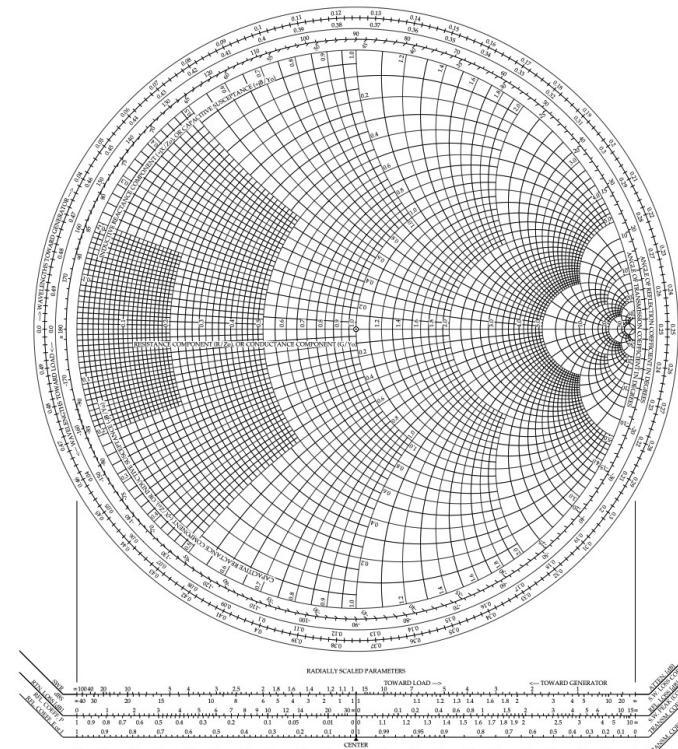


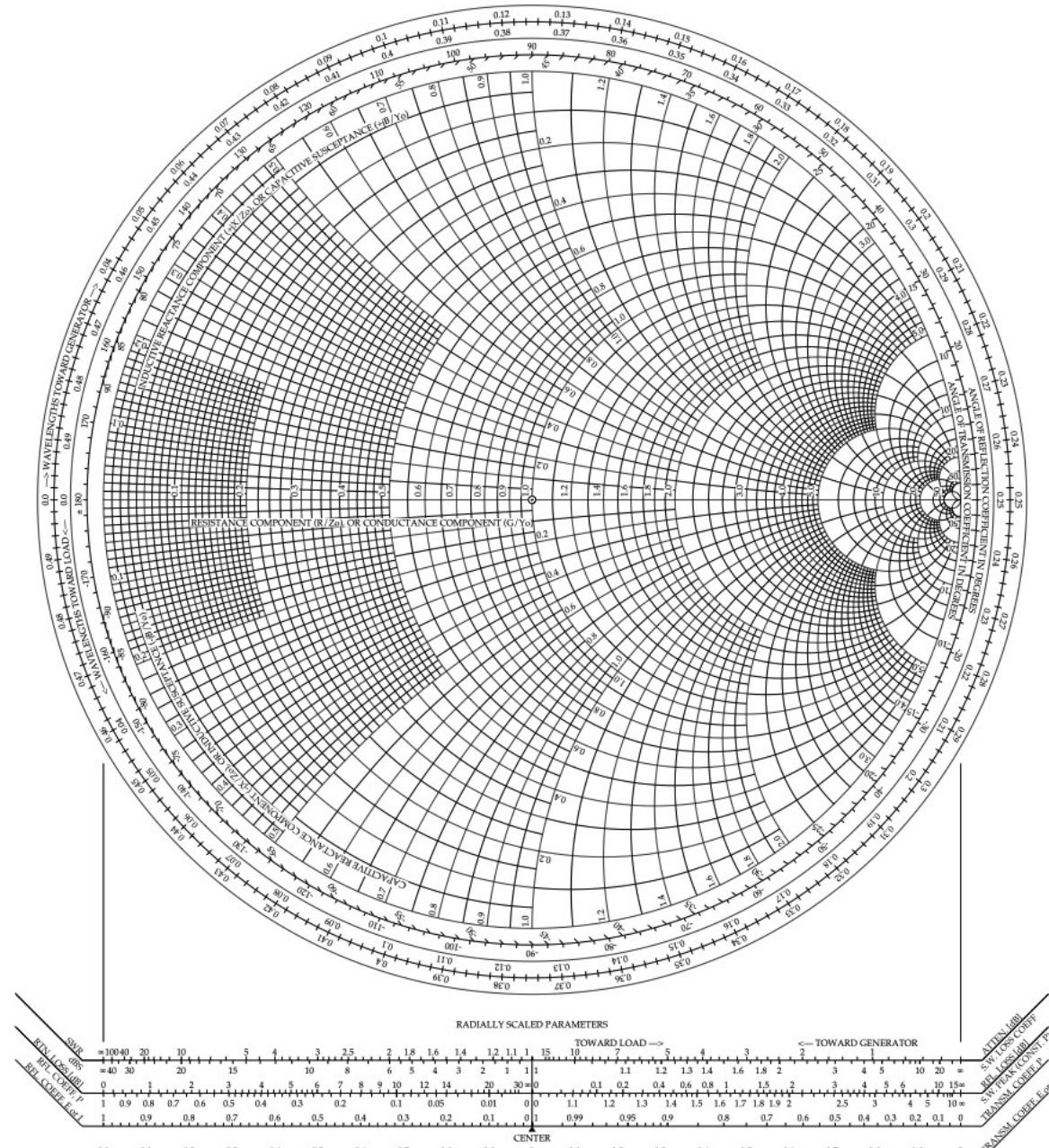
What IS a Smith Chart anyway ?

