Math 21A
Vogler
Worksheet 4

1.) Use the limit definition of derivative to compute $f'(x)$ for each of the following functions.

a.) $f(x) = \dfrac{1}{3+\sqrt{x}}$

b.) $f(x) = \dfrac{x}{x^2+1}$

c.) $f(x) = \sin 3x$

d.) $f(x) = \sqrt{3+\sqrt{x}}$

2.) Use any method to differentiate each of the following functions.

a.) $y = 1 + 5x - 6x^5$

b.) $f(x) = x^3 \sin x$

c.) $y = \dfrac{x+5}{x^2 \tan x}$

d.) $g(x) = \dfrac{x \cos x}{\tan x - 5 \sec x}$

3.) Determine a function whose derivative is :

a.) $f'(x) = 1 + 5x - 6x^5$

b.) $f'(x) = 4 - \sqrt{x}$

c.) $y' = \dfrac{x^2+1}{x^2}$

d.) $y' = \dfrac{4x^3 + 3x^2 + 2x + 1}{x^4 + x^3 + x^2 + x + 1}$

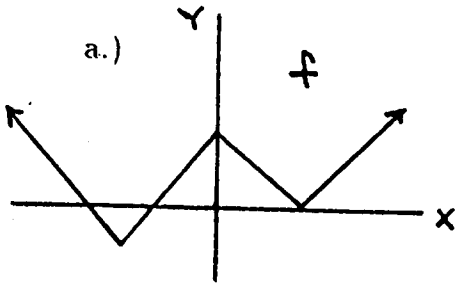
4.) Use the limit definition of derivative to show that $f(x) = |x|$ is NOT differentiable at $x = 0$, i.e., show that $f'(0)$ does not exist.

5.) Use the limit definition of derivative to show that the following function IS differentiable at $x = 1$, i.e., show that $f'(1)$ does exist.

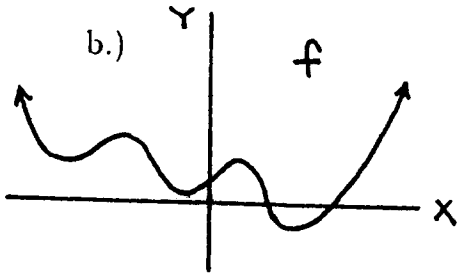
$$f(x) = \begin{cases} 2 + \sqrt{x}, & \text{if } x \geq 1 \\ \dfrac{1}{2}x + \dfrac{5}{2}, & \text{if } x < 1 \end{cases}$$

6.) Draw a possible graph for f' using the given graph of $y = f(x)$.

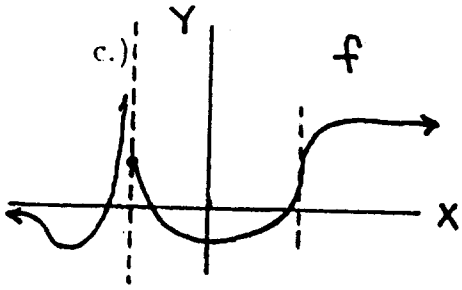
a.)



b.)



c.)



7.) Let $f(x) = \dfrac{x}{x^2+1}$. Slove $f'(x) = 0$ for x. What is the geometric significance of these x-vaules ?

8.) Assume that $h(x) = f(x)g(x)$ and that $f(0) = 1$, $f'(0) = 2$, $g(0) = -1$, and $g'(0) = 3$. Determine the value of $h'(0)$.

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The following problem is for recreational purposes only.

9.) A snail is at the bottom of a well which is 100 feet deep. Each day it climbs up 5 feet and back down 4 feet. In how many days will the hapless snail reach the top of the well ?

Thanks to Dr. Kouba