Problem 1.1)
Convert the following to polar form:

(a) $\boldsymbol{z = -j10}$

$z = 10e^{j-\frac{\pi}{2}}$

(b) $\boldsymbol{z = 5}$

$z = 5e^{j0}$

(c) $\boldsymbol{z = (-5, 5)}$

$z = 5\sqrt{2}e^{j2.356}$

(d) $\boldsymbol{z = -1 + j}$

$z = \sqrt{2}e^{j2.356}$

(e) $\boldsymbol{z = 1 - j\frac{1}{\sqrt{3}}}$

$z = 1.155e^{-j0.524}$

(f) $\boldsymbol{z = -2}$

$z = 2e^{j\pi}$

Problem 1.2)
Convert the following to rectangular form:

(a) $\boldsymbol{z = 2e^{j\left(\frac{3\pi}{4}\right)}}$

$z = -\sqrt{2} + j\sqrt{2}$

(b) $\boldsymbol{z = 5e^{-j\left(\frac{\pi}{2}\right)}}$

$z = -j5$

(c) $\boldsymbol{z = 4 \angle \frac{\pi}{6}}$

$z = 3.464 + j2$

(d) $\boldsymbol{z = 3 \angle -4.5\pi}$

$z = -j3$

Problem 1.3)
Evaluate the following and give the answer in both rectangular and polar form.

$$\boldsymbol{z_1 = 3 - j3 = 3\sqrt{2} \angle -\frac{\pi}{4}}$$

$$\boldsymbol{z_2 = e^{j\left(\frac{3\pi}{4}\right)} = -\frac{\sqrt{2}}{2} \angle \frac{\sqrt{2}}{2}}$$

(a) Conjugate: $\boldsymbol{z_1^*}$

$= 3 + j3 = 3\sqrt{2}e^{j\frac{\pi}{4}}$

(b) $\boldsymbol{jz_2}$

$= 1 \angle -\frac{3\pi}{4} = 2.56e^{-j1.17}$

(c) $\frac{z_2}{z_1}$

$= \sqrt{2} \angle \frac{\pi}{4} = 1.62e^{j0.51}$

(d) z_2^2

$= 1 \angle -\frac{\pi}{2} = 1.862e^{-j}$

(e) $z_1^{-1} = \frac{1}{z_1}$

$= \frac{\sqrt{2}}{6} \angle \frac{\pi}{4} = 0.82e^{j1.28}$

(f) $z_1 z_2$

$= \frac{\sqrt{2}}{2} \angle -\frac{\pi}{4} = 1.057e^{-j0.84}$

(g) $z_1 + z_2^*$

$= \frac{\sqrt{2}}{2} \angle \frac{3\pi}{4} = 2.46e^{j1.28}$

(h) $|z_2|^2 = z_2 z_2^*$

$= 1 \angle \frac{\pi}{2} = 1.86e^{j}$

(i) $z_2 + z_2^*$

0

Problem 1.4)

(a)

$\left(A\frac{\sqrt{3}}{2} + jA\frac{1}{2}\right) \rightarrow A\frac{\sqrt{3}}{2}$

(b)

$\left(-A\frac{1}{2} - j\frac{\sqrt{3}}{2}\right)$

(c)

$(3\cos(\phi) + j3\sin(\phi)) \rightarrow -3\sin(\phi)$

(d)

$\sqrt{\left(-\alpha\sqrt{3}^2\right) + (\alpha^2)}\, e^{\arctan\left(\frac{\alpha}{-\alpha\sqrt{3}}\right)}$

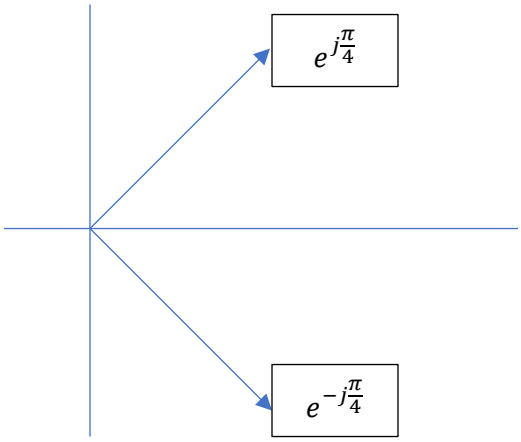
(e)

$$\frac{A}{\left(A\cos\left(\frac{2\pi}{3}\right)-A\sin\left(\frac{2\pi}{3}\right)\right)}$$

Problem 1.5)

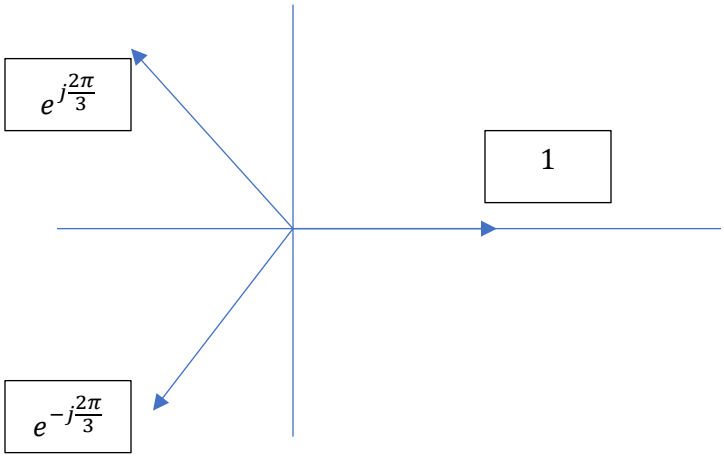
(a)

$$= \left(1 \angle -\frac{\pi}{4}\right) + \left(1 \angle \frac{\pi}{4}\right) = \sqrt{2} \angle 0°$$



(b)

$$= (1\angle 0) + \left(1\angle -\frac{3\pi}{2}\right) + \left(1\angle \frac{3\pi}{2}\right) = 0$$



(c)

```
clc; clear all; close all

z_a = exp(-i*(pi/4)) + exp(i*(pi/4))

mag_z_a = abs(z_a)
phase_z_a = angle(z_a)

z_b = 1 + exp(-2i*(pi/3)) + exp(2i*(pi/3))

mag_z_b = abs(z_b)
phase_z_b = angle(z_b)
```

Problem 1.6)

$A = 75$

$\omega_0 = \frac{\pi}{2} = \frac{2\pi}{T}$

$f_0 = \frac{1}{4} = \frac{1}{T}$

$t_d = 3$

$\phi = -(t_d)(\omega_0) = -\frac{3\pi}{2}$