Math 131 - Test 3

April 14, 2021

Name _____

Score _____

Show all work to receive full credit. Supply explanations where necessary. Use differentiation rules for all derivatives. Unless otherwise indicated, do not simplify your derivatives.

1. (12 points) The graph of the equation $2x^3 + 2y^3 - 9xy = 0$ is called a *folium of Descartes*.

    (a) Use implicit differentiation to find dy/dx.

    (b) Find an equation of the line tangent to the graph at the point $(2, 1)$.

    (c) Find an equation of the line normal to the graph at the point $(2, 1)$.

2. (5 points) Think about the graph of $y = \cos^{-1}(x^2)$. Find the slope of the tangent line at the point where $x = 1/2$. Round your answer to four places.

3. (7 points) Let $f(x) = x^3 + 2x + 3$. Compute $(f^{-1})'(0)$.

4. (6 points) Use logarithmic differentiation to find dy/dx if $y = x^{\ln x}$.

5. (15 points) Differentiate. Do not simplify.

(a) $\dfrac{d}{dx}(2^{4x} + 4x^2)$

(b) $\dfrac{d}{dt}\log_7(6t^4 + 3)^5$

(c) $\dfrac{d}{dx}(1 + \tan^{-1} x)^3$

6. (8 points) A particle is moving along the circle $x^2 + y^2 = 25$. At the point in the 1st quadrant where $x = 3$, $\dfrac{dy}{dt} = -7$. Find $\dfrac{dx}{dt}$ at that point.

7. (8 points) Find the linearization of $f(x) = \dfrac{1}{x}$ at $x = 3$. Then use your linearization to approximate $\dfrac{1}{2.97}$.

8. (5 points) Find the differential dy if $y = \dfrac{x^2 + 2}{x - 1}$.

9. (6 points) Find the critical points: $\quad y = \sqrt{4 - x^2}$.

10. (10 points) Find the absolute extreme values of $g(x) = 3x^4 - 8x^3 - 48x^2 + 5$ on $[-3, 1]$.

11. (5 points) Some values of $f(x)$ and $f'(x)$ are given in the table below. Use the table to find the linearization of f at $x = 1.25$

x	0.50	0.75	1.00	1.25	1.50
$f(x)$	6.08	6.90	8.00	9.41	11.14
$f'(x)$	2.74	3.82	5.00	6.26	7.60

12. (3 points) Is it possible for a function to have more than one absolute maximum value? Explain.

13. (3 points) Is it possible for a function to have no absolute maximum value? Explain.

14. (4 points) Explain what it means to be a critical point for a function.

15. (3 points) When looking at the graph of a function, how would you identify any critical points for the function?