

First name and Last name printed correctly as seen on ROSI (1 mark)

Legibility and neatness (1 mark)

MIE 100S - Quiz number 1c: Jan 14, 2015
Solution

a)

First derive the velocity equations:

$$\begin{aligned}x &= \sin(3t) \\ \dot{x} &= 3 \cos(3t) \\ y &= 4x^3 \\ \dot{y} &= 12x^2\dot{x} \\ &= 36 \sin^2(3t) \cos(3t) \\ &= 18 \sin(3t) \sin(6t) \quad * \text{using } \rightarrow \sin(2u) = 2 \sin(u) \cos(u)\end{aligned}\tag{1}$$

Find the velocities at t = 4s and combine them:

$$\begin{aligned}\dot{x}(4) &= 3 \cos(3 * 4) \\ &= 2.53 & 2.93^{**} & \tag{3}\end{aligned}$$

$$\begin{aligned}\dot{y}(4) &= 36 \sin^2(3 * 4) \cos(3 * 4) \\ &= 8.75 & 1.52^{**} & \tag{4}\end{aligned}$$

$$\boxed{4 \text{ marks}} \quad \begin{aligned}v(4) &= \sqrt{\dot{x}(4)^2 + \dot{y}(4)^2} \\ &= 9.11 \leftarrow \text{final answer} & 3.31^{**} & \tag{5}\end{aligned}$$

b)

First derive the x acceleration equation:

$$\ddot{x} = -9 \sin(3t) \tag{6}$$

Find the x acceleration at t = 7s:

$$\boxed{4 \text{ marks}} \quad \begin{aligned}\ddot{x} &= -9 \sin(3 * 7) \\ &= -7.53 \leftarrow \text{final answer} & -3.23^{**} & \tag{7}\end{aligned}$$