Day 1 Homework

PARAMETRIC EQUATIONS

Make a table of values and sketch the curve, indicating the direction of your graph. Then eliminate the parameter. Do not use your calculator.

1. $x = 2t + 1$ and $y = t - 1$
2. $x = 2t$ and $y = t^2, -1 \le t \le 2$
3. $x = 2 - t^2$ and $y = t$
4. $x = \sqrt{t}$ and $y = t - 3$
5. $x = t - 2$ and $y = 1 - \sqrt{t}$
6. $x = 2t$ and $y = |t - 1|$
7. $x = t$ and $y = \frac{1}{t^2}$
8. $x = 2\cos t - 1$ and $y = 3\sin t + 1$
9. $x = 2\sin t - 1$ and $y = \cos t + 2$
10. $x = \sec t$ and $y = \tan t$

DAY 3 HW

Multiple-Choice Items: MOTION ALONG A LINE

1. 2003 AP Calculus AB Exam, Item 25 (no calculator):

   A particle moves along the x-axis so that at time $t \ge 0$ its position is given by $x(t) = 2t^3 - 21t^2 + 72t - 53$. At what time t is the particle at rest?

   (A) $t = 1$ only

   (B) $t = 3$ only

   (C) $t = \frac{7}{2}$ only

   (D) $t = 3$ and $t = \frac{7}{2}$

   (E) $t = 3$ and $t = 4$

---

2. 1998 AP Calculus AB Exam, Item 24 (no calculator):

   The maximum acceleration attained on the interval $0 \le t \le 3$ by the particle whose velocity is given by $v(t) = t^3 - 3t^2 + 12t + 4$ is

   (A) 9

   (B) 12

   (C) 14

   (D) 21

   (E) 40

3. AP Calculus AB, sample multiple-choice Item 9 (no calculator):
The position of a particle moving along a line is given by $s(t) = 2t^3 - 24t^2 + 90t + 7$ for $t \geq 0$.

For what values of t is the speed of the particle increasing?

(A) $3 < t < 4$ only

(B) $t > 4$ only

(C) $t > 5$ only

(D) $0 < t < 3$ and $t > 5$

(E) $3 < t < 4$ and $t > 5$

---

4. 2003 AP Calculus AB Exam, Item 76 (calculator):
A particle moves along the x-axis so that at any time $t \geq 0$, its velocity is given by $v(t) = 3 + 4.1\cos(0.9t)$. What is the acceleration of the particle at time $t = 4$?

(A) –2.016

(B) –0.677

(C) 1.633

(D) 1.814

(E) 2.97

---

5. 2003 AP Calculus AB Exam, Item 91 (calculator):
A particle moves along the x-axis so that at any time $t > 0$, its acceleration is given by $a(t) = \ln(1 + 2^t)$. If the velocity of the particle is 2 at time $t = 1$, then the velocity of the particle at time $t = 2$ is

(A) 0.462

(B) 1.609

(C) 2.555

(D) 2.886

(E) 3.346

6. AP Calculus AB, sample multiple-choice Item 19 (calculator):
Two particles start at the origin and move along the x-axis. For $0 \le t \le 10$, their respective position functions are given by $x_1 = \sin t$ and $x_2 = e^{-2t} - 1$. For how many values of t do the particles have the same velocity?

(A) None

(B) One

(C) Two

(D) Three

(E) Four

---

7. AP Calculus AB, sample multiple-choice Item 15 (calculator):

A particle travels along a straight line with a velocity of $v(t) = 3e^{\left(-\frac{1}{2}\right)}\sin(2t)$ meters per second. What is the total distance traveled by the particle during the time interval $0 \le t \le 2$ seconds?

(A) 0.835

(B) 1.850

(C) 2.055

(D) 2.261

(E) 7.025

Free-Response Questions:

8. 2004 AP Calculus AB Exam, FRQ 3 (calculator):
A particle moves along the y-axis so that its velocity at time $t \ge 0$ is given by $v(t) = 1 - \tan^{-1}(e^t)$. At time $t = 0$, the particle is at $y = -1$. (Note: $\tan^{-1} x = \arctan x$.)

(a) Find the acceleration of the particle at time $t = 2$.

(b) Is the speed of the particle increasing or decreasing at time $t = 2$? Give a reason for your answer.

(c) Find the time $t \ge 0$ at which the particle reaches its highest point. Justify your answer.

(d) Find the position of the particle at time $t = 2$. Is the particle moving toward the origin or away from the origin at time $t = 2$? Justify your answer.

9. 2006 AP Calculus AB/BC Exams, Item 4 (no calculator):

t (seconds)	0	10	20	30	40	50	60	70	80
$v(t)$ (feet per second)	5	14	22	29	35	40	44	47	49

Rocket A has positive velocity $v(t)$ after being launched upward from an initial height of 0 feet at time $t = 0$ seconds. The velocity of the rocket is recorded for selected values of t over the interval $0 \le t \le 80$ seconds, as shown in the table above.

(a) Find the average acceleration of rocket A over the time interval $0 \le t \le 80$ seconds. Indicate units of measure.

(b) Using correct units, explain the meaning of $\int_{10}^{70} v(t)\,dt$ in terms of the rocket's flight. Use a midpoint Riemann sum with 3 subintervals of equal length to approximate $\int_{10}^{70} v(t)\,dt$.

(c) Rocket B is launched upward with an acceleration of $a(t) = \frac{3}{\sqrt{t+1}}$ feet per second. At time $t = 0$ seconds, the initial height of the rocket is 0 feet, and the initial velocity is 2 feet per second. Which of the two rockets is traveling faster at time $t = 80$ seconds? Explain your answer.