DPP-15 Maths - IV Unit - 1

Topic ⇒

Q-1:- Solve $(x^2D^2+2xyDD'+y^2D'^2)z = x^m y^n$

Let $x = e^u$, $y = e^v$

$u = \log x$, $v = \log y$

$x^2 \frac{\delta^2 z}{\delta x^2} = D(D-1)z$

$y^2 \frac{\delta^2 z}{\delta y^2} = D'(D'-1)z$

$xy \frac{\delta^2 z}{\delta x \delta y} = DD'z$

Given equation reduced into

$[D(D-1) + 2DD' + D'(D'-1)]z = e^{mu+nv}$

$(D^2 - D + 2DD' + D'^2 - D')z = e^{mu+nv}$

$[(D+D')^2 - (D+D')]z = e^{mu+nv}$

$(D+D')(D+D'-1)z = e^{mu+nv}$

$C.F. = f_1(v-u) + e^u f_2(v-u)$

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$$C.F. = f_1(\log y - \log x) + x f_2(\log y - \log x)$$

$$= f_1\left(\log \frac{y}{x}\right) + x f_2\left(\log \frac{y}{x}\right)$$

$$\boxed{C.F. = g_1\left(\frac{y}{x}\right) + x g_2\left(\frac{y}{x}\right)}$$

$$P.I. = \frac{1}{(D+D')(D+D'-1)} e^{mu+nv}$$

$$P.I. = \frac{1}{D+D'}\left[\frac{1}{D+D'-1} e^{mu+nv}\right]$$

$$P.I = \frac{1}{D+D'}\left[\frac{1}{m+n-1} e^{mu+nv}\right]$$

$$P.I. = \frac{1}{(m+n)(m+n-1)} e^{mu+nv}$$

$$\boxed{P.I. = \frac{x^m y^n}{(m+n)(m+n-1)}}$$

Complete solution $\Rightarrow$ $Z = C.F + PI$

$$\boxed{Z = g_1\left(\frac{y}{x}\right) + x g_2\left(\frac{y}{x}\right) + \frac{x^m y^n}{(m+n)(m+n-1)}}$$

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