
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 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, class notes, calculators and crib sheets are NOT permitted. **Please start each new problem on a new page of the bluebook.**

1. (40 points, 4 points each) Answer each of the following unrelated questions. No partial credit will be awarded, and no justification is necessary.
 - (a) Find the slope of the tangent line to the curve $x^2y^2 + xy = 2$ at the point $(-1,-1)$.
 - (b) True or False: the function $f(x) = x^{1/3}$ satisfies the hypotheses of the Mean Value Theorem on the interval $[1,8]$.
 - (c) Find the critical points of the function $g(x) = x^4(x-1)^3$.
 - (d) Evaluate the limit: $\lim_{x \rightarrow \infty} \sqrt{\frac{12x^3 - 5x + 2}{1 + 4x^2 + 3x^3}}$
 - (e) Find all values of c that satisfy the conclusion of the Mean Value Theorem for the function $h(x) = \frac{x}{x+2}$ on the interval $[1,4]$.
 - (f) True or False: the derivative of a differentiable even function is an odd function.
 - (g) Find $\frac{d^{2009}}{dx^{2009}} \sin x$.
 - (h) True or False: if c is an interior point in the domain of f and $f'(c) = 0$, then $x = c$ is a critical point of f .
 - (i) Find the derivative of the function $p(t) = \sqrt[3]{t^3 + \sqrt{t}}$. No simplification is necessary.
 - (j) Evaluate the limit: $\lim_{q \rightarrow \infty} q \sin \frac{1}{q}$
2. (18 points) A spherical balloon is inflated with helium at the rate of 100π cubic feet per minute. How fast is the balloon's radius increasing at the instant the radius is 5 ft? How fast is the surface area increasing then?
3. (18 points) A poster is to have an area of 180 square inches with 1-inch margins at the bottom and sides and a 2-inch margin at the top. What dimensions will give the largest printed area?
4. (24 points) Consider the function $A(x) = x\sqrt{x+3}$.
 - (a) Find the intervals on which the function is increasing/decreasing.
 - (b) Find the local maximum and minimum values.
 - (c) Find the intervals of concavity and any inflection points.
 - (d) Use the information from (a)-(c) to sketch the graph of $A(x)$. Label all critical points and inflection points.