Quiz 9 asks you to evaluate real and imaginary parts of two successive complex scalar multiples of a complex vector.

$$\begin{bmatrix} z_1 \\ z_2 \\ z_3 \end{bmatrix} \to z_4 \begin{bmatrix} z_1 \\ z_2 \\ z_3 \end{bmatrix} \to z_5\, z_4 \begin{bmatrix} z_1 \\ z_2 \\ z_3 \end{bmatrix}$$

Each product of two complex numbers must be simplified to a single complex number by identifying real & imaginary parts:

$$z_1 z_2 = (x_1 + iy_1)(x_2 + iy_2) = x_1x_2 + i^2 y_1 y_2 + i x_1 y_2 + i x_2 y_1$$
$$= (x_1x_2 - y_1y_2) + i\,(x_1y_2 + x_2y_1)$$

A product of 3 complex numbers requires you to do this twice.

Multiplication is simpler using the polar form.

$$z_4 \begin{bmatrix} z_1 \\ z_2 \\ z_3 \end{bmatrix} = r_4 e^{i\theta_4} \begin{bmatrix} r_1 e^{i\theta_1} \\ r_2 e^{i\theta_2} \\ r_3 e^{i\theta_3} \end{bmatrix} = \begin{bmatrix} r_4 r_1\, e^{i(\theta_1+\theta_4)} \\ r_4 r_2\, e^{i(\theta_2+\theta_4)} \\ r_4 r_3\, e^{i(\theta_3+\theta_4)} \end{bmatrix}$$

This is useful for understanding easily the ~~r~~relative amplitudes and phaseshifts of eigenvalue exponential scaled eigenvectors:

$$\underbrace{y_i}_{z_5}\ \underbrace{e^{\lambda_i t}}_{z_4}\ \underbrace{b_i}_{\begin{bmatrix} z_1 \\ z_2 \\ z_3 \end{bmatrix}} = \text{tedious in terms of real \& imaginary parts}$$

(sorry)