The Complete Smith Chart
Black Magic Design



The Complete Smith Chart

Black Magic Design



Wow, That is INTENSE !!

What could it possibly be used for ???

Wow, That is INTENSE !!

What could it possibly be used for ???

- Typical answer is
- "Used for
 - Impedance Matching
 - Transmission line analysis"

Huh.....?

OK smart a... What is impedance?

OK smart a... What is impedance?

Let's start with

- $R = \text{Resistance}$
- Recall Ohm's law?

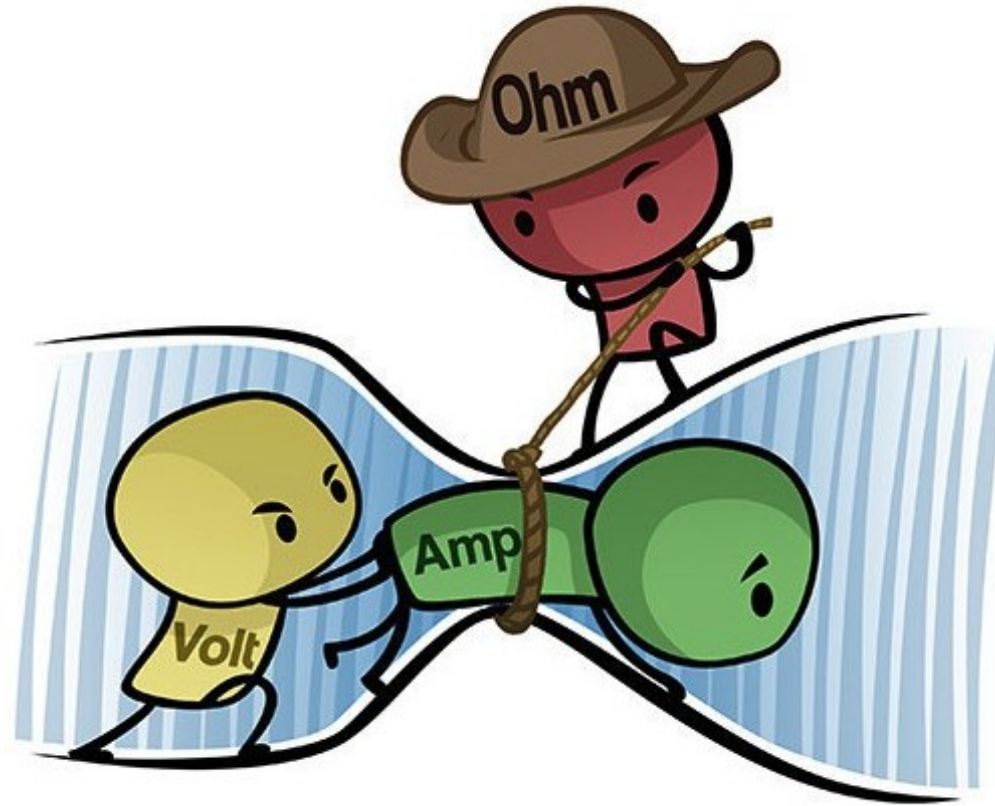
OK smart a... What is impedance?

