

Signal Analysis – Homework 01
(Math Revision)

1) – Write in the **polar form**:

a) $z = -4 + 3j$

b) $z = -j$

c) $z = (3 + 4j)$

d) $z = (2 + 4j)(3 - j)$

e) $z = (5 + 4j)(5 - 4j)$

f) $z = 10$

g) $z = -10$

2) – Write in the **Cartesian form**:

a) $z = 2e^{-j(3\pi/2)}$

b) $z = 2e^{-j(3\pi/4)}$

c) $z = 5 \angle -60^\circ$

d) $z = 1 \angle 90^\circ$

e) $z = (5 + 4j)(5 - 4j)$

f) $z = 4e^{j(\pi/6)}$

g) $z = 3e^{j(\pi/2)} + 2 \angle -90^\circ$

3) – Write in the **Cartesian form**:

a) $z = \frac{5 + 2j}{3 + 7j}$

b) $z = \frac{10 - 5j}{-6 + 3j}$

c) $z = \frac{7 - 12j}{4 + 2,333j}$

d) $z = \frac{5j}{6 - 2j}$

e) $z = \frac{-2 + 3j}{j}$

f) $z = \frac{(a-1)}{(2-a+j)}, a \in \mathbb{R}$

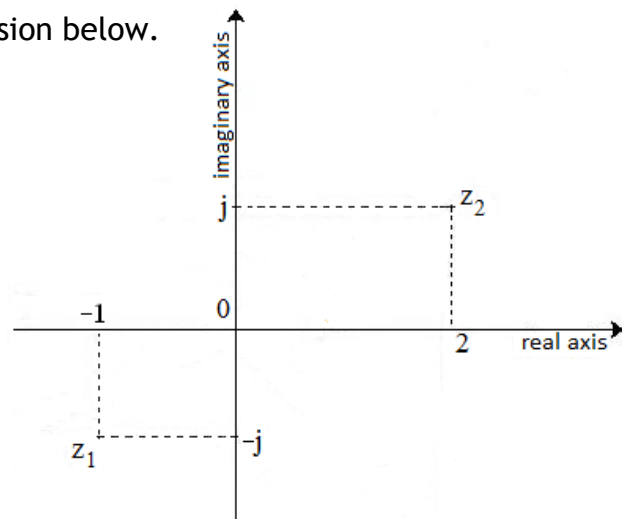
g) $z = \frac{j\omega + a}{j\omega - b}, a, b, \omega \in \mathbb{R}, a > b > 0$

h) $z = \frac{2}{(j\omega - b)(j\omega + a)}, a, b, \omega \in \mathbb{R}, a > b > 0$

4) – Find the values of α , and β in expression below.

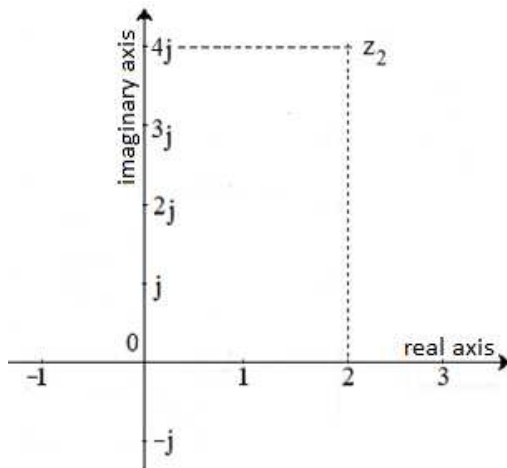
($\bar{Z}_2$ = conjugate of Z_2)

$$z = \frac{Z_1}{-\bar{Z}_2} = \alpha + \beta \cdot j$$



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- 5) – Find the values of z_4 , and β in expression below knowing that $\bar{z}_1 = z_2$, also that $z_3 \in$ imaginary axis, that $\text{Im}(z_3) = -\text{Im}(z_2)$, that $\text{Re}(z_4) = -\text{Re}(z_1)/3$.



($\bar{z}_1 =$ conjugate of z_1 and $\bar{z}_4 =$ conjugate of z_4)

$$z = \frac{z_1 \cdot z_2}{-(z_3)^2 \cdot \bar{z}_4} = \frac{-17}{66} + \beta j$$

- 6) – Calculate the expressions as indicated

a) $x(t) = \frac{(t-2)}{(t^2+8t+21)}$, calculate $\frac{dx}{dt}$

b) $x(t) = \frac{(t+10)(t-1)^2}{(t+1)}$, calculate $\frac{dx}{dt}$

c) $y(t) = (t+2)(t-3)$, calculate $\int y(\tau) d\tau$

d) $y(t) = (t+1)e^{-2t}$, calculate $\int_0^3 y(\tau) d\tau$

e) $v(t) = \int_{-\pi}^{\pi} (4 \sin(2t) + 3 \cos(2t)) dt$

- 7) – Calculate the values as indicated below:

a) $17|_{\text{dB}} = ? \text{ dB}$

b) $0,26|_{\text{dB}} = ? \text{ dB}$

c) $\sqrt{3}|_{\text{dB}} = ? \text{ dB}$

d) If $x|_{\text{dB}} = 3,75 \text{ dB}$, then $x = ?$

e) If $x|_{\text{dB}} = 34,8 \text{ dB}$, then $x = ?$

f) If $x|_{\text{dB}} = 126 \text{ dB}$, then $x = ?$

- 8) - Using only the results obtained in the previous exercise, calculate:

a) $1700|_{\text{dB}} = ? \text{ dB}$

b) $2,6|_{\text{dB}} = ? \text{ dB}$

c) $\sqrt{0.03}|_{\text{dB}} = ? \text{ dB}$

d) $\frac{\sqrt{3}}{17}|_{\text{dB}} = ? \text{ dB}$

e) If $x|_{\text{dB}} = 23,75 \text{ dB}$, then $x = ?$

f) If $x|_{\text{dB}} = 14,8 \text{ dB}$, then $x = ?$

g) If $x|_{\text{dB}} = -16,25 \text{ dB}$, then $x = ?$

h) If $x|_{\text{dB}} = -114 \text{ dB}$, then $x = ?$