

DIGITLE – BC CALCULUS

Puzzle 209 – Polar 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) Convert the rectangular equation $x^2 - y^2 = 4$ to a polar equation.

A. $r = 2$

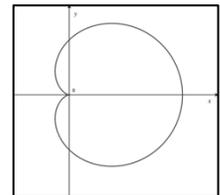
B. $r = 2\sqrt{\csc\theta}$

C. $r = \frac{4}{\cos 2\theta}$

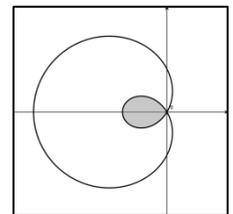
D. $r = 2\sqrt{\sec 2\theta}$

2) For the polar curve $r = 3\sin\theta + 4\cos\theta$, find $\frac{dy}{dx}$ at $\theta = \pi/2$.

3) (Calculator) The graph of the polar curve $r = 1 + \cos\theta$ is to the right. Find its arc length.



4) The graph of the limaçon $r = 3 - 6\cos\theta$ is shown in the figure to the right. Which of the following gives the area of the shaded inner loop?



I. $\int_0^{\pi/3} (3 - 6\cos\theta)^2 d\theta$

II. $\frac{1}{2} \int_{5\pi/3}^{7\pi/3} (3 - 6\cos\theta)^2 d\theta$

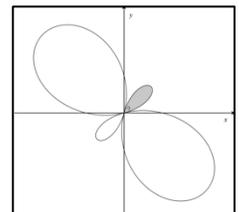
A. I only

B. II only

C. I and II

D. Neither

5) (Calculator) The graph of $r = 10\sin(2\theta) - 5$ is to the right. Find the area of the shaded region to the nearest integer.



Three Digit Answer:

6) The graph of the lemniscate $r = 28\sqrt{\cos 2\theta}$ is shown in the figure to the right. Find the shaded area.

