

# 2021 Radian Mode

a) Speed =  $\|v(t)\| = \|r'(t)\| = \sqrt{\left[\frac{dx}{dt}\right]^2 + \left[\frac{dy}{dt}\right]^2}$

$s = \sqrt{[x'(1.2)]^2 + [y'(1.2)]^2} \approx 1.271488 +1$

Acceleration =  $a(t) = r''(t) = \langle x''(1.2), y''(1.2) \rangle$   
 $= \langle 6.246630, 0.405125 \rangle$

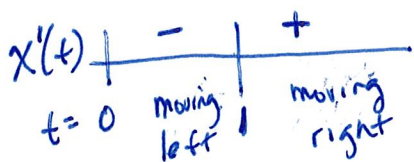
with supporting notation

$+1$  or  $6.2466\hat{i} + 0.4051\hat{j}$

b)  $L = \int_0^{1.2} \sqrt{[x'(t)]^2 + [y'(t)]^2} dt$  ← don't forget

$\approx 1.009817 +1$

c)  $\frac{dx}{dt} = (t-1)e^{t^2} = 0 \Rightarrow t=1$



$x(1) = -2 + \int_0^1 x'(t) dt \approx -2.603511$

$y(1) = 5 + \int_0^1 y'(t) dt \approx 5.410486$

Farthest to the left at  $t=1$

@  $(-2.6035, 5.4104)$

$+1$        $+1$

$+1$   $x'(t) > 0$  for all  $t > 1 \therefore$  the particle continues to move to the right and there is no point the particle is farthest right for  $t \geq 0$

2016 #2 BC

+1 uses initial condition

$$\begin{aligned} \text{a) } x(3) &= x(0) + \int_0^3 x'(t) dt \\ &= 5 + 9.377035 \\ &= 14.377 \\ y(3) &= -\frac{1}{2} \end{aligned}$$

$$\text{b) } \frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{\frac{1}{2}}{t^2 + \sin(3t^2)} \Big|_{t=3} = 0.05$$

+1 w/ supporting work

$$\begin{aligned} \text{c) } \text{Speed} &= \sqrt{(x'(3))^2 + (y'(3))^2} \\ &= 9.969 \text{ or } 9.968 \end{aligned}$$

$$\text{d) } \text{Distance} = \int_0^2 \sqrt{(x'(t))^2 + (y'(t))^2} dt$$

$$\begin{aligned} +1 &= \int_0^1 \sqrt{(x'(t))^2 + (-2)^2} dt + \int_1^2 \sqrt{(x'(t))^2 + (0)^2} dt \\ &= 4.350 \text{ or } 4.349 \end{aligned}$$

2015 #2 BC

a)  $x(2) = 3 + \int_1^2 v(t) dt = 2.557$  or  $2.556$   
+1 +1 +1

b)  $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{e^{0.5t}}{\cos(t^2)} = 2$   $t = 0.840$   
+1 +1

c) Speed =  $\sqrt{\cos^2(t^2) + e^t}$  +1  
 $\sqrt{\cos^2(t^2) + e^t} = 3$   
 $t = 2.196$  or  $2.195$  +1

d) Distance =  $\int_0^1 \sqrt{\cos^2(t^2) + e^t} dt$  +1  
 $= 1.595$  or  $1.594$  +1

2012 #2 BC

a)  $\frac{dx}{dt} \Big|_{t=2} = \frac{2}{e^2} > 0$

The particles horizontal movement is to the right because  $x'(2) > 0$  +1

$\frac{dy}{dx} = \frac{dy/dt}{dx/dt} \Big|_{t=2} = 3.055$  or  $3.054$  +1

b)  $x(4) = 1 + \int_2^4 x'(t) dt$  +1

$= 1.253$  or  $1.252$  +1

c) Speed =  $\sqrt{(x'(4))^2 + (y'(4))^2} = 0.575$  or  $0.574$  +1

Acceleration =  $\langle x''(4), y''(4) \rangle$   
 $= \langle -0.041, 0.989 \rangle$  +1

d) Distance =  $\int_2^4 \sqrt{(x'(t))^2 + (y'(t))^2} dt$  +1  
 $= 0.651$  or  $.650$  +1

2011 #1BC

$$\begin{aligned} \text{a) Speed} &= \sqrt{(x'(3))^2 + (y'(3))^2} \\ &= 13.006 \text{ or } 13.007 \quad +1 \end{aligned}$$

$$\begin{aligned} \text{Acceleration} &= \langle x''(3), y''(3) \rangle \\ &= \langle 4, -5.466 \rangle \text{ or } \langle 4, -5.467 \rangle \quad +1 \end{aligned}$$

$$\text{b) } \frac{dy}{dx} = \frac{dy/dt}{dx/dt} \Big|_{t=3} \text{ or } \frac{y'(3)}{x'(3)} = 0.031 \quad +1$$

$$\text{c) } x(3) = 0 + \int_0^3 x'(t) dt = \underline{21} \quad +1$$

$$y(3) = -4 + \int_0^3 y'(t) dt = \underline{-3.226} \quad +1$$

$$\text{d) Distance} = \int_0^3 \sqrt{x'(t)^2 + y'(t)^2} dt = \underline{21.091} \quad +1$$