

You are encouraged to work in groups of two to four on this assignment and make a single group submission. Each problem is worth 3 points for correct and clearly justified answers. An additional quality point will be awarded to submissions which are presented in a manner appropriate to good college-level work.

1. A ball is bouncing up and down. Each time the ball bounces, it rebounds with 60% of the velocity it had before impact. If the ball is initially thrown downward at 30 feet per second from a height of 20 feet, find how long it takes for the ball to peak for the second time.

2. a) A car is traveling 120 feet per second along the interstate, and suddenly hits its brakes to avoid hitting a baby rhinoceros. If the car decelerates by 20 feet per second each second until coming to a stop, how much distance does it travel before coming to a stop?

b) If the car is traveling 10% faster when the brakes are first applied, how much (in feet and as a percentage) does this affect the stopping distance?

3. [From Briggs/Cochran 4th] Perhaps the simplest change of variables is the shift or translation given by $u = x + c$, where c is a real number.

- a) Prove that shifting a function does not change the net area under the curve, in the sense that

$$\int_a^b f(x+c) dx = \int_{a+c}^{b+c} f(u) du$$

- b) Draw a picture to illustrate this change of variables in the case that $f(x) = \sin x$, $a = 0$, $b = \pi$, $c = \pi/2$.