Section 3.5

higher order

$$\frac{d}{dx}[f'(x)] = \frac{f'(x+h) - f'(x)}{h}$$

$$= f''(x)$$

how about

$$\frac{d}{dx}[f''(x)]$$

$$= f'''(x)$$

in general, the higher-order derivatives are

$$f(x),\ f''(x),\ f'''(x),\ \ldots,\ f^{(n)}(x)$$

or

$$D^1 f(x),\ D^2 f(x),\ D^3 f(x),\ \ldots,\ D^n f(x)$$

or

$$y',\ y'',\ y''',\ \ldots,\ y^{(n)}$$

or

$$\frac{dy}{dx},\ \frac{d^2y}{dx^2},\ \frac{d^3y}{dx^3},\ \ldots,\ \frac{d^n y}{dx^n}$$

P2

find all the derivatives of all orders of

$$f(x) = x^5 - 3x^4 + 4x^3 - 2x^2 + x - 8$$

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

$$f''(x) = 20x^3 - 36x^2 + 24x - 4$$

$$f'''(x) = 60x^2 - 72x + 24$$

$$f^{(4)}(x) = 120x - 72$$

$$f^{(5)}(x) = 120$$

$$f^{(6)}(x) = 0$$

$$f^{(7)}(x) = ?$$

$$f^{(n)}(x) = ? \quad \text{for} \quad n \geq 6$$

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find third derivative of

$$y = x^{2/3}$$

$$y^{(1)} = \frac{2}{3} x^{2/3 - 1} = \frac{2}{3} x^{-1/3}$$

$$y^{(2)} = -\frac{2}{9} x^{-4/3}$$

$$y^{(3)} = \frac{8}{27} x^{-7/3}$$