Last Class…

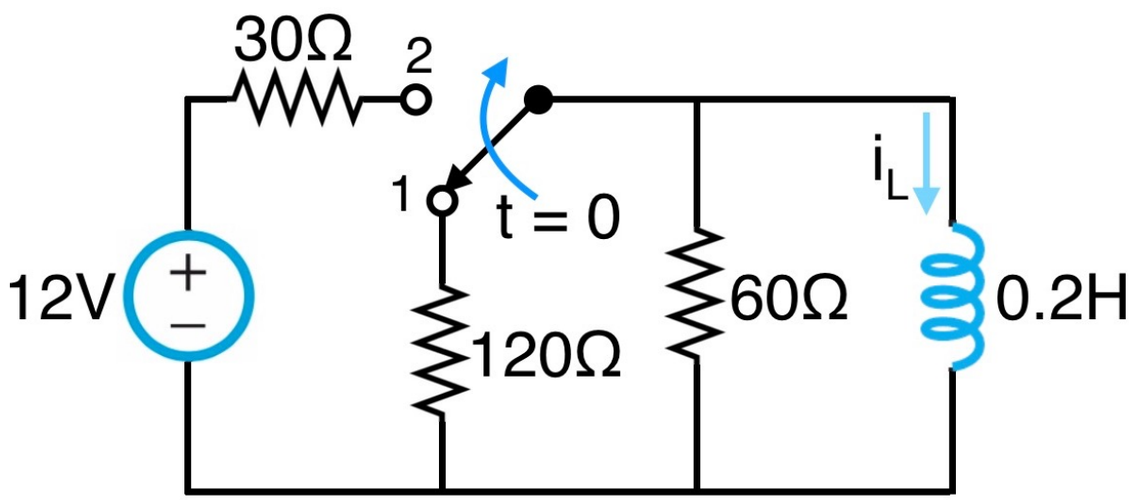
After having been in position 1 for a long time, the switch in the circuit was moved to position 2 at t = 0. Determine:

A. $i_L(0)$

B. $i_L(\infty)$

C. $i_L(t)$ for $t \geq 0$

D. $v_L(t)$ for $t \geq 0$



THE OHIO STATE UNIVERSITY

COLLEGE OF ENGINEERING

Sinusoids and Complex Numbers

Review

In-class participation

1. A sinusoidal waveform is characterized by three parameters. What are they, and what does each one of them specify?

2. Express the voltage $v(t) = 150\sin(300t + 60°)$ in cosine form.

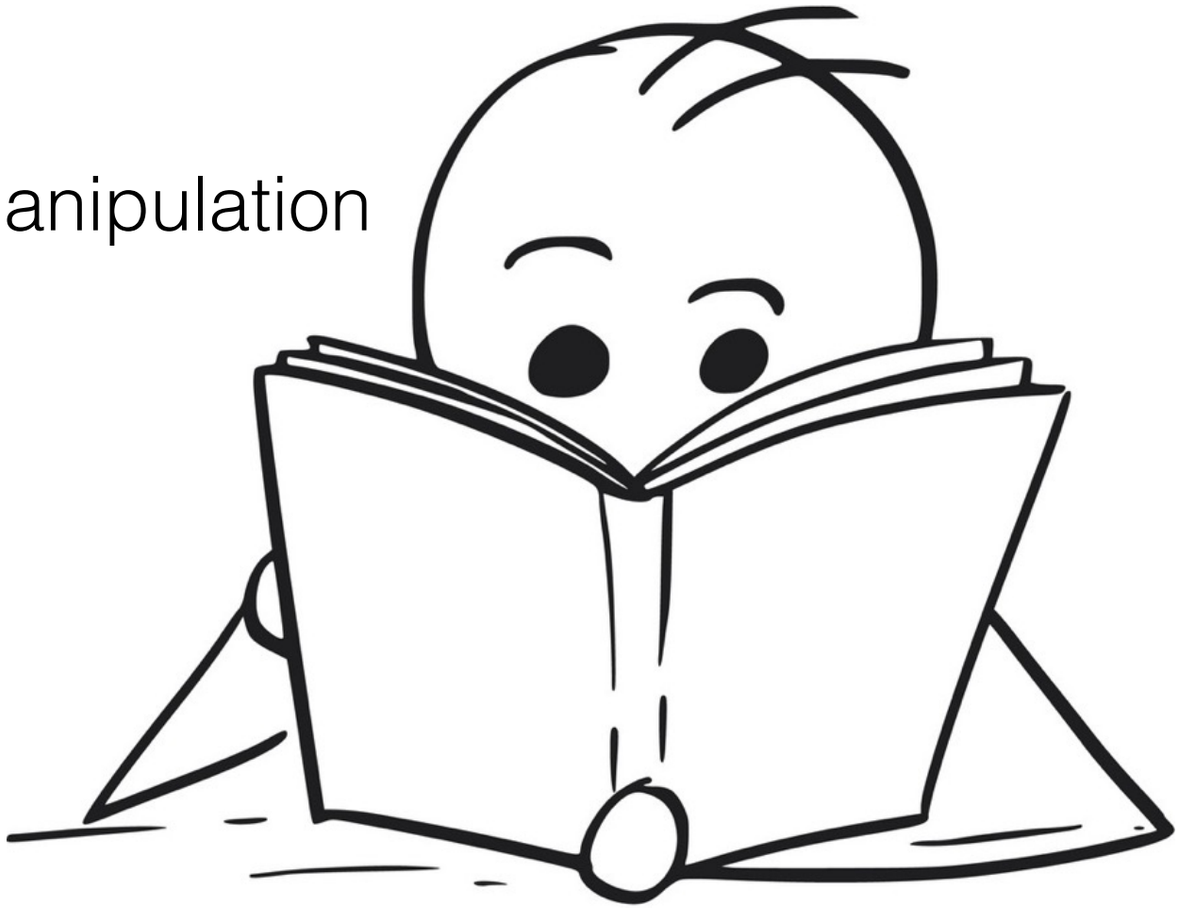
3. Find the value of ω if the frequency is 5Hz?

