

"Derivative"

$$F'(x) = \lim_{h \rightarrow 0} \frac{F(x+h) - F(x)}{h}$$

Base 1

① $F(x) = a$

$a = \text{constant}$

$$F'(x) = 0$$

یعنی = عیب و نقص نیست *

Examples

① $F(x) = 2 \rightarrow F'(x) = 0$

② $F(x) = -5 \rightarrow F'(x) = 0$

③ $F(x) = \frac{3}{2} \rightarrow F'(x) = 0$

Base 2

② $F(x) = x^n$

$$F'(x) = nx^{n-1}$$

Examples

① $F(x) = x^2 \rightarrow F'(x) = 2x^{2-1} = 2x$

② $F(x) = x^7 \rightarrow F'(x) = 7x^{7-1} = 7x^6$

③ $F(x) = x^{\frac{3}{2}} \rightarrow F'(x) = \frac{3}{2}x^{\frac{3}{2}-1} = \frac{3}{2}x^{\frac{3-2}{2}} = \frac{3}{2}x^{\frac{1}{2}}$

④ $F(x) = 5x^3 \rightarrow F'(x) = 5(3x^2) = 15x^2$

5) $F(x) = 9x^5 \rightarrow F'(x) = 9(5x^4) = 45x^4$

6) $F(x) = x^{-3} \rightarrow F'(x) = -3x^{-3-1} = -3x^{-4}$

7) $F(x) = 5x^{-5} \rightarrow F'(x) = 5(-5x^{-6}) = -25x^{-6}$

8) $F(x) = -3x^{-2} \rightarrow F'(x) = -3(-2x^{-2-1}) = +6x^{-3}$

9) $F(x) = 5x \rightarrow F'(x) = 5(1x^{-1}) = 5x^0 = 5$

10) $F(x) = -7x$
 $F'(x) = -7$

* $F(x) = ax \rightarrow F'(x) = a$

* مشتقة منسوب الى الـ x
 $F(x) = (ax)$
هو الـ (a)
 $F'(x) = a$

11) $F(x) = \frac{3}{2}x \rightarrow F'(x) = \frac{3}{2}$

12) $F(x) = 2\sqrt{3}x^2 = 2\sqrt{3}(2x) = 4\sqrt{3}x$

13) $F(x) = -\sqrt{5}x \rightarrow F'(x) = \sqrt{5}$

14) $F(x) = \frac{1}{x^2} \rightarrow F'(x) = ~~x^{-2}~~ \rightarrow F'(x) = -2x^{-2-1} = -2x^{-3}$

* $F(x) = \frac{a}{x^n} = ax^{-n}$
 $F'(x) = -anx^{-n-1}$

15) $F(x) = \frac{5}{x^3} = 5x^{-3} \Rightarrow F'(x) = 5(-3x^{-3-1}) = -15x^{-4}$

16) $F(x) = \frac{6}{x^{-4}} = 6x^4 \rightarrow F'(x) = 6(4x^3) = 24x^3$

17) $F(x) = \frac{x^{13}}{x^5} \rightarrow F(x) = x^{13-5} = x^8 \Rightarrow F'(x) = 8x^7$

18) $F(x) = \frac{x^3}{x^2} \rightarrow F(x) = x^{3-2} = x \Rightarrow F'(x) = 1$

② Base 3
 $F(x) = h(x) \mp g(x)$

$F'(x) = h'(x) \mp g'(x)$

Examples

① $F(x) = x^3 + x^2 \Rightarrow F'(x) = 3x^2 + 2x$

② $F(x) = x^3 - 5x^2 + 10 \Rightarrow F'(x) = 3x^2 - 10x + 0$
 $F'(x) = 3x^2 - 10x$

③ $F(x) = 3x^2 + 5x + 8$ find $F'(x)$ when $x = 1$
 $F'(x) = 3(2x) + 5 + 0 = 6x + 5$ at $x = 1$
 $F'(1) = 6 \times 1 + 5 = \boxed{11}$

④ $F(x) = \frac{3}{2x^2} + \frac{5x^2}{3} + \frac{7x}{5} - \frac{1}{6}$
 $F(x) = \frac{3}{2}x^{-2} + \frac{5}{3}x^2 + \frac{7}{5}x - \frac{1}{6}$
 $F'(x) = \frac{3}{2}(-2x^{-3}) + \frac{5}{3}(2x) + \frac{7}{5} - 0$
 $F'(x) = \frac{-6}{2}x^{-3} + \frac{10}{3}x + \frac{7}{5}$
 $F'(x) = -3x^{-3} + \frac{10}{3}x + \frac{7}{5}$
 $F'(x) = \frac{-3}{x^3} + \frac{10}{3}x + \frac{7}{5}$

(4)

$$5) F(x) = 10 \left(\frac{x^2}{50} + \frac{x}{9} - \frac{1}{3} \right)$$

$$F'(x) = 10 \left[\frac{2x}{50} + \frac{1}{9} - 0 \right]$$

$$F'(x) = 10 \left[\frac{x}{25} + \frac{1}{9} \right]$$

$$F'(x) = \frac{10}{25}x + \frac{10}{9}$$

* Base 4

(4) $F(x) = h(x)g(x)$ اذا كانت الدالة مخرجة والسين

$$F'(x) = h(x)g'(x) + g(x)h'(x)$$

* مشتقة مخرجة والسين = الاولى * مشتقة الباقى + الباقى * مشتقة الاولى

Examples

① $F(x) = (3 - 2x - x^5)(2x^7 + 5)$

$$F'(x) = (3 - 2x - x^5) * (14x^6 + 0) + (2x^7 + 5) * (0 - 2 - 5x^4)$$

$$F'(x) = (3 - 2x - x^5)(14x^6) + (2x^7 + 5)(-2 - 5x^4)$$

$$F'(x) = 42x^6 - 28x^7 - 14x^{11} + (-4x^7 - 10 - 10x^{11} - 25x^4)$$

$$F'(x) = 42x^6 - 28x^7 - 14x^{11} - 4x^7 - 10 - 10x^{11} - 25x^4$$

$$F'(x) = -24x^{11} - 32x^7 + 42x^6 - 25x^4 - 10$$

Ans.

$$\textcircled{2} \quad F(x) = (x^2 + x^3)(3x^2 - x^5 + 3)$$

$\textcircled{5}$

$$F'(x) = (x^2 + x^3) \times (6x - 5x^4) + (3x^2 - x^5 + 3) \times (2x + 3x^2)$$

$$F'(x) = 6x^{\textcircled{3}} - 5x^{\textcircled{6}} + 6x^{\textcircled{4}} - 5x^{\textcircled{7}} + 6x^{\textcircled{3}} + 9x^{\textcircled{4}} - 2x^{\textcircled{6}} - 3x^{\textcircled{7}} + 6x + 9x^2$$

$$F'(x) = -8x^7 - 7x^6 + 15x^4 + 12x^3 + 9x^2 + 6x$$

Ans.