



*University of California, San Diego*  
*Department of Mathematics*

**Instructions**

1. Write your *Name*, *PID*, *Section*, and *Exam Version* on the front of your Blue Book.
  2. No calculators or other electronic devices are allowed during this exam.
  3. You may use one page of notes, but no books or other assistance during this exam.
  4. Read each question carefully, and answer each question completely.
  5. Write your solutions clearly in your Blue Book.
    - (a) Carefully indicate the number and letter of each question and question part.
    - (b) Present your answers in the same order they appear in the exam.
    - (c) Start each problem on a new page.
  6. Show all of your work. No credit will be given for unsupported answers, even if correct.
  7. Turn in your exam paper with your Blue Book.
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**DO NOT TURN OVER UNTIL INSTRUCTED TO DO SO**

**Question Zero:**

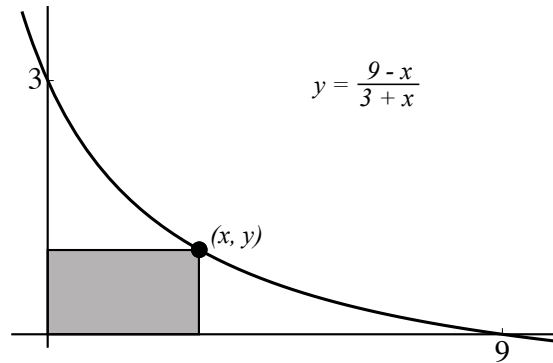
0. (1 point) Carefully read and complete the instructions at the top of this exam sheet and any additional instructions written on the chalkboard during the exam.

(This exam is worth 80 points.)

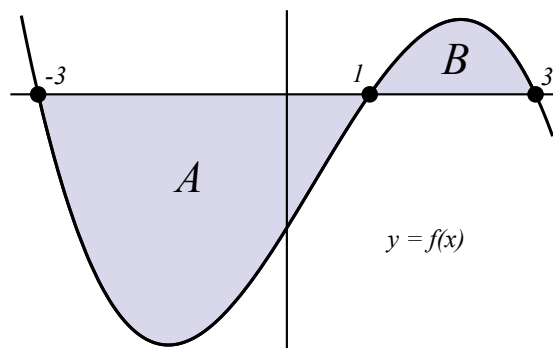
- (9 points) Let  $y = e^x \sin(x)$  and compute  $\frac{dy}{dx}$ .
- (10 points) Find the equation of the tangent line to the curve  $x^3 + y^3 = 2xy$  at the point  $(1, 1)$ .
- (10 points) Evaluate the following limits or state that they do not exist (DNE):

$$(a) \lim_{x \rightarrow 0} \frac{x^2}{\ln(x^2 + 2)} \qquad (b) \lim_{x \rightarrow 0} \frac{1 - \cos(2x)}{1 - \cos(3x)}$$

- (10 points) Find the coordinates of the point  $(x, y)$  so that the shaded rectangle has maximum area. (The rectangle is inscribed in the region bounded by the graph of  $y = \frac{9-x}{3+x}$  and the axes.)



- (10 points) The function  $f(x) = e^{x^3-3x^2}$  has **first derivative**  $f'(x) = 3x(x-2)e^{x^3-3x^2}$ . Find the critical points of  $f$  and identify each as a local maximum, local minimum, or neither.
- (10 points) The function  $g(x) = \ln(x^2 + 2x + 5)$  has **second derivative**  $g''(x) = -\frac{2(x+3)(x-1)}{(x^2+2x+5)^2}$ . Find the inflection points of  $g$  and determine the intervals where  $g$  is concave up or concave down.
- (10 points) Compute the indefinite integral:  $\int (3x^6 - 4x^{-1} + \sin x) dx$
- (10 points) The graph of  $y = f(x)$  is given below:



The area of the region marked  $A$  is 12 and the area of the region marked  $B$  is 4. Compute the following:

$$(a) \int_{-3}^3 f(x) dx \qquad (b) \int_{-3}^3 |f(x)| dx \qquad (c) \int_1^3 (5f(x) + x) dx$$