4. Express the following complex function in polar form: $z_1 = (4 - 3j)^2$

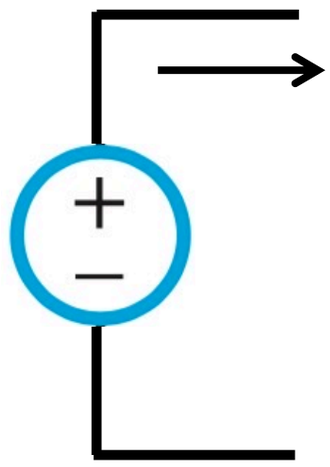
5. If two complex numbers have the same magnitude, are they necessarily equal to each other?

This Lecture…

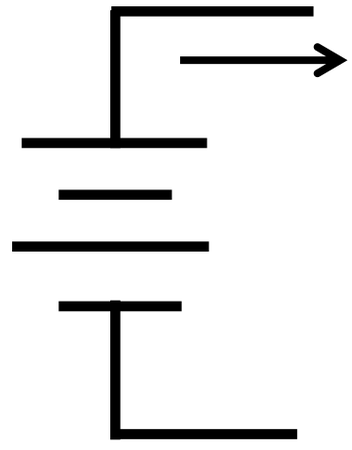
- Learning Objectives:
  - Identify the general form or a sinusoidal signal.
  - Understand the geometric interpretation of complex numbers and the relationship between the polar and rectangular form.
  - Perform basic algebraic manipulation with complex numbers.



