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$$x = t^2 - 4t + 20$$

$$y = 3 \sin 2t$$

$$\dot{x} = 2t - 4$$

$$\dot{y} = 6 \cos 2t$$

$$\ddot{x} = 2$$

$$\ddot{y} = -12 \sin 2t$$

At time $t = 3$ sec :

$$\dot{x} = 2 \text{ in./sec}$$

$$\dot{y} = 5.76 \text{ in./sec}$$

$$\ddot{x} = 2 \text{ in./sec}^2$$

$$\ddot{y} = 3.35 \text{ in./sec}^2$$

$$v = \sqrt{\dot{x}^2 + \dot{y}^2} = \sqrt{2^2 + 5.76^2} = 6.10 \text{ in./sec}$$

$$a = \sqrt{\ddot{x}^2 + \ddot{y}^2} = \sqrt{2^2 + 3.35^2} = 3.90 \text{ in./sec}^2$$

$$\underline{v} = 2\hat{i} + 5.76\hat{j} \text{ in./sec}, \quad \underline{a} = 2\hat{i} + 3.35\hat{j} \text{ in./sec}^2$$

$$\theta = \cos^{-1} \frac{\underline{v} \cdot \underline{a}}{va} = \cos^{-1} \left(\frac{2(2) + 5.76(3.35)}{(6.10)(3.90)} \right)$$

$$= 11.67^\circ$$