Math 122 (Fall '12)

Sample Questions for Midterm 1

NOTE: The format of the midterm will be slightly different (e.g. fewer exercises).

1. Solve the following equations:
   i) $2x^3 = 3x^{-2}$
   ii) $\ln 3x - \ln x^2 = 2$
   iii) $5e^{3t} = 8e^{2t}$
   iv) $(x+1)^2 = x+3$

2. Let $f(x) = 2x + 3$ and $g(x) = e^x$. Find
   i) $f(g(x))$
   ii) $g(f(x))$
   iii) $f(f(x))$

   Furthermore, decide if any of the functions from (i-iii) is linear or exponential.

3. i) What annual percent growth rate is equivalent to a continuous percent growth rate of 8%?
   ii) What continuos percent rate is equivalent to an annual percent growth rate of 10%?

4. i) Which (if any) of the functions in the following table could be linear? Find formulas for those functions.
   ii) Which (if any) of the functions in the following table could be exponential? Find formulas for those functions.

x	-2	-1	0	1	2
f(x)	12	17	20	21	18
g(x)	16	24	36	54	81
h(x)	37	34	31	28	25

5. When a new product is advertised, more and more people try it. However, the rate at which new people try it slows as the time goes on.

   a) Graph the total number of people who have tried such a product against time.

   b) What do you know about the concavity of the graph?

6. Using the fact that $(\sqrt{x})' = \frac{1}{2\sqrt{x}}$, estimate the value of $\sqrt{10}$.

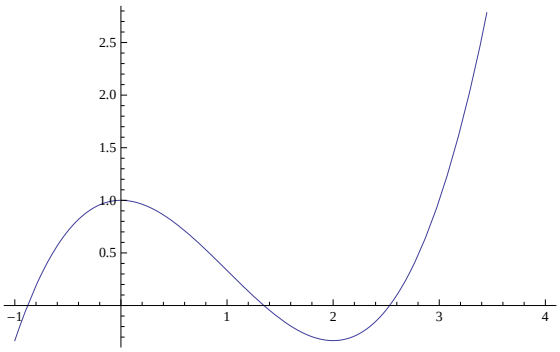
7. Values of f are given in the following table

t	0	2	4	6	8	10
f(t)	150	145	137	122	98	56

   i) Does the function appear to have a positive or negative first derivative? Second derivative? Explain.

   ii) Estimate $f'(2)$ and $f'(8)$.

8. The following is the graph of a function $f(x)$.



   i) Identify the intervals on which $f'(x) > 0$ and those on which $f'(x) < 0$. For which value of x, $f'(x) = 0$? Justify your answer.

   ii) Identify the intervals on which $f''(x) > 0$ and those on which $f''(x) < 0$. For which value of x, $f''(x) = 0$? Justify your answer.

   iii Sketch a possible graph for $f''(x)$.

iv) Sketch a possible graph for $f'(x)$. [Hint: here you need to use both the information about f' from i), and also that about f'' from ii).]

9. Let $P(t)$ represent the price of a share of stock of a corporation at time t. What does each of the following statements tell us about the signs of the first and second derivatives of $P(t)$?

   i) "The price of the stock is rising faster and faster".

   ii) "The price of the stock is close to bottoming out".

   Furthermore, suppose that at each time you know the sign of $P'(t)$ and $P''(t)$. Devise a strategy for when to buy and sell the stock.

10. Which of the following statements are true:

   - when $B > 0$, we have $\ln(2B) = 2\ln(B)$
   - the relative change in a quantity is the change divided by the size of the quantity before the change
   - any power function has constant rate of change
   - the relative rate of change of an exponential function is constant
   - if $S = 25t^{-\frac{1}{3}}$, then S is inversely proportional to the cube root of t
   - If the cost C (in dollars) of feeding x students in the dinning center is given by $C = f(x)$, then the units of dC/dx are dollars per student.
   - if $f''(x)$ is constant (but not zero), then $f(x)$ is linear
   - if $f'(x) > 0$ and $f''(x) > 0$ for all x, then $f(x) > 0$ for all $x > 0$
   - if $f(0) > 0$ and $f'(x) > 0$ for all x, then $f(x) > 0$ for all $x > 0$
   - If f' is decreasing on an interval, then f is concave down on that interval.

More recommended textbook questions: §1.3: 25, 41, §1.6: 21, 37, §1.9: 20, Ch.1 Review (p. 79): 24, §2.1: 17, 19, §2.2: 27, 30, §2.3: 13, 27, §2.4: 22, 23