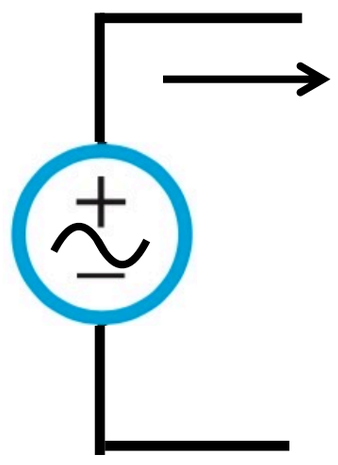
AC Circuits



Generic



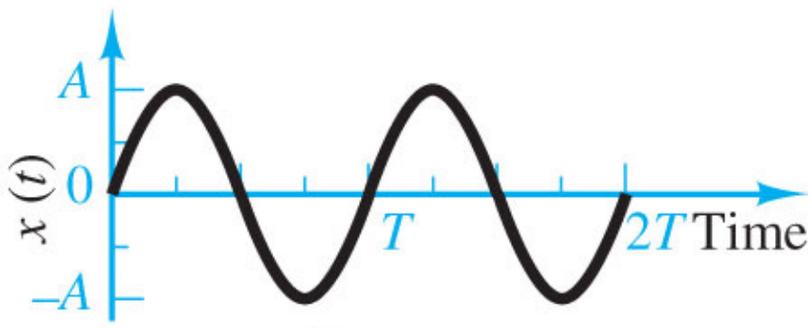
DC voltage



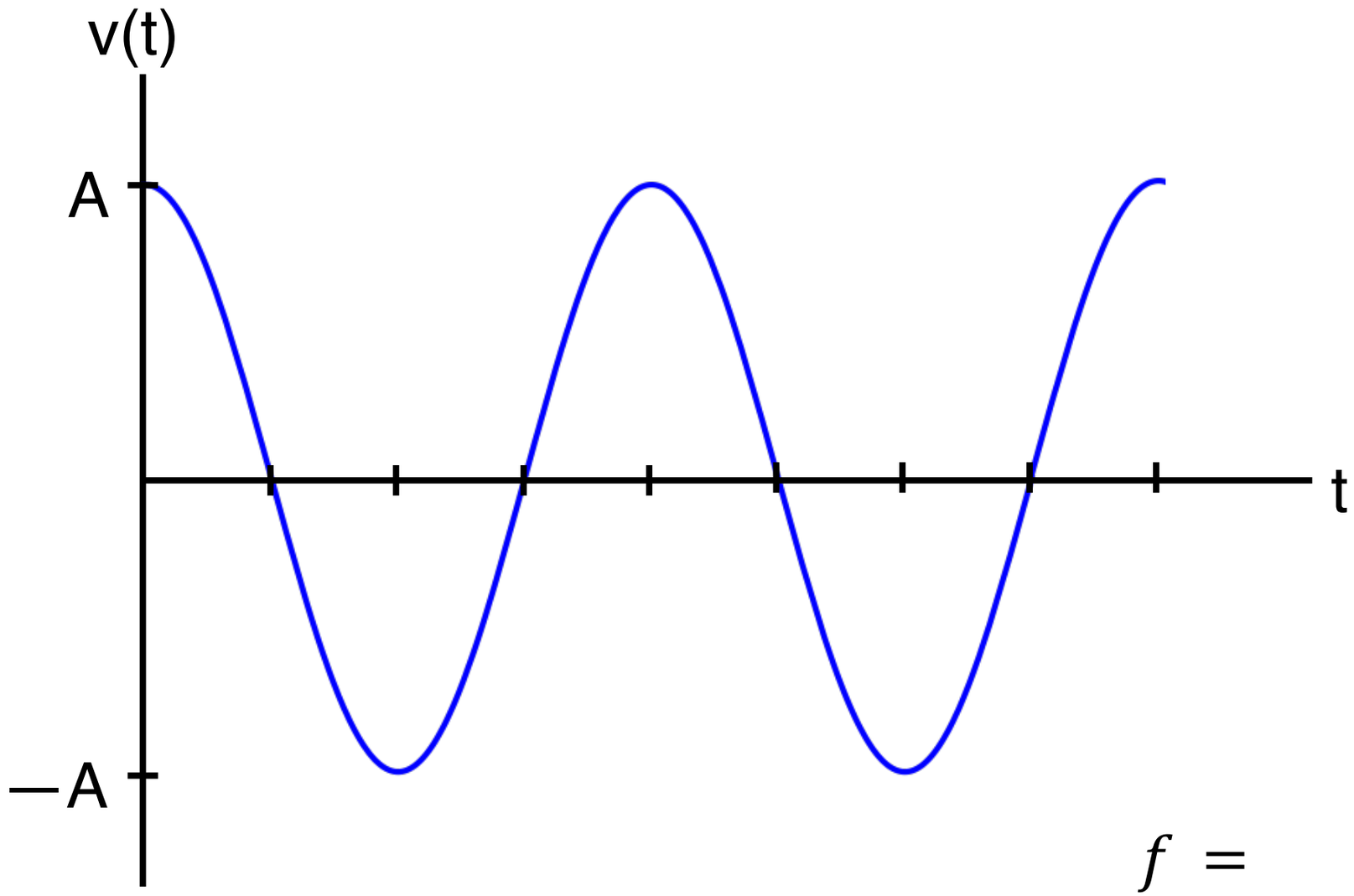
AC voltage

Alternative Current

- Time-Dependent Sources.
- Electric power delivered in the form of periodic voltages and currents.
- Alternative Current



