Math 2 Winter 2006

Calculus with Algebra and Trigonometry

Midterm 1 – Extra credit problem due Friday, January 27 by 4:00pm. You may place it inside of the envelope on your instructor's door if they are not in their office.

Your Name (Please Print): _____ Key _____

Section (Please Circle): Andersen   Henrich

The Honor Principle requires that you neither give nor receive any aid on this exam.

(3pt) Suppose that a ball is dropped from 10 feet above the ground and air resistance is negligible. Determine the average velocity of the ball from the time it is dropped until it hits the ground. (Use $-32 ft/sec^2$ as the gravitational constant.)

$$h(0) = 10 \qquad h'(t) = v(t) \qquad v'(t) = a(t) = -32$$
$$v(0) = 0 \qquad \text{velocity} \qquad \text{acceleration}$$

$$v(t) = \int a(t)\, dt = \int -32\, dt = -32t + c$$

$$v(0) = -32 \cdot 0 + c = 0 \quad \Rightarrow c = 0$$

$$h(t) = \int v(t)\, dt = \int -32t\, dt = -16t^2 + c$$

$$h(0) = -16 \cdot 0^2 + c = 10 \quad \Rightarrow \quad c = 10$$

$$h(t) = -16t^2 + 10$$

Ball hits the ground when $h(t) = 0$:

$$-16t^2 + 10 = 0 \quad \Rightarrow \quad t^2 = \frac{10}{16} \quad \Rightarrow \quad t = \frac{\sqrt{10}}{4}$$

$$V_{av} = \frac{1}{\left(\frac{\sqrt{10}}{4} - 0\right)} \int_0^{\sqrt{10}/4} v(t)\, dt = \frac{4}{\sqrt{10}}\left[-16t^2\right]_0^{\sqrt{10}/4} = -4\sqrt{10}$$