

# Differentiation by the Chain Rule - Homework

46) A  
47) B  
48) C

Find the derivatives of the following:

1.  $y = (3x-8)^4$

$$y' = 4(3x-8)^3 \cdot 3$$

$$y' = 12(3x-8)^3$$

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

$$y' = 5(3x^2+2)^4 \cdot 6x$$

$$= 30x(3x^2+2)^4$$

3.  $y = 4(x^2+x-1)^{10}$

$$y' = 40(x^2+x-1)^9 (2x+1)$$

4.  $y = -5(4-9x)^{3/2}$

$$y' = \frac{-5}{2}(4-9x)^{1/2} \cdot (-9)$$

$$= \frac{45\sqrt{4-9x}}{2}$$

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

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

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

6.  $y = \frac{-1}{(x^2-5x-6)^2} = -(x^2-5x-6)^{-2}$

$$y' = 2(x^2-5x-6)^{-3} (2x-5)$$

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

7.  $y = \left(\frac{2}{2-x}\right)^2$

$$y' = -8(2-x)^{-3} \cdot (-1)$$

$$= \frac{8}{(2-x)^3}$$

8.  $y = \frac{4x}{(x+1)^2} = 4x \cdot (x+1)^{-2}$

$$y' = 4x \cdot -2(x+1)^{-3} + (x+1)^{-2} \cdot 4$$

$$= \frac{-8x}{(x+1)^3} + \frac{4}{(x+1)^2} = \frac{-8x + 4(x+1)}{(x+1)^3} = \frac{-4(x-1)}{(x+1)^3}$$

9.  $y = \frac{-3}{(x^3-x^2+3)^3} = -3(x^3-x^2+3)^{-3}$

$$y' = 9(x^3-x^2+3)^{-4} (3x^2-2x)$$

$$= \frac{9x(3x-2)}{(x^3-x^2+3)^4}$$

10.  $y = x^3(5x-1)^4$

$$y' = x^3 \cdot 4(5x-1)^3 \cdot 5 + (5x-1)^4 \cdot 3x^2$$

$$= x^2(5x-1)^3(20x + 3(5x-1))$$

$$= x^2(5x-1)^3(35x-3)$$

11.  $y = \sqrt{1-t}$

$$\frac{dy}{dt} = \frac{1}{2}(1-t)^{-1/2} \cdot (-1)$$

$$= \frac{-1}{2\sqrt{1-t}}$$

12.  $y = \sqrt[3]{3x^3-4x+2} = (3x^3-4x+2)^{1/3}$

$$\frac{dy}{dx} = \frac{1}{3}(3x^3-4x+2)^{-2/3} (9x^2-4)$$

$$= \frac{9x^2-4}{3(3x^3-4x+2)^{2/3}}$$

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

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

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

14.  $y = \frac{-1}{\sqrt{x+1}} = -(x^{1/2}+1)^{-1}$

$$\frac{dy}{dx} = 1 \cdot (\sqrt{x}+1)^{-2} \cdot \frac{1}{2}x^{-1/2}$$

$$= \frac{1}{2(\sqrt{x}+1)^2 \cdot \sqrt{x}}$$

15.  $y = \sqrt{\frac{3x}{2x-3}} = \left(\frac{3x}{2x-3}\right)^{1/2}$

$$\frac{dy}{dx} = \frac{1}{2} \left(\frac{3x}{2x-3}\right)^{-1/2} \cdot \left(\frac{(2x-3) \cdot 3 - 3x \cdot 2}{(2x-3)^2}\right)$$

$$\frac{x^{1/2}}{x^2} = \frac{1}{x^{3/2}} \Rightarrow \frac{dy}{dx} = \frac{1}{2} \sqrt{\frac{2x+3}{3x}} \cdot \frac{6x-9-6x}{(2x-3)^2} \Rightarrow \frac{-9}{2\sqrt{3x}(2x-3)^{3/2}} \text{ or } \frac{-9}{2\sqrt{3x(2x-3)^3}}$$