

College of the Holy Cross, Fall Semester, 2016  
MATH 135, section 1, Midterm 3  
Monday, December 5

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	/ 40
2	/ 20
3	/ 15
4	/ 25
Total	/100

1. Find  $\frac{dy}{dx}$  and simplify:

A) (10)  $y = \frac{e^x + x^2}{\sqrt{x + x + 1}}$

B) (10)  $y = \sin(3 \ln(x)) - 4 \sec(x)$

C) (10)  $y = \tan^{-1}(e^{-4x})$

D) (10)  $x^3y^2 - 4\sin^{-1}(x^2) + y = x$  (use implicit differentiation)

2. (20) A stationary observer watches a weather balloon being launched straight upward from a point 450 feet away from her position. The distance between her and the balloon is increasing at a rate of 18 feet per second. How fast is the balloon's height changing when it is 600 feet above the ground?

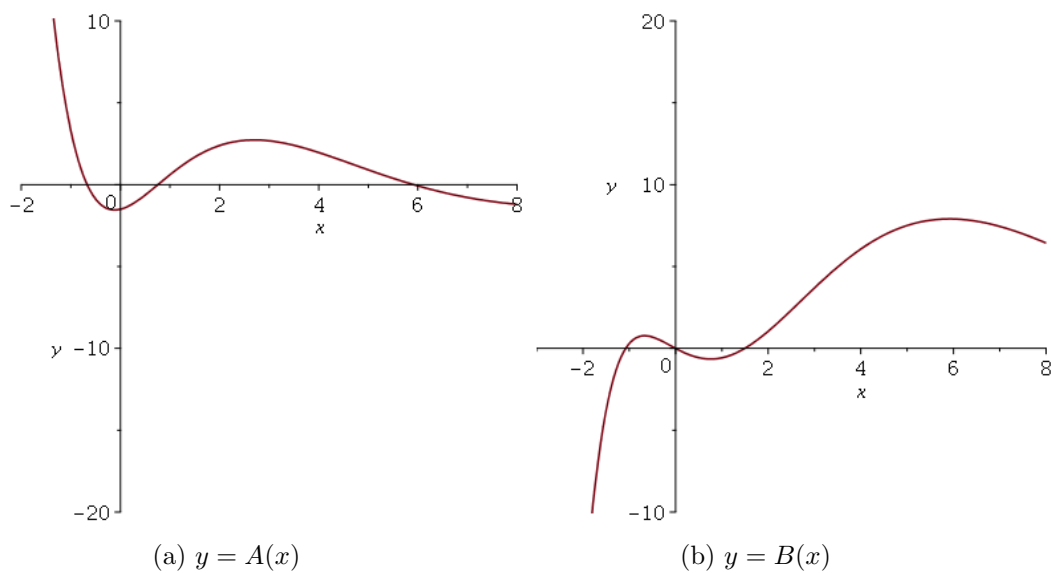


Figure 1: Plots for Problem 3

3. All parts of this question refer to the plots in Figure 1. Assume the whole domain of the functions is the interval  $[-2, 8]$  shown (don't try to extrapolate what might happen on a larger interval).

(A) (3) Is  $A'(4)$  positive or negative? Answer: \_\_\_\_\_

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

(C) (3) On the  $x$ -interval  $(2, 4)$ , is  $A''(x)$  positive or negative? Answer: \_\_\_\_\_

(D) (3) On the  $x$ -interval  $(2, 4)$  is  $B'(x)$  positive or negative? Answer: \_\_\_\_\_

(E) (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 \_\_\_\_\_.

4. All parts of this problem refer to  $f(x) = x^4 - 4x^2 - 5$ .

(A) (10) Find all critical points of  $f(x)$ .

(B) (10) Find the absolute maximum and minimum values of  $f(x)$  on the interval  $[0, 3]$ .

(C) (5) Which of the critical points you found in part A are local maximum points and which are local minimum points? (Any correct method for this is OK.)