Chain Rule

Section 4.1

1. $y = 3x^2$

$\frac{dy}{dx} = 3 \cdot 2x^{2-1} \frac{dx}{dx}$

$\frac{dy}{dx} = 6x$

Chain Rule:

$(f \circ g)'(x)$ OR $\frac{d}{dx}[f(g(x))]$

$= f'(g(x)) \cdot g'(x)$

2. $y = 5(2x+3)^3$

$y' = 5 \cdot 3(2x+3)^2 \cdot (2)$

$y' = 30(2x+3)^2$

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

$y' = 20(5-2x)^4 \cdot (-2)$

$y' = -40(5-2x)^4$

4. $y = \sqrt{3x^2 - 5x}$

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

$y' = \frac{1}{2}(3x^2-5x)^{-1/2} \cdot (6x-5)$

$y' = \frac{6x-5}{2\sqrt{3x^2-5x}}$

5. $y = \cos(3x-4)$

$y' = -\sin(3x-4) \cdot (3)$

$y' = -3\sin(3x-4)$

6. $y = \tan(4x - x^3)$

$y' = \sec^2(4x-x^3) \cdot (4-3x^2)$

$y' = (4-3x^2) \cdot \sec^2(4x-x^3)$

7. $y = \sec(3x-2)$

$y' = \sec(3x-2)\tan(3x-2) \cdot (3)$

$y' = 3\sec(3x-2)\tan(3x-2)$

8. $y = x^2 \cdot \sqrt[3]{3x-1}$

$y = x^2 \cdot (3x-1)^{1/3}$

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

the back of the book will simplify the answer as follows

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

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

9. $y = \sin^5 x$

$y = (\sin x)^5$

$y' = 5(\sin x)^4 \cdot \cos x$

10. $y = \cos^3(x^2 - 1)$

$y = [\cos(x^2-1)]^3$

$y' = 3[\cos(x^2-1)]^2 \cdot -\sin(x^2-1) \cdot (2x)$

11. $y = \sin\sqrt{5x-1}$

$y = \sin(5x-1)^{1/2}$

$y' = \cos(5x-1)^{1/2} \cdot \frac{1}{2}(5x-1)^{-1/2} \cdot 5$

12. $y = \csc(5x^2 - 2)$

$y' = -\cot(5x^2-2) \cdot \csc(5x^2-2) \cdot (10x)$

13. $y = \frac{1}{(2-5x)^3}$

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

$y' = -3(2-5x)^{-4} \cdot (-5)$

$y' = \frac{15}{(2-5x)^4}$

14. $y = \cos^{-3} x - \sin^5 x$

$y = (\cos x)^{-3} - (\sin x)^5$

$y' = -3(\cos x)^{-4}(-\sin x) - 5(\sin x)^4(\cos x)$

15. $y = \sec^5(x^3 + x)$

$y = [\sec(x^3+x)]^5$

$y' = 5[\sec(x^3+x)]^4 \cdot \sec(x^3+x)\tan(x^3+x) \cdot (3x^2+1)$