UNIT 7 – Parametric, Vector and Polar Functions

Lesson 4

Name _____ PER_____ DATE_____

DO NOW –
Answer the question below without a calculator. Show your steps and circle the correct answer.

The maximum acceleration attained on the interval $0 \le t \le 3$ by the particle whose velocity is given by $v(t) = t^3 - 3t^2 + 12t + 4$ is

(A) 9
(B) 12
(C) 14
(D) 21
(E) 40

TPS-C

Describe how the problem below and the DO NOW problem are similar. Then describe how they are different.

Differences	Similarities

15. For any time $t \ge 0$, if the position of a particle in the xy-plane is given by $x = t^2 + 1$ and $y = \ln(2t+3)$, then the acceleration vector is

(A) $\left(2t, \frac{2}{(2t+3)}\right)$
(B) $\left(2t, \frac{-4}{(2t+3)^2}\right)$
(C) $\left(2, \frac{4}{(2t+3)^2}\right)$
(D) $\left(2, \frac{2}{(2t+3)^2}\right)$
(E) $\left(2, \frac{-4}{(2t+3)^2}\right)$

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3. A particle is moving along a curve so that its position at time t is $(x(t), y(t))$, where $x(t) = t^2 - 4t + 8$ and $y(t)$ is not explicitly given. Both x and y are measured in meters, and t is measured in seconds. It is known that $\frac{dy}{dt} = te^{t-3} - 1$.

   (a) Find the speed of the particle at time $t = 3$ seconds.

   (b) Find the total distance traveled by the particle for $0 \le t \le 4$ seconds.

   (c) Find the time t, $0 \le t \le 4$, when the line tangent to the path of the particle is horizontal. Is the direction of motion of the particle toward the left or toward the right at that time? Give a reason for your answer.

   (d) There is a point with x-coordinate 5 through which the particle passes twice. Find each of the following.

   (i) The two values of t when that occurs

   (ii) The slopes of the lines tangent to the particle's path at that point

   (iii) The y-coordinate of that point, given $y(2) = 3 + \frac{1}{e}$

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2. The velocity vector of a particle moving in the xy-plane has components given by

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

   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 $t = 1$.