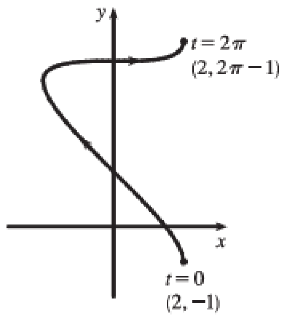
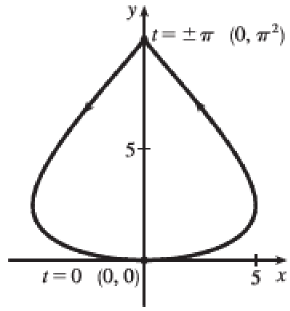
**2.** $x = 2\cos t, \quad y = t - \cos t, \quad 0 \le t \le 2\pi$

| $t$ | $0$ | $\pi/2$ | $\pi$ | $3\pi/2$ | $2\pi$ |
|---|---|---|---|---|---|
| $x$ | $2$ | $0$ | $-2$ | $0$ | $2$ |
| $y$ | $-1$ | $\pi/2$ | $\pi+1$ | $3\pi/2$ | $2\pi-1$ |
| | | 1.57 | 4.14 | 4.71 | 5.28 |




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

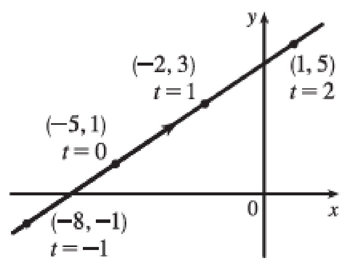
| $t$ | $-\pi$ | $-\pi/2$ | $0$ | $\pi/2$ | $\pi$ |
|---|---|---|---|---|---|
| $x$ | $0$ | $-5$ | $0$ | $5$ | $0$ |
| $y$ | $\pi^2$ | $\pi^2/4$ | $0$ | $\pi^2/4$ | $\pi^2$ |
| | 9.87 | 2.47 | | 2.47 | 9.87 |




**5.** $x = 3t - 5, \quad y = 2t + 1$

(a)

| $t$ | $-2$ | $-1$ | $0$ | $1$ | $2$ | $3$ | $4$ |
|---|---|---|---|---|---|---|---|
| $x$ | $-11$ | $-8$ | $-5$ | $-2$ | $1$ | $4$ | $7$ |
| $y$ | $-3$ | $-1$ | $1$ | $3$ | $5$ | $7$ | $9$ |



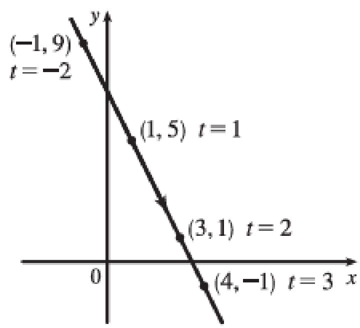

(b) $x = 3t - 5 \quad \Rightarrow \quad 3t = x + 5 \quad \Rightarrow \quad t = \frac{1}{3}(x+5) \quad \Rightarrow$

$y = 2 \cdot \frac{1}{3}(x+5) + 1$, so $y = \frac{2}{3}x + \frac{13}{3}$.

**6.** $x = 1 + t, \quad y = 5 - 2t, \quad -2 \le t \le 3$

(a)

| $t$ | $-2$ | $-1$ | $0$ | $1$ | $2$ | $3$ |
|---|---|---|---|---|---|---|
| $x$ | $-1$ | $0$ | $1$ | $2$ | $3$ | $4$ |
| $y$ | $9$ | $7$ | $5$ | $3$ | $1$ | $-1$ |



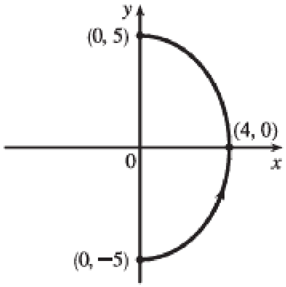

(b) $x = 1 + t \quad \Rightarrow \quad t = x - 1 \quad \Rightarrow \quad y = 5 - 2(x-1)$,

so $y = -2x + 7, \quad -1 \le x \le 4$.

**12.** (a) $x = 4\cos\theta$, $y = 5\sin\theta$, $-\pi/2 \leq \theta \leq \pi/2$.

$\left(\frac{x}{4}\right)^2 + \left(\frac{y}{5}\right)^2 = \cos^2\theta + \sin^2\theta = 1$, which is an ellipse with $x$-intercepts $(\pm 4, 0)$ and $y$-intercepts $(0, \pm 5)$. We obtain the portion of the ellipse with $x \geq 0$ since $4\cos\theta \geq 0$ for $-\pi/2 \leq \theta \leq \pi/2$.

