Rules for Finding Derivatives

3.3

Find $D_x y$.

(4) $y = \pi x^4$

$\boxed{D_x y = 4\pi x^3}$

(6) $y = -3x^{-4}$

$D_x y = -4 \cdot -3x^{-4-1}$

$\boxed{D_x y = 12x^{-5}}$

(8) $y = \frac{\alpha}{x^3}$

$y = \alpha x^{-3}$

$D_x y = -3\alpha x^{-3-1}$

$= -3\alpha x^{-4}$

$\boxed{D_x y = \frac{-3\alpha}{x^4}}$

(10) $y = \frac{3\alpha}{4x^5}$

$y = \frac{3\alpha}{4} \cdot x^{-5}$

$D_x y = -5 \cdot \frac{3\alpha}{4} x^{-5-1}$

$= \frac{-15\alpha}{4} \cdot \frac{1}{x^6}$

$\boxed{D_x y = \frac{-15\alpha}{4x^6}}$

(12) $y = 3x^4 + x^3$

$D_x y = 4 \cdot 3x^{4-1} + 3x^{3-1}$

$\boxed{D_x y = 12x^3 + 3x^2}$

(14) $y = 3x^4 - 2x^3 - 5x^2 + \pi x + \pi^2$

$D_x y = 4 \cdot 3x^{4-1} - 3 \cdot 2x^{3-1} - 2 \cdot 5x^{2-1} + \pi + 0$

$\boxed{D_x y = 12x^3 - 6x^2 - 10x + \pi}$

(16) $y = x^{12} + 5x^{-2} - \pi x^{-10}$

$D_x y = 12x^{12-1} - 2 \cdot 5x^{-2-1} + 10 \cdot \pi x^{-10-1}$

$\boxed{D_x y = 12x^{11} - 10x^{-3} + 10\pi x^{-11}}$

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

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

$D_x y = -1 \cdot \frac{2}{3} x^{-1-1} - 0$

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

$\boxed{D_x y = \frac{-2}{3x^2}}$

Rules for Finding Derivatives

3.3

Find $D_x y$

(24) $y = 3x(x^3-1)$

$y = 3x^4 - 3x$

$D_x y = 4 \cdot 3x^{4-1} - 3x^{1-1}$

$= 12x^3 - 3x^0$

$\boxed{D_x y = 12x^3 - 3}$

(26) $y = (-3x+2)^2$

$= (-3x+2)(-3x+2)$

$y = 9x^2 - 12x + 4$

$D_x y = 2 \cdot 9x^{2-1} - 12x^{1-1} + 0$

$= 18x^1 - 12x^0$

$\boxed{D_x y = 18x - 12}$

(28) $y = \underbrace{(x^4-1)}_{f} \cdot \underbrace{(x^2+1)}_{g}$

$f = x^4 - 1 \qquad g = x^2 + 1$

$f' = 4x^3 \qquad g' = 2x$

$y' = f' \cdot g + f \cdot g'$ ← PRODUCT RULE!

$= (4x^3)(x^2+1) + (x^4-1)(2x)$

$= 4x^5 + 4x^3 + 2x^5 - 2x$

$\boxed{y' = 6x^5 + 4x^3 - 2x}$

3.3

30 Find y'

$$y = \underbrace{(x^4+2x)}_{f} \cdot \underbrace{(x^3+2x^2+1)}_{g}$$

$f = x^4+2x$

$f' = 4x^3+2$

$y' = f' \cdot g + f \cdot g'$

$g = x^3+2x^2+1$

$g' = 3x^2+4x$

$= (4x^3+2) \cdot (x^3+2x^2+1) + (x^4+2x)(3x^2+4x)$

$= 4x^6+8x^5+4x^3+2x^3+4x^2+2+3x^6+4x^5+6x^3+8x^2$

$$\boxed{y' = 7x^6+12x^5+12x^3+12x^2+2}$$

OR expand then find dy/dx

$y = (x^4+2x)(x^3+2x^2+1)$

$y = x^7+2x^6+x^4+2x^4+4x^3+2x$

$y' = 7x^6+12x^5+4x^3+8x^3+12x^2+2$

$$\boxed{y' = 7x^6+12x^5+12x^3+12x^2+2}$$

SAME!

3.3 Rules for Finding Derivatives

34) $y = \dfrac{2}{5x^2-1} = \dfrac{f}{g}$ $\qquad f=2 \quad g=5x^2-1$

$\qquad f'=0 \quad g'=10x$

$$y' = \frac{f'\cdot g - f\cdot g'}{g^2}$$

$$= \frac{0\cdot(5x^2-1) - 2(10x)}{(5x^2-1)^2}$$

$$\boxed{y' = \frac{-20x}{(5x^2-1)^2}}$$

44) $y = \dfrac{x^2-2x+5}{x^2+2x-3} = \dfrac{f}{g}$ $\qquad f=x^2-2x+5 \quad g=x^2+2x-3$

$\qquad f'=2x-2 \quad g'=2x+2$

$$y' = \frac{f'\cdot g - f\cdot g'}{g^2}$$

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

$$= \frac{2x^3+4x^2-6x-2x^2-4x+6-(2x^3+2x^2-4x^2-4x+10x+10)}{(x^2+2x-3)^2}$$

$$= \frac{2x^3+2x^2-10x+6-2x^3-2x^2+4x^2+4x-10x-10}{(x^2+2x-3)^2}$$

$$\boxed{y' = \frac{4x^2-16x-4}{(x^2+2x-3)^2}}$$