Math 180: Calculus I **Fall 2014**

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TA: Brian Powers

For **position** function $s = f(t)$, we have **velocity** at time t is $v(t) = f'(t)$, **speed** at time t is $|v(t)|$, and **acceleration** at t is $a(t) = v'(t) = f''(t)$. **Average cost** $\overline{C}(x) = C(x)/x$. **Marginal cost** is $C'(x)$. For demand function $D = f(p)$, **price elasticity** is $E(p) = \frac{dD}{dp}\frac{p}{D}$. If $-\infty < E(p) < -1$ demand is **elastic**, when $-1 < E(p) < 0$ demand is **inelastic**.

1. Suppose a stone is thrown vertically upward from the edge of a cliff with initial velocity 64 ft/s from a height of 32 ft above the ground. The height h (in ft) of the stone above the ground t seconds after it is thrown is $h = -16t^2 + 64t + 32$.
   (a) Determine the velocity v of the stone after t seconds.
   (b) When does the stone reach its highest point, and what is its height then?
   (c) When does the stone strike the ground, and what is its velocity at that point?
   (d) On what intervals is its speed increasing?
2. For the following (i) find the average cost and marginal cost functions, (ii) Determine the average and marginal cost when $x = a$, and interpret these values
   (a) $C(x) = 1000 + 0.1x, 0 \leq x \leq 5000; a = 2000$
   (b) $C(x) = -0.01x^2 + 40x + 100, 0 \leq x \leq 1500; a = 1000$
3. Compute the elasticity for the exponential demand function $D(p) = ae^{-bp}$, where a and b are positive real numbers. For what prices is the demand elastic? Inelastic?
4. Show that the demand function $D(p) = a/p^b$, where a and b are positive real numbers, has a constant elasticity for all positive prices.