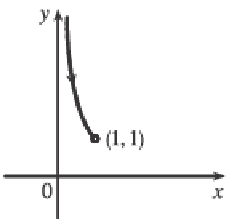
(b)




**13.** (a) $x = \sin t$, $y = \csc t$, $0 < t < \frac{\pi}{2}$.

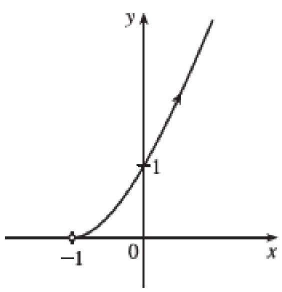
$y = \csc t = \dfrac{1}{\sin t} = \dfrac{1}{x}$. For $0 < t < \frac{\pi}{2}$, we have $0 < x < 1$ and $y > 1$. Thus, the curve is the portion of the hyperbola $y = 1/x$ with $y > 1$.

(b)



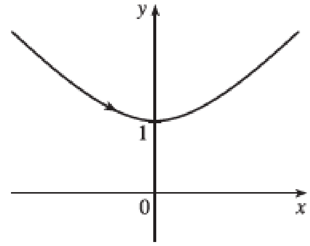

**14.** (a) $x = e^t - 1$, $y = e^{2t}$. $y = (e^t)^2 = (x+1)^2$ and since $x > -1$, we have the right side of the parabola $y = (x+1)^2$.

(b)



**17.** (a) $x = \sinh t$, $y = \cosh t \quad \Rightarrow \quad y^2 - x^2 = \cosh^2 t - \sinh^2 t = 1$. Since $y = \cosh t \geq 1$, we have the upper branch of the hyperbola $y^2 - x^2 = 1$.

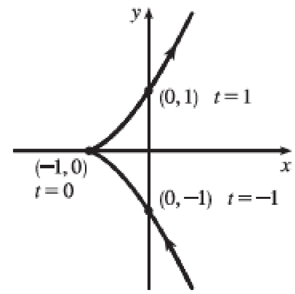
(b)




**19.** $x = 3 + 2\cos t$, $y = 1 + 2\sin t$, $\pi/2 \leq t \leq 3\pi/2$. By Example 4 with $r = 2$, $h = 3$, and $k = 1$, the motion of the particle takes place on a circle centered at $(3, 1)$ with a radius of 2. As $t$ goes from $\frac{\pi}{2}$ to $\frac{3\pi}{2}$, the particle starts at the point $(3, 3)$ and moves counterclockwise to $(3, -1)$ [one-half of a circle].

**20.** $x = 2\sin t$, $y = 4 + \cos t \quad \Rightarrow \quad \sin t = \frac{x}{2}$, $\cos t = y - 4$. $\sin^2 t + \cos^2 t = 1 \quad \Rightarrow \quad \left(\frac{x}{2}\right)^2 + (y - 4)^2 = 1$. The motion of the particle takes place on an ellipse centered at $(0, 4)$. As $t$ goes from 0 to $\frac{3\pi}{2}$, the particle starts at the point $(0, 5)$ and moves clockwise to $(-2, 4)$ [three-quarters of an ellipse].

**25.** When $t = -1$, $(x, y) = (0, -1)$. As $t$ increases to 0, $x$ decreases to $-1$ and $y$ increases to 0. As $t$ increases from 0 to 1, $x$ increases to 0 and $y$ increases to 1. As $t$ increases beyond 1, both $x$ and $y$ increase. For $t < -1$, $x$ is positive and decreasing and $y$ is negative and increasing. We could achieve greater accuracy by estimating $x$- and $y$-values for selected values of $t$ from the given graphs and plotting the corresponding points.




**26.** For $t < -1$, $x$ is positive and decreasing, while $y$ is negative and increasing (these points are in Quadrant IV). When $t = -1$, $(x, y) = (0, 0)$ and, as $t$ increases from $-1$ to 0, $x$ becomes negative and $y$ increases from 0 to 1. At $t = 0$, $(x, y) = (0, 1)$ and, as $t$ increases from 0 to 1, $y$ decreases from 1 to 0 and $x$ is positive. At $t = 1$, $(x, y) = (0, 0)$ again, so the loop is completed. For $t > 1$, $x$ and $y$ both become large negative. This enables us to draw a rough sketch. We could achieve greater accuracy by estimating $x$- and $y$-values for selected values of $t$ from the given graphs and plotting the corresponding points.