Unit 8 Review Name: _____
AP Calculus BC
Parametric and Polar Coordinates

1. For the parametric curve defined by $x = t^3 - 12t$ and $y = t^2 - 1$, find $\frac{d^2y}{dx^2}$.

2. Consider the polar curve $r = \sin\theta\cos\theta$.

What is the equation of the tangent line to the curve r at $\theta = \frac{\pi}{3}$? Give exact values only (so, don't use a calculator).

3. Consider the polar curve $r = 2 + 6\sin\theta$.

Use a calculator to find the slope of the line tangent to the curve r when $\theta = \frac{\pi}{6}$? Round your answer to the nearest thousandths place.

4. A curve in the plane is defined parametrically be the equations $x = tan(2t)$ and $y = sin(4t - \frac{\pi}{2})$.

Find the value of $\frac{dy}{dx}$ at $t = \frac{\pi}{2}$.

Choose the answer:

(A) 1 (B) -2 (C) 2 (D) 0

5. Let h be a vector-valued function defined by $h(t) = (3\cos t, -\sqrt{4t})$.

Find $h'(t)$.

Choose the answer:

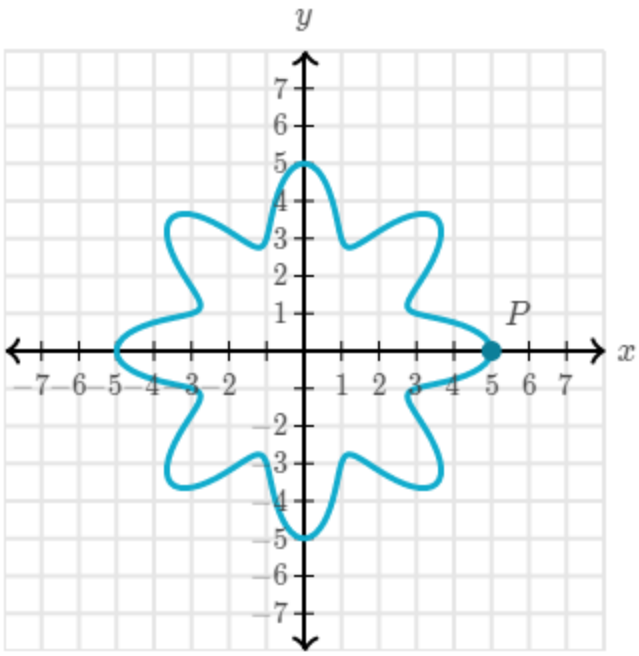
(A) $-3\sin t + \frac{2}{\sqrt{t}}$

(B) $\left(3\sin t, -\frac{2}{\sqrt{t}}\right)$

(C) $(-3\cos t, -2t)$

(D) $(-3\sin t, -\frac{1}{\sqrt{t}})$

6. Let r be the polar function $r(\theta) = \cos(8\theta) + 4$. Here is the graph for $0 \le \theta \le 2\pi$.



What is the rate of change of the x-coordinate with respect to θ at the point P?

7. Consider the polar curve $r = 4\sin\theta$.

What is the equation of the tangent line to the curve r at $\theta = \frac{\pi}{6}$?

(A) $y + 1 = \frac{1}{\sqrt{3}}(x + \sqrt{3})$

(B) $y + 1 = \sqrt{3}(x + \sqrt{3})$

(C) $y - 1 = \sqrt{3}(x - \sqrt{3})$

(D) $y - 1 = \frac{1}{\sqrt{3}}(x - \sqrt{3})$

8. For $t \geq 0$, a particle is moving along a curve so that its position at time t is $(x(t), y(t))$. At time $t = 2$, the particle is at position (1, 5). It is known that $\frac{dx}{dt} = \frac{\sqrt{t+2}}{e^t}$ and $\frac{dy}{dt} = \sin^2 t$.

a. Is the horizontal movement of the particle to the left or to the right at time $t = 2$? Explain your answer.

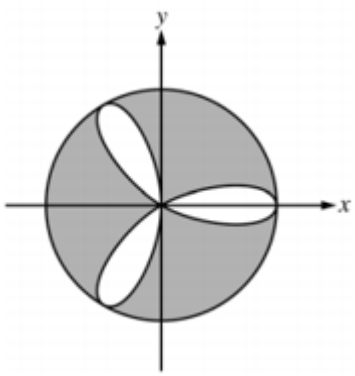
b. Find the slope of the path of the particle at time $t = 2$.

c. Find the x-coordinate of the particle's position at time $t = 4$.

d. Find the speed of the particle at time $t = 4$.

e. Find the acceleration vector of the particle at time $t = 4$.

f. Find the distance traveled by the particle from time $t = 2$ to $t = 4$.



9. The figure above shows the graphs of the polar curves $r = 2\cos(3\theta)$ and $r = 2$. What is the sum of the areas of the shaded regions?

(A) 0.858

(B) 3.142

(C) 8.566

(D) 9.425

(E) 15.708