- R = Resistance

- Recall Ohm's law? $V = I R$

Voltage = Current x Resistance

$$V = I \times R$$



$V = I \times R$ uses “Real” numbers

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- But there are also “Complex” numbers
 - Instead of R
 - Lets use a complex number such as

$$Z = R + jX$$

Z is now a complex number

$V = I \times R$ uses “Real” numbers

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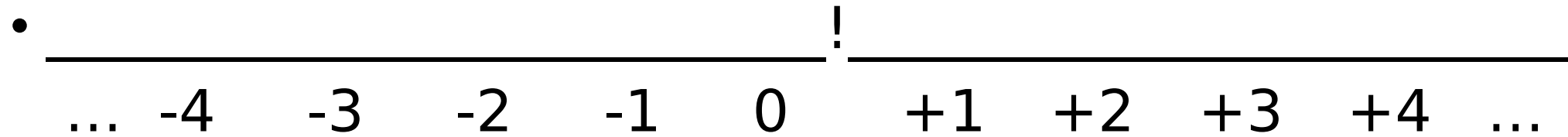
$$Z = R + jX \quad (Z = R + iX \text{ a mathematician version})$$

Z is now a complex number

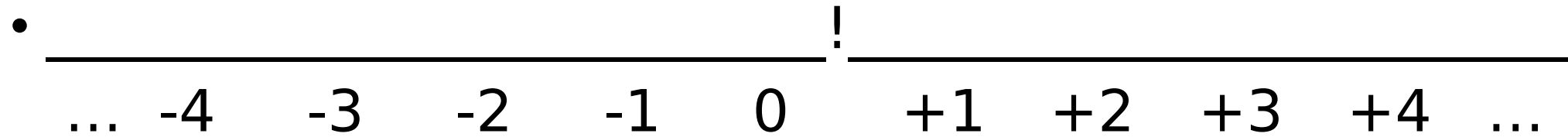
So, $Z = (R + j X)$

So, lets start by drawing a Real
number plane

So, lets draw a Real number plane

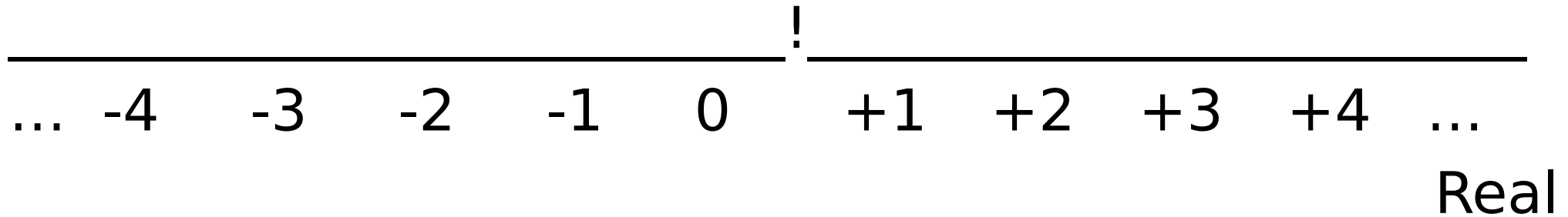


So, lets draw a Real number plane

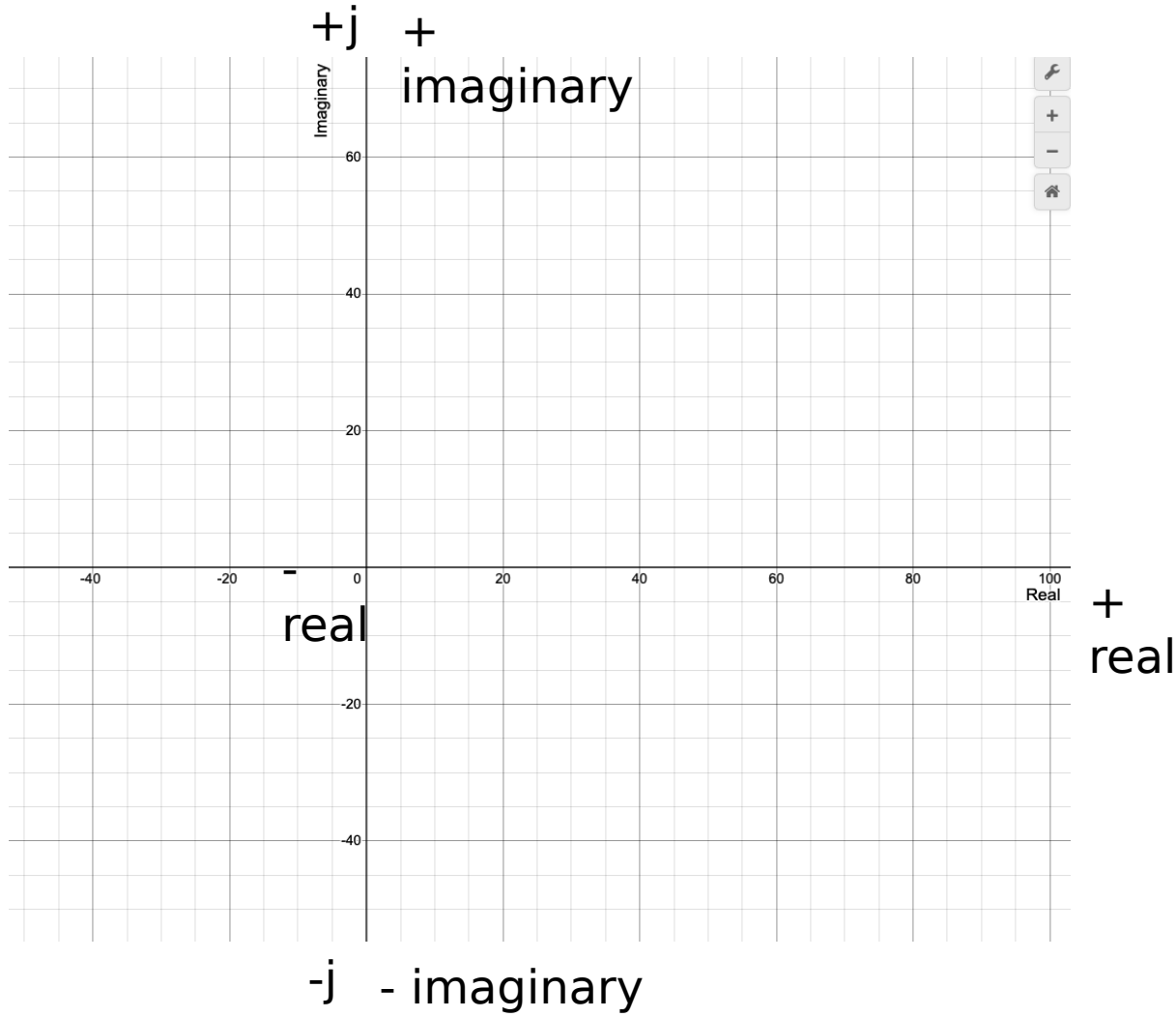


Note a one dimensional line.

Now, let's make a 2 dimensional
number plane



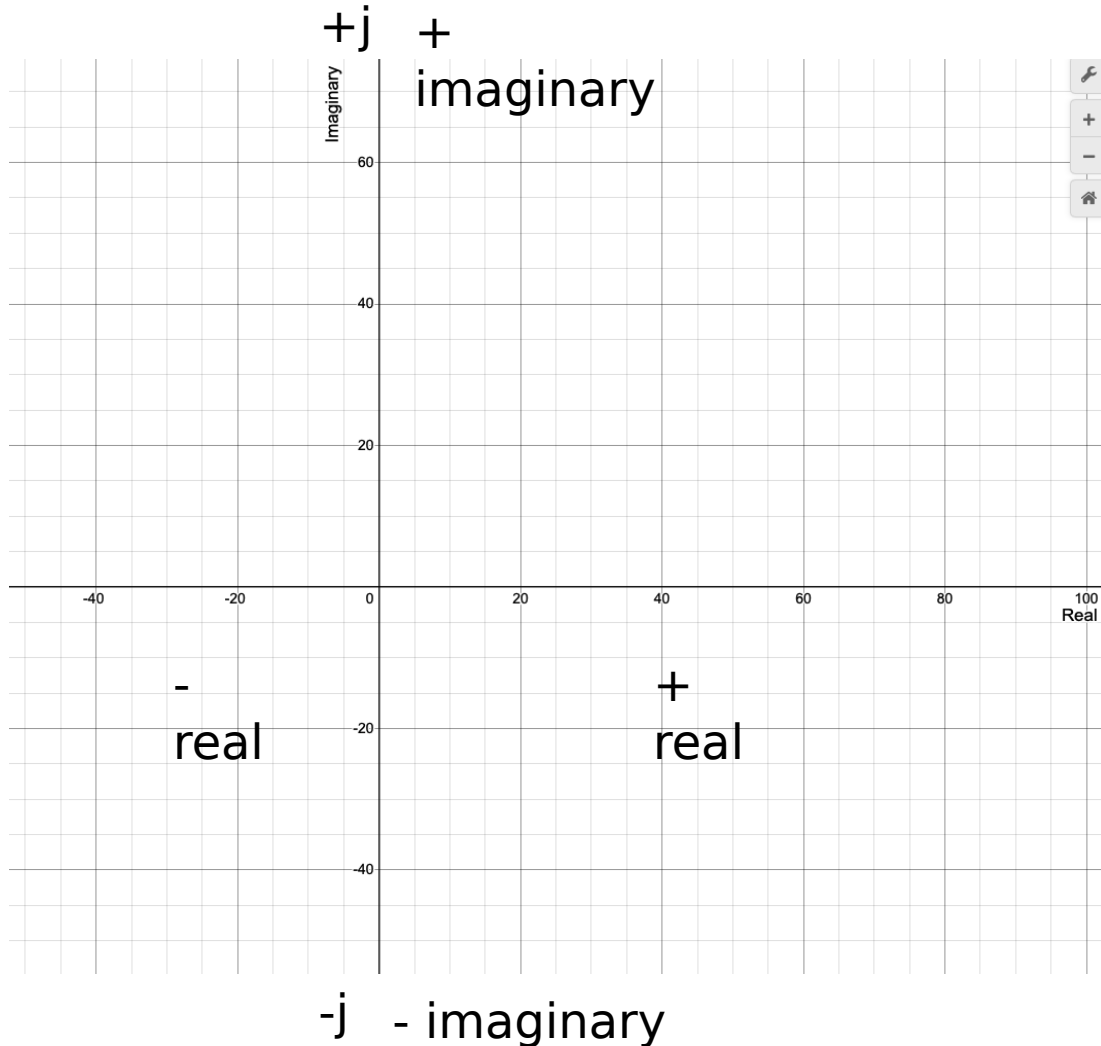
Note "Imaginary" numbers on vertical plane



