



Functions

Derivation (part 2)



Important Notes

□ If $f(x) = U \pm V$ then $f'(x) = U' \pm V'$

□ If $f(x) = U.V$ then $f'(x) = U'V + V'U$

□ If $f(x) = \frac{U}{V}$ then $f'(x) = \frac{U'V - V'U}{V^2}$

Derivative

Function	Derivative	Example
➤ $f(x) = k \quad k \in \mathbb{R}$	$f'(x) = 0$	$g(x) = -8$ then $g'(x) = 0$
➤ $f(x) = kx^n \quad k \text{ \& } n \in \mathbb{R}$	$f'(x) = knx^{n-1}$	$h(x) = 5x^3$ then $h'(x) = 15x^2$
➤ $f(x) = kU^n$	$f'(x) = knU^{n-1} \cdot \mathbf{U'}$	$m(x) = 3(5x - 2)^2$ $m'(x) = 3 \times 2(5x - 2)^1 \times \mathbf{5}$
➤ $f(x) = k\sqrt{x}$	$f'(x) = \frac{k}{2\sqrt{x}}$	$u(x) = -5\sqrt{x}$ then $u'(x) = \frac{-5}{2\sqrt{x}}$
➤ $f(x) = k\sqrt{U}$	$f'(x) = \frac{k \cdot \mathbf{U'}}{2\sqrt{U}}$	$n(x) = 4\sqrt{3x^2 - 5x}$ $n'(x) = \frac{4 \cdot \mathbf{(6x - 5)}}{2\sqrt{3x^2 - 5x}}$



Solved Examples

Ex1

$$f(x) = 3(-4x^3 - 5x^2 + 1)^7$$

$$f'(x) = 21(-4x^3 - 5x^2 + 1)^6(-12x^2 - 10x)$$

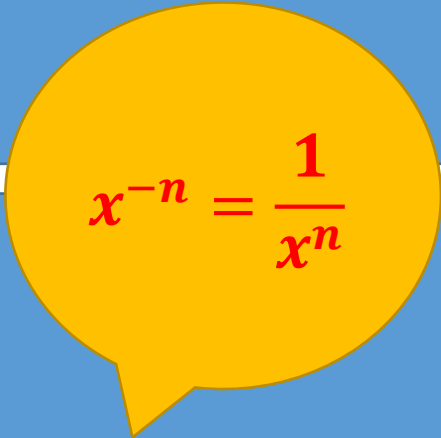


Solved Examples

Ex2

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

$$f(x) = 5x^{-1} - 3x^{-2} + 2x^{-4}$$


$$x^{-n} = \frac{1}{x^n}$$

$$\begin{aligned} f'(x) &= -5x^{-2} + 6x^{-3} - 8x^{-5} \\ &= \frac{-5}{x^2} + \frac{6}{x^3} - \frac{8}{x^5} \end{aligned}$$



Solved Examples

Ex3

$$f(x) = \sqrt{7x^2 + 5x + 1} + \frac{3}{\sqrt{x}}$$

$$f(x) = \sqrt{7x^2 + 5x + 1} + 3x^{-\frac{1}{2}}$$

$$\sqrt{x} = x^{\frac{1}{2}}$$

$$\begin{aligned} f'(x) &= \frac{14x+5}{2\sqrt{7x^2+5x+1}} - \frac{3}{2}x^{-\frac{3}{2}} \\ &= \frac{14x+5}{2\sqrt{7x^2+5x+1}} - \frac{3}{2x\sqrt{x}} \end{aligned}$$

$$\begin{aligned} x^{\frac{3}{2}} &= \sqrt{x^3} \\ &= x\sqrt{x} \end{aligned}$$



Solved Examples

Ex4

$$f(x) = (2x + 1)(3x^2 - 5x)^4$$

$$f(x) = UV$$
$$f'(x) = U'V + V'U$$

$$U = 2x + 1$$
$$V = (3x^2 - 5x)^4$$

$$U' = 2$$
$$V' = 4(3x^2 - 5x)^3(6x - 5)$$

$$f'(x) = 2(3x^2 - 5x)^4 + (2x + 1)4(3x^2 - 5x)^3(6x - 5)$$



Solved Examples

Ex5

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

$$f(x) = \frac{U}{V}$$

$$f'(x) = \frac{U'V - V'U}{V^2}$$

$$U = 2x + 1$$
$$V = (3x^2 - 5x)^4$$

$$U' = 2$$
$$V' = 4(3x^2 - 5x)^3(6x - 5)$$

$$f'(x) = \frac{2(3x^2 - 5x)^4 - (2x + 1)4(3x^2 - 5x)^3(6x - 5)}{[(3x^2 - 5x)^4]^2}$$



