EECE 2150 - Circuits and Signals: Biomedical Applications Fall 2018 - Section 3
Quiz 5

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Student Name: _____

$$z_1 = 5\angle 30^\circ \qquad z_2 = 5\angle 60^\circ$$

1. What is the sum of z_1 and z_2?

Rectangular form: $z_1 + z_2 =$ _____

Polar form: $z_1 + z_2 =$ _____

2. What is the product of z_1 and z_2?

Polar form only: $z_1 z_2 =$ _____

3. What is the sum of z_1 and its complex conjugate?

$z_1 + z_1^* =$ _____

4. What is the product of z_1 and the complex conjugate of z_2?

$z_1 z_2^* =$ _____

5. A signal is expressed by its complex voltage, $V = 2\,\text{Volts} \times e^{j2\pi ft}$. The real signal is $V + V^*$. This voltage is applied across a resistor, R. What is equation for the power as a function of time? Hint: use $P = V^2/R$.

$P(t) =$ _____

$$z_1 = 5\angle 30^\circ \qquad z_2 = 5\angle 60^\circ$$

1.

$$z_1 + z_2 = 5\cos(30\,\text{deg}) + j5\sin(30\,\text{deg}) + 5\cos(60\,\text{deg}) + j5\sin(60\,\text{deg})$$

$$= 5\cos(30\,\text{deg}) + j5\sin(30\,\text{deg}) + 5\sin(30\,\text{deg}) + j5\cos(30\,\text{deg})$$

$$= 6.83 + j6.83$$

$$= 6.83 \times \sqrt{2}\angle 45\,\text{deg} = 9.66\angle 45\,\text{deg}$$

2.

$$z_1 z_2 = 5 \times 5\angle(30+60)^\circ = 25j$$

3.

$$z_1 + z_1^* = 5\cos(30\,\text{deg}) + j5\sin(30\,\text{deg}) + 5\cos(30\,\text{deg}) - j5\sin(30\,\text{deg}) =$$

$$10\cos(30\,\text{deg}).$$

4.

$$5\angle 30^\circ \times 5\angle -60^\circ = 5 \times 5\angle(30-60)\ \text{deg} = 25\angle -30^\circ$$

5.

$$v^2 = \left(2\,\text{Volts} \times e^{j2\pi ft} + 2\,\text{Volts} \times e^{-j2\pi ft}\right) \times$$

$$\left(2\,\text{Volts} \times e^{j2\pi ft} + 2\,\text{Volts} \times e^{-j2\pi ft}\right) =$$

$$8\,\text{Volts}^2 \times e^{j2\pi ft} \times e^{-j2\pi ft} +$$

$$4\,\text{Volts}^2 \times e^{j2\pi ft} \times e^{j2\pi ft} + 4\,\text{Volts}^2 \times e^{-j2\pi ft} \times e^{-j2\pi ft} =$$

$$8\,\text{Volts}^2 + 4\,\text{Volts}^2 \times e^{j4\pi ft} + 4\,\text{Volts}^2 \times e^{-j4\pi ft} =$$

$$8\,\text{Volts}^2 + \text{Volts}^2 \cos 4\pi ft.$$