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151ENG041049

ELECTRICAL AND ELECTRONICS

ENG 381

ASSIGNMENT 3

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

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

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

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

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

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

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

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

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

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

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

$$w = y''$$

$$w^n = y^{n+2}$$

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

$$v = 2x+1$$

$$v' = 2$$

$$v'' = 0$$

$$u = y'$$

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

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

$$Q = 2y$$

$$Q^n = 2y^n$$

$$w^n = p^n + Q^n$$

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

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

2) using the Leibnitz theorem, given that

$$y = x^3 e^{4x}$$

determine  $y^{(5)}$

$$V = x^3$$

$$u = e^{4x}$$

$$v' = 3x^2$$

$$v'' = 6x$$

$$v''' = 6$$

$$v^{(4)} = 0$$

$$u' = 4e^{4x}$$

$$u'' = 4 \cdot 4e^{4x} = 16e^{4x}$$

$$u''' = 4 \cdot 4 \cdot 4e^{4x} = 64e^{4x}$$

$$u^{(4)} = 4^4 e^{4x}$$

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

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

$$y^{(5)} = 4^5 e^{4x} x^3 + 4e^{4x} 3x^2 + 20 \cdot 4^3 e^{4x} 3x + 60 \cdot 4^2 e^{4x}$$

iii)  $x^2 y'' + xy' + y = 0$  Show that  $x^2 y^{(n+2)} + (2n+1)xy^{(n+1)} + (n^2+1)y^n = 0$

let  $w = x^2 y''$

$$v = x^2$$

$$v' = 2x$$

$$v'' = 2$$

$$v''' = 0$$

$$u = y''$$

$$u' = y'''$$

$$u'' = y^{(4)}$$

$$u^n = y^{n+2}$$

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

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

let  $p = xy'$

$$v = x$$

$$v' = 1$$

$$v'' = 0$$

$$u = y'$$

$$u' = y''$$

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

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

$$p^n = x y^{n+1} + n y^n$$

$$Q = y$$

$$Q^n = y^n$$

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

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

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

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