CALCULUS I
Worksheet #72

For #1 – 5, find velocity and acceleration, if s represents the position of the body at any time t.

$$v = \frac{ds}{dt}$$
$$a = \frac{dv}{dt} = \frac{d^2s}{dt^2}$$

1. $s = t^2 - 4t + 3$

2. $s = 2t^3 - 5t^2 + 4t - 3$

3. $s = 3 + 4t - t^2$

4. $s = (2t + 3)^2$

5. $s = gt^2 + v_o t + s_o$ (g, v_o, s_o constants.)

6. A particle projected vertically upward with a speed of 160 $\frac{ft}{sec}$ reaches an elevation $s = 160t - 16t^2$ at the end of t seconds.

   (a) How high does it rise?
   (b) How fast is it traveling when it reaches an elevation of 256 feet going up; and again when it reaches that elevation coming down?

7. A particle moves along the x-axis in such a way that its acceleration at time t for $t > 0$ is given by $a(t) = \frac{3}{t^2}$. When $t = 1$, the position of the particle is 6 and the velocity is 2.

   (Hint: This is an initial value problem from first semester)

   a) Write an equation of the velocity, v(t), of the particle for all $t > 0$.
   b) Write an equation for the position, x(t), of the particle for all $t > 0$.
   c) Find the position of the particle when $t = e$.

8. Let f be the function defined by $f(x) = \begin{cases} x^3 & \text{for } x \le 0, \\ x & \text{for } x > 0. \end{cases}$

   Which of the following statements about f is true?

   A) f is an odd function B) f is discontinuous at $x = 0$
   C) f has a relative minimum D) $f'(0) = 0$ E) $f'(x) > 0$ for $x \neq 0$

9. Let R be the region in the first quadrant enclosed by the graph of $y = (x + 1)^{1/3}$, the line $x = 7$, the x-axis, and the y-axis. The volume of the solid generated when R is revolved about the x-axis is given by

   A) $\pi \int_0^7 (x+1)^{2/3}\,dx$ B) $\pi \int_0^7 (x+1)^{1/3}\,dx$ C) $\pi \int_0^2 (x+1)^{2/3}\,dx$

   D) $\pi \int_0^2 (x+1)^{1/3}\,dx$ E) $\pi \int_0^7 (y^3 - 1)^2\,dy$

Answers:

1. $v = 2t - 4$, $a = 2$	2. $v = 6t^2 - 10t + 4$, $a = 12t - 10$	3. $v = 4 - 2t$, $a = -2$
4. $v = 8t + 12$, $a = 8$	5. $v = 2gt + v_o$, $a = 2g$	6a. 400 ft. b. $v_{up} = 96 \frac{ft.}{sec}$, $v_{down} = -96 \frac{ft.}{sec}$
7a. $v = \frac{-3}{t} + 5$ b. $x = -3\ln\lvert t\rvert + 5t + 1$ c. $x(e) = 5e - 2$	8. E	9. A