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21/50

I. FIND THE DY/DX (LONG METHOD)

1. $y = 3x^3 - 6x^2 - x + 7 = f(x)$

$\frac{dy}{dx}\, 3x^3 - 6x^2 - x + 7 \longrightarrow$ constant rule

$+0 \quad \frac{dy}{dx}\, 3x^3 - 6x^2 - x \longrightarrow$ exponent raise to 0

$-1+0 \quad \frac{dy}{dx}\, 3x^3 - 6x^2 \longrightarrow$ Power Rule and constant multiple

$3(3x^2) - 6(2x) - 1 + 0$

~~$y' = 9x^2 - 12x - 1$~~

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

$$\lim_{h \to 0} \frac{(3(x+h)^3 - 6(x+h)^2 - (x+h) + 7) - (3x^3 - 6x^2 - x + 7)}{h}$$

$$\lim_{h \to 0} \frac{3(x^3 + 3x^2h + 3xh^2 + h^3) - 6(x^2 + 2xh + h^2) - (x+h) + 7 - [3x^3 - 6x^2 - x + 7]}{h}$$

$$\lim_{h \to 0} \frac{(3x^3 + 9x^2h + 9xh^2 + 3h^3) - (6x^2 + 12xh + 6h^2)(x+h) + 7 - [3x^3 - 6x^2 - x + 7]}{h}$$

$$\lim_{h \to 0} (3x^3 + 9x^2 + 9xh + 3h^2) - (6x^2 + 12x + 6h) - x + 7 - [3x^3 - 6x^2 - x + 7] \qquad h \neq 0$$

$$\lim_{h \to 0} (\cancel{3x^3} + 9x^2 + 0 + 0) - (\cancel{6x^2} + 12x + 0) \cancel{-x} \cancel{+7} - [\cancel{3x^3} \cancel{-6x^2} \cancel{-x} \cancel{+7}]$$

$$\boxed{\frac{dy}{dx} = \lim_{h \to 0} 9x^2 - 12x - 1}$$

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2) $y = \sqrt{x}$ or $x^{1/2}$

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \frac{dy}{dx} = \lim_{h \to 0} \left(\frac{(x^{1/2} + h) - x^{1/2}}{h}\right)^2 \qquad \left(\frac{\sqrt{x} + h - \sqrt{x}}{h}\right)^2$$

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

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

$$= \lim_{h \to 0} x + 2x^{1/2} + h - x \quad \rightarrow h \approx 0 \qquad \cancel{x} + 2\sqrt{x} + h - \cancel{(x)}$$

$$= \lim_{h \to 0} \cancel{x} + 2x^{1/2} + (0) \cancel{-x} \qquad 2\sqrt{x} + h \quad h \approx 0$$

$$\frac{dy}{dx} = \lim_{h \to 0} 2x^{1/2} \qquad 2\sqrt{x} + 0$$

$$\frac{dy}{dx} = \lim_{h \to 0} \frac{1}{2} x^{-1/2}$$

or

$$\frac{dy}{dx} = \lim_{h \to 0} \frac{1}{2\sqrt{x}}$$