問1

（1）

$$Z_L = j\omega L = j \times 2 \times \pi \times f \times L = j \times 2 \times 3.14 \times 1 \times 10^3 \times 3 \times 10^{-3} = j18.84[\Omega]$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j \times 2 \times \pi \times f \times C} = \frac{1}{j \times 2 \times 3.14 \times 1 \times 10^3 \times 30 \times 10^{-6}} = -j5.31[\Omega]$$

$$Z = Z_R + \frac{1}{\frac{1}{Z_L} + \frac{1}{Z_C}} = Z_R + \frac{Z_L Z_C}{Z_L Z_C} = 10 + \frac{j18.84 \times (-j5.31)}{j18.84 + (-j5.31)} = 10 - j7.39[\Omega]$$

（2）

$$Z = \sqrt{10^2 + (-7.39)^2} \angle \tan^{-1}(\frac{-7.39}{10}) = 12.43 \angle -36.5° \ [\Omega]$$

（3）

$$I = \frac{V}{Z} = \frac{10 \angle 20°}{12.43 \angle -36.5°} = \frac{10}{12.43} \angle 20° - (-36.5°) = 0.805 \angle 56.5° \ [\mathrm{V}]$$

（4）

$$V = IZ = 2 \angle 30° \times 12.43 \angle -36.5° = 2 \times 12.43 \angle 30° + (-36.5°) = 24.86 \angle -6.5 \ [\mathrm{V}]$$

問2

（1）

$$Z_1 = 10\cos 30° + j10\sin 30° = 8.66 + j5[\Omega]$$

$$Z_2 = 10\cos 70° + j10\sin 70° = 3.42 + j9.4[\Omega]$$

$$Z = Z_1 + Z_2 = 8.66 + j5 + 3.42 + j9.4 = 12.09 + j14.4[\Omega]$$

$$= \sqrt{12.09^2 + 14.4^2} \angle \tan^{-1}(\frac{14.4}{12.09}) = 18.8 \angle 50°[\Omega]$$

（2）

$$I = \frac{V}{Z} = \frac{30 \angle -40°}{18.8 \angle 50°} = \frac{30}{18.8} \angle -40° - 50° = 1.6 \angle -90° \ [\mathrm{A}]$$

（3）

$$V = IZ = 3 \angle -40° \times 18.8 \angle 50° = 3 \times 18.8 \angle -40° + 50° = 56.4 \angle 10° \ [\mathrm{V}]$$

（4）

$$I = \frac{V}{Z} = \frac{30\angle -40°}{18.8\angle 50°} = \frac{30}{18.8}\angle -40° - 50° = 1.6\angle -90°[A]$$

$$V1 = IZ_1 = 1.6\angle 90° \times 10\angle 30° = 1.6 \times 10\angle 90° + 30° = 16\angle -60°[V]$$

（5）

$$I = \frac{V}{Z} = \frac{30\angle -40°}{18.8\angle 50°} = \frac{30}{18.8}\angle -40° - 50° = 1.6\angle -90°[A]$$

$$V2 = IZ_2 = 1.6\angle -90° \times 10\angle 70° = 1.6 \times 10\angle -90° + 70° = 16\angle -20°[V]$$

問3

（1）

$$Z_1 = 10\cos 30° + j10\sin 30° = 8.66 + j5[\Omega]$$

$$Z_2 = 10\cos 70° + j10\sin 70° = 3.42 + j9.4[\Omega]$$

$$Z = \frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{(8.66 + j5) \times (3.42 + j9.4)}{8.66 + j5 + 3.42 + j9.4} = \frac{-17.38 + j98.5}{12.09 + j14.4} = \frac{(-17.38 + j98.5)(12.09 - j14.4)}{(12.09 + j14.4)(12.09 - j14.4)} = 3.42 + j4.08[\Omega]$$

$$= \sqrt{3.42^2 + 4.08^2}\angle \tan^{-1}(\frac{4.08}{3.42}) = 5.32\angle 50°[\Omega]$$

（2）

$$I = \frac{V}{Z} = \frac{30\angle -40°}{5.32\angle 50°} = \frac{30}{5.32}\angle -40° - 50° = 5.64\angle -90°\ [\mathrm{A}]$$

（3）

$$V = IZ = 3\angle -40° \times 5.32\angle 50° = 3 \times 5.32\angle -40° + 50° = 16.17\angle 10°\ [\mathrm{V}]$$