

# Math 2374 - Midterm 1

Name: \_\_\_\_\_

Section: \_\_\_\_\_

Student ID: \_\_\_\_\_

Signature: \_\_\_\_\_

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- This exam consists of 6 pages (including this one) and 5 questions.
  - Do not give numerical approximations to quantities such as  $\sin 5$ ,  $\pi$ , or  $\sqrt{2}$ . However, you should simplify  $\cos \pi/4 = \sqrt{2}/2$ ,  $e^0 = 1$ , and so on.
  - Show your work, in a reasonably neat and coherent way, in the space provided. All answers must be justified by valid mathematical reasoning, including the evaluation of definite and indefinite integrals. To receive full credit on a problem, you must show enough work so that your solution can be followed by someone without a calculator.
  - Mysterious or unsupported answers will not receive full credit. Your work should be mathematically correct and carefully and legibly written.
  - A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations will receive partial credit.
  - Full credit will be given only for work that is presented neatly and logically; work scattered all over the page without a clear ordering will receive from little to no credit.
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1	2	3	4	5	Total

1. (20 points) Compute the area of the triangle with vertices

$$A = (1, 2), \quad B = (2, 3), \quad C = (3, 5).$$

2. (20 points) Given the function

$$f(x, y) = \frac{x^2 - y^2}{x^2 + y^2}$$

Can one define  $f(0, 0)$  so that the  $f$  is continuous there? Explain your answer.

3. (20 points) Consider the function

$$f(x, y) = e^{x-y} + xy.$$

Compute the equation of the plane tangent to the graph of  $f$  at the point  $P = (3, 2, e + 6)$ .

4. (20 points) Consider the function

$$f(x, y) = x^2 - y^2.$$

- Compute the gradient  $\nabla f = (\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y})$  at the point  $(1, 2)$ .

- Find a unit vector that is orthogonal to  $\nabla f(1, 2)$ .  
*Remember that a vector is called a unit vector when its length is one.*

5. (20 points) Given the functions

$$f(x, y) = (x^2 - y^2, 2xy)$$

and

$$g(x, y) = (ye^x, xe^y)$$

compute the matrix of partial derivatives of the composition  $f \circ g$  at the point  $(1, 1)$ .