

Name: Solution I.D. # _____ Section # _____ Serial # _____

1. Use the definition find
- $f'(x)$
- if
- $f(x) = \frac{1}{x+5}$

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{\frac{1}{x+h+5} - \frac{1}{x+5}}{h} \\ &= \lim_{h \rightarrow 0} \frac{\frac{x+5 - x-h-5}{(x+h+5)(x+5)}}{h} \\ &= \lim_{h \rightarrow 0} \frac{-h}{h(x+h+5)(x+5)} = \lim_{h \rightarrow 0} \frac{-1}{(x+h+5)(x+5)} = \frac{-1}{(x+5)^2} \end{aligned}$$

2. Find
- $\frac{dy}{dx}$
- for each of the following:

i) $y = x \left(\frac{1+x^4}{2-x} \right)$

$$y = \frac{x+x^5}{2-x}$$

$$\begin{aligned} \frac{dy}{dx} &= \frac{(2-x)(1+5x^4) - (x+x^5)(-1)}{(2-x)^2} \\ &= \frac{-5x^5 + 10x^4 - x + 2 + x + x^5}{(2-x)^2} \\ &= \frac{-4x^5 + 10x^4 + 2}{(2-x)^2} \end{aligned}$$

ii) $y = \frac{\sqrt{\pi}}{3}$

$$\frac{dy}{dx} = 0$$

3. Find
- y'''
- at
- $x = -1$
- if
- $y = x^{-4} + x$

$$y' = -4x^{-5}$$

$$y'' = 20x^{-6}$$

$$y''' = -120x^{-7} = -\frac{120}{x^7}$$

$$y''' = 120$$

$$x = -1$$