Note Real numbers on horizontal plane

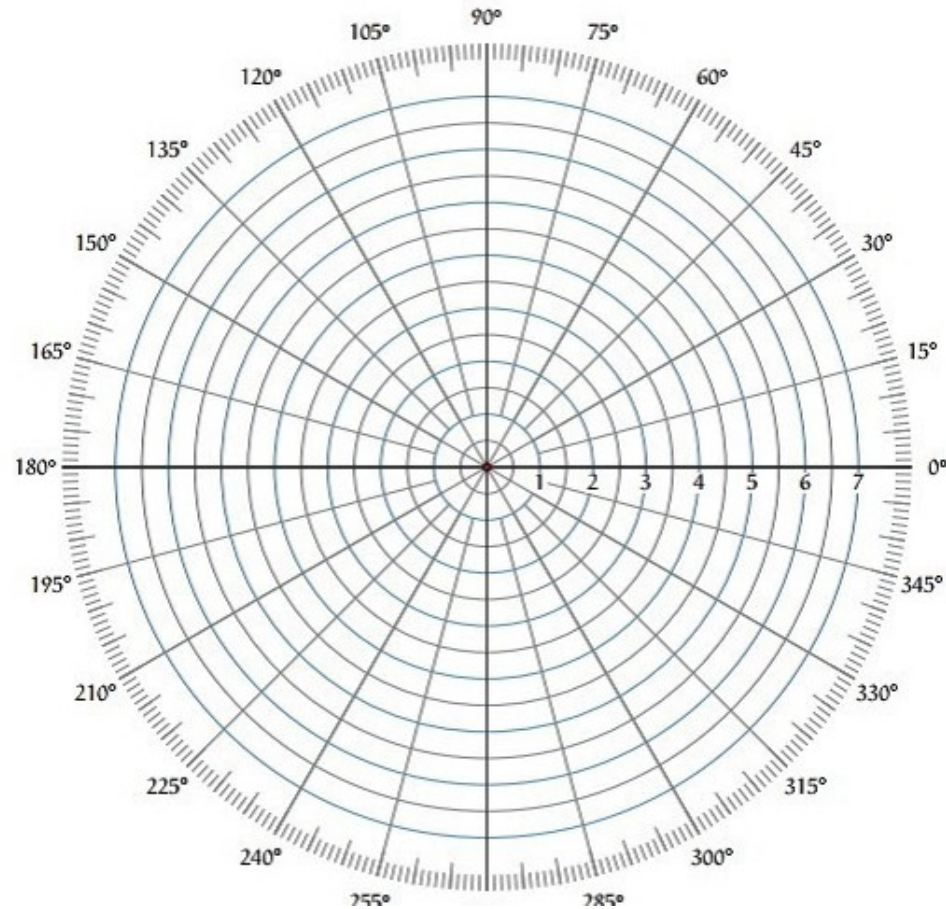
This is an X Y plot or cartesian coordinates.

