Write your TA’s name and discussion time on the front page of the exam booklet.

Write all your work on the booklet and turn in this sheet with your booklet.

Calculator is allowed but cannot be shared.

Put a box around your answer and show your work for partial credit.

1. (15 pts.) Given that 
\[ f(x) = \begin{cases} 
-4 & \text{if } x < 0 \\
2x - 4 & \text{if } 2 > x \geq 0 \\
3 - 2x^2 & \text{if } x \geq 2 
\end{cases} \]

Which of the following statements are true? Write your answer on the booklet.

T F (a) \( \lim_{x \to 0} f(x) = -4 \)
T F (b) \( f(x) \) is continuous at \( x = 0 \)
T F (c) \( \lim_{x \to 2} f(x) = -2 \)
T F (d) \( f(2) \) does not exist
T F (e) \( \lim_{x \to -\infty} f(x) = -4 \)

2. (20 pts.) Find \( f'(x) \) for \( f(x) = x^2 - 2x \) by using the definition of the derivative.

3. (15 pts.) Find an equation of the line tangent to the curve 
\[ f(x) = \frac{x^2 - 3x + 2}{2x^2 - 1} \] at \( x = 0 \).

4. (15 pts.) If \( f(x) = x^2 - 3x + 5 \)

   (a) Use calculus to estimate the change in \( f \) if \( x \) changes from 4 to 6.

   (b) Estimate the percentage change in \( f \) if \( x \) changes from 4 to 6.
5. (15 pts.) A manufacturer’s total cost is \( C(q) = 0.1q^3 - 0.5q^2 + 500q + 200 \) dollars, where \( q \) is the number of units produced.

(a) Use marginal analysis to estimate the cost of manufacturing the 4th unit.

(b) Compute the actual cost of manufacturing the 4th unit.

6. (20 pts each) Find the derivative of the function. DO NOT simplify.

(a) \( f(x) = (4x + 1)^9 \cdot \sqrt[3]{(1 - 3x)^5} \)

(b) \( xy^3 = 3y + 2x \), find \( \frac{dy}{dx} \).