

We represent alternating voltage using complex numbers

Imaginary



And also with our phasor  
(Argand) diagram;

**Note:**

i) Real part of complex number is the ..... quantity.

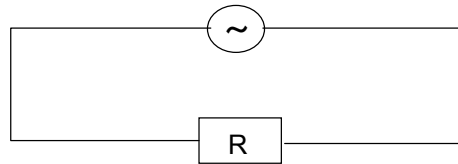
ii)  $j = \sqrt{-1}$

iii)

III.2 Passive elements in an AC circuit.

a) Resistance

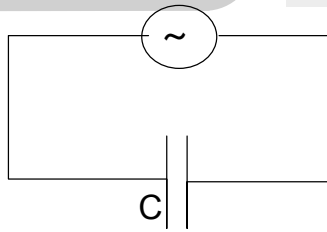
Generator:  
 $V = V_0 \exp(j\omega t)$



Ohm's Law is obeyed:



## b) Capacitance



The ..... stored depends on the value of .... and the ..... across it.

A quick bit of electrical maths.

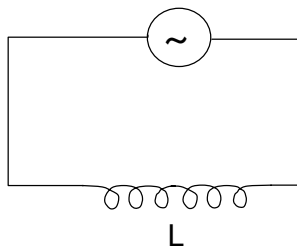


(For a point in a circuit, the rate of change of charge is the electrical current.)



$I$  is the current in the leads connected to the capacitor.

## c) Inductance



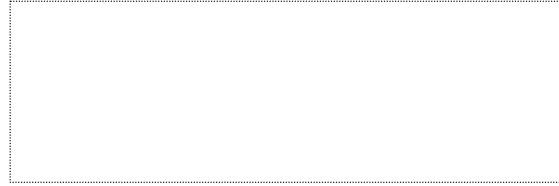
An inductor is a device that ..... in current.

This opposition is .....  
.....

It does this by creating an ..... voltage.



This analysis uses complex number notation.



**Resistor**

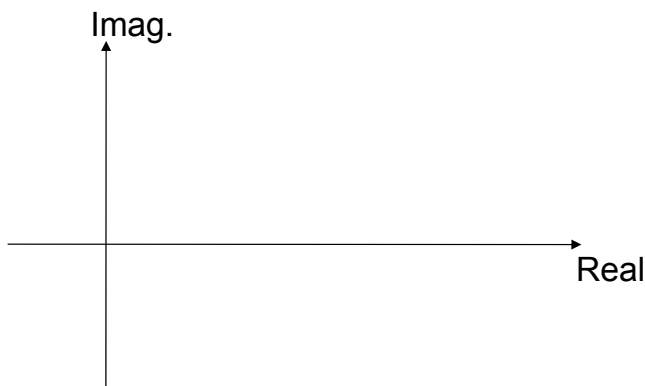
We can write;



So the **current phasor** has magnitude  $I_0$   
and the **voltage phasor** has magnitude  $V_0$

They are  
in phase!

This diagram deals with .....



**i.e. it shows the phase between the  
..... and the .....**

**i.e. ....**

## Capacitance

By substitution;

The equations  
we know.

Now we prefer to express our equations  
with voltage as the subject;

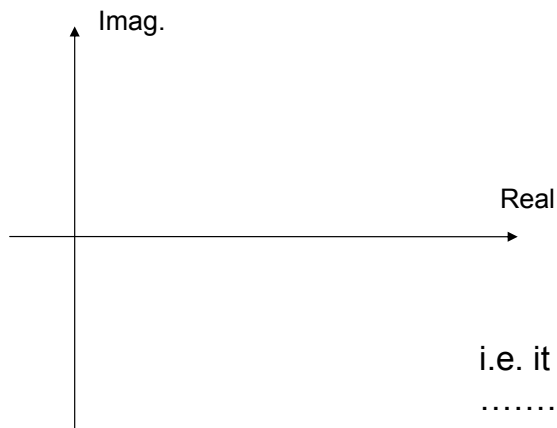
(Compare  
to  $V=I.R$ )

The voltage across  
the capacitor;

**There is a phase difference of  $-j$  between the driving  
voltage and the current “through” the capacitor.**

**So the ..... leads the ..... by  $\pi/2$**

**Phasor diagram (Capacitor)**



Remember, this diagram  
illustrates **phases**.

i.e. it shows the phase between the  
..... and the ..... (capacitor)

# Inductance

Start with

The equations we know.

Integrate w.r.t. time;

Constant = 0 since there are no DC components



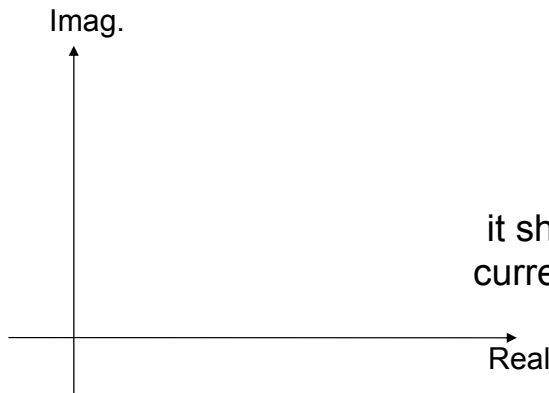
(Compare to  $V=I.R$ )

The voltage across the inductor;

**There is a phase difference of  $j$  between the driving voltage and the current through the inductor.**

**So the ..... leads the ..... by .....**

**Phasor diagram (Inductor)**



it shows the phase between the current and the voltage (inductor)