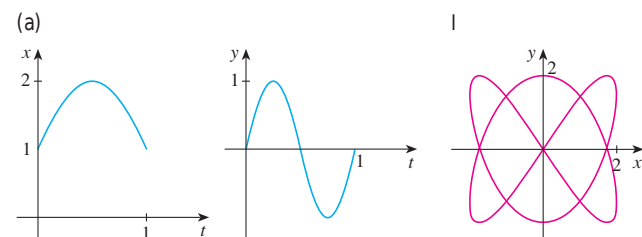
25–27 Use the graphs of $x = f(t)$ and $y = g(t)$ to sketch the parametric curve $x = f(t)$, $y = g(t)$. Indicate with arrows the direction in which the curve is traced as t increases.

25.

26.

27.
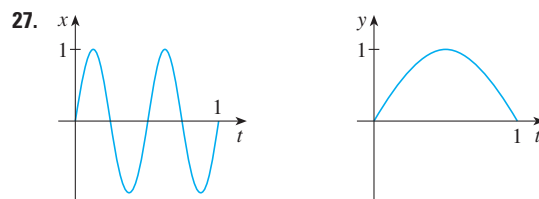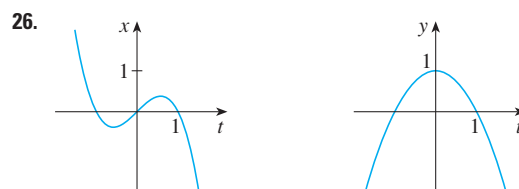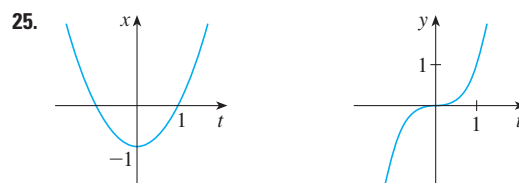
28. Match the parametric equations with the graphs labeled I-VI. Give reasons for your choices. (Do not use a graphing device.)
(a) $x = t^4 - t + 1$, $\quad y = t^2$
(b) $x = t^2 - 2t$, $\quad y = \sqrt{t}$
(c) $x = \sin 2t$, $\quad y = \sin(t + \sin 2t)$
(d) $x = \cos 5t$, $\quad y = \sin 2t$
(e) $x = t + \sin 4t$, $\quad y = t^2 + \cos 3t$
(f) $x = \dfrac{\sin 2t}{4 + t^2}$, $\quad y = \dfrac{\cos 2t}{4 + t^2}$

I

II

III

IV

V

VI