Put answers on a separate piece of paper. Label each Section. Show all work for Free Response questions.

## Quick Quiz for AP* Preparation: Sections 10.1–10.3

You may use a graphing calculator to solve the following problems.

**1. Multiple Choice** Which of the following is equal to the area of the region inside the polar curve $r = 2\cos\theta$ and outside the polar curve $r = \cos\theta$?

(A) $3\int_0^{\pi/2} \cos^2\theta\, d\theta$ (B) $3\int_0^{\pi} \cos^2\theta\, d\theta$

(C) $\frac{3}{2}\int_0^{\pi/2} \cos^2\theta\, d\theta$ (D) $3\int_0^{\pi/2} \cos\theta\, d\theta$

(E) $3\int_0^{\pi} \cos\theta\, d\theta$

**2. Multiple Choice** For what values of $t$ does the curve given by the parametric equations $x = t^3 - t^2 - 1$ and $y = t^4 + 2t^2 - 8t$ have a vertical tangent?

(A) 0 only (B) 1 only

(C) 0 and 2/3 only (D) 0, 2/3, and 1

(E) No value

**3. Multiple Choice** The length of the path described by the parametric equations $x = t^2$ and $y = t$ from $t = 0$ to $t = 4$ is given by which integral?

(A) $\int_0^4 \sqrt{4t+1}\, dt$ (B) $2\int_0^4 \sqrt{t^2+1}\, dt$ (C) $\int_0^4 \sqrt{2t^2+1}\, dt$

(D) $\int_0^4 \sqrt{4t^2+1}\, dt$ (E) $2\pi\int_0^4 \sqrt{4t^2+1}\, dt$

**4. Free Response** A polar curve is defined by the equation $r = \theta + \sin 2\theta$ for $0 \le \theta \le \pi$.

**(a)** Find the area bounded by the curve and the $x$-axis.

**(b)** Find the angle $\theta$ that corresponds to the point on the curve where $x = -2$.

**(c)** For $\frac{\pi}{3} < \theta < \frac{2\pi}{3}$, $\frac{dr}{d\theta}$ is negative. How can this be seen from the graph?

**(d)** At what angle $\theta$ in the interval $0 \le \theta \le \pi/2$ is the curve farthest away from the origin? Justify your answer.

## Ch 10 Review Section

### AP* Examination Preparation

You may use a graphing calculator to solve the following problems.

**51.** A particle moves along the graph of $y = \cos x$ so that its $x$-component of acceleration is always 2. At time $t = 0$, the particle is at the point $(\pi, -1)$ and the velocity of the particle is $\langle 0, 0\rangle$.

**(a)** Find the position vector of the particle.

**(b)** Find the speed of the particle when it is at the point $(4, \cos 4)$.

**52.** Two particles move in the $xy$-plane. For time $t \ge 0$, the position of particle $A$ is given by $x = t - 2$ and $y = (t-2)^2$, and the position of particle $B$ is given by $x = \frac{3}{2}t - 4$ and $y = \frac{3}{2}t - 2$.

**(a)** Find the velocity vector for each particle at time $t = 3$.

**(b)** Find the distance traveled by particle $A$ from $t = 0$ to $t = 3$.

**(c)** Determine the exact time when the particles collide.

**53.** A region $R$ in the $xy$-plane is bounded below by the $x$-axis and above by the polar curve defined by $r = \frac{4}{1+\sin\theta}$ for $0 \le \theta \le \pi$.

**(a)** Find the area of $R$ by evaluating an integral in polar coordinates.

**(b)** The curve resembles an arch of the parabola $8y = 16 - x^2$. Convert the polar equation to rectangular coordinates and prove that the curves are the same.

**(c)** Set up an integral in rectangular coordinates that gives the area of $R$.