COMPLEX NUMBERS

$\sqrt{x} \triangleq$ the number which when squared, equals x

$\sqrt{-1} = j$ Imaginary #

$j^2 = -1$

$\frac{1}{j} = \frac{j}{j^2} = -j$

$3j + 2j = 5j$

$5j \times 2j = -10$

$3 + 2j = ?$

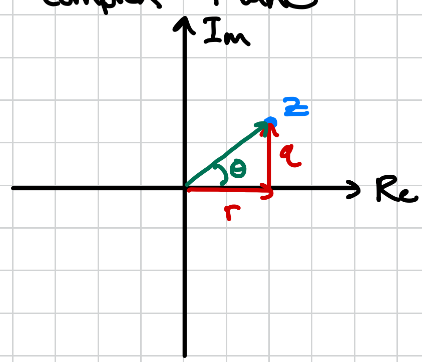
Complex #

$Z = r + qj$

r: Real part of z, $Re\{z\}$

q: Im part of z, $Im\{z\} = q$ is Real

Complex Plane



$z_1 \pm z_2 = (r_1 \pm r_2) + (q_1 \pm q_2)j$

$z_1 \times z_2 = |z_1| \times |z_2| \angle (\theta_1 + \theta_2)$

$\frac{z_1}{z_2} = \frac{|z_1|}{|z_2|} \angle (\theta_1 - \theta_2)$

WHERE DOES e COME IN

$e^z ?$

$e^{r+qj} = e^r \times e^{qj}$

$\frac{d}{dq} e^{qj} = j e^{qj}$

$\boxed{e^{qj} = \cos(q) + j\sin(q)}$ Eulers' Formula

$\frac{d}{dq} e^{qj} = -\sin(q) + j\cos(q)$

$= j \times [\cos(q) + j\sin(q)]$

$= je^{qj}$

Instead of $z = |z| \angle \theta$

$\Rightarrow z = |z| e^{j\theta}$

$z = |z|\cos\theta + j|z|\sin\theta$

$$A\cos(\omega t + \phi) = \mathrm{Re}\{Ae^{(\omega t+\phi)j}\}$$

$$RC\frac{dV_c}{dt} + V_c = V_{in}$$

$$RC\frac{d}{dt}\mathrm{Re}\{V_c e^{j(\omega t+\phi)}\} + \mathrm{Re}\{V_c e^{j(\omega t+\phi)}\} = \mathrm{Re}\{V_{in} e^{j(\omega t)}\}$$