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16/ENG04/050
ELECT/ELECT ENGR

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

$\frac{dy}{dx} = (2x+1)e^{x^2+x}$

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

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

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

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

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

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

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

$w_1 \quad w_2 \quad w_3$

w_1

$v = y^2$

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

w_2

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

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

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

w_3

$u = y \quad v = 2$

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

$w_1 = w_2 + w_3$

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

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

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

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

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

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

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

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

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

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

$n = 5$

$= 4^5 e^{4x} x^3 + 5 4^4 e^{4x} \cdot 3x^2 + 10 4^3 e^{4x} \cdot 6x + 10 4^2 e^{4x} \cdot 6$

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

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

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

$w_1 \quad w_2 \quad w_3$

w_1

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

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

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

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

w_2

$u = y^{(n)} \qquad v = x$

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

$u^{n-1} = y^n \qquad v'' = 0.$

w_3

$u = y$

$u^n = y^n$

$w_1 + w_2 + w_3$

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

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

$= 0$

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

$xy^{n+1} + ny^n + y^n = 0.$

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

$n(n-1)y^n + ny^n + y^n$

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

$(n(n-1) + n + 1)$

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

$(n(n-1) + n + 1)$

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

$= 0.$

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