

# Math 131 - Quiz 4

September 30, 2020

Name key

Score \_\_\_\_\_

Show all work to receive full credit. Supply explanations when necessary. This quiz is due on October 5.

1. (3 points) Use the limit definition of derivative to determine  $f'(x)$  if  $f(x) = \frac{2}{\sqrt{x-3}}$ .

$$f'(x) = \lim_{h \rightarrow 0} \frac{\frac{2}{\sqrt{x+h-3}} - \frac{2}{\sqrt{x-3}}}{h} = 2 \lim_{h \rightarrow 0} \frac{\sqrt{x-3} - \sqrt{x+h-3}}{h \sqrt{x+h-3} \sqrt{x-3}} \cdot \frac{\sqrt{x-3} + \sqrt{x+h-3}}{\sqrt{x-3} + \sqrt{x+h-3}}$$

$$= 2 \lim_{h \rightarrow 0} \frac{(x-3) - (x+h-3)}{h \sqrt{x+h-3} \sqrt{x-3} (\sqrt{x-3} + \sqrt{x+h-3})}$$

$$= 2 \lim_{h \rightarrow 0} \frac{-1}{\sqrt{x+h-3} \sqrt{x-3} (\sqrt{x-3} + \sqrt{x+h-3})}$$

$$= \frac{-2}{\sqrt{x-3} \sqrt{x-3} (2\sqrt{x-3})} = \frac{-1}{(\sqrt{x-3})^3} \Rightarrow f'(x) = \frac{-1}{(\sqrt{x-3})^3}$$

2. (2 points) Suppose the function  $g$  is continuous at  $x = 3$ . Describe one way that it might be possible for  $g'(3)$  to not exist.

THE GRAPH MAY HAVE A SHARP POINT AT  $x=3$ .

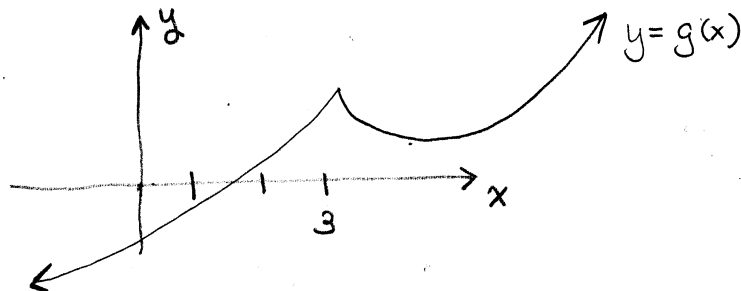
THAT IS TO SAY, THE TANGENT LINE FROM THE

LEFT DOES NOT MATCH THE TANGENT LINE FROM

THE RIGHT.

For example

...



3. (3 points) Use the appropriate differentiation rules to determine the derivative of each function.

(a)  $f(x) = \frac{3}{x^2} + \sqrt[3]{x} + 14x^{2/7}$

$$f(x) = 3x^{-2} + x^{1/3} + 14x^{2/7} \Rightarrow f'(x) = -6x^{-3} + \frac{1}{3}x^{-2/3} + 4x^{-5/7}$$

(b)  $y = \frac{x^2 + 2x}{x - 1}$

$$\frac{dy}{dx} = \frac{(x-1)(2x+2) - (x^2+2x)(1)}{(x-1)^2} = \frac{x^2 - 2x - 2}{(x-1)^2}$$

(c)  $g(t) = (t^9 + 3t^2 + 2)(\cos t)$

$$g'(t) = (9t^8 + 6t)(\cos t) + (t^9 + 3t^2 + 2)(-\sin t)$$

4. (2 points) Find an equation of the line tangent to the graph of  $f(t) = 3\sin t$  at the point where  $t = \pi/6$ .

$$f'(t) = 3\cos t$$

$$m = f'\left(\frac{\pi}{6}\right) = 3\cos\frac{\pi}{6} = \frac{3\sqrt{3}}{2}$$

Point:  $t = \frac{\pi}{6}, f(t) = \frac{3}{2}$   
 $\left(\frac{\pi}{6}, \frac{3}{2}\right)$

TAN. LINE ...

$$y - \frac{3}{2} = \frac{3\sqrt{3}}{2}\left(x - \frac{\pi}{6}\right)$$