11)

$2x\frac{dx}{dt}+2y\frac{dy}{dt}=0\Rightarrow\frac{dy}{dt}=-\frac{3}{4}\frac{dx}{dt}$ at (3,4) $\quad\sqrt{\left(\frac{dx}{dt}\right)^2+\left(\frac{dy}{dt}\right)^2}=2\Rightarrow\left(\frac{dx}{dt}\right)^2+\left(\frac{dy}{dt}\right)^2=4$

$\left(\frac{dx}{dt}\right)^2+\left(-\frac{3}{4}\frac{dx}{dt}\right)^2=4\Rightarrow\frac{25}{16}\left(\frac{dx}{dt}\right)^2=4\Rightarrow\frac{dx}{dt}=\pm\frac{8}{5}$, but counterclockwise $\Rightarrow\frac{dx}{dt}=-\frac{8}{5}$ **A)**

$\frac{dy}{dt}=\frac{6}{5}\qquad\mathbf{v}=-\frac{8}{5}\mathbf{i}+\frac{6}{5}\mathbf{j}$

12) **D) 1< *t* < 1**

For problems 13-16, use the following:

$\mathbf{r}=\left(3\cos\left(\frac{\pi}{3}t\right)\right)\mathbf{i}+\left(2\sin\left(\frac{\pi}{3}t\right)\right)\mathbf{j}$ is the position vector from the origin to a moving point $P(x,y)$ at time t.

13) $x=3\cos\left(\frac{\pi}{3}t\right),\ y=2\sin\left(\frac{\pi}{3}t\right)\quad\left(\frac{x}{3}\right)^2+\left(\frac{y}{2}\right)^2=1\Rightarrow4x^2+9y^2=36$ **E)**

14) $v=\left\langle-\pi\sin\left(\frac{\pi}{3}t\right),\frac{2\pi}{3}\cos\left(\frac{\pi}{3}t\right)\right\rangle$ speed at $t=3\Rightarrow\|v\|=\sqrt{0^2+\left(-\frac{2\pi}{3}\right)^2}=\frac{2\pi}{3}$ **A)**

15) $a=\left\langle-\frac{\pi^2}{3}\cos\left(\frac{\pi}{3}t\right),-\frac{2\pi^2}{9}\sin\left(\frac{\pi}{3}t\right)\right\rangle$ When $t=3,\ \|a\|=\sqrt{\left(-\frac{\pi^2}{3}\right)^2+0}=\frac{\pi^2}{3}$ **B)**

16) At the point where $t=\frac{1}{2}\left[\left(\frac{3\sqrt{3}}{2},1\right)\right]$ the slope of the curve along which the particle moves is:

$\frac{dy}{dx}=\frac{\frac{2\pi}{3}\cos\left(\frac{\pi}{3}t\right)}{-\pi\sin\left(\frac{\pi}{3}t\right)}=-\frac{2}{3}\cot\left(\frac{\pi}{3}t\right)\qquad$ At $t=\frac{1}{2},\ \frac{dy}{dx}=-\frac{2}{3}\cot\left(\frac{\pi}{6}\right)=-\frac{2\sqrt{3}}{3}$ **D)**

17) **D) Its velocity and acceleration vectors must be perpendicular.**