# Tutorato MATEMATICA APPLICATA

A.A. 2019/2020
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## **Esercitazione 1** del 01/10/2019
*Algebra lineare*

**1**) Risolvere le seguenti operazioni con i numeri complessi

$$(3+i)(3-i)\left(\frac{1}{5}+\frac{1}{10}i\right),$$

$$(4+2i)(1-i)+(3-5i)(2+i).$$

SOLUZIONE: $(3+i)(3-i)\left(\frac{1}{5}+\frac{1}{10}i\right)=2+i$, $(4+2i)(1-i)+(3-5i)(2+i)=17-9i$.

**2**) Risolvere le seguenti equazioni di secondo grado

$$\textbf{a}) \quad x^2+4=0,$$

$$\textbf{b}) \quad 3x^2-5x+4=0.$$

SOLUZIONE: **a**) $x_{1,2}=\pm 2i$. **b**) $x_{1,2}=\frac{5\pm i\sqrt{23}}{6}$.

**3**) Dati i seguenti vettori

$$\mathbf{x}=\begin{bmatrix}1\\-\frac{1}{3}\\\frac{1}{4}\\4\end{bmatrix}, \qquad \mathbf{y}=\begin{bmatrix}\frac{2}{3}\\1\\\frac{3}{4}\\-10\end{bmatrix}, \qquad \mathbf{z}=\begin{bmatrix}1+4i\\i\\3-2i\end{bmatrix}, \qquad \mathbf{w}=\begin{bmatrix}3+2i\\2\\-1-4i\end{bmatrix}$$

calcolare le somme $\mathbf{x}+\mathbf{y}$, $\mathbf{z}+\mathbf{w}$.
SOLUZIONE: $\mathbf{x}+\mathbf{y}=\left[\frac{5}{3},\frac{2}{3},1,-6\right]^T$, $\quad \mathbf{z}+\mathbf{w}=[4+6i,2+i,2-6i]^T$.

**4**) Dati i seguenti vettori

$$\mathbf{x}=\begin{bmatrix}1\\-\frac{1}{3}\\\frac{1}{2}\end{bmatrix}, \qquad \mathbf{y}=\begin{bmatrix}1+4i\\i\\3-2i\end{bmatrix}, \qquad \mathbf{z}=\begin{bmatrix}-3\\5+2i\\1-i\end{bmatrix}, \qquad \mathbf{w}=\begin{bmatrix}\frac{2}{3}\\\frac{1}{6}\\0\\1\end{bmatrix}$$

calcolare le loro norme 1, 2 e $\infty$.
SOLUZIONE:
$\|\mathbf{x}\|_1=\frac{11}{6}$, $\quad \|\mathbf{x}\|_2=\frac{7}{6}$, $\quad \|\mathbf{x}\|_\infty=1$
$\|\mathbf{y}\|_1=\sqrt{17}+1+\sqrt{13}$, $\quad \|\mathbf{y}\|_2=\sqrt{31}$, $\quad \|\mathbf{y}\|_\infty=\sqrt{17}$
$\|\mathbf{z}\|_1=3+\sqrt{29}+\sqrt{2}$, $\quad \|\mathbf{z}\|_2=2\sqrt{10}$, $\quad \|\mathbf{z}\|_\infty=\sqrt{29}$
$\|\mathbf{w}\|_1=\frac{11}{6}$, $\quad \|\mathbf{w}\|_2=\frac{\sqrt{53}}{6}$, $\quad \|\mathbf{w}\|_\infty=1$

**5**) Date le matrici

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 0 & \frac{1}{2} & 0 & 2 & 1 \\ 3 & 5 & 2 & \frac{2}{3} & 0 \\ 1 & 0 & 0 & 2 & \frac{1}{2} \\ 6 & 7 & 8 & 9 & 10 \end{bmatrix}, \qquad B = \begin{bmatrix} 2 & 5 & 1 & 10 \\ 3 & 0 & 1 & 7 \\ 8 & 4 & 2 & 11 \end{bmatrix}, \qquad C = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \\ 0 & 1 \end{bmatrix}$$

ed i vettori

$$\mathbf{x} = \begin{bmatrix} 10 \\ 2 \\ 3 \\ 1 \\ 6 \end{bmatrix}, \qquad \mathbf{y} = \begin{bmatrix} 1 \\ 5 \\ 7 \\ 9 \\ 2 \end{bmatrix}, \qquad \mathbf{z} = \begin{bmatrix} 3 \\ 4 \\ 2 \\ 5 \end{bmatrix}$$

calcolare i prodotti $A\mathbf{x}$, $BC$, $C^T\mathbf{z}$, $\mathbf{x}^T\mathbf{y}$, $\mathbf{x}\mathbf{y}^T$.
SOLUZIONE:

$$A\mathbf{x} = \begin{bmatrix} 57 \\ 9 \\ \frac{140}{3} \\ 15 \\ 167 \end{bmatrix}, \qquad BC = \begin{bmatrix} 22 & 40 \\ 8 & 19 \\ 30 & 55 \end{bmatrix}, \qquad C^T\mathbf{z} = \begin{bmatrix} 25 \\ 39 \end{bmatrix},$$

$$\mathbf{x}^T\mathbf{y} = 62, \qquad \mathbf{x}\mathbf{y}^T = \begin{bmatrix} 10 & 50 & 70 & 90 & 20 \\ 2 & 10 & 14 & 18 & 4 \\ 3 & 15 & 21 & 27 & 6 \\ 1 & 5 & 7 & 9 & 2 \\ 6 & 30 & 42 & 54 & 12 \end{bmatrix}$$