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

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

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

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

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

Hence; $|x|_1 = y^2$ $\quad W_2 = y'(2x+1)$

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

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

$u^{(n-1)} = y^{(n} \quad v'' = 0$

$W_3 = 2y$

$u = y \quad v = 2$

$u^n = y^n \quad v' = 0$

$W_1 = W_2 + W_3$

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

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

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

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

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

$u^n = 4^n e^{4x} \quad v' = 3x^2$

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

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

$u^{(n-3)} = 4^{(n-3)} e^{4x} \quad v^4 = 0$

$$y^n = u^n v + n u^{(n-1)} v' + \frac{n(n-1)}{2!} u^{(n-2)} v^2 + \frac{n(n-1)(n-2)}{3!} u^{(n-3)} v^3$$

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

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

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

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

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

$\therefore x^2 y'' + x y' + y = 0$

$W_1 = x^2 y''$ $\quad W_2 = x y$ $\quad W_3 = y$

$u = y^2$ $\quad v = x^2$ $\quad u = y'$ $\quad u = y$ $\quad v = 1$

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

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

$n^{(n-2)} = y^n$ $\quad v''' = 0$

$\therefore W_1 + W_2 + W_3$

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

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

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

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

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

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