

Name: _____ PID: _____

- Print your *NAME* on every page and write your *PID* in the space provided above.
 - Show all of your work in the spaces provided. No credit will be given for unsupported answers, even if correct.
 - No calculators, tablets, phones, or other electronic devices are allowed during this exam. You may use one page of handwritten notes, but no books or other assistance.
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(1 pt) 0. Follow the instructions on this exam and any additional instructions given during the exam.

(5 pt) 1. Use the Product Rule and the Quotient Rule to compute the following derivatives.

(a) $f(x) = x^{16} \cos(x)$

(b) $g(x) = \sin(x) \cos(x) e^{-x}$

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(5 pt) 2. Use the Chain Rule to compute the following derivatives.

(a) $h(x) = \sqrt[3]{x^4 + \sin^2(x)}$

(b) $f(z) = \ln(\sec(e^{3z}))$

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(5 pt) 3. In the theory of relativity, the mass of a particle with speed v is

$$m = f(v) = \frac{m_0}{\sqrt{1 - v^2/c^2}},$$

where m_0 is the rest mass of the particle and c is the speed of light in a vacuum. Assume $m_0 = 1$ and find an equation of the tangent line to the curve $m = f(v)$ when $v = \frac{c}{2}$.

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- (5 pt) 4. Let $g(x) = x^4 - 2x^2 + 3$.
- (a) On which interval or intervals is the graph of g increasing?
 - (b) On which interval or intervals is the graph of g concave down?

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(4 pt) 5. The table below gives several values for a function f and its derivative f' .

x	2	4	6	8
$f(x)$	3	-5	1	4
$f'(x)$	-1	2	-3	e

- (a) Let $h(x) = [f(x)]^3$ and compute $h'(2)$.
(b) Let $k(x) = f(x^3)$ and compute $k'(2)$.