

Derivative Assignment

6/29/2020

$$1. f(x) = \frac{2x+3}{7x-1}$$

using quotient rule

$$u(x) = 2x+3 \quad v(x) = 7x-1$$

$$u'(x) = 2 \quad v'(x) = 7$$

$$f'(x) = \frac{2(7x-1) - 7(2x+3)}{(7x-1)^2}$$

$$= \frac{14x - 2 - 14x - 21}{(7x-1)^2}$$

$$= \frac{-23}{(7x-1)^2}$$

$$2. f(x) = 3x^5 e^x$$

Using the product rule $u(x) = 3x^5, v(x) = e^x$

$$u'(x) = 15x^4, v'(x) = e^x$$

$$f'(x) = 3x^5 e^x + 15x^4 e^x$$

$$= \boxed{3x^4 e^x (x+5)}$$

$$3. f(x) = 3x^5 - 2x^4 + x^2 + 5x - 2$$

Using power rule for each term

$$f'(x) = 15x^4 - 8x^3 + 2x + 5$$

$$4. f(x) = 4x^3 \tan(3x-1)$$

Applying product rule with $u = x^3$ and $v = \tan(3x-1)$

$$u'(x) = 3x^2, \quad v'(x) = \sec^2(3x-1)$$

$$f'(x) = 4 [3x^2 \tan(3x-1) + x^3 \sec^2(3x-1) \cdot 3]$$

$$= 4 [3x^2 \tan(3x-1) + 3x^3 \sec^2(3x-1)]$$

$$= 12x^2 (\tan(3x-1) + x \sec^2(3x-1))$$

$$5. f(x) = \frac{3x}{x^2+5}, \quad \text{product rule with } u = 3x \quad v = x^2+5$$

$$\text{derivatives } u'(x) = 3, \quad v'(x) = 2x$$

$$f'(x) = \frac{3(x^2+5) - 3x(2x)}{(x^2+5)^2}$$

$$= \frac{3x^2 + 15 - 6x^2}{(x^2+5)^2} = \frac{-3x^2 + 15}{(x^2+5)^2}$$

$$= \frac{-3(x^2-5)}{(x^2+5)^2}$$

$$\begin{aligned} 6. f(x) &= \sqrt[5]{x^3} \\ &= (x^3)^{1/5} \\ &= x^{3/5} \end{aligned}$$

$$f'(x) = \frac{d}{dx} (x^{3/5}) \text{ using power rule.}$$

$$= \frac{3}{5} x^{2/5}$$

$$7. f(x) = -2 \sin^3(4x+1)$$

$$\begin{aligned} f'(x) &= -2 \cdot 3 \sin^2(4x+1) \cdot \frac{d}{dx} [\sin(4x+1)] \\ &= -6 \sin^2(4x+1) \cos(4x+1) \cdot \frac{d}{dx} (4x+1) \\ &= -6 \sin^2(4x+1) \cos(4x+1) \cdot 4 \\ &= \underline{\underline{-24 \cos(4x+1) \sin^2(4x+1)}} \end{aligned}$$

$$8. f(x) = 3(x^2 - 3)^5$$

using substitution $u = x^2 - 3$

$$f(u) = 3u^5$$

$$f'(u) = 15u^4$$

$$f'(x) = 15(x^2 - 3)^4 \cdot \frac{d}{dx}(x^2 - 3)$$

$$= 15(x^2 - 3)^4 \cdot 2x$$

$$= \boxed{30x(x^2 - 3)^4}$$

$$9. g(x) = 3, g'(x) = -4, h(x) = 1, h'(x) = 2$$

$$f'(x) = ? \quad f(x) = \frac{g(x)}{h(x)}$$

Using Quotient rule.

$$f'(x) = \frac{g'(x)h(x) - h'(x)g(x)}{(h(x))^2}$$

$$= \frac{(-4)(1) - (2)(3)}{(1)^2}$$

$$= \frac{-4 - 6}{1}$$

$$= \frac{-10}{1}$$

$$= -10$$

$$= \boxed{-10}$$