

NAME: \_\_\_\_\_

SID#: \_\_\_\_\_

Check one	Section	Instructor	Time
	1	Brad Sullivan	MW 8:30 - 9:45
	2	Katherine Fedde	MW 1:00 - 2:15
	3	Brad Sullivan	TR 8:30 - 9:45
	4	Sara Boerckel	TR 11:30 - 12:45

Directions: This is a two part exam. For Part 1, no technology will be allowed. After you have completed Part 1, turn it in, and then you may use technology (your calculator) for Part 2. **Part 1 must be turned in no later than 11:15am.**

- Please **PRINT** your name and student ID number on *both* this page and the next.
- Mark your section above.
- Check that you have 8 pages and 14 problems.
- No calculators or notes are allowed on Part 1.
- For non-multiple choice questions *show all work* and *box* your final answer.
- For multiple choice questions there will be no partial credit.
- You may use the back of the sheets as scratch paper, but please indicate clearly where you work each problem.

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TOTAL PART I \_\_\_\_\_(125)

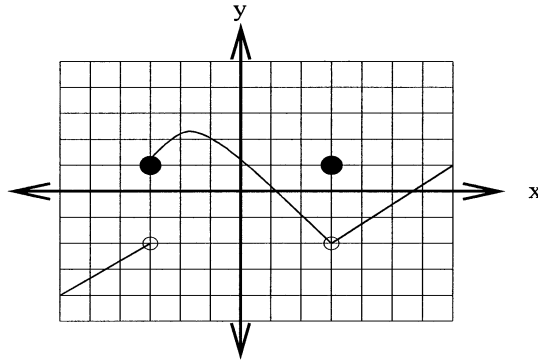
TOTAL PART II \_\_\_\_\_(50)

**Total** \_\_\_\_\_(175)

NAME: \_\_\_\_\_

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1. (10 pts) Use the graph of  $y = f(x)$  to find the following limits.



(a)  $\lim_{x \rightarrow -3^-} f(x)$   
A) -2 B) 0 C) 1 D) 1.5 E) Does not exist

(b)  $\lim_{x \rightarrow -3^+} f(x)$   
A) -2 B) 0 C) 1 D) 1.5 E) Does not exist

(c)  $\lim_{x \rightarrow 3} f(x)$   
A) -2 B) 0 C) 1 D) 1.5 E) Does not exist

(d) At what value(s) of  $x$  is  $f(x)$  discontinuous?

(e) How could you define  $f(x)$  at  $x = 3$ , in order to remove the discontinuity?

\_\_\_\_\_

2. (6 pts) Evaluate each limit. If it does not exist, write DNE.

(a)  $\lim_{x \rightarrow 0} \frac{2x}{3x^2 - 2x}$

(b)  $\lim_{x \rightarrow -4} \sqrt[3]{2x}$

3. (5 pts) Evaluate

$$\frac{d}{dx} \left( \frac{2}{x^3} - 5x^4 - 5x + 6 \right).$$

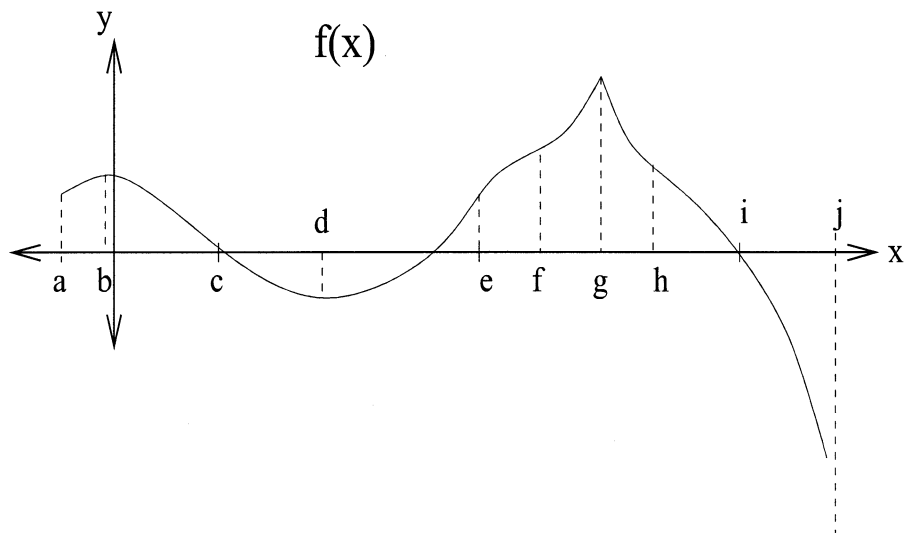
4. (15 pts) Find the derivative and simplify.

