[B7(b)]

Note that $\psi(z) = p\psi(z+1) + (1-p)\psi(z-1)$ is equivalent to

$$p\,\psi(z) + (1-p)\psi(z) = p\psi(z+1) + (1-p)\psi(z-1)$$

or $(1-p)[\psi(z) - \psi(z-1)] = p(\psi(z+1) - \psi(z))$

or $\psi(z+1) - \psi(z) = R(\psi(z) - \psi(z-1))$ (*)

where $R = (1-p)/p$.

We can easily check that $\psi(z) = \dfrac{R^z - 1}{R^g - 1}$ satisfies (*):

$$\frac{R^{z+1}-1}{R^g-1} - \frac{R^z-1}{R^g-1} = R\left(\frac{R^z-1}{R^g-1} - \frac{R^{z-1}-1}{R^g-1}\right)$$

is equivalent to

$$R^{z+1} - R^z = R(R^z - R^{z-1})$$

which is obviously true.

The boundary conditions $\psi(0) = 0$ and $\psi(g) = 1$ are also obviously true for $\psi(z) = \dfrac{R^z-1}{R^g-1}$.