P 9.22 [a]
$$Z_{ab} = j5\omega + \frac{(4000)(10^9/j\omega 625)}{4000 + (10^9/j625\omega)}$$
$$= j5\omega + \frac{4 \times 10^{12}}{2500 \times 10^3 j\omega + 10^9}$$
$$= j5\omega + \frac{4 \times 10^7}{10^4 + j25\omega}$$
$$= j5\omega + \frac{4 \times 10^{11}}{10^8 + 625\omega^2} - j\frac{100 \times 10^7 \omega}{10^8 + 625\omega^2}$$
$$\therefore \; 5 = \frac{10^9}{10^8 + 625\omega^2}$$
$$5 \times 10^8 + 3125\omega^2 = 10^9$$
$$\omega = 4 \times 10^2 = 400\,\text{rad/s}$$

[b]
$$Z_{ab}(400) = j2000 + \frac{(4000)(-j4000)}{4000 - j4000} = 2\,\text{k}\Omega$$

P 9.23
$$Z_1 = 10 - j40\,\Omega$$
$$Z_2 = \frac{(5 - j10)(10 + j30)}{15 + j20} = 10 - j10\,\Omega$$
$$Z_3 = \frac{20(j20)}{20 + j20} = 10 + j10\,\Omega$$
$$\therefore \; Z_{ab} = Z_1 + Z_2 + Z_3 = 30 - j40\,\Omega = \underline{50/-53.15^\circ\,\Omega}$$

P 9.24 [a]
$$Y_1 = \frac{1}{5000} = 0.2 \times 10^{-3}\,\text{℧}$$
$$Y_2 = \frac{1}{1200 + j0.2\omega}$$
$$= \frac{1200}{1.44 \times 10^6 + 0.04\omega^2} - j\frac{0.2\omega}{1.44 \times 10^6 + 0.04\omega^2}$$
$$Y_3 = j\omega 50 \times 10^{-9}$$
$$Y_T = Y_1 + Y_2 + Y_3$$

For i_g and v_o to be in phase the j component of Y_T must be zero; thus,
$$\omega 50 \times 10^{-9} = \frac{0.2\omega}{1.44 \times 10^6 + 0.04\omega^2}$$