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17/ENG03/025

ENG 381

Engineering Mathematics

Assignment II

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

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

from the above equation

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

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

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

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

$\therefore B^n = (y^{n+1})(2x+1) + n(y^n)(2) + 0$, $B^n = (2x+1)y^{n+1} + 2ny^n$

Part C, $C = 2y$

$C^n = 2y^n$

$\therefore A^n = B^n + C^n$, $y^{n+2} = (2x+1)y^{n+1} + 2ny^n + 2y^n$

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

2) $y = 2x^3 e^{4x}$ determine y^5

Let $U = e^{4x}$, $U' = 4e^{4x}$, $U'' = 16e^{4x}$, $U^n = 4^n e^{4x}$

Let $V = 2x^3$, $V' = 6x^2$, $V'' = 12x$, $V''' = 12$, $V^4 = 0$

by Leibnitz theorem

$y^n = 4^n e^{4x} (2x^3 + n \cdot 4^{n-1} e^{4x} \cdot 6x^2 + n(n-1) \cdot 4^{n-2} e^{4x} \cdot 12x + n(n-1)(n-2) \cdot 4^{n-3} e^{4x} \cdot 12 + 0)$

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

3)

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

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

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

$$\text{II.}) \quad x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = 0$$

Show that:

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

for part D

$$A = x^2 y''$$

$$U = y'', \quad U^n = y^{n+2}$$

$$V = x^2, \quad V' = 2x, \quad V'' = 2, \quad V''' = 0$$

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

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

part D

$$B = x y$$

$$U = y', \quad U^n = y^{n+1}$$

$$V = x, \quad V' = 1, \quad V'' = 0$$

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

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

for part C

$$C = y$$

$$C^n = y^n$$

$$A^n + B^n + C^n = 0$$

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

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

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