2.55 A lossless 50-Ω transmission line is terminated in a short circuit. Use the Smith chart to determine:

(a) The input impedance at a distance 2.3λ from the load.

(b) The distance from the load at which the input admittance is $Y_{\text{in}} = -j0.04$ S.

Solution: Refer to Fig. P2.55.

(a) For a short, $z_{\text{in}} = 0 + j0$. This is point *Z-SHORT* and is at 0.000λ on the WTG scale. Since a lossless line repeats every $\lambda/2$, traveling 2.3λ toward the generator is equivalent to traveling 0.3λ toward the generator. This point is at *A* : *Z-IN*, and

$$Z_{\text{in}} = z_{\text{in}} Z_0 = (0 - j3.08) \times 50\ \Omega = -j154\ \Omega.$$

(b) The admittance of a short is at point *Y-SHORT* and is at 0.250λ on the WTG scale:

$$y_{\text{in}} = Y_{\text{in}} Z_0 = -j0.04\ \text{S} \times 50\ \Omega = -j2,$$

which is point *B* : *Y-IN* and is at 0.324λ on the WTG scale. Therefore, the line length is $0.324\lambda - 0.250\lambda = 0.074\lambda$. Any integer half wavelengths farther is also valid.

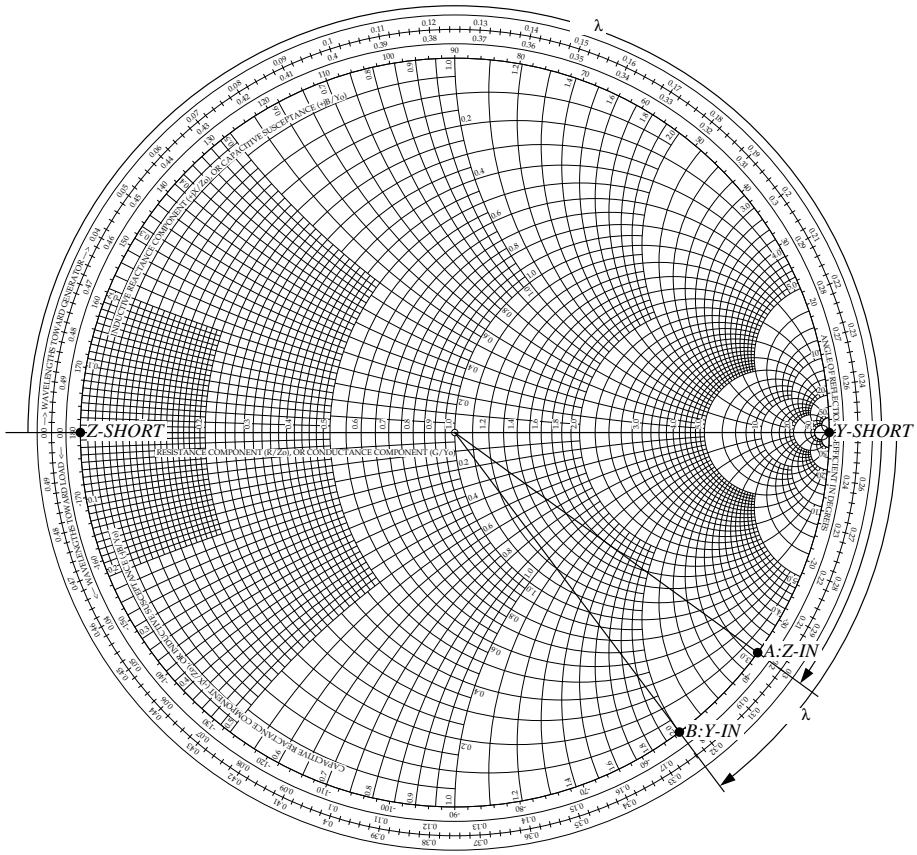

Figure P2.55: Solution of Problem 2.55.