Day :-> 13 SivaReddy Bodapati 14.07.2021

12:30

Polynomial Derivates

(1) $f(x) = x^2 + 2x + 1$

derivative $\frac{d}{dx} f(x) = f'(x)$

$f'(x) = 2x + 2 + 0$

$\boxed{f'(x) = 2(x+1) \text{ (or) } 2x+2}$

alternative solution with limit

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \to 0} \frac{(x+h)^2 + 2(x+h) + 1 - x^2 - 2x - 1}{h}$$

$$= \lim_{h \to 0} \frac{2hx + \cancel{x^2} + h^2 + \cancel{2x} + 2h + \cancel{1} - \cancel{x^2} - \cancel{2x} - \cancel{1}}{h}$$

$$= \lim_{h \to 0} \frac{h^2 + 2h + 2hx}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(h + 2 + 2x)}{\cancel{h}}$$

$$= \lim_{h \to 0} h + 2 + 2x$$

$$= 0 + 2 + 2x$$

$$\boxed{f'(x) = 2x + 2 \text{ (or) } 2(x+1)}$$

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

$$f'(x) = \frac{\cancel{2}x}{\cancel{2}} - 5 + 0$$

$$\boxed{f'(x) = x - 5}$$

③ $f(x) = \sqrt{x}$

$f(x) = x^{1/2}$ (from) $f'(x^n) = nx^{n-1}$

$f'(x) = \frac{1}{2} x^{1/2 - 1}$

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

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

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

$\boxed{f'(x) = \frac{1}{2\sqrt{x}}}$

④ $f(x) = \frac{6x^6}{4} - \frac{9x^5}{7} + 2x^2$

$f'(x) = \left(\frac{6}{4} \cdot 6x^5\right) - \left(\frac{9}{7} \cdot 5x^4\right) + (2 \cdot 2x^1)$

$= 9x^5 - \frac{45}{7}x^4 + 4x$

$= 9x^5 - \left(\frac{45}{7}\right)x^4 + 4x$

$\boxed{f'(x) = 9x^5 - \frac{45}{7}x^4 + 4x}$

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

$f'(x) = \frac{3x^2}{2} - 2x + 0 + (2 \cdot 2)x$

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

$\boxed{f'(x) = \frac{3}{2}x^2 + 2x \text{ (or) } x\left(\frac{3}{2}x + 2\right)}$

⑥ $f(x) = \frac{x^{-1/2}}{2}$

$f'(x) = \frac{1}{2} \cdot -\frac{1}{2} x^{-1/2 - 1}$

$= -\frac{1}{4} x^{\frac{-1-2}{2}}$

$\cancel{= -\frac{1}{4} x^{-4/2}}$ $= -\frac{1}{4} x^{-\frac{3}{2}}$

$\cancel{= -\frac{1}{4} x^{-2}}$ $= -\frac{1}{4}\cancel{x}\frac{1}{x^{3/2}}$ $= -\frac{1}{4} \frac{1}{x^{3/2}}$

$\cancel{f'(x) = -\frac{1}{4x^2}}$ $\boxed{f'(x) = \frac{-1}{4x^{3/2}}}$

⑦ $f(y) = \frac{x^{-1}}{2} y^5$

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

$= 5 \frac{x^{-1}}{2} y^4$

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

(or) (ib) $f(y) = \frac{x}{2} - 1 \cdot y^5$

$\boxed{f'(y) = -5y^4}$

Trignomatry

① $f(x) = \cos x$

$\boxed{f'(x) = -\sin x}$

② $f(x) = \sin x$

$\boxed{f'(x) = \cos x}$

③ $f(x) = \cos(x^2)$

$f'(x) = -\sin(x^2) \times 2x$

$\boxed{f'(x) = -2x \sin(x^2)}$

$\frac{d}{dx} \cos(g(x)) = -\sin(g(x)) \cdot \frac{d}{dx} g(x)$

$= -\sin(g(x)) \cdot g'(x)$

④ $f(x) = \sin(\sqrt{x})$

$f'(x) = \frac{d}{dx} (\sin \sqrt{x})$

$= \cos(\sqrt{x}) \cdot \frac{d}{dx} (\sqrt{x})$

$= \cos(\sqrt{x}) \cdot \frac{d}{dx} x^{1/2}$

$= \cos \sqrt{x} \cdot \frac{1}{2} x^{\frac{1}{2} - 1}$

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

$= \frac{1}{2} \cos \sqrt{x} \cdot \frac{1}{\sqrt{x}}$

$\boxed{f'(x) = \frac{1}{2\sqrt{x}} \cos(\sqrt{x})}$

Logarithms

① $f(x) = \ln(x)$

$$f'(x) = \frac{d}{dx}\ln(x)$$

$$= \frac{\frac{d}{dx}(x)}{x}$$

$$f'(x) = \frac{1}{x}$$

y won formulae

$$\left[\frac{d}{dx}\ln(g(x)) = \frac{g'(x)}{g(x)}\right]$$

② $f(x) = \ln(x) - \ln(-x)$

$$f'(x) = \frac{1}{x} - \frac{\frac{d}{dx}(-x)}{-x}$$

$$= \frac{1}{x} - \frac{(-1)}{-x}$$

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

$$f'(x) = 0$$

③ $f(x) = \ln(x^2)$

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

$$f'(x) = \frac{2}{x}$$

④ $f(x) = \ln(x^2+1)$

$$f'(x) = \frac{\frac{d}{dx}(x^2+1)}{x^2+1}$$

$$f'(x) = \frac{2x+0}{x^2+1}$$

$$f'(x) = \frac{2x}{x^2+1}$$