

p. 106  
#16

$$s(t) = (t^3 + t^2)^{\frac{1}{2}}, \quad t \geq 0 \quad \text{Find } v(3).$$

$$\begin{aligned} &= (3t^2 + 2t) \left(\frac{1}{2}\right) (t^3 + t^2)^{-\frac{1}{2}} \\ &= \frac{3t^2 + 2t}{2(t^3 + t^2)^{\frac{1}{2}}} \end{aligned}$$

$$\begin{aligned} v(3) &= \frac{3(3)^2 + 2(3)}{2(3^3 + 3^2)^{\frac{1}{2}}} \\ &= 2.75 \end{aligned}$$

$\therefore$  The velocity of  
the particle after 3 sec.  
 $\Rightarrow 2.75 \frac{m}{s}$  Forward.

## L.11 (2.5) Combining the Rules of Derivatives

Ex1: Find the derivative of the function in one line. Do not change the given function.

$$\begin{aligned} \text{a) } y &= (x^2 + 3)^4 (4x - 5)^3 && x^4 \quad 4x^3 \\ &= \underbrace{g'(x)f(x)} + \underbrace{g(x)f'(x)} \\ &= \underline{4(x^2+3)^3(2x)(4x-5)^3} + \underline{(x^2+3)^4(3)(4x-5)^2(4)} \end{aligned}$$

$$\begin{aligned} \text{b) } y &= \frac{(x^5 + x)^6}{\sqrt{3x+1}} \quad \frac{g(x)}{f(x)} \\ &= \frac{g'(x)f(x) - g(x)f'(x)}{(f(x))^2} \\ &= \frac{6(x^5+x)^5(5x^4+1)\sqrt{3x+1} - (x^5+x)^6\left(\frac{1}{2}\right)(3x+1)^{-\frac{1}{2}}(3)}{3x+1} \end{aligned}$$

$$\begin{aligned} \text{c) } y &= \left(\frac{x^2+5}{8-x^3}\right)^{10} \\ &= (x^2+5)^{10} (8-x^3)^{-10} \end{aligned}$$

$$y' = 10(x^2+5)^9(2x)(8-x^3)^{-10} - 10(8-x^3)^{-11}(-3x^2)(x^2+5)^{10}$$

$$\text{c) } y = \left(\frac{x^2+5}{8-x^3}\right)^{10}$$

Simplifying is easiest with:

$$\begin{aligned} y' &= 10(x^2+5)^9(2x)(8-x^3)^{-10} - 10(8-x^3)^{-11}(-3x^2)(x^2+5)^{10} \\ &= \frac{20x(x^2+5)^9}{(8-x^3)^{10}} + \frac{30x^2(x^2+5)^{10}}{(8-x^3)^{11}} \\ &= \frac{20x(x^2+5)^9(8-x^3) + 30x^2(x^2+5)^{10}}{(8-x^3)^{11}} \\ &= \frac{10x(x^2+5)^9[2(8-x^3) + 3x(x^2+5)]}{(8-x^3)^{11}} \\ &= \frac{10x(x^2+5)^9(16-2x^3+3x^3+15x)}{(8-x^3)^{11}} \\ &= \frac{10x(x^3+15x+16)(x^2+5)^9}{(8-x^3)^{11}} \end{aligned}$$

Ex2: Find the derivative. Simplify fully. Express your answer in factored form.

$$\begin{aligned} \text{a) } y &= (x^2 + 3)^4 (4x - 5)^3 \\ &= \underbrace{g'(x)f(x)} + \underbrace{g(x)f'(x)} \\ &= \underbrace{4(x^2+3)^3(2x)} \underbrace{(4x-5)^3} + (x^2+3)^4 \underbrace{(3)(4x-5)^2(4)} \\ &= \underline{8x} \underbrace{(4x-5)^3} \underbrace{(x^2+3)^3} + \underline{12} \underbrace{(4x-5)^2} \underbrace{(x^2+3)^4} \\ &= 4(4x-5)^2 (x^2+3)^3 \left( \underline{2x(4x-5) + 3(x^2+3)} \right) \\ &= 4(4x-5)^2 (x^2+3)^3 \left( 8x^2 - 10x + 3x^2 + 9 \right) \\ &= 4(4x-5)^2 (x^2+3)^3 \left( 11x^2 - 10x + 9 \right) \end{aligned}$$

$$b) \quad y = \left( \frac{\sqrt[3]{3x+5}}{1-x^2} \right)^2$$

$$y = (3x+5)^{2/3} (1-x^2)^{-2}$$

$$= \frac{2}{3} (3x+5)^{-1/3} (3) (1-x^2)^{-2} - 2 (1-x^2)^{-3} (-2x) (3x+5)^{2/3}$$

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Assigned Work:

Worksheet #1 - 19

#5 correction: 
$$\frac{-2(x^2 - 3x - 1)}{(x^2 + 1)^2}$$