Sinusoidal Signals



$$v_{AC} = A\cos(\omega t + \varphi)$$

A =

v_{pp} =

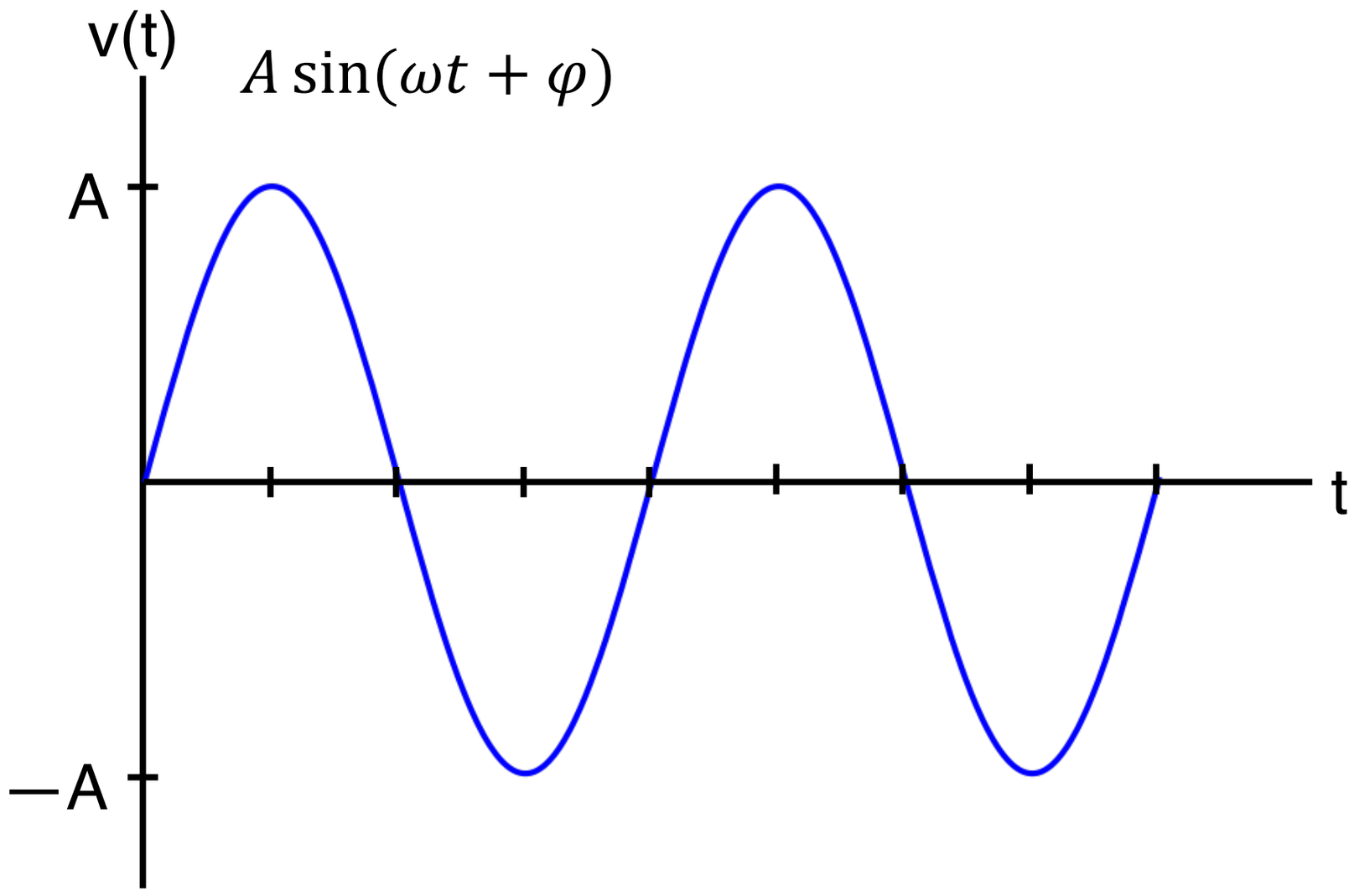
T =

f =

ω =

φ =

Sinusoidal Signals



$$v_{AC} = A\cos(\omega t + \varphi)$$

Phase shift (φ) must be defined between $180°$ and $-180°$ degress.

