NUAESHIYA [illegible] CHUKS
16/[illegible]/017
ELECT/ELECT ENGR

Part 1

① If $y = e^{x^2+x}$

$u = x^2 + x$

$\frac{du}{dx} = 2x + 1$

$y = e^u$

$\frac{dy}{du} = e^u$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= e^u \times 2x + 1$

$2x + 1e^u$ $\quad u = x^2 + x$

$\frac{dy}{dx} = 2x + 1e^{x^2+x}$

$\frac{d^2y}{dx^2} = 2e^{x^2+x} + 4x^2 + 4x + 1e^{x^2+x}$

$\frac{d^2y}{dx^2} = 2e^{x^2+x} + 4x^2 + 4x + 1e^{x^2+x}$

$y'' = \frac{d^2y}{dx^2}$ $\quad y' = \frac{dy}{dx}$ $\quad y = e^{x^2+x}$

$y'' = y'(2x+1) + 2y$

$y'' = 2e^{x^2+x} + 4x^2 + 4x + 1e^{x^2+x}$

$y'(2x+1) = (2x+1)(2x+1)e^{x^2+x}$

$2y = 2e^{x^2+x}$

$y'(2x+1) + 2y = 2e^{x^2+x} + 4x^2 + 4x + 1e^{x^2+x}$

$y'' = 2e^{x^2+x} + 4x^2 + 4x + 1e^{x^2+x}$

$y'' = y'(2x+1) + 2y$

$\downarrow$ L_1 $\quad L_2$ $\quad \downarrow$ L_3

w_1

$u = y''$ $\quad u = 1$

$u^n = y^{n+2}$ $\quad v = 0$

$= y^{n+2} \cdot 1 + 0$

w_2

$u = y'$ $\quad v = 2x + 1$

$u^n = y^{n+1}$ $\quad v' = 2$

$u^{n-1} = y^n$ $\quad v = 0$

$= y^{n+1}(2x+1) + n(y^n) \cdot 2 + 0$

$= y^{n+1}(2x+1) + 2n(y^n)$

w_3

$u = y$ $\quad v = 1$

$u^n = y^n$ $\quad v' = 0$

$= 2[(y^n \cdot 1) + 0]$

$= 2y^n$

$w_1 = w_2 + w_3$

$y^{n+2} = y^{n+1}(2x+1) + 2n(y^n) + 2y^n$

② Using the Leibnitz theorem Given that $y = x^3 e^{4x}$ Determine $y^{(5)}$

Soln

$u = e^{7x}$ $\quad v = x^3$

$y^{(5)} = u^{(5)}v + 5u^4v' + 10u^3v'' + 10u^2v^3 + 5u'v'$
$+ uv^5$

$= 4^5 e^{4x} \cdot x^3 + 5(4^4 e^{4x} \cdot 3x^2) + 10(4^3 e^{4x} 6x)$
$+ 5(4^2 e^{4x} \cdot 6) + 0$

$= 1024 e^{4x} x^3 + 1280 e^{7x} \cdot 3x^2 + 670 e^{7x} \cdot 6x + 80 e^{4x} \cdot 6$

$= 1024 e^{4x} x^3 + 3840 e^{4x} x^2 + 3846 e^{4x} x + 480 e^{4x}$

① $x^2 d^2y/dx^2 + x \frac{dy}{dx} + y = 0$

$x^2 y'' + x y' + y = 0$

$\quad \downarrow \quad\quad \downarrow \quad \downarrow$

$\quad w_1 \quad\quad w_2 \quad w_3$

NWACONYE UCHE CHUKS
15/ENG04/037
ELECT/ELECT ENGR

Part 2

$W_1 + W_2 + W_3 = 0$

For W_1

$u = y''$ $\quad$ $v = x^2$

$u^n = y^{n+2}$ $\quad$ $v' = 2x$

$u^{n-1} = y^{n+1}$ $\quad$ $v'' = 2$

$u^{n-2} = y^n$ $\quad$ $v''' = 0$

$= y^{(n+2)}(x^2) + n(y^{n+1})2x + \frac{n(n-1)y^n \cdot x}{2!} + 0$

$= x^2 y(n+2) + 2nx(y^{n+1}) + n(n-1)y^n$

For W_2

$u = y'$ $\quad$ $v = x$

$u^n = y^{n+1}$ $\quad$ $v = 1$

$u^{n-1} = y^n$ $\quad$ $v'' = 0$

$= y^{n+1} \cdot x + ny^n + 0$

For W_3

$u = y$ $\quad$ $v = 1$

$u^n = y^n$ $\quad$ $v' = 0$

$= y^n \cdot 1$

$W_1 + W_2 + W_3 = 0$

$x^2 y^{n+2} + 2nx y^{n+1} + (n^2 - n)y^n + xy^{n+1} + ny^n + y^n$

$x^2 y^{n+2} + 2nx y^{n+1} + xy^{n+1} + n^2 y^n - ny^n + ny^n + y^n$

$x^2 y^{n+2} + 2n + 1(xy^{n+1}) + (n^2+1)y^n$

Scanned by CamScanner