Math 30 Exam 2
Monday, March 8, 2020

Professor Michael VanValkenburgh

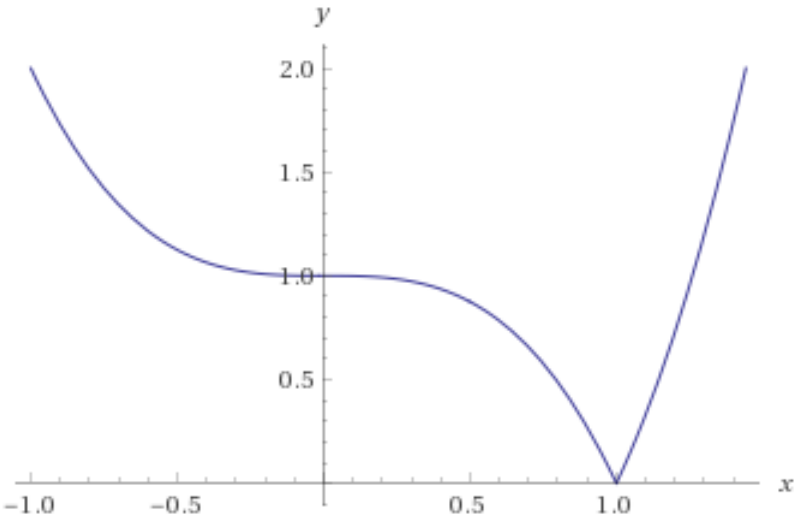
Name: _____

Instructions: Show all of your work, and clearly indicate your answers. Use the backs of pages as scratch paper. You will need pencils/pens and erasers, nothing more. Keep all devices capable of communication turned off and out of sight.

Please do not wear a hat.

Problem	Your score	Possible Points
1		15
2		15
3		15
4		15
5		25
6		15
Total		100

1. The curve $y = f(x)$ is plotted below. (Note: It is "pointy" at $(1, 0)$.)



a. Draw the tangent line to the curve at the point $\left(\frac{1}{2}, \frac{7}{8}\right)$.

b. Sketch the graph of the derivative $f'(x)$.

2. Consider the function $f(x) = 3x^2 + 1$. Use the definition of the derivative to calculate $f'(a)$. [That is, set up and evaluate a limit. And be sure to write "$\lim_{\#\to\#}$" !]

3. Find the equation of the tangent line to the curve

$$y = x \cos x + 5x - 1$$

at the point $(0, -1)$.

4a. What is the Chain Rule? (Your answer must be a correct **equation**.)

b. Consider the function

$$h(x) = 1 + \sin(x^3 + x - 1).$$

What is the "inside function"? What is the "outside function"? Calculate the derivative $h'(x)$.

5. Calculate the derivatives of the following functions:

a. $h(x) = \dfrac{\sin x}{x}$

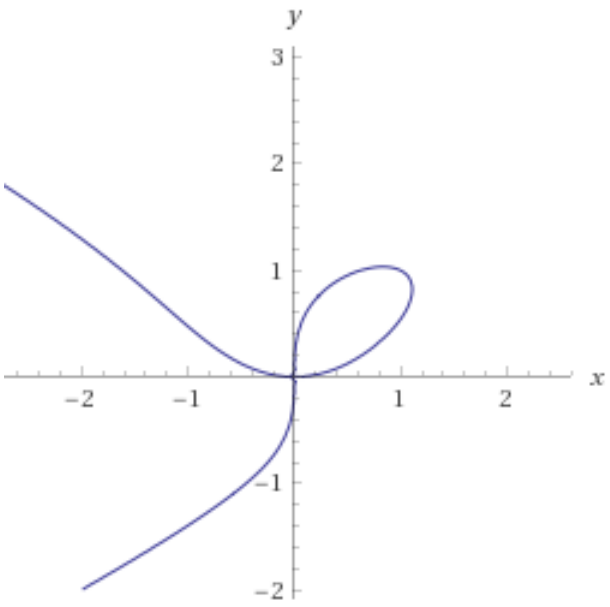
b. $h(x) = 1 + x^3 e^x$

c. $h(x) = \tan^2 x$

d. $h(x) = \tan(x^2)$

e. $h(x) = (1 + xe^{2x})^5$ (You don't need to multiply it out.)

6. Say hello to Kleef, whose equation is $x^3 - 2xy + y^4 = 0$.
   Find the equation of the tangent line at the point $(x, y) = (1, 1)$ and plot it.



Gotta Diff 'Em All!