Note and “Imaginary” numbers on vertical plane



Note Real numbers on horizontal plane

Let us look at a “polar plot” of the SAME info

$$Z = R + jX$$


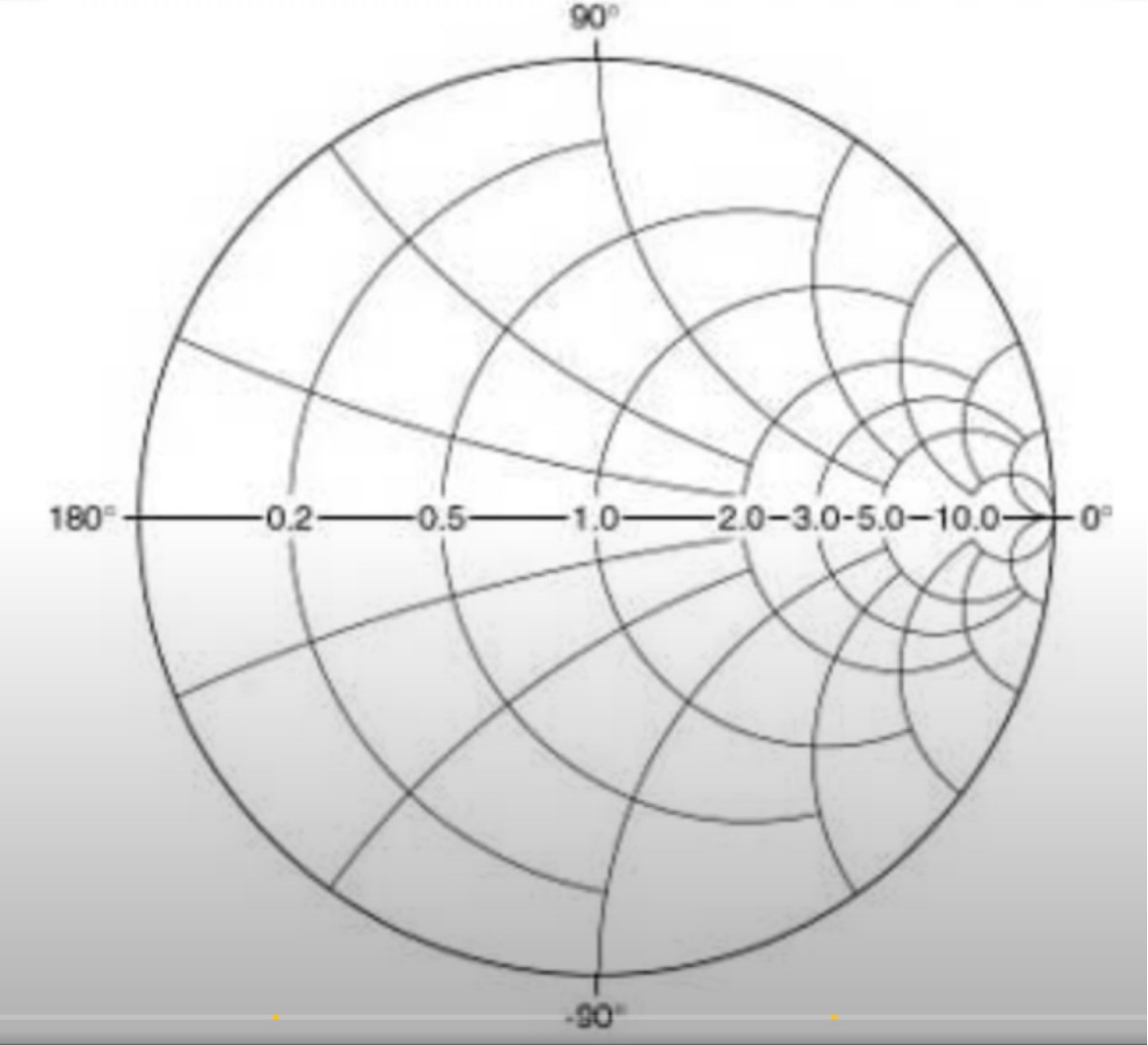
$$Z = R + jX = \sqrt{R^2 + X^2} \angle \tan^{-1}(X/R)$$

