Higher Order Derivatives

$f(x)$ y

$f'(x)$ $\frac{dy}{dx}$ → f↑ f↓ vel

$f''(x)$ $\frac{d^2y}{dx^2}$ → CU/CD accel.

$f'''(x)$ $\frac{d^3y}{dx^3}$

$f^4(x)$

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

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

$f''(x) = 6x + 4$

$f'''(x) = 6$

$f^4(x) = 0$

n^{th} degree poly -

$(n+1)$th deriv $= 0$

$$f(x) = \sec x$$

$$f'(x) = \sec x \tan x$$

$$f''(x) = \sec x \sec^2 x + \tan x \sec x \tan x$$

$$= \sec x \left(\sec^2 x + \tan^2 \right)$$

$6x - 2 - 6x - 3$

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

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

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

$$f''(x) = 10(3x-1)^{-3}(3)$$

$$= \frac{30}{(3x-1)^3}$$

$f(x) = \sin x$

$f'(x) = \cos x$

$f''(x) = -\sin x$

$f'''(x) = -\cos x$

$f^{4}(x) = \sin x$

Given $f(x) = \sin x$, find $f^{555}(x)$.

$$4\overline{)555} \quad 138 \text{ r } 3$$

$f^{555}(x) = f'''(x)$

$f'(x) = \cos x$

$f''(x) = -\sin x$

$f'''(x) = -\cos x$

$\therefore f^{555}(x) = -\cos x$

$f(x) = \cos x$

$f'(x) = -\sin x$

$f''(x) = -\cos x$

$f'''(x) = \sin x$

$f^4(x) = \cos x$

Given $f(x) = \cos x$, find $f^{321}(x)$.

$$4\overline{)321} \quad 80 \text{ R } 1$$

$f^{321}(x) = f'(x)$

$f'(x) = -\sin x$

$\therefore f^{321}(x) = -\sin x$