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 MATH 141-01
 Mutungi
 Homework
 Benedict College

Homework 5

- Definitions of the Derivative
 HW problems 2, 4, 6, 8

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

2. $f(x) = -4x - 2$

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \rightarrow \frac{-4(x+h) - 2 - (-4x - 2)}{h} \rightarrow \frac{-4x - 4h - 2 + 4x + 2}{h} \rightarrow \frac{-4h}{h} = -4$$

$$\boxed{f'(x) = -4}$$

4. $f(x) = -3x^2 + 4$

$$\lim_{h \rightarrow 0} \frac{-3(x+h)^2 + 4 - (-3x^2 + 4)}{h} \rightarrow \frac{-3x^2 - 6xh - 3h^2 + 4 + 3x^2 - 4}{h} \rightarrow \frac{-6xh - 3h^2}{h} \rightarrow -6x - 3h \rightarrow -6x$$

$$\boxed{f'(x) = -6x}$$

6. $3x^2 + 3x + 3$

$$\lim_{h \rightarrow 0} \frac{3(x+h)^2 + 3(x+h) + 3 - (3x^2 + 3x + 3)}{h} \rightarrow \frac{3x^2 + 6xh + 3h^2 + 3x + 3h + 3 - 3x^2 - 3x - 3}{h} \rightarrow \frac{6xh + 3h^2 + 3h}{h} \rightarrow 6x + 3h + 3 \rightarrow 6x + 3$$

$$\boxed{6x + 3 = f'(x)}$$

$$8. f(x) = \sqrt{4x-5}$$

$$= \lim_{h \rightarrow 0} \frac{\sqrt{4(x+h)-5} - \sqrt{4x-5}}{h}$$

$$\lim_{h \rightarrow 0} \frac{(\sqrt{4(x+h)-5} - \sqrt{4x-5}) (\sqrt{4(x+h)-5} + \sqrt{4x-5})}{h (\sqrt{4(x+h)-5} + \sqrt{4x-5})}$$

$$= \frac{4x + 4h - 5 - \cancel{4x - 5}}{h (\sqrt{4(x+h)-5} + \sqrt{4x-5})}$$

$$= \frac{4h}{h (\sqrt{4(x+h)-5} + \sqrt{4x-5})}$$

$$= \frac{4}{\sqrt{4x-5} + \sqrt{4x-5}}$$

$$\boxed{f'(x) = \frac{4}{2\sqrt{4x-5}}}$$