St. Joseph's University
Date: November 13, 2024 Professor: Asher Roberts

Calculus I Take-Home Test 3

Directions: Solve each of the following problems using separate paper, while clearly indicating each problem number when solving. Irrelevant work will detract from your score, while answers without work shown will be awarded no credit. Answers with partially correct work will receive partial credit. Each problem is worth 10 points. You must work alone, but you may use a graphing calculator as a supplement to your own work if you indicate the steps used. You may not use computational intelligence or AI.

1. Find $f'(x)$ if $f(x) = (6x+4)^3(8x-2)^{-4}$.
2. Find $\dfrac{d}{dx}\left(\log_5(\log_3 x)\right)$.
3. Find $\dfrac{d}{dx}\left(\ln 3^{2x}\right)$.
4. If $\sin x = e^y$, $0 < x < \pi$, what is $\dfrac{dy}{dx}$ in terms of x?
5. Find $\dfrac{d^2y}{dx^2}$ for $\sqrt{x} + \sqrt{y} = 100$. Simplify where possible.
6. What is an equation for a tangent to the graph of $y = \arcsin\dfrac{x}{2}$ at $x = 0$?
7. Use the table below to find $(f^{-1})'(1)$.

x	$f(x)$	$f'(x)$	$f^{-1}(x)$
1	-1	4	2
2	1	-1	-6

8. A cylindrical marshmallow is placed in a microwave, which causes the volume to expand at a rate of 4 cm^3/s. What is the volume of the marshmallow when its radius is 1 cm and its height and radius are both expanding at a rate of 1 cm/s?
9. Let $f(x) = e^{3x-4} - ex$. Where does f have critical points?
10. Find the absolute maximum and absolute minimum values of $f(x) = x\sqrt{4-x^2}$ on the interval $[-1, 2]$.