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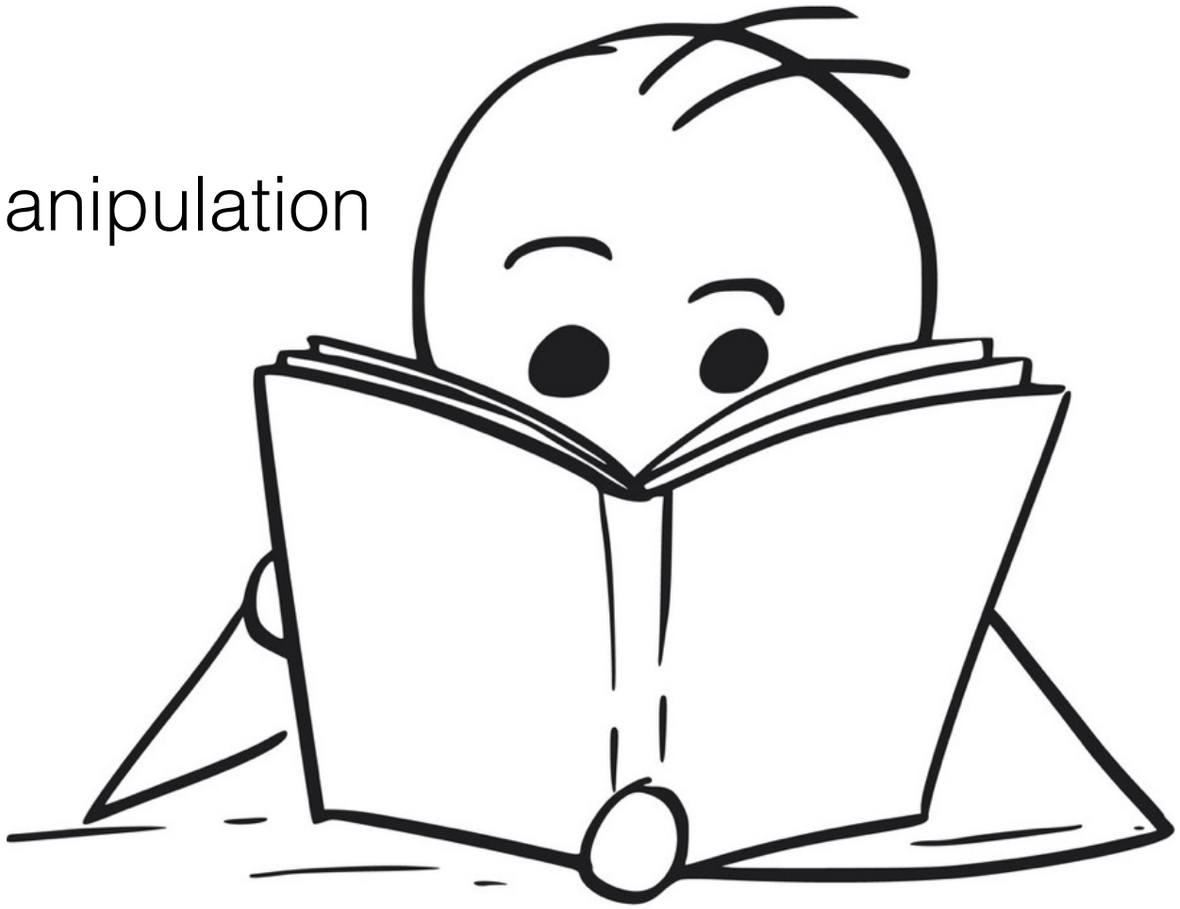
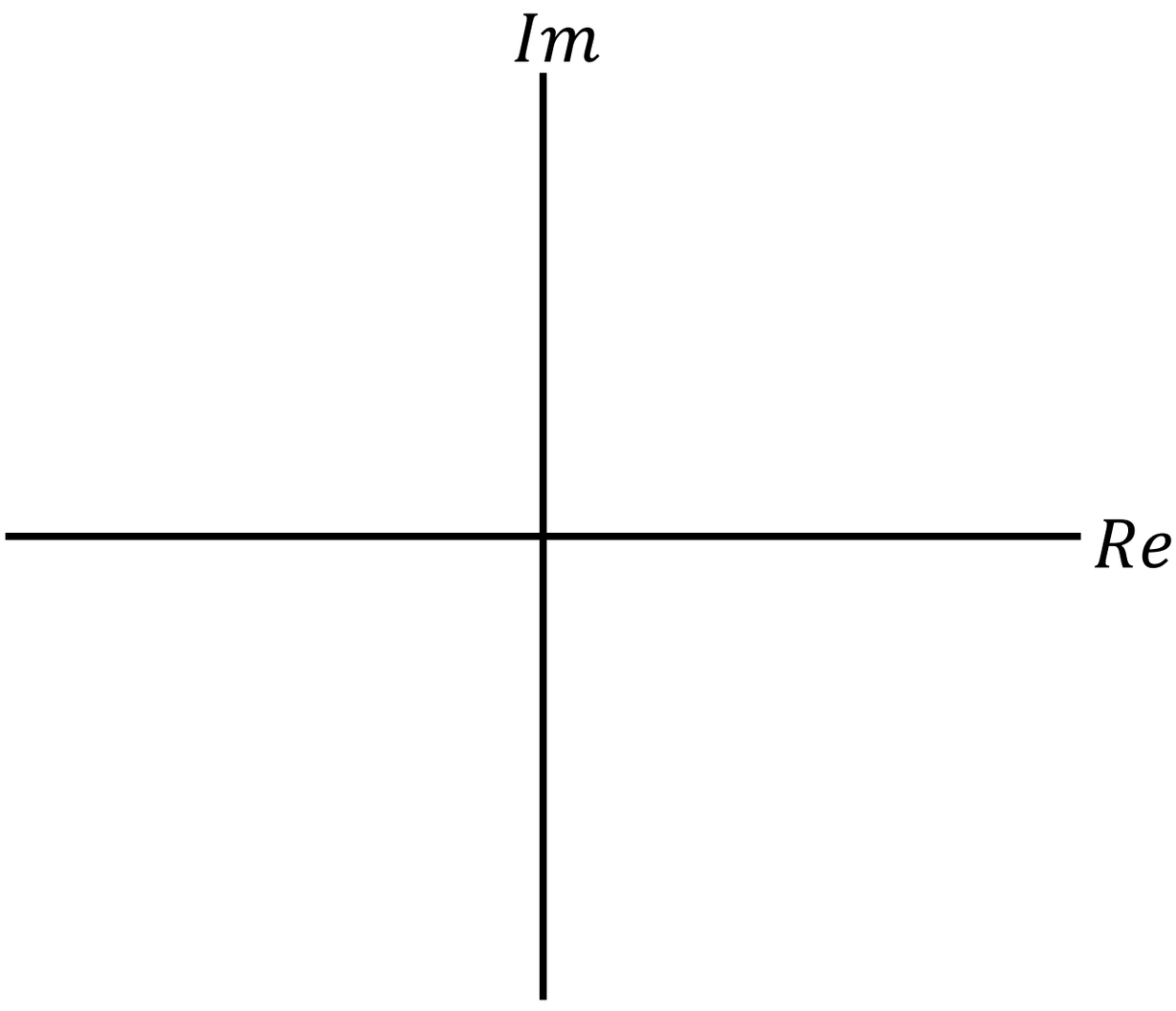


