Polar Review
AP Calculus

Name:______________________________

Find the slope of the tangent line to the graphs at the indicated points.

(a) $r = \cos\theta$ at $\theta = 0, \pi/4$

(b) $r = \sin(5\theta)$ at $\theta = 0, \pi/2$

Find the points where the indicated graphs have horizontal and vertical tangent lines.

(a) $r = \cos\theta$

(b) $r = \sin(4\theta)$

(c) $r = 5\cos\theta$

Find the area of the following curves.

(a) interior of $r = \sin\theta$

(b) $r = \sin 5\theta$ (all petals)

(c) $r = \sin 5\theta$ (the petal in the 3rd quadrant with proper limits)

(d) $r = 3 - 5\sin\theta$ (area of the outer loop)

Find the area bounded by the following sets of equations.

(a) Bounded inside of $r = 6\sin 2\theta$ and outside of $r = 3$ in Quadrant 1.

(b) Common area of $r = 6\sin 2\theta$ and $r = 3$ on the whole *xy*-plane.

(c) Inside $r = 3\cos\theta$ and outside $r = 2 - \cos\theta$.

(d) Common interior of $r = 3\cos\theta$ and $r = 1 + \cos\theta$.

(e) Inside $r = 3\sin\theta$ and outside $r = 1 + \sin\theta$.

Multiple Choice

The area enclosed inside the polar curve $r^2 = 10\cos 2\theta$ is

(A) 10 (B) 5π (C) 20 (D) 10π (E) 25π

The area enclosed by the polar curve $r\cos\frac{1}{2}\theta = 1$ in the interval $0 \le \theta \le \frac{\pi}{2}$ is

(A) $\frac{1}{2}$ (B) $\frac{\sqrt{2}}{2}$ (C) $\frac{\pi}{4}$ (D) 1 (E) 2

Free Response

The graphs of the polar curves $r = 2$ and $r = 3 + 2\cos\theta$ can be graphed in the *xy*-plane.

(a) Let R be the region that is inside the graph of $r = 2$ and also inside the graph of $r = 3 + 2\cos\theta$. Find the area of R.

(b) A particle moving with nonzero velocity along the polar curve given by $r = 3 + 2\cos\theta$ has a position $(x(t), y(t))$ at time t, with $\theta = 0$ when $t = 0$. This particle moves along the curve so that $\frac{dr}{dt} = \frac{dr}{d\theta}$. Find the value of $\frac{dr}{dt}$ at $\theta = \frac{\pi}{3}$ and interpret your answer in terms of the motion of the particle.

(c) For the particle described in part (b), $\frac{dy}{dt} = \frac{dy}{d\theta}$. Find the value of $\frac{dy}{dt}$ at $\theta = \frac{\pi}{3}$ and interpret your answer in terms of the motion of the particle.