EKE, UKOUPA VICTOR.

15/ENG06/023

MECHANICAL ENG.

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

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

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

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

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

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

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

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

$w_1 \quad w_2 \quad w_3$

w_2	w_1	w_3
$v = 2x+1$	$u = y'$	$v = y^2$	$u = y$	$v = 2$
$v' = 2$	$u^n = y^{n+1}$	$v^n = y^{(n+2)}$	$u^n = y^n$	$v' = 0$
$v'' = 0$	$u^{n-1} = y^n$			

Using $d_1 = d_2 + d_3$

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

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

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

2 Using the leibnitz theorem given that.

a $y = x^3e^{4x}$, determine $y^{(v)}$

b $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$, show that

Show that.

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

Solution

a. $y = x^3e^{4x}$ $\qquad v = x^3$

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

$u^n = 4^ne^{4x}$ $\qquad v'' = 6x$

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

$u^{n-2} = 4^{(n-2)}e^{4x}$ $\qquad v^{iv} = 0$

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

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

When $n = 5$.

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

$y^5 = 4^5 e^{4x} x^3 + 20^4 e^{4x} \cdot 3x^2 + 10(256) e^{4x} \cdot 6x + (10)(16) e^{4x} \cdot 6.$

$y^5 = 4^5 e^{4x} x^3 + 20^4 e^{4x} \cdot 3x^2 + 2560\, e^{4x} \cdot 6x + 160 e^{4x} \cdot 6$

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

$x^2(y^{11}) + xy^1 + y = 0$

let d_1, d_2 and d_3 represent y'', y' and y

d_1		d_2		d_3
$u = y^2$	$v = x^2$	$u = y^1$	$v = x$	$u = y$
$u^n = y^{n+2}$	$v^1 = 2x$	$u^n = y^{n+1}$	$v^1 = 1$	$u^n = y^n$
$u^{n-1} = y^{n+1}$	$v^{11} = 2$	$u^{n-1} = y^n$	$v^{11} = 0$	
$y^{n-2} = y^n$	$v^{111} = 0$			

using $d_1 + d_2 + d_3 = 0$

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

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

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

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

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