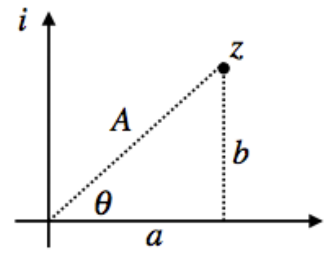
1. Euler's Equation : $\exp(i\theta) = \cos(\theta) + i\sin(\theta)$



Recall that a complex number z can always be written in two ways:

$z = a + ib$, or $z = A\exp(i\theta)$

where *A*, *a*, *b*, and θ are real numbers such that:

$$|z| = A = \sqrt{a^2 + b^2} \qquad a = A\cos(\theta) \qquad b = A\sin(\theta)$$

When multiplying two complex numbers, the phase angles add:

$$z_1 = A_1 \exp(i\theta_1) \qquad z_2 = A_2 \exp(i\theta_2)$$

$$z_1 \cdot z_2 = A_1 A_2 \exp\left[i(\theta_1 + \theta_2)\right]$$

Rewrite the following complex numbers in the form $A\exp(i\theta)$

$-i =$ $\qquad\qquad$ $\dfrac{5}{i} =$

$1 + i =$ $\qquad\qquad$ $\dfrac{1}{1-i} =$

Use these last two answers and the rules for multiplying complex exponentials to find:

$$\frac{1+i}{1-i} =$$

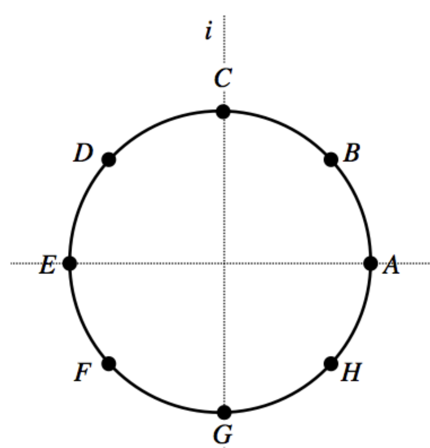
2. Identify the following complex numbers with their location in the complex plane:

$\exp(i\pi/4)$

-1

$\cos(3\pi/4) - i\sin(\pi/4)$

$\exp(-i \cdot 3\pi/4)$



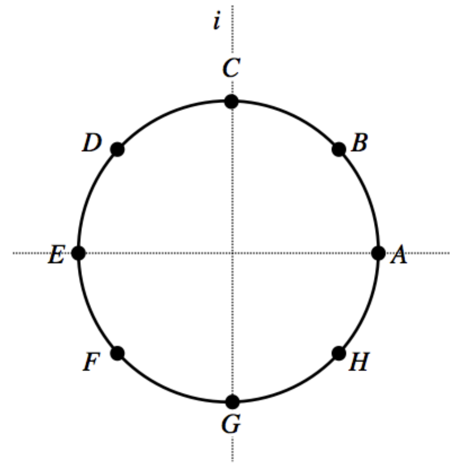
(*When you are done, answer the clicker question on the screen*)

3. Now, do the same task for the function $\exp(-i\omega t)$ at the various times given below:

$$\omega t_1 = \frac{\pi}{4}$$

$$\omega t_2 = \frac{\pi}{2}$$

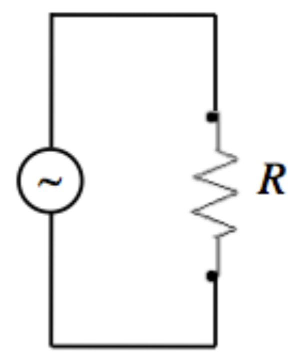
$$\omega t_3 = \frac{3\pi}{4}$$



Would an arrow representing $\exp(-i\omega t)$ in the complex plane rotate *clockwise* or *counter-clockwise* as time advances?

4. The circuit at right contains a resistor *R* and an AC voltage source, which we often represented by the following expression:

$$V(t) = V_0 \exp(i\omega t)$$



What is the magnitude of the physical current through the resistor when $\omega t = \pi / 3$? Explain in words how you arrived at your answer.