$\Rightarrow$ I think $dF = F' \cdot \omega$ is wrong. ⅃

Now, we may express C as the complex torus $\mathbb{C}/\Lambda$; let z be the Euclidean coordinate on C with $\omega = dz$. The function then the Weierstrass $\wp$- function: its derivative $(\partial/\partial z)\wp = -2F'$ is denoted $\wp'$.

Γ Wrong ! Again

$$\frac{\partial F}{\partial z} = -\frac{2}{z^3} + a_0 + [1].$$

Suppose we choose $F' = \lambda \frac{dF}{\omega} + \lambda' F$. Anyway, I think they made mistakes in taking care about constants. ⅃

Note that the Laurent expansion for $\wp$ around p_0 can contain no terms of odd degree, since otherwise $\wp(z) - \wp(-z)$ would be a nonconstant holomorphic function on C.

If not,

Γ $\wp(z) - \wp(-z) = F(z) - F(-z) = \frac{1}{z^2} + [1] - \frac{1}{z^2} - [1]$

$= [1]$ around p_0 $\Rightarrow$ Since F is holomorphic on $C - \{p_0\}$, $\wp(z) - \wp(-z)$ is holomorphic, nonconstant. $\Rightarrow$ Contradiction. ⅃

Thus
$$\wp(z) = \frac{1}{z^2} + az^2 + bz^4 + [6],$$
$$\wp'(z) = -\frac{2}{z^3} + 2az + 4bz^3 + [5],$$
$$\wp(z)^3 = \frac{1}{z^6} + \frac{3a}{z^2} + 3b + [2],$$
$$\wp'(z) = \frac{4}{z^6} - \frac{8a}{z^2} - 16b + [2]$$