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$$\Rightarrow \quad dv_j \wedge \frac{\partial \varphi'}{\partial v_j} + dv_j \wedge \frac{\partial \varphi''}{\partial v_j} \wedge dv_\ell = 0$$

$$\Rightarrow \quad \frac{\partial \varphi'}{\partial v_j} = 0 \quad \text{and} \quad \frac{\partial \varphi''}{\partial v_j} = 0 .$$

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Since φ is holomorphic in v, we may use formal integration of power series to solve

$$\varphi'' = \frac{\partial \eta}{\partial v_\ell},$$

where η has the same order pole in u as φ'' and $\partial\eta/\partial v_j = 0$ for all $j > \ell$.

$\ulcorner$ According to P25 ~ P26, we don't need power series.

$$\varphi = \varphi' + \varphi'' \wedge dv_\ell$$

$\Rightarrow \varphi''$ is holomorphic in v. $\Rightarrow \varphi'' = \sum_{\substack{\#I + \\ \#J = p-1}} \varphi_{IJ}\, du_I \wedge dv_J$

where φ_{IJ}'s holomorphic on $P^*(k.n)$.
Since φ'' is holomorphic in v_ℓ, each φ_{IJ} is holomorphic in v_ℓ.

$$\Rightarrow \quad \varphi'' = \sum_{I.J} \varphi_{IJ}\, du_I \wedge dv_J$$

$$= \sum_{I.J} \sum_{n=0}^{\infty} a_{IJ.n} \quad v_\ell^n\, du_I \wedge dv_J$$

$$\Rightarrow \quad \eta = \sum_{\substack{I,J \\ J \not\ni \ell \cdots k}} \sum_{n=0}^{\infty} a_{IJ.n} \frac{v_\ell^{n+1}}{n}\, du_I \wedge dv_J$$

where $a_{I.J.n}$ is a function of u, & $v_{J'}$, $J' \not\ni \ell$.

$\partial\varphi''/\partial v_j = \partial^2\eta/\partial v_\ell \partial v_j = 0 \Rightarrow \partial\eta/\partial v_j = 0$ since in some sence $\int \varphi'' dv_\ell = \eta$

Refer to P196 Th 8.3 & Remark (Silverman. Complex variables).

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