

Name: _____

1. Differentiate the following functions using derivative rules.

$$3 \quad (a) f(x) = 4x^3 + 75\sqrt[3]{x} + 10x + 3$$

$$F'(x) = 12x^2 + 25x^{-2/3} + 10$$

$$3 \quad (b) y = x^4 \cos(x)$$

$$y' = 4x^3 \cos x - x^4 \sin x$$

$$3 \quad (c) w = \frac{\tan \theta}{1+\theta^2}$$

$$w' = \frac{\sec^2 \theta (1+\theta^2) - 2\theta \tan \theta}{(1+\theta^2)^2}$$

2. Using the formal definition of the derivative, find the derivative of $f(x) = x^2 + x$

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

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

$$= \lim_{h \rightarrow 0} \frac{\cancel{x^2} + 2xh + h^2 + \cancel{x} + h - \cancel{x^2} - \cancel{x}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{2xh + h^2 + h}{h}$$

$$= \lim_{h \rightarrow 0} 2x + h + 1 = 2x + 1$$