3 MONDAY 270-095

4 TUESDAY

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CIVIL ENGINEERING

16/ENG03/035

Assignment 2 ENG 381

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

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

where $u = 2x+1$, $v = e^{x^2+x}$

$\frac{du}{dx} = 2$ $\qquad \frac{dv}{dx} = (2x+1)e^{x^2+x}$

$y'' = u\frac{dv}{dx} + v\frac{du}{dx}$

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

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

From Leibnitz Theorem

$y'' - y'(2x+1) - 2y = 0$

$w_1 = y''$ $\qquad v' = 1$ $\qquad u^n = y^{n+2}$

$u = y''$ $\qquad v' = 0$ $\qquad m_1^n = {}^nC_0 u^{n-0} v$

$= y^{n+2}$

$w_2 = y'(2x+1)$ $\qquad v = 2x+1$

$u = y'$ $\qquad v' = 2$

$u^n = y^{n+1}$ $\qquad v_1^n = {}^nC_0 u^{n-0} v^0 + {}^nC_1 u^{n-1} v'$

$v'' = 0$

$= u^n v + n u^{n-1}$

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

NOTES

$w_3 = 2y$

$u = y$ $\qquad v = 2,\ v' = 0$

$u^n = y^n$

$w_3^n = {}^nC_0 u^{n-0} v$

$= 2y^n$

JANUARY S 1 8 15 22 29 S FEBRUARY 5 12 19 26 MARCH S 5 12 19 26 S 30 2 9 APRIL 16 23 MAY S 7 14 21 28

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

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

$v^0 = x^3,\ v' = 3x^2,\ v'' = 6x,\ v''' = 6$

$u = e^{4x},\ u' = 4e^{4x},\ u'' = 16e^{4x},\ u''' = 64e^{4x}$

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

$$y^n = {}^nC_0 u^{n-0} v^0 + {}^nC_1 u^{n-1} v' + {}^nC_2 u^{n-2} v'' + {}^nC_3 u^{n-3} v'''$$
$$= v^n v' + n u^{n-1} v' + \frac{n(n-1)}{2!} u^{n-2} v'' + \frac{n(n-1)(n-2)}{3!} v'''$$
$$= 4^n e^{4x} x^3 + n 4^{n-1} e^{4x} \cdot 3x^2 + n(n-1) 4^{n-2} e^{4x} 6x^3 + \frac{n(n-1)(n-2) 4^{n-3} e^{4x} \cdot 6}{3 \times 2}$$
$$4^n e^{4x} x^3 + n 4^{n-1} e^{4x} \cdot 3x^2 + n(n-1) 4^{n-2} e^{4x} \cdot 3x + n(n-1)(n-2) 4^{n-3} e^{4x}$$
$$4^{n-3} e^{4x} [4^3 x^3 + n 4^2 \cdot 3x^2 + n(n-1) 4 \cdot 3x + n(n-1)(n-2)]$$
$$y^3 = 4^{5-3} e^{4x} [64x^3 + (5 \times 48) x^2 + 12 \times 5(5-1) x + 5(5-1)(5-2)]$$
$$= 16 e^{4x} [64x^3 + 240x^2 + 240x + 60]$$

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

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

$w_1 = x^2 y''$

$u^0 = u = y''$

$u' = y''',\ u'' = y^{iv}$

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

$v = x^2,\ v' = 2x,\ v'' = 2$

$v''' = 0$

$W_2 = xy'$

$u = y'$ $\qquad v = x,\ v' = 1,\ v'' = 0$

$u' = y'',\ u'' = y'''$

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

$W_3 = y$

$u = y$ $\qquad v = 1,\ v' = 0$

$u' = y',\ u'' = y''$

$u^n = y^n$

$W_1^n = {}^nC_0 u^{n-0} v^0 + {}^nC_1 u^{n-1} v' + {}^nC_2 v^{n-2} v''$

$= u^n v + n u^{n-1} v' + \frac{n(n-1)}{2!} u^{n-2} v''$

$y^{n+2} v + n y^{n+1} 2x + \frac{n(n-1)}{\cancel{2}} y^n \cancel{2}$

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

$y^n[y^2x^2 + ny^2x + n(n-1)]$

$W_2^n = {}^nC_0 u^{n-0} v^0 + {}^nC_1 u^{n-1} v' + {}^nC_2 u^{n-2} v'' + {}^nC_3 u^{n-3} v''$

$= u^n v^0 + n u^{n-1} v' + \frac{(n-1)n}{2!} u^{n-2} = 0$

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

$= y^n (xy + n)$

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

$W_1 + W_2 + W_3 = 0$

$y^n[y^2x^2 + n2xy + n(n-1)] + y^n(xy+n) + y^n = 0$

At $x = 0$

$y^n n(n-1) + y^n n + y^n = 0$

$n(n-1)+n+1=0$

$y^{n} - y^{n} n (n-1) = ny^{n}$

at $n=1$

$y = -0 - y'$

$y = -y'$

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

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

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

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