

BONUS ASSIGNMENT  
 MARCH 7th 2011  
 SECOND DERIVATIVES

① Find the 18<sup>th</sup> derivative of  $f(x) = e^{2x}$

Sol<sup>n</sup>.

WE MUST OBSERVE THE PATTERN IN THE DERIVATION PROCESS :

$$f'(x) = e^{2x} (2) = 2e^{2x}$$

$$f''(x) = 2e^{2x} (2) = 2^2 e^{2x}$$

$$f'''(x) = 2^2 e^{2x} (2) = 2^3 e^{2x}$$

$$f^4(x) = 2^3 e^{2x} (2) = 2^4 e^{2x}$$

WE CAN CONCLUDE THAT  $f^{18}(x) = 2^{18} e^{2x}$

② Find the 99<sup>th</sup> derivative of  $f(x) = -\cos(3x)$

$$f'(x) = \sin(3x) \cdot 3 = 3\sin 3x$$

$$f''(x) = (3\cos 3x) \cdot 3 = 3^2 \cos 3x$$

$$f'''(x) = -3^2 \sin 3x (3) = -3^3 \sin 3x$$

$$f^4(x) = 3^3 \cos(3x) (3) = -3^4 \cos 3x$$

EVERY 4th DERIVATIVE INVOLVES a  $-\cos 3x$   
 AT EACH STEP WE MULTIPLY BY 3

therefore  $f^{99}(x) = -3^{99} \sin 3x$