Complex Arithmetic

## Addition & Subtraction

Z₁ = 2 + 3j

Z₂ = 4 – 5j

Z₁ + Z2 = (2 + 3j) + (4 – 5j) = 6 – 2j

Using “Brute Force”, can only be done in “Rectangular” or “Cartesian” form

Z3 = (4 < 25°)

Z4 = (3 < -15°)

Z3 + Z4 = 4cos(25) + j4sin(25) + 3cos(-15) + j3sin(-15)

= (4cos(25) + 3cos(-15) + j(4sin(25) + 3sin(-15))

=6.59 < 8°

## Multiplication

Z1 = 2 + 3j

Z2 = 4 – 5j

Z1 \* Z2 = (2 + 3j) \* (4 – 5j)

= (2 \* 4) + (3j \* 4) + (2 \* -5j) + (3j \* -5j)

= 8 + 12j – 10j + 15 = 23 + 2j

Z3 = 4 < 25°

Z4 = 3 < -15°

Z3 \* Z4 = (4 < 25°) \* (3 < -15°)

= (4 \* 3) < (25 + (-15))° = 12 < 10°

## Division

Z1 = 2 + 3j

Z2 = 4 – 5j

Z1 / Z2 = (2 + 3j / 4 – 5j) \* (4 + 5j / 4 + 5j) = (-7 + 22j) / (4^2 + -5^2)

Z3 = 4 < 25°

Z4 = 3 < -15°

Z3 / Z4 = (4 < 25 / 3 < -15) = (4 / 3) < (25 – (-15)) = (4 / 3) < 40°

## Euler Identities

Leonhardt Euler – Smart fella, not a fart smella.

Euler used exponentials with ‘imaginary’ powers to represent sinusoids.

## Sinusoids

Magnitude (amplitude) of a sinusoids is half of the difference between “peak” and “valley”, or min and max values.

Peak: Cosine has peaks when “argument” is an integer multiple of 2π radians

Midpoints: Happen between peaks & valleys when sin has argument that is an integer multiple of π

Midpoints between peaks & valleys

…when sinusoid is rising

Argument of sine integer is multiple of 2π

A = ½ of difference between peak and valley

Time spacing between consecutive peaks

X = DC offset (average