

**Differentiate each function with respect to x.**

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

$$\begin{aligned}\frac{dy}{dx} &= 3(2x + 3)^2 \cdot 2 \\ &= 6(2x + 3)^2\end{aligned}$$

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

$$\begin{aligned}\frac{dy}{dx} &= 5(2x + 3)^4 \cdot 2 \\ &= 10(2x + 3)^4\end{aligned}$$

3)  $y = (4x^3 + 5)^3$

$$\begin{aligned}\frac{dy}{dx} &= 3(4x^3 + 5)^2 \cdot 12x^2 \\ &= 36x^2(4x^3 + 5)^2\end{aligned}$$

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

$$\begin{aligned}\frac{dy}{dx} &= 5(-4x^3 - 5)^4 \cdot -12x^2 \\ &= -60x^2(-4x^3 - 5)^4\end{aligned}$$

5)  $y = \sin 2x^3$

$$\begin{aligned}\frac{dy}{dx} &= \cos 2x^3 \cdot 6x^2 \\ &= 6x^2 \cos 2x^3\end{aligned}$$

6)  $y = \tan 5x^4$

$$\begin{aligned}\frac{dy}{dx} &= \sec^2 5x^4 \cdot 20x^3 \\ &= 20x^3 \sec^2 5x^4\end{aligned}$$

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

$$\begin{aligned}\frac{dy}{dx} &= 3((2x^5 + 3)^5 - 4)^2 \cdot 5(2x^5 + 3)^4 \cdot 10x^4 \\ &= 150x^4((2x^5 + 3)^5 - 4)^2 \cdot (2x^5 + 3)^4\end{aligned}$$

8)  $y = ((x + 4)^5 + 5)^4$

$$\begin{aligned}\frac{dy}{dx} &= 4((x + 4)^5 + 5)^3 \cdot 5(x + 4)^4 \\ &= 20((x + 4)^5 + 5)^3 \cdot (x + 4)^4\end{aligned}$$

9)  $y = \cos(\cos 2x^4)$

$$\begin{aligned}\frac{dy}{dx} &= -\sin(\cos 2x^4) \cdot -\sin 2x^4 \cdot 8x^3 \\ &= 8x^3 \sin(\cos 2x^4) \sin 2x^4\end{aligned}$$

10)  $y = \cos(\sin 2x^4)$

$$\begin{aligned}\frac{dy}{dx} &= -\sin(\sin 2x^4) \cdot \cos 2x^4 \cdot 8x^3 \\ &= -8x^3 \sin(\sin 2x^4) \cos 2x^4\end{aligned}$$

$$11) y = (5x^5 - 3)^5(3x^2 - 1)$$

$$\begin{aligned} \frac{dy}{dx} &= (5x^5 - 3)^5 \cdot 6x + (3x^2 - 1) \cdot 5(5x^5 - 3)^4 \cdot 25x^4 \\ &= x(5x^5 - 3)^4(405x^5 - 18 - 125x^3) \end{aligned}$$

$$12) y = (2x^5 + 3)^3(2x + 5)$$

$$\begin{aligned} \frac{dy}{dx} &= (2x^5 + 3)^3 \cdot 2 + (2x + 5) \cdot 3(2x^5 + 3)^2 \cdot 10x^4 \\ &= 2(2x^5 + 3)^2(32x^5 + 3 + 75x^4) \end{aligned}$$

$$13) y = \frac{2x^5 - 5}{(-2x^3 - 1)^4}$$

$$\begin{aligned} \frac{dy}{dx} &= \frac{(-2x^3 - 1)^4 \cdot 10x^4 - (2x^5 - 5) \cdot 4(-2x^3 - 1)^3 \cdot -6x^2}{((-2x^3 - 1)^4)^2} \\ &= \frac{2x^2(14x^5 - 5x^2 - 60)}{(-2x^3 - 1)^5} \end{aligned}$$

$$14) y = \frac{(x^2 + 3)^4}{4x^5 + 3}$$

$$\begin{aligned} \frac{dy}{dx} &= \frac{(4x^5 + 3) \cdot 4(x^2 + 3)^3 \cdot 2x - (x^2 + 3)^4 \cdot 20x^4}{(4x^5 + 3)^2} \\ &= \frac{12x(x^2 + 3)^3(x^5 - 5x^3 + 2)}{(4x^5 + 3)^2} \end{aligned}$$

$$15) y = \frac{(3x^3 - 5)^4}{(2x^4 + 1)^5}$$

$$\begin{aligned} \frac{dy}{dx} &= \frac{(2x^4 + 1)^5 \cdot 4(3x^3 - 5)^3 \cdot 9x^2 - (3x^3 - 5)^4 \cdot 5(2x^4 + 1)^4 \cdot 8x^3}{((2x^4 + 1)^5)^2} \\ &= \frac{4x^2(3x^3 - 5)^3(-12x^4 + 9 + 50x)}{(2x^4 + 1)^6} \end{aligned}$$

$$16) y = (-5x + 3)^5 \cdot (-3x^3 + 1)^3$$

$$\begin{aligned} \frac{dy}{dx} &= (-5x + 3)^5 \cdot 3(-3x^3 + 1)^2 \cdot -9x^2 + (-3x^3 + 1)^3 \cdot 5(-5x + 3)^4 \cdot -5 \\ &= (-5x + 3)^4 \cdot (-3x^3 + 1)^2(210x^3 - 81x^2 - 25) \end{aligned}$$