
On the front of your bluebook, please write: a grading key, your name, student ID, your lecture number and instructor.

This exam is worth 100 points and has 5 questions.

- Submit this exam sheet with your bluebook. However, nothing on this exam sheet will be graded. Make sure all of your work is in your bluebook.
 - **Show all work and simplify your answers!** Answers with no justification will receive no points unless otherwise noted. **Please begin each problem on a new page.**
 - You will be taking this exam in a proctored and honor code enforced environment. This means: no notes or papers, calculators, cell phones, or other electronic devices are permitted.
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1. [30 pts] For the given function, find the indicated derivative. Simplify your final answers, writing them without negative exponents.

a. $p(t) = \frac{1}{\sqrt{3-t}} + 2\pi^7$, $\frac{d^2p}{dt^2}$ b. $y(\theta) = \sin(\cos 6\theta)$, $y' \left(\frac{\pi}{4} \right)$ c. $f(x) = \frac{1+x \tan x}{\sqrt{x}}$, $f'(x)$

2. [10 pts] Use differentials/linearization to approximate the value of $\sqrt[3]{26}$.

3. [10 pts] The curve $Ax^2 + By^2 - 3y = 2$ has the tangent line $y = 1 - \frac{2}{5}(x - 1)$ at the point $(1, 1)$. Assuming that the given equation determines y implicitly as a differentiable function of x , find the constants A and B .

4. The following questions are not related.

(a) [20 pts] Consider the function $f(x) = x^3 + \frac{48}{x}$.

i. Find all the critical points of $f(x)$.

ii. Find, if they exist, the absolute/global extrema of $f(x)$ on $[1, 3]$.

(b) [10 pts] Answer true or false, justifying your answer: There must be a point in $(0, 3)$ where the instantaneous rate of change of the function $f(x) = |x - 1|$ equals the average rate of change of the function over the interval $[0, 3]$.

(c) [10 pts] Does $g(x) = x^4 - x^2 + 3$ satisfy the hypotheses of Rolle's Theorem on the interval $[0, 1]$? If so, find the c guaranteed by Rolle's theorem. If not, explain why not.

5. [10 pts] Two hikers begin walking from the same point at constant speeds. One travels north at 1.5 mph and the other travels east. Two hours later, the distance between them is 4 miles and is increasing at 3 mph. How fast is the eastbound hiker walking?