

APPM 1345

Exam 3

Spring 2023

<b>Name</b>		
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1. (23 pts) Parts (a) and (b) are unrelated.

(a) Find the inverse function of  $g(x) = 6x^5 - 1$ .

(b) Consider the function  $f(x) = 2x^5 + x^3 + 3x + 2$ .

i. Explain why  $f$  is invertible, based on its derivative.

ii. Find an equation of the line that is tangent to the curve  $y = f^{-1}(x)$  at the point  $(8; 1)$ .

2. (27 pts) Parts (a), (b) and (c) are unrelated.

(a) Suppose  $\frac{1}{3}$  of a radioactive substance remains after decaying exponentially for 10 years. Find the half-life of the substance, including the correct unit of measurement. Fully support your answer.

(b) Identify all critical numbers of the function  $h(x) = x^2 3^x$ , if any.

(c) Rewrite the expression  $e^{(5 \ln 2)t}$  so that it includes no logarithmic terms.

3. (24 pts) Evaluate the following derivatives using properties of logarithms and/or logarithmic differentiation. Do **not** fully simplify your answers, although they must be expressed as functions of  $x$ .

(a)  $\frac{d}{dx} \ln \frac{(x-2)^{3-2} (\cos x + 2)}{x^2 + 4}, \quad x > 2$

(b)  $\frac{d}{dx} (x^6 + 1)^{\sin x}$

4. (26 pts) Evaluate the following integrals. Fully simplify your answers.

(a)  $\int_4^9 \frac{dx}{x(1-2\sqrt{x})}$

(b)  $\int \cot x \, dx$

END OF TEST

Your Initials \_\_\_\_\_

ADDITIONAL BLANK SPACE

If you write a solution here, please clearly indicate the problem number.