(a)  $f(x) = x^4 e^x$

(b)  $h(x) = \frac{e^x}{x^2 + 9}$

(c)  $g(x) = \sqrt{\ln x}$

5. (18 pts) Use the graph of  $f(x)$  to find the following.



- (a) Identify the interval(s) over which  $f(x)$  is decreasing.
- (b) Identify  $x$ -coordinate(s) of the points where  $f'(x) = 0$ .
- (c) Identify  $x$ -coordinate(s) of the points where  $f'(x)$  does not exist.
- (d) Identify  $x$ -coordinate(s) where  $f(x)$  has local maximum(s).
- (e) Identify the interval(s) over which  $f''(x) > 0$ .
- (f) Identify  $x$ -coordinate(s) where  $f(x)$  has inflection point(s).

6. (6 pts) Construct a sign chart to find intervals where the following function is increasing/decreasing. Find the local extrema and determine whether the extrema are local maxima or minima.

$$f(x) = x^2 + 2x - 8$$

7. (3 pts) Find the equation for the horizontal asymptote(s) for  $f(x) = \frac{2x^2 + x - 3}{4x^2 + 5}$

8. (3 pts) Find the equation for the vertical asymptote(s) for  $f(x) = \frac{x^2 + 9}{x^2 - 9}$ .

9. (8 pts) For the function  $g(x) = x^3 + 3x^2 - 9x$ ,

(a) Find the critical values.

(b) Find the absolute maximum and absolute minimum on the interval  $[0, 3]$ .

10. (10 pts) If  $y = \ln w$ ,  $w = 2 + e^u$ ,  $u = x^2$  determine

(a) (2 pts)  $\frac{dy}{dw}$

(b) (2 pts)  $\frac{dw}{du}$

(c) (2 pts)  $\frac{du}{dx}$

(d) (4 pts)  $\frac{dy}{dx}$  in terms of  $x$  only.

11. (7 pts) Given  $3y^2 - y - 4x^2 = 0$ , use implicit differentiation to find  $y'(x)$ .

12. (20 pts) Integrate.

(a)  $\int (5x^3 - 6x + 2) dx$

(b)  $\int 8\sqrt[3]{x^2} dx$

(c)  $\int (4x - 2e^x + \frac{5}{x}) dx$

(d)  $\int_1^2 (5 - 16x^{-3}) dx$

13. (8 pts) Use  $u$ -substitution to find the following integral. State clearly what  $u$  is. Express your answer in terms of  $x$ .

$$\int 7x^2(x^3 - 7)^4 dx$$

Let  $u = \underline{\hspace{2cm}}$

14. (6 pts) Suppose

$$\int_0^2 f(x) dx = 1 \quad \int_0^2 g(x) dx = 8 \quad \int_2^3 g(x) = 2.$$

Determine

(a)  $\int_0^3 3g(x) dx$

(b)  $\int_0^2 (g(x) - 7f(x)) dx$

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Directions: This is the second part of a two part exam. You may use technology (your calculator) for this part.

