

Math 131 - Quiz 4

February 15, 2023

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (5 points) Use the limit definition of derivative to determine $f'(x)$ when $f(x) = 3x - x^2$.

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{[3(x+h) - (x+h)^2] - [3x - x^2]}{h} \\ &= \lim_{h \rightarrow 0} \frac{3x + 3h - x^2 - 2xh - h^2 - 3x + x^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{3h - 2xh - h^2}{h} = \lim_{h \rightarrow 0} (3 - 2x - h) \\ &= \boxed{3 - 2x} \end{aligned}$$

2. (2 points) Suppose $F(x) = (x+2)e^{x^2}$. Later, we will learn how to show that $F'(x) = (2x^2 + 4x + 1)e^{x^2}$. For now, just use the given information to find an equation of the line tangent to the graph of F at the point where $x = 0$.

Slope: $m = F'(0) = 1e^0 = 1$

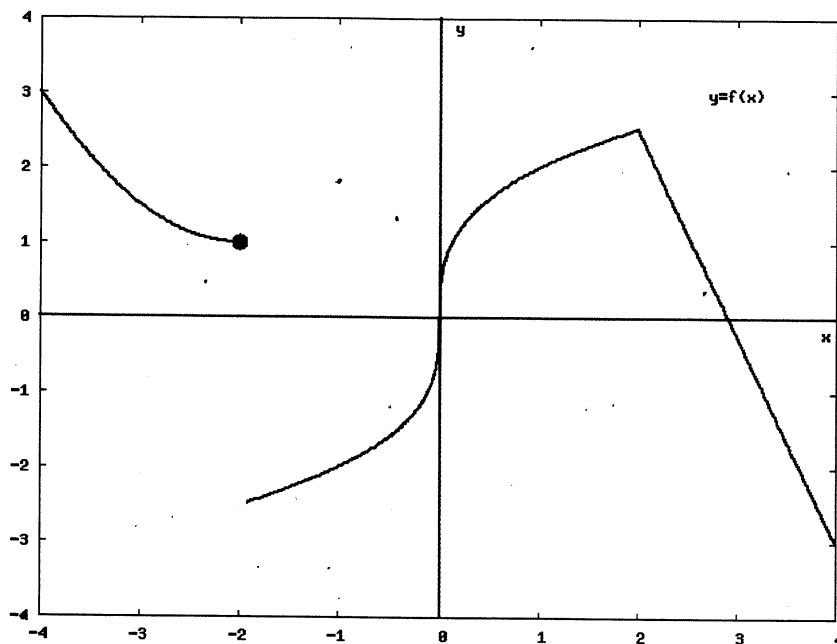
Point: $x = 0$
 $y = F(0) = 2e^0 = 2$ } $(0, 2)$

↑
THIS IS THE y-INT!

Equation is $\boxed{y = x + 2}$

Turn over.

3. (3 points) The graph of $y = f(x)$ is shown below. Give the x -coordinates of three points at which $f'(x)$ does not exist. For each point, very briefly say why f' does not exist.



- ① $x = -2$ --- f HAS A DISCONT. AT $x = -2$
- ② $x = 0$ --- THERE IS A TANGENT LINE AT $x = 0$,
BUT IT IS VERTICAL. NO SLOPE \Rightarrow
NO DERIVATIVE
- ③ $x = 2$ --- THE GRAPH HAS A SHARP POINT
AT $x = 2$. THE TANGENT LINE
FROM THE LEFT DOES NOT MATCH
THE TANGENT LINE FROM THE RIGHT.