Complex Numbers Review

Rectangular form

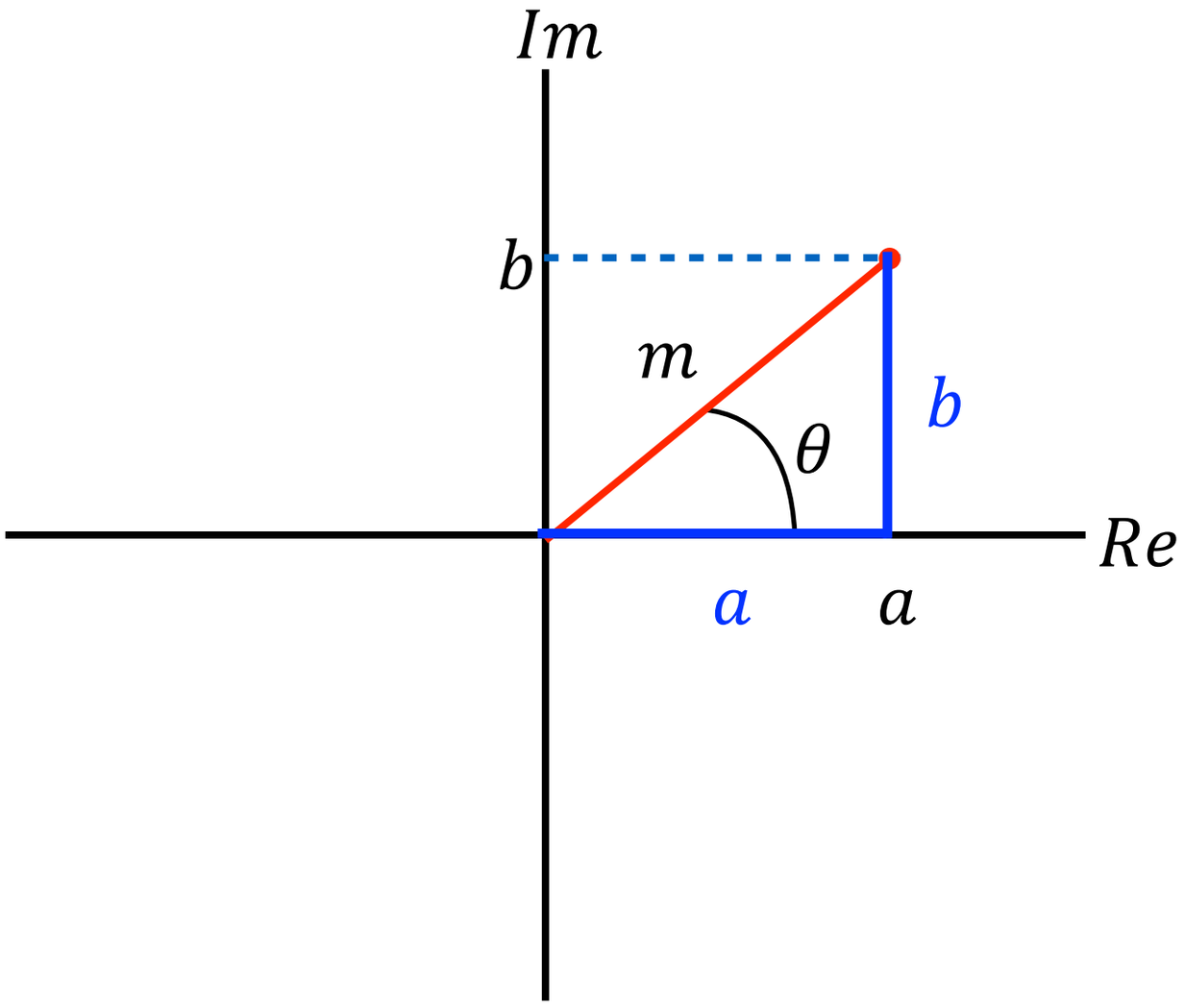


Polar form

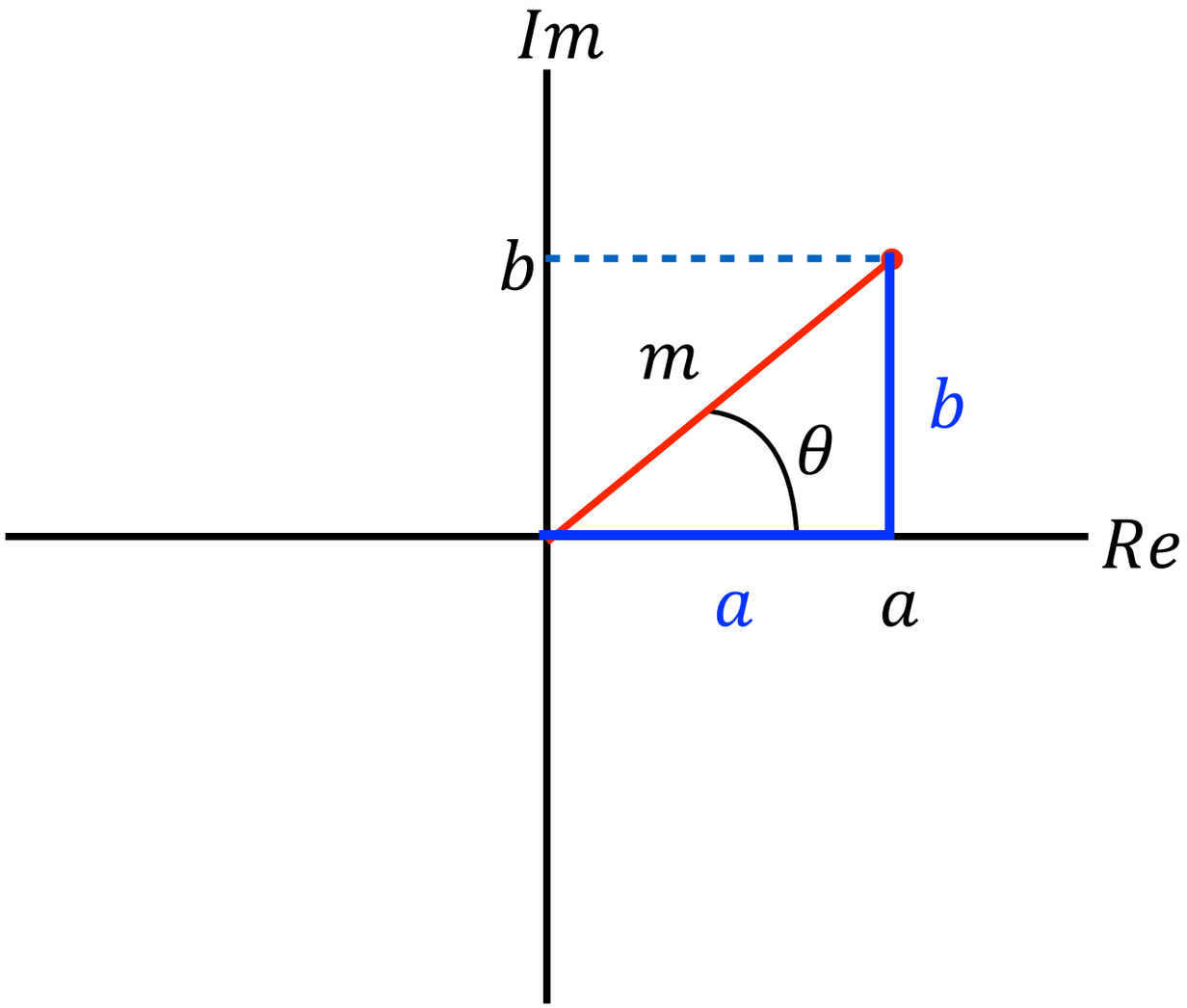
Rectangular to Polar Form

Rectangular form

$$z = a + jb$$



