15/ENG04/002

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ELECTRICAL/ELECTRONICS ENGINEERING.

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

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

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

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

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

Using the Leibnitz theorem

$y'' = y^{(2)}$

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

for $y'(2x+1)$

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

$u = y^{(1)}$ $\quad v = (2x+1)$

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

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

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

for $2y$

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

$u^n = y^n$

$\therefore y^n$

$\therefore y^{(n+2)} = \cancel{\#}(2x+1)y^{(n+1)} + 2ny^{(n)} + 2y^{(n)}$

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

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

$u = e^{4x}$ $\quad$ $v = x^3$

$u = 4^n e^{4x}$ $\quad$ $v^{(1)} = 3x^2$

$u^{(n-1)} = 4^{(n-1)} e^{4x}$ $\quad$ $v^{(2)} = 6x$

$u^{(n-2)} = 4^{(n-2)} e^{4x}$ $\quad$ $v^{(3)} = 6$

$u^{(n-3)} = 4^{(n-3)} e^{4x}$

$$y^{(n)} = 4^n x^3 e^{4x} + n4^{(n-1)} \cdot 3x^2 e^{4x} + \frac{n(n-1)}{2!} 4^{(n-2)} \cdot 6x e^{4x} + \frac{n(n-1)(n-2)}{3!} 4^{(6-3)} \cdot 6e^{4x}$$

$$y^{(5)} = 4^{(5)} x^3 e^{4x} + 5 \cdot 4^{(4)} \cdot 3x^2 e^{4x} + \frac{5(5-1)}{2!} 4^{(3)} \cdot 6x e^{4x} + \frac{5(5-1)(5-2)}{6} 4^{(2)} \cdot 6e^{4x}$$

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

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

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

For $x^2 y^{(2)}$

$u = y^{(2)}$

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

$u^{(n-1)} = y^{(n+1)}$ $\quad$ $v^{(1)} = 2x$

$y^{(n-2)} = y^{(n)}$ $\quad$ $v^{(2)} = 2$

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

for $x y^{(1)}$

$u = y^{(1)}$ $\quad$ $v = x$

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

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

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

for y

$\therefore y^{(n)}$

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

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

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