

Answers of homework Exercises

Module CNAP: Complex Numbers And Phasors

Course: Signals Processing Basics (5ESE0)

Notes:

- During the contact hours complete workout of exercises can be explained by a tutor on request.
- The symbol [P] in the margin of an exercise denotes there is a pencast available.

Exercise 1

$$A = 20; \omega = 2\pi f = 50\pi \text{ [rad/sec]}; \varphi = \frac{\pi}{2}$$

Exercise 2

- a. $\sin(\frac{\pi}{3}) = \frac{\sqrt{3}}{2} = \cos(\frac{\pi}{6})$; $\cos(\frac{\pi}{3}) = \frac{1}{2} = \sin(\frac{\pi}{6})$; $\tan(\frac{\pi}{3}) = \sqrt{3}$; $\tan(\frac{\pi}{6}) = \frac{1}{\sqrt{3}}$; $\sin(\frac{\pi}{4}) = \frac{1}{\sqrt{2}} = \cos(\frac{\pi}{4})$; $\tan(\frac{\pi}{4}) = 1$
- b. $\Re\{e^{j\frac{2\pi}{3}}\} = -\frac{1}{2}$ and $\Im\{e^{j\frac{2\pi}{3}}\} = \frac{\sqrt{3}}{2}$.
- c. $\Im\{e^{j\frac{\pi}{4}}\} = \frac{\sqrt{2}}{2}$. All missing values are depicted in Fig.1.

[P1]

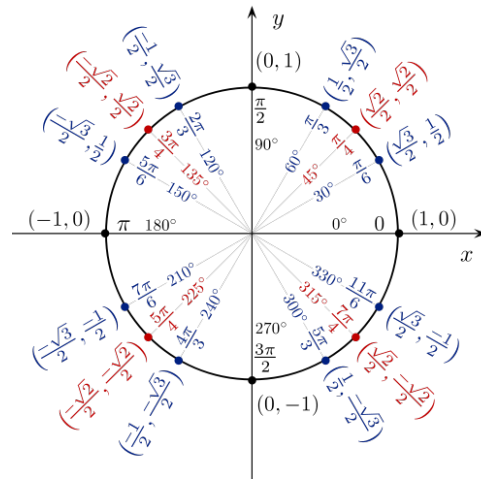


Figure 1

Exercise 3

- a. $z = 2e^{j\frac{\pi}{2}}$
- b. $z = \sqrt{3}e^{-j\frac{5\pi}{6}}$

Exercise 4

- a. $z = -1 + j$
- b. $z = -3j$

Exercise 5

- a. $z_3 = (3 + \frac{\sqrt{3}}{2}) + (4\frac{1}{2})j$.

[P2]

- b. $z_3 = 4j$
- c. $z_3 = -\frac{3}{2}$

Exercise 6

[P3]

- a. $z = 0$
- b. $z = -\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}j$
- c. $z = -j$

Exercise 7

- a. $|z|^2 = 194$
- b. $\Re\{z \cdot e^{-j\frac{\pi}{2}}\} = 5$
- c. $\Im\{z\} = \frac{1}{2}$

Exercise 8

[P4]

- a. $z_{1,2} = \pm 6j$.
- b. $z_{1,2} = -4 \pm 2j$
- c. $z_{1,2} = -\frac{1}{2} \pm \frac{\sqrt{3}}{2}j$

Exercise 9

$A = 2$; $\omega = 300\pi$ and $\varphi = \frac{5\pi}{4}$.

Exercise 10

$\theta = \frac{\pi}{6}$ and $r = 3 - 2\sqrt{3}$ OR $\theta = \frac{5\pi}{6}$ and $r = 3 + 2\sqrt{3}$

Exercise 11

[P5]

$\psi = 0$ and $M = 0$ OR $\psi = \frac{2\pi}{3}$ and $M = 5\sqrt{3}$.