

Higher Order Derivatives

$f(x)$	y	
$f'(x)$	$\frac{dy}{dx}$	→ inst rate of change (vel) $f \uparrow f \downarrow$
$f''(x)$	$\frac{d^2y}{dx^2}$	$C > 0 / C < 0$ (accel)
$f'''(x)$		
$f^{(4)}(x)$	$\frac{d^3y}{dx^3}$	
↓	↓	
$f^{(n)}(x)$	$\frac{d^ny}{dx^n}$	

$$f(x) = x^3 + 3x^2 - 4x + 7$$

$$f'(x) = 3x^2 + 6x - 4$$

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

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

$$f^{(4)}(x) = 0$$

Polynomial func.

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

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

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

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

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

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

$$= \frac{6x+3-6x+4}{(2x+1)^2}$$

$$= \frac{7}{(2x+1)^2}$$

$$= 7(2x+1)^{-2}$$

$$f''(x) = -14(2x+1)^{-3}(2) = -\frac{28}{(2x+1)^3}$$

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

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

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

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

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

$$\text{Given } f(x) = \sin x$$

$$\text{find } f^{333}(x)$$

$$4 \overline{) 8321}$$

$$f^{333}(x) = f'(x)$$

$$= \cos x.$$

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

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

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

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

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

Given $f(x) = \cos x$, find $f^{515}(x)$.

$$\begin{array}{r} 128R3 \\ 4 \overline{) 515} \end{array}$$

$$f^{515}(x) = f'''(x)$$

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

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

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

$$\therefore f^{515}(x) = \sin x$$