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16/ENG06/087
MECHANICAL ENGINEERING.
ENG 381 (ASSIGNMENT).

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

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

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

$= e^{x^2+x}(12x+1)(2x+1)+2).$

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

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

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

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

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

$w_1 \quad w_2 \quad w_3.$

w_1

$U = y^2$

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

w_2

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

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

~~$U^{n-1} = y^{n-1}$~~ $\quad$ ~~$v'' = 0$~~

$u = y \quad v = 2$

$U^n = y^n \quad v = 0.$

$w_1 = w_2 + w_3.$

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

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

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

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

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

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

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

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

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

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

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

$\times 4^{n-3} e^{4x} \cdot 6$

$n = 5$

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

(3) $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$ Show that $x^2 y^{(n+2)} + (2n+1) x y^{(n+1)} + (n^2+1) y^n = 0$.

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

$w_1 \quad w_2 \quad w_3$

w_1

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

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

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

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

w_2

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

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

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

w_3

$u = y$

$u^n = y^n$.

$w_1 + w_2 + w_3$.

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

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

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

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

$$= x^2 y^{(n+2)} + x \cdot y^{(n+1)} (2n+1) + y^n (n \cancel{-n+n} + 1).$$

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

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