- Please **PRINT** your name and student ID number on *both* this page and the next.
- Mark your section above.
- Check that you have 6 pages and 5 problems.
- *Show all work* and *box* your final answer.
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**Total** \_\_\_\_\_(50)

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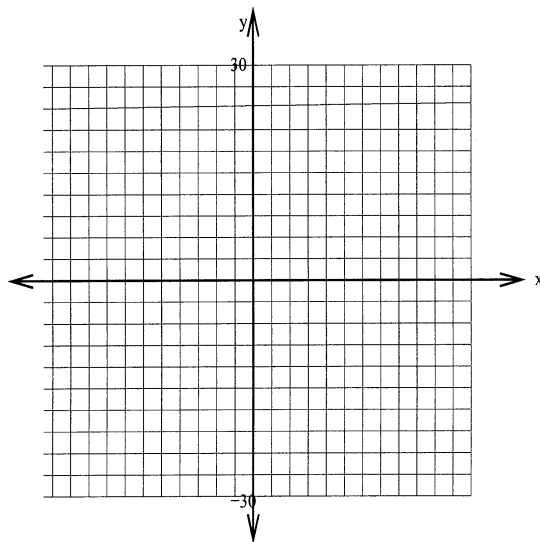
1. (13 pts) Given the function  $f(x) = x^3 - 4x^2 - 4x + 2$ ,

(a) (3 pts) Find  $f'(x)$ .

(b) (2 pts) Find  $f'(-1)$ .

(c) (4 pts) Find the equation of the tangent line at  $x = 2$ . (Express your solution in slope-intercept form).

(d) (4 pts) Graph the function  $f(x)$  and the tangent line on the same graph. (Hint: let the window of the  $y$ -axis be  $[-30, 30]$ ). Show the scale of the  $x$  and  $y$ -axis. Plot points for accuracy.



2. (15 pts) A market research department of a local business recommends that the company manufacture and market a new C.D. player. The price-demand equation is given by

$$x = 12,000 - 500p$$

where  $x$  is the number of C.D. players at a price of  $\$p$  per C.D. player. The cost function is given by

$$C(x) = 25,000 + 5x$$

where  $\$25,000$  is a fixed cost and there is a variable cost of  $\$5$  per player.

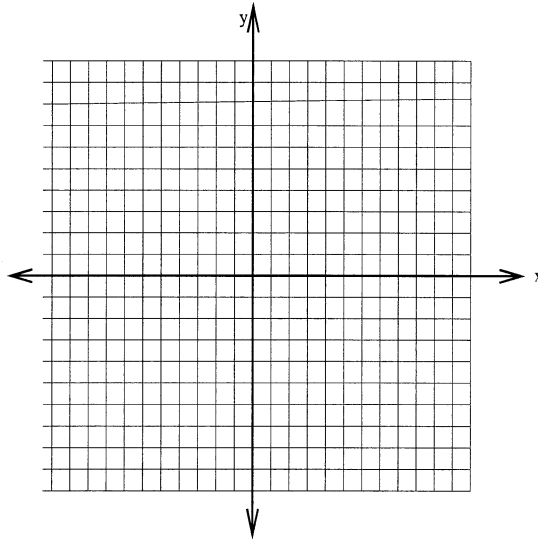
- (a) (2 pts) Find the domain of the price function,  $p$ , defined by the price-demand equation.

- (b) (3 pts) Find the revenue function.

- (c) (4 pts) Find the marginal revenue at  $x = 500$  players.

(continued on next page)

- (d) (6 pts) Graph the revenue function and the cost function. Label the axes and show how you scale them. Identify regions of profit and loss.



3. (6 pts) How long will it take money to double if it is invested at an interest rate of 7% compounded continuously? How long will it take to triple?

4. (8 pts) In 1995 the U.S. consumption of renewable energy was 7.42 quadrillion BTU's. Since 1960, consumption has been growing at a rate given by  $f'(t) = 0.003t + 0.081$ , where  $t$  is years after 1960. Find  $f(t)$  and estimate the U.S. consumption of renewable energy in 2010.

5. (8 pts) Consider the two functions  $y = 3 - 2x^2$  and  $y = 2x^2 - 4x$ . Using your calculator, graph the equations and find relevant intersection points. Then find the area bounded by the curves. Compute the answer to 3 decimal places.