YAKUBU HEEKMAT OHUNENE
17/ENG02/080
COMPUTER ENGINEERING
ENG 381

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

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

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

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

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

$= (2x+1)e^{x^2+x} \cdot (2x+1) + 2(e^{x^2+x})$

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

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

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

$A = y''$, $A' = y'''$, $A^n = y^{2+n}$

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

$u = y'$, $u^n = y^{n+1}$

$v = 2x+1$, $v' = 2$, $v'' = 0$

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

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

$C = 2y$

$C^n = 2y^n$

$A^n = B^n + C$

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

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

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

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→ $y = x^3 e^{4x}$, Determine y^5

let u & v be as follows

$v = x^3$, $v' = 3x^2$, $v'' = 6x$, $v''' = 6$

$u = e^{2x}$, $u' = 2e^{2x}$, $u'' = 4e^{2x}$, $u''' = 2^n e^{2x}$

Using Leibnitz theorem

$$y^n = 4^n e^{4x} \cdot x^3 + n \cdot 4^{n-1} e^{4x} \cdot 3x^2 + \frac{n(n-1)}{2!} \cdot 4^{n-3} e^{4x} \cdot 6x + \frac{n(n-1)(n-2)}{3!} \cdot 4^{n-3} e^{4x} \cdot 6 + C.$$

$$y^n = 4^n e^{4x} \cdot x^3 + 3x^2 n \cdot 4^{n-1} e^{4x} + 3n(n-1) \cdot 4^{n-2} e^{4x} \cdot x + n(n-1)(n-2) \cdot 4^{n-3} e^{4x}$$

$$y^5 = 4^5 e^{4x} \cdot x^3 + 3x^2(5) \cdot 4^{5-1} e^{4x} + 3(5)(4) \cdot 4^3 e^{4x} \cdot x + 5(4)(3) \cdot 4^2 e^{4x}$$

$$y^5 = 1024 e^{4x} \cdot x^3 + 3840 e^{4x} \cdot x^2 + 3840 e^{4x} \cdot x + 960 e^{4x}$$

$$y^5 = 64 e^{4x}(16x^3 + 60x^2 + 60x + 15)$$

→ $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$. Show that $x^2 y^{(n+2)} + (2n+1)xy^{(n+1)} + (n^2+1)y = 0$.

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

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

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

$$+x\frac{dy}{dx} = + y^{(n+1)} x + n y^n + 0.$$

$$+y = \quad + y^n = 0$$

$$= x^2 y^{(n+2)} + (2n+1) x y^{(n+1)} + [n(n-1) + n + 1] y^{(n)} = 0$$

$$= x^2 y^{(n+2)} + (2n+1) x y^{(n+1)} + (n^2+1) y^{(n)} = 0.$$ Shown.

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