College of the Holy Cross, Fall Semester, 2017
MATH 133, Midterm 3
Friday, November 10

Your Name: _____

Instructions: Please show all work necessary to justify your answers, and write your answers in the spaces provided. Use the back of the preceding page if you need more space for scratch work. There are 100 possible points distributed as below.

Please do not write in the space below

Problem	Points/Poss
1	/ 20
2	/ 20
3	/ 40
4	/ 20
Total	/100

1. A) (5) State the limit definition of the derivative $f'(x)$ as an equation starting with
   $f'(x) =$.

B) (10) Use the limit definition to compute $f'(x)$ for $f(x) = 3x^2 + 4x - 2$.

C) (5) Find the equation of the line tangent to the graph $y = 3x^2 + 4x - 2$ at $x = 1$.

2. (20) The bluebook value of a 2013 model car at time t years after 2013 is approximated by $P(t) = 24e^{(-.2)t}$ (in units of $1000). What was the value in 2015, and what was the rate of change of the value then? (Give your answer with units.) Was the value increasing or decreasing?

3. Compute the indicated derivatives of *any four of* the following functions. If you submit answers for all five, the best four will be used to compute your score on this question. You may use any correct method. You do not need to simplify your answers unless specifically directed to do so. But you must show work for full credit.

(A) (10) $f(x) = (e^x + \sin(x))(\cos(x) + \pi^e)$. Compute $f'(x)$.

(B) (10) $g(x) = \dfrac{x^4 - 3x^2}{x^3 + 1}$. Compute $g'(x)$ and simplify your answer.

(C) (10) $h(x) = \dfrac{1}{\sqrt{x^2 + 4x + 2}}$. Compute $h'(x)$.

(D) (10) $j(x) = (x^2 + 3)e^{x^3 - 5\sin(2x)}$. Compute $j'(x)$.

(E) (10) $k(x) = 3x^{7/4} - \dfrac{3}{x^3} + e^3$. Compute both $k'(x)$ and $k''(x)$.

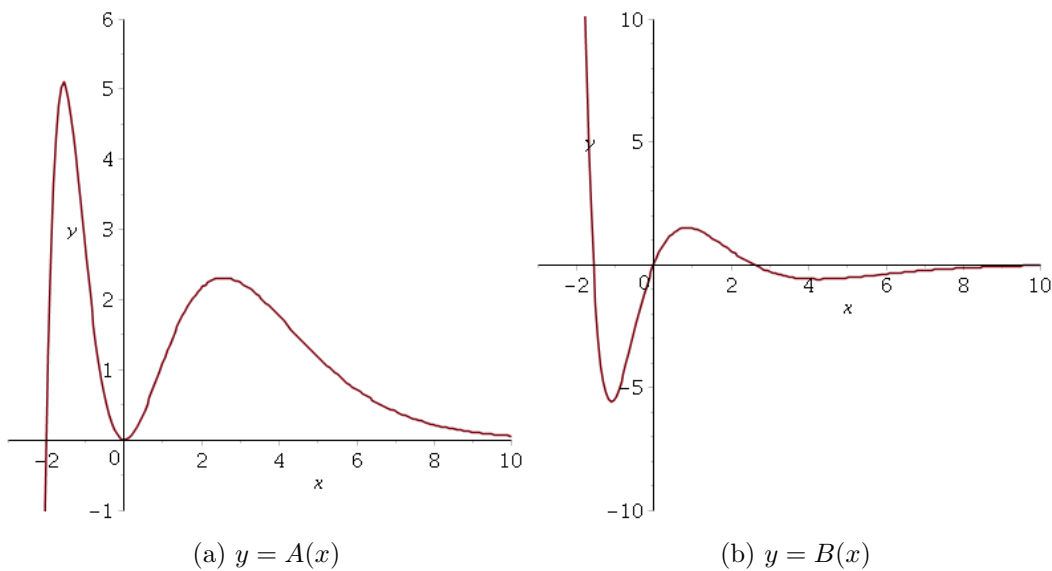(a) $y = A(x)$ (b) $y = B(x)$

Figure 1: Plots for Problem 3

4. All parts of this question refer to the plots in Figure 1. Assume the whole domain of the functions is the interval $[-2, 10]$ shown.

(A) (4) Which has the larger slope: The secant line to $y = A(x)$ through $(0, A(0))$ and $(2, A(2))$ or the tangent line to $y = A(x)$ at $(0, A(0))$?
Answer: _____

(B) (4) Is $A'(4)$ positive or negative? Answer: _____

(C) (3) At how many different points is $A'(x) = 0$? Estimate the x-values from the graph. Answer: _____

(D) (3) On the x-interval $(0, 2)$, is $B''(x)$ positive or negative? Answer: _____

(E) (3) On the x-interval $(1, 3)$ is $B'(x)$ positive or negative? Answer: _____

(F) (3) One of the two functions $A(x)$ and $B(x)$ is the derivative of the other. Which is which? Answer: _____ is the derivative of _____.