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Conversion between forms

Convert the following from rectangular to polar form:

- a. $4 + j6$
- b. $3 + j3$
- c. $5 + j15$
- d. $500 + j50$
- e. $-1000 + j2000$
- f. $-0.2 + j0.4$

Convert the following from rectangular to polar form:

- a. $-8 - j16$
- b. $+8 - j4$
- c. $0.02 - j0.003$
- d. $-6 \times 10^{-3} - j6 \times 10^{-3}$
- e. $200 + j0.02$
- f. $-1000 + j20$

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. $5 \times 10^{-4} \angle -20^\circ$

Convert the following from polar to rectangular form:

- a. $42 \angle 0.15^\circ$
- b. $2002 \angle -60^\circ$
- c. $0.006 \angle -120^\circ$
- d. $8 \times 10^{-3} \angle -220^\circ$
- e. $15 \angle +180^\circ$
- f. $1.2 \angle -89.9^\circ$

Mathematical Operations with Complex Numbers

Perform the following additions in rectangular form:

- a. $(4.2 + j6.8) + (7.6 + j0.2)$
- b. $(142 + j7) + (9.8 + j42) + (0.1 + j0.9)$
- c. $(4 \times 10^{-6} + j76) + (7.2 \times 10^{-7} - j5)$

Perform the following subtractions in rectangular form:

- a. $(8.8 + j6.2) - (5.6 + j5.6)$
- b. $(197 + j243) - (-42.3 - j58)$
- c. $(-36.0 + j70) - (-5 - j6) + (10.5 - j72)$

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. $20 \angle -120^\circ - 10 \angle -150^\circ + 8 \angle -210^\circ + 8 \angle +240^\circ$

Perform the following multiplications in rectangular form:

- a. $(2 + j3)(6 + j8)$
- b. $(7.8 + j1)(4 + j2)(7 + j6)$
- c. $(400 - j200)(-0.01 - j0.5)(-1 + j3)$

Perform the following multiplications in polar form:

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

Perform the following divisions in polar form:

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

Perform the following divisions, and leave the answer in rectangular form:

- $(8 + j8)/(2 + j2)$
- $(8 + j42)/(-6 - j4)$
- $(-4.5 - j6)/(0.1 - j0.8)$

Perform the following operations, and express your answer in rectangular form:

- $\frac{(4 + j3) + (6 - j8)}{(3 + j3) - (2 + j3)}$
- $\frac{8 \angle 60^\circ}{(2 \angle 0^\circ) + (100 + j400)}$
- $\frac{(6 \angle 20^\circ)(120 \angle -40^\circ)(3 + j8)}{2 \angle -30^\circ}$

Perform the following operations, and express your answer in polar form:

- $\frac{(0.4 \angle 60^\circ)^2 (300 \angle 40^\circ)}{3 + j9}$
- $\left(\frac{1}{(0.02 \angle 10^\circ)^2} \right) \left(\frac{2}{j} \right)^3 \left(\frac{1}{6^2 - j\sqrt{900}} \right)$

- Determine a solution for x and y if

$$(x + j5) + (3x + jy) - j6 = 16 \angle 0^\circ$$

- Determine x if

$$(18 \angle 20^\circ)(x \angle -60^\circ) = 30.64 - j25.72$$

- Determine a solution for x and y if

$$(5x + j10)(2 - jy) = 90 - j70$$

- Determine θ if

$$\frac{80 \angle 0^\circ}{20 \angle \theta} = 3.464 - j2$$

Phasors

Express the following in phasor form:

- $\sqrt{2}(180)\sin(\omega t + 40^\circ)$
- $\sqrt{2}(25 \times 10^{-3})\sin(157t - 60^\circ)$
- $300 \sin(\omega t - 120^\circ)$

Express the following in phasor form:

- $30 \sin(377t - 180^\circ)$
- $6 \times 10^{-6} \cos \omega t$
- $5.6 \times 10^{-6} \cos(754t - 40^\circ)$

Express the following phasor currents and voltages as sine waves if the frequency is 60 Hz:

- $\mathbf{I} = 40 \text{ A} \angle 20^\circ$
- $\mathbf{V} = 120 \text{ V} \angle 10^\circ$
- $\mathbf{I} = 8 \times 10^{-3} \text{ A} \angle -110^\circ$
- $\mathbf{V} = \frac{6000}{\sqrt{2}} \text{ V} \angle -180^\circ$