

ON THE FRONT OF YOUR BLUEBOOK write: (1) your name, (2) your student ID number, and (3) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and **BOX IN YOUR FINAL ANSWERS**. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books and class notes and calculators are NOT permitted. A one-page crib sheet is allowed. Please start each new problem on a new page of the bluebook.

1. (20 points) Evaluate each of the following limits, if the limit exists. If the limit does not exist, state this. Explain your reasoning in each case!

(a)
$$\lim_{x \rightarrow \infty} \frac{3 - \frac{2}{x}}{4 + \frac{\sqrt{2}}{x^2}}$$

(b)
$$\lim_{x \rightarrow \infty} \frac{2 - x + \sin x}{x + \cos x}$$

(c)
$$\lim_{x \rightarrow \infty} \frac{\sqrt{x^4 + 5}}{\sqrt[3]{x^6 + x^4}}$$

2. (20 points) Consider the function $y = x^4 - 8x^2 + 16$ on the closed interval $[-3, 3]$.
- (a) Find all critical points.
 - (b) Determine all the local maximum and minimum values of the function.
 - (c) Determine the absolute maximum and minimum values.
 - (d) Are there any inflection points?
3. (20 points) A rectangle has its base on the x -axis and its upper two vertices on the parabola $y = 12 - x^2$. What is the largest area the rectangle can have?
4. (20 points) Use Newton's method to estimate the two zeros of the function $f(x) = 2x - x^2 + 1$. Start with $x_0 = 0$ for the left-hand zero and with $x_0 = 2$ for the right. Then, in each case find x_1 .

5. (20 points) Evaluate the following integrals. Show all of your work.

(a)
$$\int (3x^9 + 4\sqrt{x} + x^7) dx$$

(b)
$$\int x(x^6 + \sin(x^2)) dx$$

(c)
$$\int \cos(x) \cos(\sin x) dx$$