27. the ray (half line) with initial point $(2, 3)$ that passes through the point $(-1, -1)$

$$t \geq 0$$

$$x_T = at + b$$

$$y_T = ct + d$$

$t = 0 \quad (2, 3)$

$$x_T = at + 2$$

$$y_T = ct + 3$$
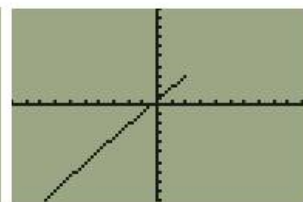
$t = 1 \quad (-1, -1)$

$-1 = a + 2 \implies a = -3$

$-1 = c + 3 \implies c = -4$

$$x_T = -3t + 2$$

$$y_T = -4t + 3$$

```
Plot1 Plot2 Plot3      WINDOW
•X1T☐-3T+2             Tmin=0
 Y1T☐-4T+3             Tmax=20
\X2T=▮                 Tstep=1
 Y2T=                  Xmin=-10
\X3T=                  Xmax=10
 Y3T=                  Xscl=1
\X4T=                 ↓Ymin=-10
```
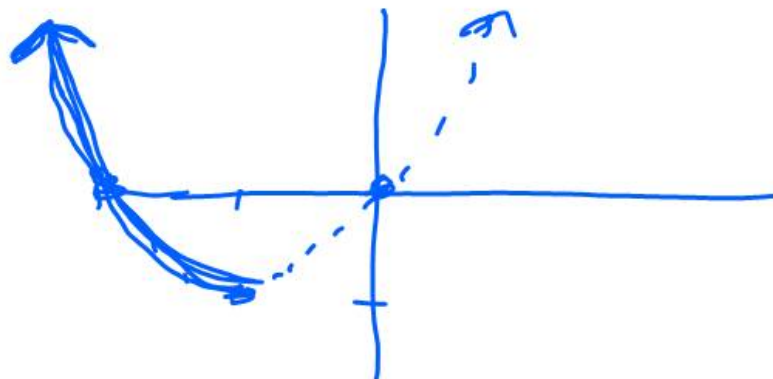
26. the left half of the parabola $y = x^2 + 2x$
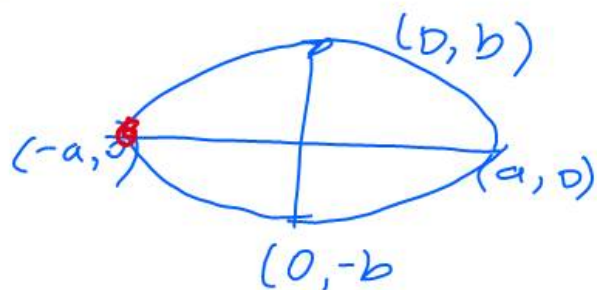
$$X_T = T$$

$$Y_T = T^2 + 2T$$

$$T \leq -1$$

36. *Ellipses* Find parametrizations to model the motion of a particle that starts at $(-a, 0)$ and traces the ellipse

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1, \quad a > 0, b > 0,$$

as indicated.

(a) once clockwise
(b) once counterclockwise
(c) twice clockwise
(d) twice counterclockwise

$(0, b)$
$(-a, 0)$
$(a, 0)$
$(0, -b)$

a)
$x_T = -a \cos T$
$y_T = b \sin T$
$0 \le T \le 2\pi$

b) $x_T = -a \cos T$
$y_T = -b \sin T$
$0 \le T \le 2\pi$

for c and d
$0 \le T \le 4\pi$

In Exercises 39 and 40, use the parametric curve $x = 5t$, $y = 3 - 3t$, $0 \leq t \leq 1$. ✳

39. Multiple Choice Which of the following describes its graph?

    (A) circle   (B) parabola   (C) ellipse

    (D) line segment   (E) line

40. Multiple Choice Which of the following is the initial point of the curve?
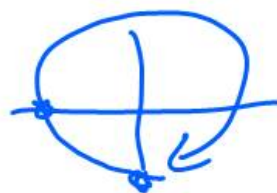
    (A) $(-5, 6)$ (B) $(0, -3)$ (C) $(0, 3)$ (D) $(5, 0)$

    (E) $(10, -3)$

41. Multiple Choice Which of the following describes the graph of the parametric curve $x = -3 \sin t$, $y = -3 \cos t$?

If $0 \le T \le 2\pi$

:p. $(0, -3)$

(A) circle   (B) parabola   (C) ellipse
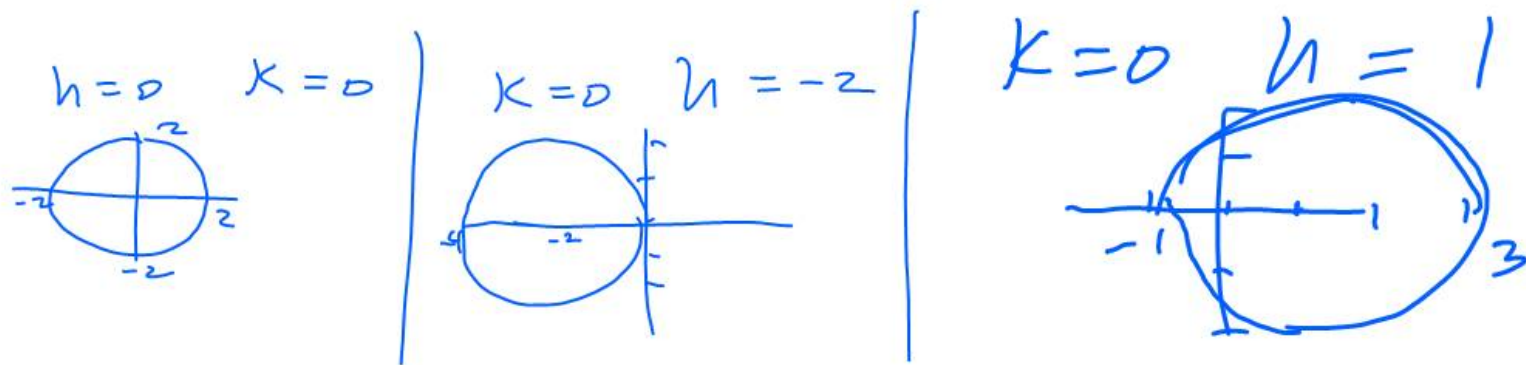
(D) hyperbola   (E) line

42. Multiple Choice Which of the following describes the graph of the parametric curve $x = 3t$, $y = 2t$, $t \ge 1$?

(A) circle   (B) parabola   (C) line segment

(D) line   (E) ray

44. Transformations Let $x = (2 \cos t) + h$ and $y = (2 \sin t) + k$.

(a) **Writing to Learn** Let $k = 0$ and $h = -2, -1, 1,$ and 2, in turn. Graph using the parameter interval $[0, 2\pi]$. Describe the role of h.

$h = 0 \quad k = 0$

$k = 0 \quad h = -2$

$k = 0 \quad h = 1$

(c) Find a parametrization for the circle with radius 5 and center at $(2, -3)$.

(d) Find a parametrization for the ellipse centered at $(-3, 4)$ with semimajor axis of length 5 parallel to the x-axis and semiminor axis of length 2 parallel to the y-axis.

c)

$$X_T = 5 \cos T + 2$$
$$Y_T = 5 \sin T - 3$$

d) $$X_T = 5 \cos T - 3$$
$$Y_T = 2 \sin T + 4$$