

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:

$$\begin{aligned}x &= \sin(3t) \\ \dot{x} &= 3 \cos(3t)\end{aligned}\tag{1}$$

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

Find the velocities at $t = 4\text{s}$ and combine them:

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

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

4 marks

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

b)

First derive the x acceleration equation:

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

Find the x acceleration at $t = 7\text{s}$:

4 marks

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