Problem 2.8

We have

$\lambda = 100\,m$

$\zeta_0 \doteq 0.5\,m$

$k = \frac{2\pi}{\lambda} = 0.0628\,m^{-1}$

$\sigma = 0.071\,N/m$

$\rho_L \approx 1000\,kg/m^3$

From Eq. (2.105)

$$\omega = \left[\sigma k^3/\rho_L + gk\right]^{1/2} = 0.785\ Rad/s$$

Eq. (2.104) gives

$$A = \zeta_0 \frac{\omega}{k} = 6.248\ m^2/s$$

The velocity in z direction is $\partial\phi/\partial z$,

and from Eq. (2.98)

$$v_{z,max}\Big|_{z=0} = Ak = 0.3924\ m/s$$

At location $-z^*$ (i.e., at a depth z^*),
again from Eq. (2.98)

$$v_{z,max}\Big|_{z=-z^*} = Ake^{-kz^*}$$

We thus get

$$v_{z,max}\Big|_{z=-10m} = 1.78\times10^{-5}\ m/s$$

$$v_{z,max}\Big|_{z=-50m} \approx 0.0$$