

Maths mli emelda curson

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Mechanisms

1. $y = e^{x^2+n}$ — 1

$y^n = a^n e^{an}$

$y' = (2n+1)e^{n^2+n}$ — 2

$n = 2n+1$ $v = e^{n^2+n}$
 $\frac{dv}{dn} = 2$ $\frac{dv}{dn} (2n+1) e^{n^2+n}$

using product rule

$y'' = u \frac{dv}{dn} + v \frac{du}{dn}$

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

from eqn 1 & 2

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

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

$w_1 = y^2$

$w_2 = y' (2n+1)$

$u = y^2$ $v = 1$

$u = y'$ $v = 2n+1$

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

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

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

$w_1^n = w_2^n \neq w_3^n$

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

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

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

2. $y = n^3 e^{4n}$ find y^5

$u = e^{4n}$

$v = n^3$

$u^n = 4^n e^{4n}$

$v' = 3n^2$

$u^{n-1} = 4^{n-1} e^{4n}$

$v'' = 6n$

$u^{n-2} = 4^{n-2} e^{4n}$

$v''' = 6$

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

$v^{(4)} = 0$

$y^5 = \frac{4^5 e^{4n} \cdot n^3 + 5(4^4 e^{4n} \cdot 3n^2 + 5(4^3 e^{4n}) \cdot 6n + 5(4^2 e^{4n}) \cdot 6}{2}$

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

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

2 (b) $x^2 y'' + xy' + y = 0$

let $w = x^2 y''$

$u = y''$, $u' = y'''$, $u'' = y^{(4)}$, $u''' = y^{(5)}$, $u^n = y^{n+2}$

$v = x^2$

$v' = 2x$

$v'' = 2$

$v''' = 0$

$$w^n = y^{n+2} \cdot x^2 + n y^{n+1} \cdot 2x + \frac{n(n-1)y^n \cdot 2}{2} + \frac{n(n-1)(n-2)y^{n-1} \cdot 0}{6}$$

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

let $w = xy'$

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

$v = x$

$v' = 1$

$v'' = 0$

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

$$w^n = x y^{n+1} + n y^n$$

let $w = y$

$u = y$, $u' = y'$, $u^n = y^n$

$v = 1$

$v' = 0$

$$w^n = y^n \cdot 1 + \frac{n y^{n-1} \cdot 0}{2}$$

$w^n = y^n$

$$\begin{aligned} &= x^2 y^{n+2} + 2x n y^{n+1} + n(n-1) y^n + x y^{n+1} + n y^n + y^n \\ &= x^2 y^{n+2} + [2x n + x] y^{n+1} + [n(n-1) + n + 1] y^n \\ &= x^2 y^{n+2} + [2n + 1] x y^{n+1} + [n^2 + n + 1] y^n \\ &= x^2 y^{n+2} + (2n+1) x y^{n+1} + (n^2 + 1) y^n \end{aligned}$$