- $Z = R + j\omega L$

- $Z = R - j[1/(\omega C)]$

- Note that BOTH contain frequency $\omega = 2\pi f$

A smith chart is a combination of XY and polar coordinates



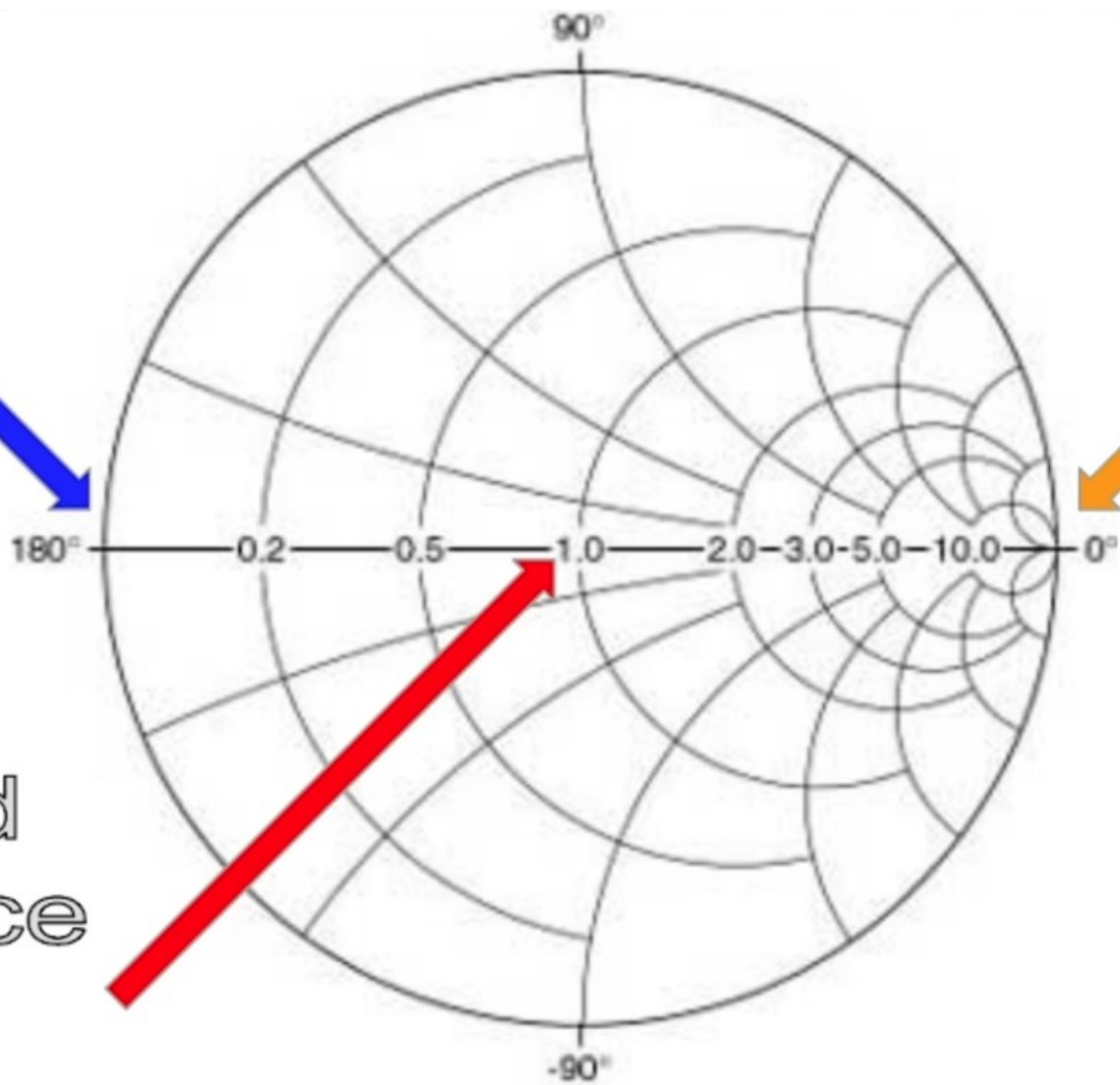
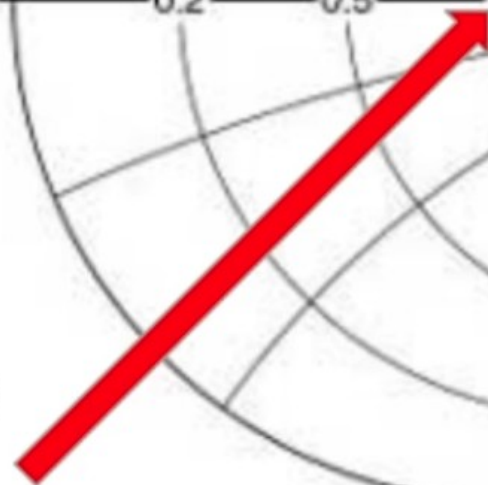
Short
Circuit



