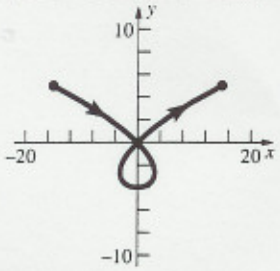
9. a.

t	x	y
−3	−15	5
−2	0	0
−1	3	−3
0	0	−4
1	−3	−3
2	0	0
3	15	5



b. Not simple; not closed

c. $x^2 = t^6 - 8t^4 + 16t^2$

$t^2 = y + 4$

$x^2 = (y+4)^3 - 8(y+4)^2 + 16(y+4)$

$x^2 = y^3 + 4y^2$

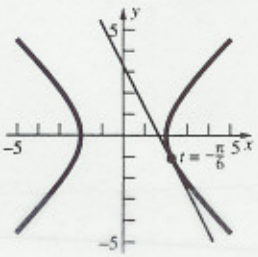
33. $\frac{dx}{dt} = 2\sec t \tan t, \frac{dy}{dt} = 2\sec^2 t$

$\frac{dy}{dx} = \csc t$

At $t = -\frac{\pi}{6}, x = \frac{4}{\sqrt{3}}, y = -\frac{2}{\sqrt{3}}$, and $\frac{dy}{dx} = -2$.

Tangent line: $y + \frac{2}{\sqrt{3}} = -2\left(x - \frac{4}{\sqrt{3}}\right)$ or

$2\sqrt{3}x + \sqrt{3}y - 6 = 0$



41. $\frac{dx}{dt} = 2e^t, \frac{dy}{dt} = \frac{9}{2}e^{3t/2}$

$L = \int_{\ln 3}^{2\ln 3} \sqrt{4e^{2t} - \frac{81}{4}e^{3t}}\,dt = \int_{\ln 3}^{2\ln 3} e^t \sqrt{4 - \frac{81}{4}e^t}\,dt$

$= \left[-\frac{8}{243}\left(4 - \frac{81}{4}e^t\right)^{3/2}\right]_{\ln 3}^{2\ln 3}$

$= \frac{713\sqrt{713} - 227\sqrt{227}}{243}$

55. $dx = dt$; when $x = 0$, $t = -1$; when $x = 1$, $t = 0$.

$\int_0^1 (x^2 - 4y)dx = \int_{-1}^0 [(t+1)^2 - 4(t^3+4)]dt$

$= \int_{-1}^0 (-4t^3 + t^2 + 2t - 15)dt$

$= \left[-t^4 + \frac{1}{3}t^3 + t^2 - 15t\right]_{-1}^0 = -\frac{44}{3}$

62. From Problem 61,

$x = (a-b)\cos t + b\cos\left(\frac{a-b}{b}t\right)$ and

$y = (a-b)\sin t - b\sin\left(\frac{a-b}{b}t\right)$.

Substitute $b = \frac{a}{4}$.

$x = \left(\frac{3a}{4}\right)\cos t + \left(\frac{a}{4}\right)\cos(3t)$

$= \left(\frac{3a}{4}\right)\cos t + \left(\frac{a}{4}\right)\cos(2t+t)$

$= \left(\frac{3a}{4}\right)\cos t + \left(\frac{a}{4}\right)(\cos 2t\cos t - \sin 2t \sin t)$

$= \left(\frac{3a}{4}\right)\cos t + \left(\frac{a}{4}\right)(\cos^3 t - \sin^2 t\cos t - 2\sin^2 t\cos t)$

$= \left(\frac{3a}{4}\right)\cos t + \left(\frac{a}{4}\right)\cos^3 t - \left(\frac{3a}{4}\right)\cos t\sin^2 t$

$= \left(\frac{3a}{4}\right)(\cos t)(1 - \sin^2 t) + \left(\frac{a}{4}\right)\cos^3 t = a\cos^3 t$

$y = \left(\frac{3a}{4}\right)\sin t - \left(\frac{a}{4}\right)\sin(3t)$

$= \left(\frac{3a}{4}\right)\sin t - \left(\frac{a}{4}\right)\sin(2t+t)$

$= \left(\frac{3a}{4}\right)\sin t - \left(\frac{a}{4}\right)(\sin 2t\cos t + \cos 2t\sin t)$

$= \left(\frac{3a}{4}\right)\sin t - \left(\frac{a}{4}\right)(2\sin t\cos^2 t + \cos^2 t\sin t - \sin^3 t)$

$= \left(\frac{3a}{4}\right)\sin t - \left(\frac{3a}{4}\right)\sin t\cos^2 t + \left(\frac{a}{4}\right)\sin^3 t$