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

Let $w = xy'$

$v = x, \quad v' = 1, \quad v'' = 0$

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

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

$= xy^{n+1} + ny^n$

Let $w = y$

$v = 1 \quad v' = 0$

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

$w^n = y^n$

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

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

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

(2.) $y = x^3 e^{4x}$ find y^5

$V = x^3$, $V' = 3x^2$, $V'' = 6x$, $V''' = 6$, $V^{iv} = 0$

$U = e^{4x}$, $U' = 4e^{4x}$, $U^2 = 16e^{4x}$, $U^3 = 64e^{4x}$, $U^4 = 256e^{4x}$

$\& \ U^5 = 1024e^{4x}$

$y^n = U^nV + nU^{n-1}V' + \frac{n(n-1)}{2!}U^{n-2}V^2 + \frac{n(n-1)(n-2)}{3!}$

$U^{n-3}V^3 + \frac{n(n-1)(n-2)(n-3)}{4!}U^{n-4}V^4$

$y^5 = U^5V + 5U^4V' + \frac{5(4)}{2\times1}U^3V^2 + \frac{5(4)(3)}{3\times2\times1}U^2V^3 + 0$

$y^5 = 1024e^{4x}(x^3) + 15x^2(256e^{4x}) + 60x(64e^{4x}) + 60(8e^{4x})$

$y^5 = x^3 1024e^{4x} + x^2 3840e^{4x} + x3840e^{4x} + 960e^{4x}$

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

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

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

let $U = x^2y''$

$V = x^2$, $V' = 2x$, $V'' = 2$, $V''' = 0$

$U = y''$, $U^n = y^{n+2}$

$U^n = U^nV + nU^{n-1}V' + \frac{n(n-1)}{2!}U^{n-2}V'' + \frac{n(n-1)(n-2)}{3!}U^{n-3}V'''$

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

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

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

Let $u = y''$

$v = 1 \quad v' = 0 \quad u = y'' \quad u^n = y^{n+2}$

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

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

Let $u = -y'(2x+1)$

$v = 2x+1 \quad v' = 2 \quad v'' = 0$

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

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

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

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

Let $u = -2y$

$v = -2 \quad v' = 0$

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

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

$= y^n - 2 + 0$

$= -2y^n$

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

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15/ENG/02/040
COMPUTER ENG

ENG 281 ASSIGNMENT

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

Sol

$y'' = y'(2x+1) + 2y$ —— *

$y'' = \frac{d^2y}{dx^2}$ · $y' = \frac{dy}{dx}$

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

Using Product rule = $V\frac{du}{dx} + U\frac{dv}{dx}$

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

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

$= (4x^2+4x+1)e^{x^2+x} + 2e^{x^2+x}$

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

Substituting RHS & LHS of the above eqn *

$(4x^2+4x+3)e^{x^2+x} = (2x+1)e^{x^2+x}(2x+1) + 2(e^{x^2+x})$

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

$= (4x^2+4x+1+3)e^{x^2+x}$

$= (4x^2+4x+4)e^{x^2+x}$

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

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