Open
Circuit



Matched
Impedance



- $Z = R + j\omega L$

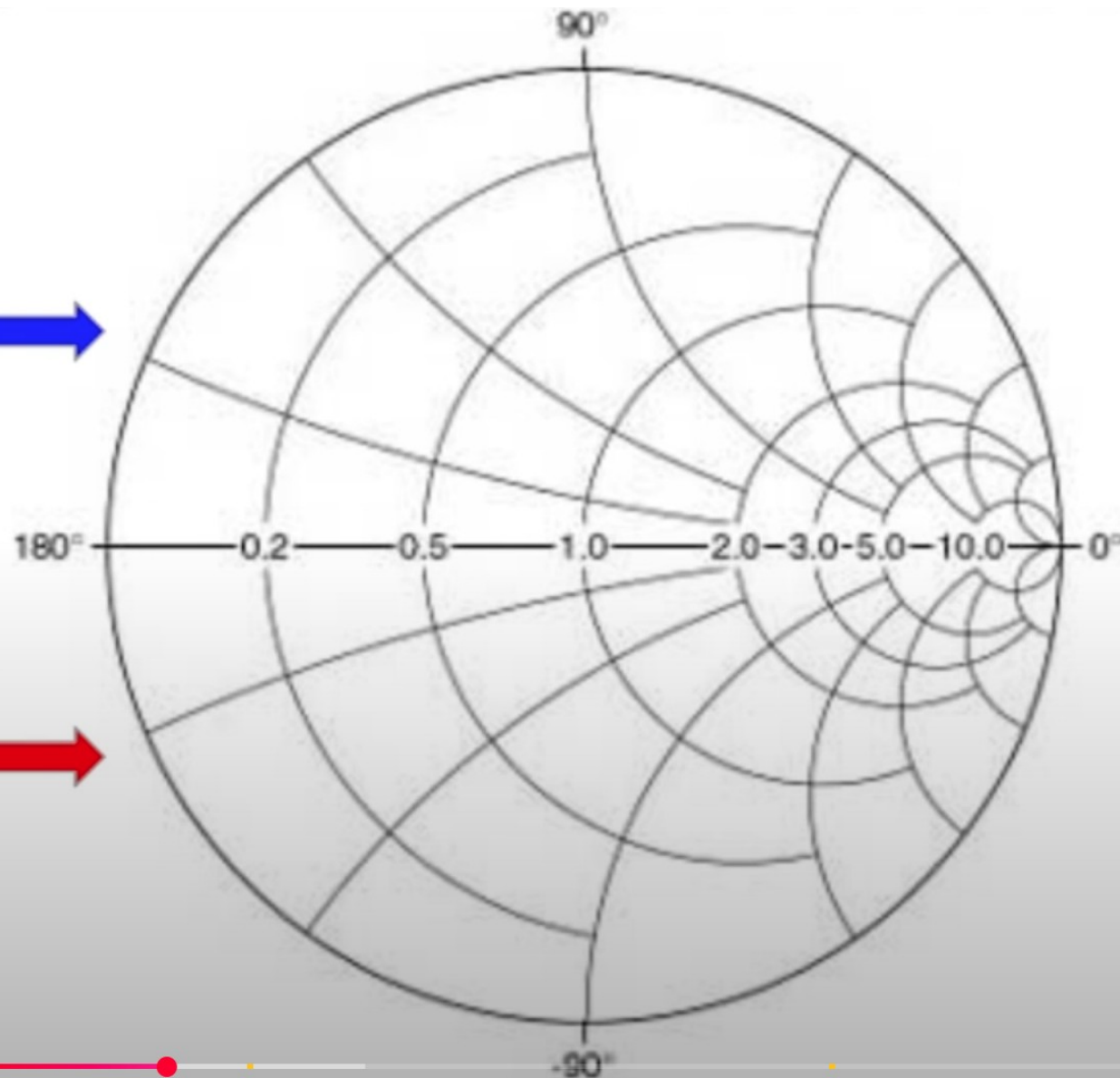
- $Z = R - j[1/(\omega C)]$

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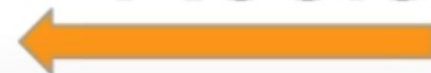
Inductive



Capacitive



Purely Resistive



Go to “Demystifying Smith Charts for Ham Radio Beginners”

For more ... ie SWR etc etc etc

- <https://www.youtube.com/watch?v=7sWOtdaGQgs>

~3:25