AP CALCULUS BC

Unit 8 Outline –Parametric and Polar Equations

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/8	**FINAL EXAM**	Go Over Final Exam
HOMEWORK		None

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/9	**PARAMETRIC EQUATIONS** **FIRST AND SECOND DERIVATIVES OF PARAMETRIC EQUATIONS**	Write in Cartesian (rectangular) form and graph: 1. $x = 5t$, $y = 25t^2$, $-2 < t < 2$ 2. $x = \sqrt{t}$, $y = t - 3$, $0 \le t \le 4$ 3. $x = \cos t$, $y = \sin t$, $0 \le t \le \pi$ 4. Find $\frac{dy}{dx}$ if $x = 3t + 1$ and $y = t^2$. 5. Find $\frac{d^2y}{dx^2}$ if $x = 3t^2 + 2$ and $y = 2t^4 - 1$ 6. Find the equation of the line tangent to $x = 5t$, $y = 25t^2$, $-\infty < t < \infty$ at $t = 2$. 7. Find all points of horizontal and vertical tangency given $x = t^2 + t$ and $y = t^2 - 3t + 5$
HOMEWORK		Worksheet 63

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/10	**PARAMETRIC EQUATIONS** **ARC LENGTH**	Ex. 1 Find the arc length of the given curve if $x = t^2$, $y = \frac{1}{3}t^3 - 2$, $0 \le t \le 2$ Ex. 2 Find the length of the curve if $x = 3\sin t$, $y = 3\cos t$, $0 \le t \le \pi$ Ex. 3 Determine the leftmost point on the curve given by the parametric equations $x(t) = \frac{1}{4}t^4 - \frac{9}{2}t^2$ and $y(t) = 3t^3 + 2t$ on the interval $0 \le t \le 4$?
AP MULTIPLE CHOICE If $x(t) = t^2 + 4$ and $y(t) = t^4 + 3$, for $t > 0$, then in terms of t, $\frac{d^2y}{dx^2} =$ (A) $\frac{1}{2}$ (B) 2 (C) $4t$ (D) $6t^2$ (E) $12t^2$		
HOMEWORK		Worksheet 64

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/11	**VECTOR CALCULUS** **PARTICLE MOTION**	Ex. 1 The position of a particle in the *xy*-plane is given by the parametric equations $s(t)=\langle 2t^3+t, t^2\rangle$. a) Find the velocity and acceleration vectors at time t. b) Find the speed of the particle at time $t=2$. c) Find the total distance traveled by the particle from time $t=0$ to $t=2$.

AP MULTIPLE CHOICE

For time $t > 0$, the position of a particle moving in the *xy*-plane is given by the parametric equations $x = 4t + t^2$ and $y = \frac{1}{3t+1}$. What is the acceleration vector of the particle at time $t = 1$?

(A) $\left(2, \frac{1}{32}\right)$ (B) $\left(2, \frac{9}{32}\right)$ (C) $\left(5, \frac{1}{4}\right)$ (D) $\left(6, -\frac{3}{16}\right)$ (E) $\left(6, -\frac{1}{16}\right)$

HOMEWORK	Worksheet 65

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/12	**VECTOR CALCULUS** **PARTICLE MOTION**	**Ex. 1** A particle moving along a curve so that its velocity for time $t \geq 0$ is given by $v(t)=\left\langle 2e^{-\frac{t}{4}}, \frac{t-4}{t+5}\right\rangle$. a) For what values of *t* is the particle moving to the right? b) For what values of *t* is the particle moving up? **Ex. 2** The velocity vector of a particle moving in the *xy*-plane is given by $v(t)=\langle \sin 2t, e^{\cos t}\rangle$. At time $t=2$, the position of the particle is $(3,2)$. What is the *x*-coordinate of the position vector at time $t=3$?

AP MULTIPLE CHOICE

The position of a particle moving in the *xy*-plane is given by the parametric equations $x(t) = t^3 - 3t^2$ and $y(t) = 12t - 3t^2$. At which of the following points (x, y) is the particle at rest?

(A) $(-4, 12)$ (B) $(-3, 6)$ (C) $(-2, 9)$ (D) $(0, 0)$ (E) $(3, 4)$

A particle moves in the *xy*-plane with position given by $(x(t), y(t)) = (5 - 2t, t^2 - 3)$ at time *t*. In which direction is the particle moving as it passes through the point $(3, -2)$?

(A) Up and to the left
(B) Down and to the left
(C) Up and to the right
(D) Down and to the right
(E) Straight up

HOMEWORK	Worksheet 66

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/16	**INTRO TO POLAR EQUATIONS**	Notes Handout
HOMEWORK		None

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/17	**POLAR EQUATIONS AND DERIVATIVES**	Notes Handout
HOMEWORK		Worksheet 67

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/18	**POLAR EQUATIONS AND MOTION**	Notes Handout

AP MULTIPLE CHOICE

What is the slope of the line tangent to the polar curve $r = 1 + 2\sin\theta$ at $\theta = 0$?

(A) 2 (B) $\frac{1}{2}$ (C) 0 (D) $-\frac{1}{2}$ (E) -2

HOMEWORK	Worksheet 68

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/19	**AREA ENCLOSED BY POLAR EQUATIONS**	Notes Handout

AP MULTIPLE CHOICE

Which of the following integrals gives the area of the region that is bounded by the graphs of the polar equations $\theta = 0$, $\theta = \frac{\pi}{4}$, and $r = \frac{2}{\cos\theta + \sin\theta}$?

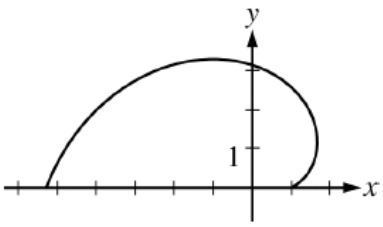
(A) $\int_0^{\pi/4} \frac{1}{\cos\theta + \sin\theta}\, d\theta$ (B) $\int_0^{\pi/4} \frac{2}{\cos\theta + \sin\theta}\, d\theta$ (C) $\int_0^{\pi/4} \frac{2}{(\cos\theta + \sin\theta)^2}\, d\theta$

(D) $\int_0^{\pi/4} \frac{4}{(\cos\theta + \sin\theta)^2}\, d\theta$ (E) $\int_0^{\pi/4} \frac{2(\cos\theta - \sin\theta)^2}{(\cos\theta + \sin\theta)^4}\, d\theta$

HOMEWORK	Worksheet 69

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/22	**AREA ENCLOSED BY POLAR EQUATIONS**	Notes Handout

AP MULTIPLE CHOICE



The graph above shows the polar curve $r = 2\theta + \cos\theta$ for $0 \le \theta \le \pi$. What is the area of the region bounded by the curve and the x-axis?

(A) 3.069 (B) 4.935 (C) 9.870 (D) 17.456 (E) 34.912

HOMEWORK	Worksheet 70

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/23	**PARAMETRIC AND POLAR EQUATIONS REVIEW**	Review
HOMEWORK		Worksheet 71

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/24	**PARAMETRIC AND POLAR EQUATIONS REVIEW**	**PARAMETRIC AND POLAR EQUATIONS PRACTICE EXAM**
HOMEWORK		Practice Exam

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
1/25	**PARAMETRIC AND POLAR EQUATIONS**	**PARAMETRIC AND POLAR EQUATIONS EXAM**
HOMEWORK		None