# Matrix theory Assignment 1

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***Abstract*—This document contains the solution complex numbers problem.** Download all python codes from

https://github.com/sahilsin/MatrixTheory/Assignment1/codes

## 1 Problem

Convert the following in Polar form:

$$a)\frac{\begin{pmatrix}1\\7\end{pmatrix}}{\begin{pmatrix}2\\-1\end{pmatrix}^2} \tag{1.0.1}$$

$$b)\frac{\begin{pmatrix}1\\3\end{pmatrix}}{\begin{pmatrix}1\\-2\end{pmatrix}} \tag{1.0.2}$$

## 2 Solution

a) Below is the solution :

$$\frac{\begin{pmatrix}1\\7\end{pmatrix}}{\begin{pmatrix}2\\-1\end{pmatrix}^2} \tag{2.0.1}$$

$$\begin{pmatrix}2\\-1\end{pmatrix}^2 = \begin{pmatrix}2&1\\-1&2\end{pmatrix}\begin{pmatrix}2&1\\-1&2\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.2}$$

$$\implies \begin{pmatrix}2\\-1\end{pmatrix}^2 = \begin{pmatrix}3&4\\-4&3\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.3}$$

$$\implies \begin{pmatrix}2\\-1\end{pmatrix}^2 = \begin{pmatrix}3\\-4\end{pmatrix} \tag{2.0.4}$$

$$= \begin{pmatrix}1\\7\end{pmatrix}\begin{pmatrix}3\\-4\end{pmatrix}^{-1} \tag{2.0.5}$$

$$= \frac{1}{25}\begin{pmatrix}1&-7\\7&1\end{pmatrix}\begin{pmatrix}3&-4\\4&3\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.6}$$

$$= \frac{1}{25}\begin{pmatrix}-25&-25\\25&-25\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.7}$$

$$= \frac{25}{25}\begin{pmatrix}-1&-1\\1&-1\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.8}$$

$$= \sqrt{2}\begin{pmatrix}\frac{-1}{\sqrt{2}}&\frac{-1}{\sqrt{2}}\\\frac{1}{\sqrt{2}}&\frac{-1}{\sqrt{2}}\end{pmatrix} \tag{2.0.9}$$

$$= \sqrt{2}\begin{pmatrix}\cos 135^\circ&-\sin 135^\circ\\\sin 135^\circ&\cos 135^\circ\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.10}$$

$$= \sqrt{2}\begin{pmatrix}\cos 135^\circ\\\sin 135^\circ\end{pmatrix} \tag{2.0.11}$$

$$= \sqrt{2}\angle 135^\circ \tag{2.0.12}$$

b) Below is the solution:

$$\frac{\begin{pmatrix}1\\3\end{pmatrix}}{\begin{pmatrix}1\\-2\end{pmatrix}} \tag{2.0.13}$$

$$\begin{pmatrix}1\\-2\end{pmatrix} = \begin{pmatrix}1 & 2\\-2 & 1\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.14}$$

$$= \begin{pmatrix}1\\7\end{pmatrix}\begin{pmatrix}1\\-2\end{pmatrix}^{-1} \tag{2.0.15}$$

$$= \frac{1}{5}\begin{pmatrix}1 & -3\\3 & 1\end{pmatrix}\begin{pmatrix}1 & -2\\2 & 1\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.16}$$

$$= \frac{1}{5}\begin{pmatrix}-5 & -5\\5 & -5\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.17}$$

$$= \frac{5}{5}\begin{pmatrix}-1 & -1\\1 & -1\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.18}$$

$$= \sqrt{2}\begin{pmatrix}\frac{-1}{\sqrt{2}} & \frac{-1}{\sqrt{2}}\\\frac{1}{\sqrt{2}} & \frac{-1}{\sqrt{2}}\end{pmatrix} \tag{2.0.19}$$

$$= \sqrt{2}\begin{pmatrix}\cos 135^\circ & -\sin 135^\circ\\\sin 135^\circ & \cos 135^\circ\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.20}$$

$$= \sqrt{2}\begin{pmatrix}\cos 135^\circ\\\sin 135^\circ\end{pmatrix} \tag{2.0.21}$$

$$= \sqrt{2}\angle 135^\circ \tag{2.0.22}$$