<u>Dragt</u> <u>5.6</u> In this problem, we are told that the potential is attractive everywhere, and hence it must be possible to have circular orbits of any radius. Consider a <u>nearly</u> circular orbit about u_0 with $\phi_0 = 0$. Then we have $u(\phi) \simeq u_0 + \Delta \cos[g(u_0)\,\phi] \simeq H(\phi)$. Then, requiring $H(\phi + \Theta_0) = H(\phi) \Rightarrow \cos[g(\phi + \Theta_0)] = \cos g\phi$

$$\Rightarrow \quad g(u_0)\,\Theta_0 = 2n\pi \quad \text{for some fixed } n.$$

Set $g(u_0) = \dfrac{2n\pi}{\Theta_0} = \lambda_0$. We must have $g(u_0) = \lambda_0$ for <u>all</u> values of u_0. It follows from (B) that

$$\lambda_0 = \left[1 - \frac{u_0\, G''(u_0)}{G'(u_0)}\right]^{1/2}$$

and since λ_0 is fixed and u_0 is arbitrary, we must have

$$\boxed{\frac{u\, G''(u)}{G'(u)} = \text{cnst} = \nu - 1} \quad \Rightarrow \quad \boxed{G(x) = a x^{\nu} + b}$$

as before