

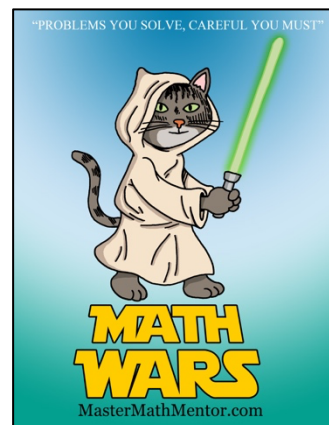
Math Wars – BC Calculus

Topic 209 – Vector-Valued Functions



Maximum Time: 8.25 Minutes

Directions: To start, you need to download the Math Wars application on your cell phone: Use the QR code or the url: <https://mastermathmentor.com/mmm/mathwars.ashx?key=209>



When ready, start the timer and then solve the problems below, entering your choice, A, B, C, D and pressing for each problem when you are sure of your answer. When complete, stop the timer. You will see problems you got correct in green and incorrect in red. You will receive a score based on how many problems you got right and your time. A perfect score is all problems correct using half the maximum time or less. You can text or email your friends with your results.

1. (1 pt) If $\mathbf{u}(t) = \left\langle t, \frac{1}{t^2} \right\rangle$ and $\mathbf{v}(t) = \langle t^2, -t \rangle$, find $D_t[\mathbf{u}(t) \cdot \mathbf{v}(t)]$.

- A. $\left\langle 3t^2, \frac{1}{t^2} \right\rangle$ B. $t^3 - \frac{1}{t}$ C. $3t^2 + \frac{1}{t^2}$ D. $\left\langle t^3, \frac{-1}{t} \right\rangle$

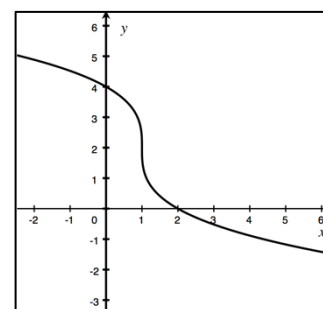
2. (3 pts) A particle moving along a curve in the xy -plane has position $(x(t), y(t))$ at time $t > 0$. The velocity of the particle is $\mathbf{v}(t) = \left\langle 1 + \frac{1}{t}, 4 - \frac{2}{t} \right\rangle$. For what time $t > 0$ does the line tangent to the path of the particle at $(x(t), y(t))$ have a slope of $\frac{2}{3}$?

- A. $\frac{4}{5}$ B. 1 C. $\frac{7}{5}$ D. $\frac{3}{2}$

3. (5 pts) A particle moving along a curve in the xy -plane has position $(x(t), y(t))$ at time $t \geq 0$ with $\frac{dx}{dt} = e^{t^2-4t+3} - 1$ and $\frac{dy}{dt} = t^2 - t$. For what value(s) of t is the particle stopped?

- I. $t = 0$ II. $t = 1$ III. $t = 3$
- A. I only B. II only C. I and III only D. II and III only

4. (7 pts) The path of an object moving along plane curve given by $r(t) = \langle 1 - t^3, 2t + 2 \rangle$, $-\infty < t < \infty$ is shown in the figure to the right. Which of the following statements are true?



- I. The object is always moving downwards.
 II. The acceleration of the object is constant.
 III. The speed of the object is steadily increasing.

- A. I only B. II only
 C. III only D. None of them

5. (9 pts) If $\mathbf{r}'(t) = \left\langle 8t, \frac{4}{1+t^2} \right\rangle$ and $\mathbf{r}(0) = \langle -1, \pi \rangle$, find $\mathbf{r}(1)$.

A. $\langle 4, \pi \rangle$

B. $\langle 4, -\pi \rangle$

C. $\langle 3, 2\pi \rangle$

D. $\langle 3, 0 \rangle$