

EXAM 4 - MATH 152

Tuesday, November 26

YOUR NAME: _____

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Find the area under the parametric curve

$$\begin{cases} x = 3 \cos t + \cos 3t \\ y = 3 \sin t - 3 \sin 3t \end{cases}, \quad \frac{\pi}{4} \leq t \leq \frac{\pi}{2}.$$

2. Find the arc length of the parametric curve

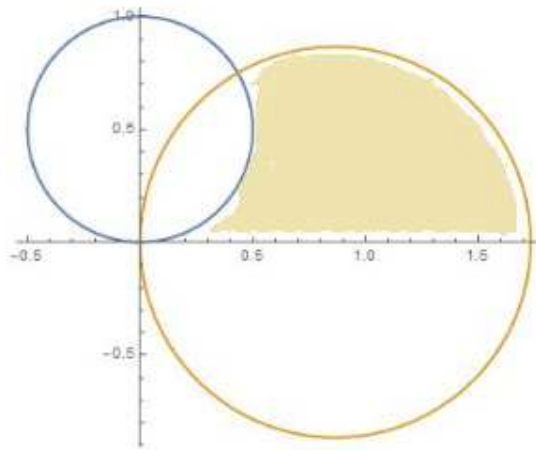
$$\begin{cases} x = \frac{1}{3}t^3 \\ y = \frac{1}{2}t^2 \end{cases}, \quad 3 \leq t \leq 9.$$

3. Show how to derive the following formulas starting from the ones for cartesian coordinates.

(a) The slope $\frac{dy}{dx}$ of the tangent line to a given polar curve $r = r(\theta)$ in terms of r and θ .

(b) The arc length of a given polar $r = r(\theta)$, $\alpha \leq \theta \leq \beta$, in terms of r and θ .

4. The small circle is given by the polar equation $r = \sin \theta$. The large circle is given by the polar equation $r = \sqrt{3} \cos \theta$. Find the area of the shaded region.



5. Find the length of the polar curve

$$r = 6\theta^2, \quad 0 \leq \theta \leq 2\pi.$$