1) crosses x when $y = 0$

$0 = 3 \sin 2t$

$0 = \sin 2t$

$2t = \sin^{-1}(0)$

$= 0, \pi$

$t = 0, \pi/2$

$x = 5 \cos(0)$ $\qquad$ $x = 5 \cos \frac{\pi}{2}$

$= 5$ $\qquad$ $= 0$

b/ $\int_0^5 3 \sin 2t \; dx$

$\int_{\frac{\pi}{2}}^{0} 3 \sin 2t \; \frac{dx}{dt} \; dt$ $\qquad$ $x = 5 \cos t$

$\frac{dx}{dt} = -5 \sin t$

$\int_{\frac{\pi}{2}}^{0} -15 \sin 2t \cdot \sin t \; dt$

$\int_{\frac{\pi}{2}}^{0} -15 \cdot 2 \sin t \cos t \sin t \; dt$

$30 \int_0^{\frac{\pi}{2}} \sin^2 t \cos t \; dt$ $\qquad$ $u = \sin t$

$\frac{du}{dt} = \cos t$

$30 \int_0^1 \cancel{\sin t} \; u^2 \cos t \; \frac{dt}{du} \; du$ $\qquad$ $\frac{dt}{du} = \frac{1}{\cos t}$

$30 \int_0^1 u^2 \; du$ $\qquad$ $u = \sin \frac{\pi}{2}$

$= 1$

$u = \sin 0$

$= 0$

$30 \left[\frac{1}{3} u^3 \right]_0^1$

10 units^2

2/ $\int_{\ln 2}^{\ln 4} \frac{1}{t+1}\, dx$

$x = \ln(t+2)$

$\frac{dx}{dt} = \frac{1}{t+2}$

$\int_0^2 \frac{1}{t+1} \cdot \frac{dx}{dt}\, dt$

$\ln 4 = \ln t + 2$

$t = 2$

$\int_0^2 \frac{1}{t+1} \cdot \frac{1}{t+2}\, dt$

$\ln 2 = \ln t + 2$

$t = 0$

$\int_0^2 \frac{1}{(t+1)(t+2)}\, dt$

b/ $\frac{1}{(t+1)(t+2)} = \frac{A}{t+1} + \frac{B}{t+2}$

$1 = A(t+2) + B(t+1)$

Let $x = -2$

$1 = -B$

$B = -1$

Let $x = -1$

$1 = A$

$\int_0^2 \frac{1}{t+1} - \frac{1}{t+2}\, dt$

$\left[\ln|t+1| - \ln|t+2| \right]_0^2$

$\left[\ln 3 - \ln 4 \right] - \left[\ln 1 - \ln 2 \right]$

$\ln 3 - 2\ln 2 + \ln 2$

$\underline{\ln 3 - \ln 2 \text{ units}^2}$

3/ Crosses x when $y = 0$

$0 = 3 \sin t$

$0 = \sin t$

$t = \sin^{-1}(0)$

$= 0$

$x = 3 \cos(2(0))$

$= 3$

$(3, 0)$

b/ $\int_0^3 3 \sin t \; dx$

$\int_{\frac{\pi}{4}}^{0} 3 \sin t \frac{dx}{dt} \; dt$

$\int_{\frac{\pi}{4}}^{0} 3 \sin t \cdot -6 \sin 2t \; dt$

$\int_{\frac{\pi}{4}}^{0} -18 \sin t \sin 2t \; dt$

$\int_0^{\frac{\pi}{4}} 18 \sin t \cdot 2 \sin t \cos t \; dt$

$\int_0^{\frac{\pi}{4}} 36 \sin^2 t \cos t \; dt.$

$x = 3 \cos 2t$

$\frac{dx}{dt} = -6 \sin 2t$

$3 = 3 \cos 2t$

$1 = \cos 2t$

$2t = 0$

$t = 0$

$0 = 3 \cos 2t$

$0 = \cos 2t$

$\frac{\pi}{2} = 2t$

$t = \frac{\pi}{4}$

c/ $u = \sin t$

$\frac{du}{dt} = \cos t.$

$\frac{dt}{du} = \frac{1}{\cos t}$

$u = \sin \frac{\pi}{4}$

$= \frac{\sqrt{2}}{2}$

$u = \sin 0$

$= 0$

$$\int_0^{\frac{\sqrt{2}}{2}} 36 \sin^2 t \cos t \frac{dt}{du} \, du$$

$$\int_0^{\frac{\sqrt{2}}{2}} 36 u^2 \cos t \cdot \frac{1}{\cos t} \, du$$

$$\int_0^{\frac{\sqrt{2}}{2}} 36 u^2 \, du$$

$$\left[12 u^3 \right]_0^{\frac{\sqrt{2}}{2}}$$

$3\sqrt{2}$ units^2