# Digital Signal Processing - SS15
# Theory Tutorial 1

## Complex Numbers

**PROBLEM ONE**  Try the following exercises to practice calculation with complex numbers.

(a) Compute

$$\frac{1+j}{\sqrt{3}+j}$$

using both rectangular arithmetic and by converting the problem first into polar form. Which method was less painful?

(b) Compute the magnitude and angle of  $e^{j}+e^{3j}$

(c) Simplify  $(\sqrt{3}-j)^{8}$

(d) Compute

$$\int_{0}^{\infty} e^{-2t}\cos(\pi t)\,dt$$

(e) Write the real part of:

$$\frac{1-z^{n}}{1-z}$$

in terms of the magnitude and phase of $z$, where $n$ is a positive integer.

# Key

(a) Rectangular: $\dfrac{(\sqrt{3}+1)+j(\sqrt{3}-1)}{4}$

Polar: $\dfrac{1}{\sqrt{2}}e^{j\pi/12}$

(b) Phase: 2; Magnitude: 2cos1

(c) $-128+j128\sqrt{3}$

(d) $\dfrac{2}{4+\pi^2}$

(e) $\displaystyle\sum_{k=0}^{n-1} r^k \cos(k\theta)$