

DIGITLE – BC CALCULUS

Puzzle 208 – Parametric Equations



Directions: The first 5 problems have single digit or letter answers. The 6th problem has a 3-digit answer (counting leading zeros if present). You have a choice: solve the easier single-character answer problems or tackle the more difficult 3-digit answer and the multiple choice. Once you have done that, attempt to solve the puzzle by entering the following url on your computer, tablet, or phone: <https://mastermathmentor.com/mmm/digitle.ashx>. The correct puzzle answer will be the digits/letters of your answer(s) scrambled. Use the following interpretation. You get 6 tries. Problems should be done without graphing calculators.

- Green :** the digit is in the answer and is in the correct spot. **Grey :** the digit is not in the answer.
Yellow: the digit is in the answer but is not in the correct spot.

Single Digit or Letter Answers:

- 1) If $x = \sqrt{t}$, $y = \frac{14}{3}t^{3/2} - 1$, find $\frac{dy}{dx}$ at $t = \frac{1}{2}$

- 2) Find the behavior of the curve at $t = 3$ of the parametric equations $x = t^2 - 10t - 8$ and $y = -8t$.

A. increasing, concave up	B. increasing, concave down
C. decreasing, concave up	D. decreasing, concave down

- 3) Let k be any value of t for which the graph of the parametric equations $x = 4t^4 - 4t^3 + 4t^2 + 1$, $y = 2t^3 - 9t^2 + 12t - 4$, $t \geq 0$, have vertical tangents. Find the sum of all such k 's.

- 4) Find the area under the curve described by $x = 2\cos t$, $y = \sin^2 t$ for $0 \leq t \leq \pi$.

A. $\frac{8}{3}$	B. $\frac{2}{3}$	C. $\frac{4}{3}$	D. $\frac{16}{3}$
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- 5) If $y = f(x)$ is the equation of the tangent line to the parametric equation $x = 2\cos 3t - 4\sin 3t$, $y = \tan 6t$, at $t = \frac{\pi}{2}$. find $f(9)$.

Three Digit Answer:

- 6) A hypocycloid has the shape shown in the figure to the right and has parametric equations $x = 125\cos^3 \theta$ and $y = 125\sin^3 \theta$, $0 \leq \theta \leq 2\pi$. Find the arc length of the hypocycloid.