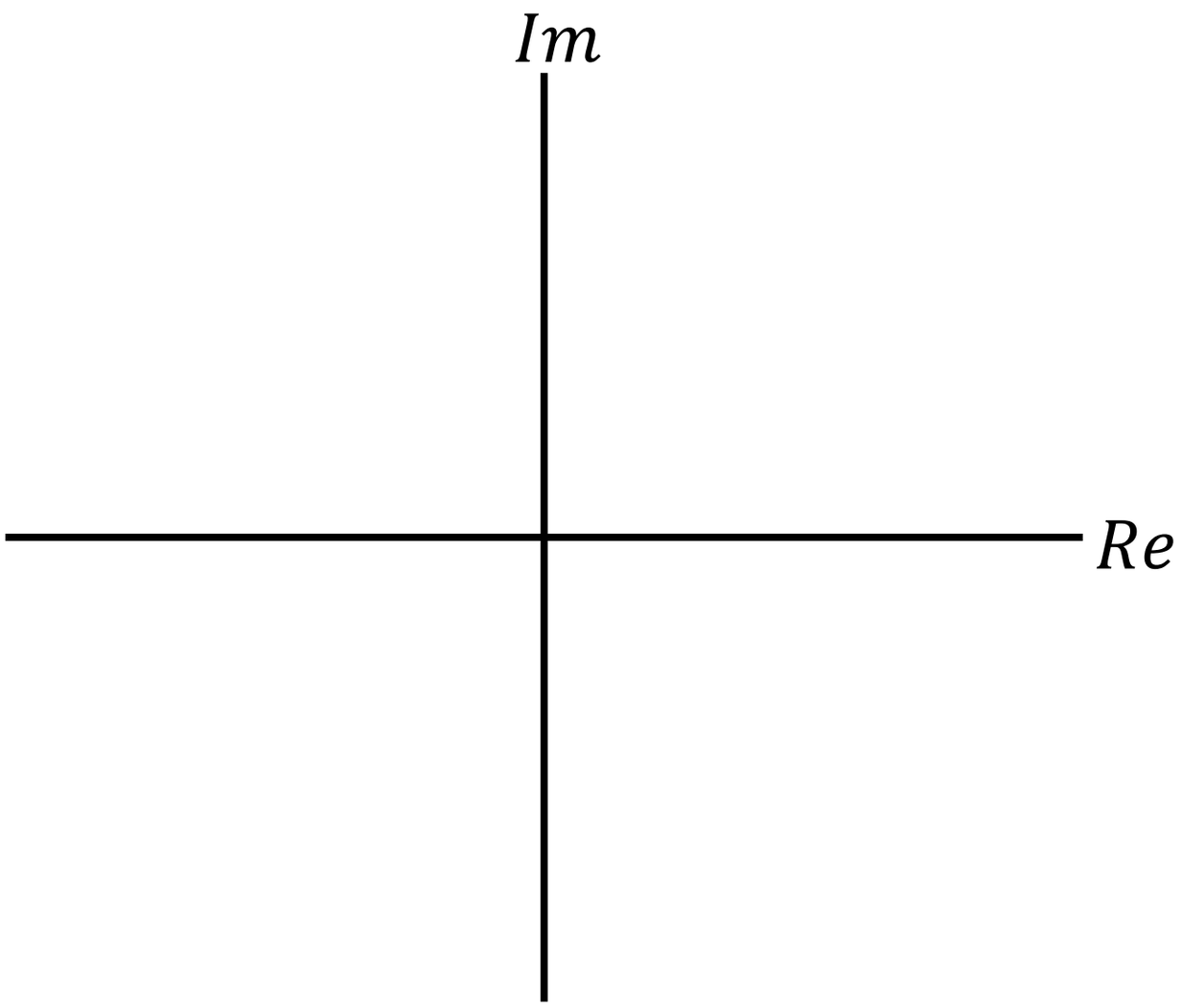
Polar to Rectangular Form



Polar form

$$z = m\angle\theta = me^{j\theta}$$

Complex Numbers Review



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

$$j^2 =$$

$$j^3 =$$

$$j^4 =$$

$$j^{-1} =$$

$$\frac{1}{100j} =$$

Complex Numbers Review

Rectangular form

$z_1 = 1 + j\,2 \qquad z_2 = 3 + j\,4$

Addition:

Polar form

$z_1 = 5e^{j30°} \qquad z_2 = 2e^{-j15°}$

Multiplication:

Division: