

Name: _____

April 2, 2021

Directions: Closed book, closed notes, no calculators. Put all phones, etc., away. You will need only a pencil or pen.1. (36 points) Find the derivatives of these functions. You do **not** need to simplify your answers.

(a) $\frac{d}{dx} [x^3 \ln(x)] =$

(b) $\frac{d}{dx} [\tan^{-1}(x)] =$

(c) $\frac{d}{dx} \left[\left(2 + \ln(x^5 - x^2) \right)^4 \right] =$

(d) $\frac{d}{dx} \left[x + \frac{\ln(x)}{x} \right] =$

(e) $\frac{d}{dx} \left[\frac{1}{\sqrt{\ln(x)}} \right] =$

(f) $\frac{d}{dx} [\sin^{-1}(x^3 + 3x)] =$

2. (4 points) Find: $\lim_{h \rightarrow 0} \frac{\tan^{-1}(2+h) - \tan^{-1}(2)}{h} =$

3. (12 points) Given the equation $\ln|x+y| = xy+1$, find y' .

4. (12 points) A spherical balloon is deflating in such a way that its volume is decreasing at a rate of 18 cubic feet per hour. At what rate is the radius changing when the radius is 3 feet?

Sphere formulas Volume: $V = \frac{4}{3}\pi r^3$ Surface area: $S = 4\pi r^2$

5. (12 points) A rocket has a height of $t+t^2$ meters t seconds after it is launched. How high is the rocket when its velocity is 101 meters per second?

6. (12 points) Find the locations (x -coordinates) of any local extrema of $f(x) = x^2e^x$.

7. (12 points) The graph of the **derivative** $f'(x)$ of a function f is shown below.

(a) State the critical points of f .

(b) State the interval(s) on which f increases.

(c) State the interval(s) on which f decreases.

