

Put your name on the line: Key Period: _____

AP Calculus AB: 3.9 Product Rule

1) Find $\frac{d}{dx}(7x^2 \cos(x))$

$$-7x^2 \sin(x) + 14x \cos(x)$$

2) Evaluate $\lim_{h \rightarrow 0} \frac{\ln(x+h) \tan(x+h) - 4(x+h) - (\ln(x) \tan(x) - 4x)}{h}$

$$f(x) = \underbrace{\ln(x) \tan(x)}_{\text{product Rule}} - 4x$$

$$f'(x) = \ln(x) \sec^2(x) + \frac{\tan(x)}{x} - 4$$

3) If $g\left(\frac{2\pi}{3}\right) = -2$ and $g'\left(\frac{2\pi}{3}\right) = 2$ Find the instantaneous rate of change of $f(x)$ at $x = \frac{2\pi}{3}$ if $f(x) = \underbrace{g(x) \cos(x)}_{\text{product}} + 5x - 2$.

$$f'(x) = g(x)(-\sin(x)) + \cos(x)g'(x) + 5$$

$$f'\left(\frac{2\pi}{3}\right) = \sqrt{3} + 4$$

4) Find $f'(0)$, if $f(x) = \underbrace{\sin(x) e^{4x^2+2x}}_{\text{product}} - \ln(x+2)$.

$$f'(x) = \sin(x)(8x+2)e^{4x^2+2x} + e^{4x^2+2x} \cos(x) - \frac{1}{x+2}$$

$$f'(0) = \frac{1}{2}$$

(calculator allowed)

5) At what x -value on the graph of $f(x) = \ln(x+5) + \sqrt{2}x$ is the tangent line parallel to $\frac{x}{2} - y = 2$? (Ans: -6.094)

$$y = \frac{x}{2} - 2$$

$$f'(x) = \frac{1}{2}$$

$$\boxed{x = -6.094}$$