

**CH.10 WS #1 Parametric****Name:** \_\_\_\_\_

- 1) A particle moving along a curve in the plane has position  $(x(t), y(t))$  at time  $t$ , where

$$\frac{dx}{dt} = 3t^2 - 1 \quad \text{and} \quad \frac{dy}{dt} = e^t + 7$$

for all real values of  $t$ . At time  $t = 0$ , the particle is at the point  $(8, 5)$ .

- a) Find the speed of the particle at time  $t = 2$ .
  
  
  
  
  
  
  
  
  
  
- b) Find the acceleration vector and the acceleration vector at time  $t = 2$ .
  
  
  
  
  
  
  
  
  
  
- c) Find the total distance traveled by the particle over the time interval  $0 \leq t \leq 5$ .
  
  
  
  
  
  
  
  
  
  
- d) Find the position of the particle at time  $t = 2$ .
  
  
  
  
  
  
  
  
  
  
- e) Find the equation of the tangent line at  $t = 0$ .

- 2) A point  $(x, y)$  is moving along a curve  $y = f(x)$ . Given  $\frac{dy}{dx} = 2t - 8$  and  $\frac{dy}{dt} = t^2 + 5$

- a) Find the rate of change, in units per second, of the  $x$ -coordinate of the point at  $t = 5$ .

- b) What is the speed of the point at this time?      c) Find  $\frac{d^2y}{dx^2}$  at  $t = 3$ .

3) A particle moving along a curve in the  $xy$ -plane has position  $(x(t), y(t))$  at time  $t \geq 0$  with

$$\frac{dx}{dt} = \sqrt{3t} \quad \text{and} \quad \frac{dy}{dt} = 3 \cos\left(\frac{t^2}{2}\right).$$

The particle is at position  $(1, 5)$  at time  $t = 4$ .

- a) Find the acceleration vector at time  $t = 4$ .
  
  
  
  
  
  
  
  
  
  
- b) Find the  $y$ -coordinate of the position of the particle at time  $t = 0$ .
  
  
  
  
  
  
  
  
  
  
- c) On the interval  $0 \leq t \leq 4$ , at what time does the speed of the particle first reach 3.5 ?
  
  
  
  
  
  
  
  
  
  
- d) Find the total distance traveled by the particle over the time interval  $0 \leq t \leq 4$ .
  
  
  
  
  
  
  
  
  
  
- e) There is a point on the curve at which the line tangent to the curve has a slope of 1.  
At what time is the object at that point?

1. At time  $t$ , a particle moving in the  $xy$ -plane is at position  $(x(t), y(t))$ , where  $x(t)$  and  $y(t)$  are not explicitly given. For  $t \geq 0$ ,  $\frac{dx}{dt} = 4t + 1$  and  $\frac{dy}{dt} = \sin(t^2)$ . At time  $t = 0$ ,  $x(0) = 0$  and  $y(0) = -4$ .
- (a) Find the speed of the particle at time  $t = 3$ , and find the acceleration vector of the particle at time  $t = 3$ .
  - (b) Find the slope of the line tangent to the path of the particle at time  $t = 3$ .
  - (c) Find the position of the particle at time  $t = 3$ .
  - (d) Find the total distance traveled by the particle over the time interval  $0 \leq t \leq 3$ .
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## Question 2

The velocity vector of a particle moving in the plane has components given by

$$\frac{dx}{dt} = 14 \cos(t^2) \sin(e^t) \quad \text{and} \quad \frac{dy}{dt} = 1 + 2 \sin(t^2), \quad \text{for } 0 \leq t \leq 1.5.$$

At time  $t = 0$ , the position of the particle is  $(-2, 3)$ .

- (a) For  $0 < t < 1.5$ , find all values of  $t$  at which the line tangent to the path of the particle is vertical.
  - (b) Write an equation for the line tangent to the path of the particle at  $t = 1$ .
  - (c) Find the speed of the particle at  $t = 1$ .
  - (d) Find the acceleration vector of the particle at  $t = 1$ .
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