Discussion Questions for October 29th

for Math 16A

Group 1

Solve for the equations of the following lines and graph them.

1. The secant line of $x^2 + 2x$ between $x = 1$ and $x = 2$.

2. The secant line of x^2 between $x = 1$ and $x = 2$.

3. The tangent line of $x^2 + 2x$ at $x = 1$.

Group 2

For each of the following functions, compute $f'(x)$, and $f'(2)$.

1. $f(x) = 3x^2 - 7$

2. $f(x) = 3/x$

3. $f(x) = \sqrt{x}$
   (hint: multiply numerator and denominator by $\sqrt{x+h} + \sqrt{x}$)

Group 3

Suppose the height of a thrown baseball is given by $b(t) = -5t^2 + 12t + 2$. Find the instantaneous rate of change at $t = 2$. Is the baseball rising or falling?

Group 4

Graph the following functions. Without computing it, does the derivative fail to exist anywhere? If so, where?

1. $f(x) = 1/x$

2. $f(x) = \sqrt{x}$

3. $f(x) = \frac{x^2 - 1}{x - 1}$

4. $f(x) = |x|$

Group 5

Application to Life Sciences: The eating behavior of a typical human during a meal can be described by

$$I(t) = 27 + 72t - 1.5t^2$$

where t is the number of minutes since the meal began and $I(t)$ represents the amount (in grams) the person has eaten at time t. ***Source: Appetite***.

1. Find the rate of food consumed 5 minutes into the meal. 24 minutes?

2. What is the rate of food consumption as a function of time?

Extra Problems

1. **Application to Economics**: Suppose customers at a hardware store are willing to buy $N(p)$ boxes of nails at p dollars per box, as given by

$$N(p) = 80 - 5p^2$$

   (a) Find the average rate of change of demand for a change in price from $2 to $3.

   (b) Find the instantaneous rate of change in demand at $p = \$2$.

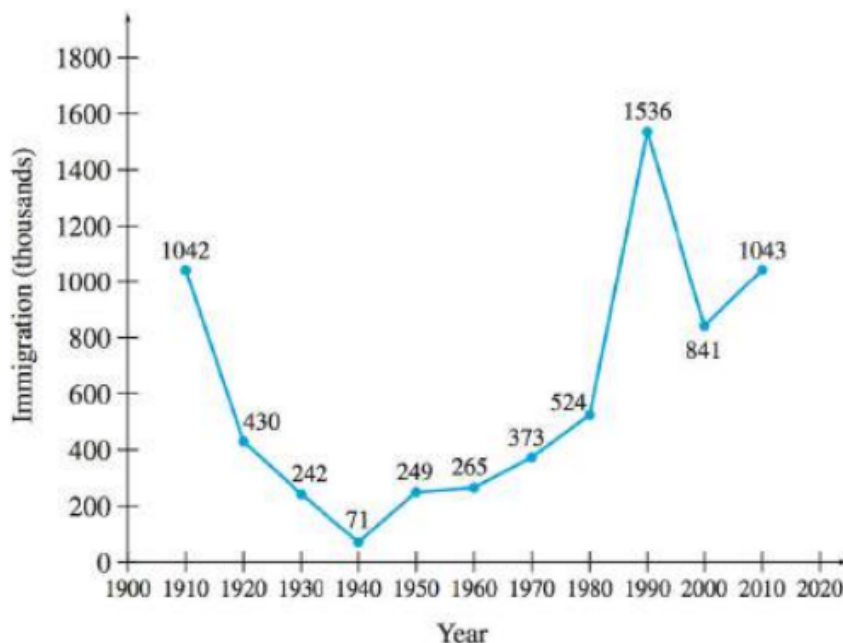   (c) Find the instantaneous rate of change in demand at $p = \$3$.

2. Find the instantaneous rate of change for each function at the given value.

   (a) $f(x) = x^2 + 2x$ at $x = 0$

   (b) $s(t) = -4t^2 - 6$ at $= 2$

   (c) $g(t) = 1 - t^2$ at $t = -1$

3. **Application to Social Sciences**: The following graph shows how immigration (in thousands) to the United States has varied over the past century. *Source: Homeland Security.*


   (a) Find the average annual change in immigration for the first half of the century (from 1910 to 1960).

   (b) Find the average annual change in immigration for the second half of the century (from 1960 to 2010).

   (c) Find the average annual rate of change for the entire century (from 1910 to 2010).

4. **Application to Economics**: Suppose the profit (in cents) from selling x lb of potatoes is given by

$$P(x) = 15x + 25x^2.$$

(a) What is the average rate of change of profit from 6 lb to 7 lb?

(b) What is the average rate of change of profit from 6 lb to 6.5 lb?

(c) What is the marginal profit (instantaneous rate of change of profit) at 6 lb?

5. **Application to Life Sciences**: In one research study, the population of a certain shellfish in an area at a time t was closely approximated by the following graph. Estimate the slope of the tangent line at each of the points.
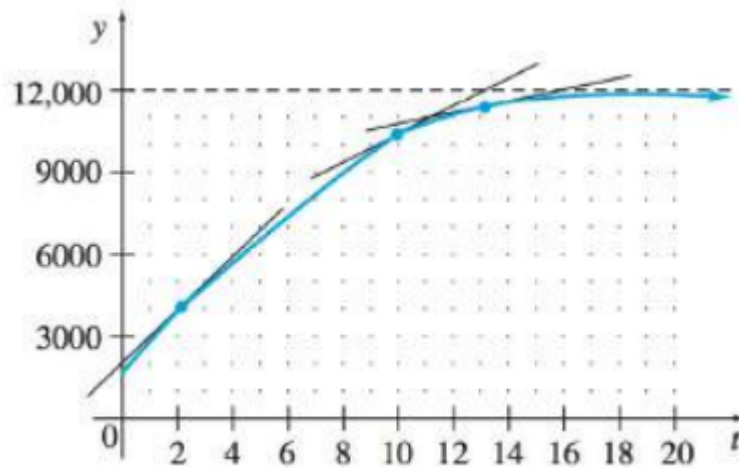
6. Find the x-values where the following does not have a derivative.