PRINT Your Name:____________________________________

Quiz for January 19, 2012

The quiz is worth 5 points. **Remove EVERYTHING from your desk except this quiz and a pen or pencil.** SHOW your work. Express your work in a neat and coherent manner. $\boxed{\text{BOX}}$ your answer.

Suppose that a car skids 15 meters if it is moving at 50 km/hr when the brakes are applied. Assuming that the car has the same constant deceleration, how far will it skid if it is moving at 100 km/hr when the brakes are applied?

ANSWER: Let $x(t)$ be the position of the car at time t. Measure t in hours and x in km. We take $x(0) = 0$. We are told that $x''(t) = -k$ for some positive constant k. For the first car, we have $x'(0) = 50$ and $x(\text{when the car stops}) = .015$. For the second car, we have $x'(0) = 100$ and we are supposed to find $x(\text{when the car stops})$.

For the first car: $x' = -kt + 50$ and $x = -kt^2/2 + 50t$. The car stops when $x'(t) = 0$; so, $t = 50/k$ and

$$.015 = x(\text{when the car stops}) = x(50/k) = -k(50/k)^2/2 + 50(50/k)$$

$$= \frac{-(50)^2/2 + (50)^2}{k} = \frac{50^2}{2k}.$$

We have learned that $k = (50)^2/2(.015)$.

Now we consider car 2. We have $x' = -kt + 100$ and $x = -kt^2/2 + 100t$. The car stops when $x'(t) = 0$; so, $t = 100/k$ and

$$x(\text{when the car stops}) = x(100/k) = -k(100/k)^2/2 + 100(100/k) = \frac{100^2}{2k}$$

$$= \frac{100^2}{2}\frac{2(.015)}{(50)^2} = 4(.015) = .06 \text{ km} = \boxed{\text{60 meters.}}$$