

ENGG104 Tutorial 9 Class Questions

Team Name: _____

Question 1

Convert the following from rectangular to polar form:

- a. $4 + j3$ b. $2 + j2$
 c. $4 + j12$ d. $1000 + j50$
 e. $-1000 + j4000$ f. $-0.4 + j0.8$

$POL(4, 3) = \text{Mag} \angle \theta$
 $(RCL)(TAN) = \theta$
 $\theta = \tan^{-1}(\frac{3}{4})$

a. $5.0 \angle 36.87^\circ$

c. $12.65 \angle 7.57^\circ$

e. $4123.11 \angle 104.04^\circ$

b. $2.83 \angle 45^\circ$

d. $1001.25 \angle 2.86^\circ$

f. $0.894 \angle 116.57^\circ$

Question 2

Convert the following from polar to rectangular form:

- a. $6 \angle 40^\circ$ b. $12 \angle 120^\circ$
 c. $2000 \angle -90^\circ$ d. $0.0064 \angle +200^\circ$
 e. $48 \angle 2^\circ$ f. $5 \times 10^{-4} \angle -20^\circ$

a. $4.6 + j3.86$

c. $-j2000$

e. $47.97 + j1.68$

b. $-6.0 + j10.39$

d. $-6 \times 10^{-3} - j2.2 \times 10^{-3}$

f. $4.7 \times 10^{-4} - j1.71 \times 10^{-4}$

$6 \angle 40^\circ = 6 \cos 40^\circ + j6 \sin 40^\circ = a + jb$
 $REC(6, 40^\circ) =$ $RCL \angle TAN$

Question 3

Perform the following additions in rectangular form:

- a. $(4.2 + j 6.8) + (7.6 + j 0.2)$
- b. $(142 + j 7) + (9.8 + j 42) + (0.1 + j 0.9)$
- c. $(4 \times 10^{-6} + j 76) + (7.2 \times 10^{-7} - j 5)$

a. **$11.8 + j7.0$**

b. **$151.90 + j49.90$**

c. **$4.72 \times 10^{-6} + j71$**

Question 4

Perform the following operations with polar numbers, and leave the answer in polar form:

- a. $6 \angle 20^\circ + 8 \angle 80^\circ$
- b. $42 \angle 45^\circ + 62 \angle 60^\circ - 70 \angle 120^\circ$
- c. $20 \angle -120^\circ - 10 \angle -150^\circ + 8 \angle -210^\circ + 8 \angle +240^\circ$

a. **$12.17 \angle 54.70^\circ$**

b. **$98.37 \angle 13.38^\circ$**

c. **$28.07 \angle -115.91^\circ$**

Question 5

Perform the following multiplications in polar form:

- a. $(2 \angle 60^\circ)(4 \angle -40^\circ)$
- b. $(6.9 \angle 8^\circ)(7.2 \angle -72^\circ)$
- c. $(0.002 \angle 120^\circ)(0.5 \angle 200^\circ)(40 \angle +80^\circ)$

Perform the following divisions in polar form:

- a. $(42 \angle 10^\circ)/(7 \angle 60^\circ)$
- b. $(0.006 \angle 120^\circ)/(30 \angle +60^\circ)$
- c. $(4360 \angle -20^\circ)/(40 \angle -210^\circ)$

a. $8.00 \angle 20^\circ$

b. $49.68 \angle -64.0^\circ$

c. $40 \times 10^{-3} \angle 40^\circ$



a. $6.0 \angle -50^\circ$

b. $200 \times 10^{-6} \angle 60^\circ$

c. $109 \angle -170^\circ$

Question 6

Express the following in phasor form:

a. $\sqrt{2}(160)\sin(\omega t + 30^\circ)$

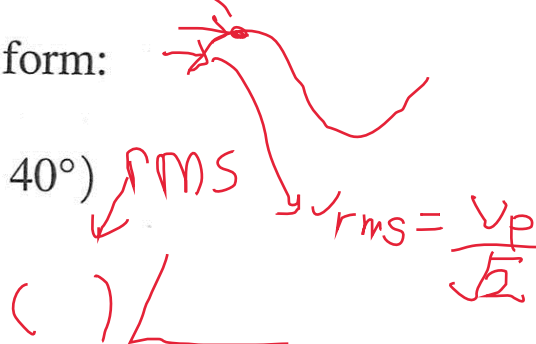
b. $\sqrt{2}(25 \times 10^{-3})\sin(157t - 40^\circ)$

c. $100 \sin(\omega t - 90^\circ)$

a. $160.0 \angle 30^\circ$

b. $25 \times 10^{-3} \angle -40^\circ$

c. $70.71 \angle -90^\circ$

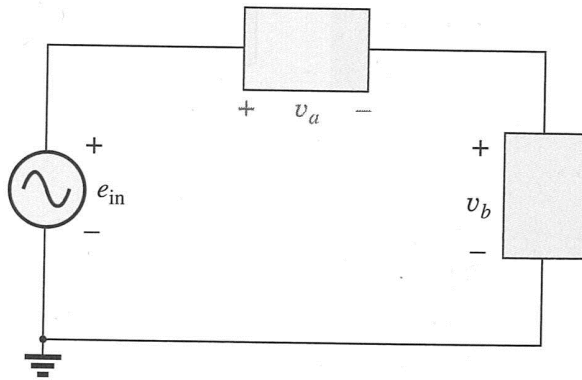


Question 7 [past exam question]

For the system in Fig. 14.84, find the sinusoidal expression for the unknown voltage v_a if

$$e_{in} = 60 \sin(377t + 45^\circ)$$

$$v_b = 20 \sin(377t - 45^\circ)$$



(Using peak values)

$$\begin{aligned} e_{in} &= v_a + v_b \Rightarrow v_a = e_{in} - v_b \\ &= 60 \text{ V } \angle 45^\circ - 20 \text{ V } \angle -45^\circ \\ &= 63.25 \text{ V } \angle 63.43^\circ \end{aligned}$$

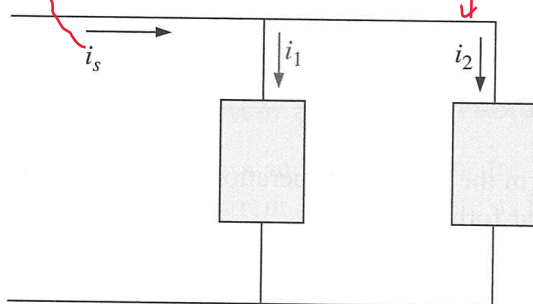
and $e_{in} = 63.25 \sin(377t + 63.43^\circ)$

Question 8

For the system in Fig. 14.85, find the sinusoidal expression for the unknown current i_1 if

$$i_s = 20 \times 10^{-6} \sin(\omega t + 60^\circ)$$

$$i_2 = 6 \times 10^{-6} \sin(\omega t - 30^\circ)$$



$$\underline{I}_s = \underline{I}_1 + \underline{I}_2$$

$$\underline{I}_1 = \underline{I}_s - \underline{I}_2$$

FIG. 14.85

Problem 56.

$$i_s = i_1 + i_2 \Rightarrow i_1 = i_s - i_2$$

(Using peak values) $= (20 \times 10^{-6} \text{ A } \angle 60^\circ) - (6 \times 10^{-6} \text{ A } \angle -30^\circ) = 20.88 \times 10^{-6} \text{ A } \angle 76.70^\circ$

$$i_1 = 20.88 \times 10^{-6} \sin(\omega t + 76.70^\circ)$$