Math Document Template

C ANISH

***Abstract*—This is a document explaining a question about the concept of solving equations using matrices.**

Download all python codes from

svn co https://github.com/chakki1234/summer−2020/trunk/linearalg/codes

and latex-tikz codes from

svn co https://github.com/chakki1234/summer−2020/trunk/linearalg/figs

1 Problem

Solve the following pair of equations:

$$\begin{aligned}\begin{pmatrix}a-b & a+b\end{pmatrix}\mathbf{x} &= a^2-2ab-b^2\\ \begin{pmatrix}a+b & a+b\end{pmatrix}\mathbf{x} &= a^2+b^2\end{aligned} \tag{1.0.1}$$

2 Solution

2.0.1. Vector form of the given equations:

$$\begin{pmatrix}a-b & a+b\\ a+b & a+b\end{pmatrix}\mathbf{x} = \begin{pmatrix}a^2-2ab-b^2\\ a^2+b^2\end{pmatrix} \tag{2.0.1.1}$$

2.0.2. To find $\mathbf{x}$:

$$\begin{pmatrix}a-b & a+b & a^2-2ab-b^2\\ a+b & a+b & a^2+b^2\end{pmatrix}$$

$$\xleftrightarrow[R_2\leftarrow\frac{R_2}{a+b}]{R_1\leftarrow\frac{R_1}{a-b}} \begin{pmatrix}1 & \frac{a+b}{a-b} & \frac{a^2-2ab-b^2}{a-b}\\ 1 & 1 & \frac{a^2+b^2}{a+b}\end{pmatrix} \tag{2.0.2.1}$$

$$\xleftrightarrow{R_2\leftarrow R_2-R_1} \begin{pmatrix}1 & \frac{a+b}{a-b} & \frac{a^2-2ab-b^2}{a-b}\\ 0 & \frac{-2b}{a-b} & \frac{4ab^2}{a^2-b^2}\end{pmatrix} \tag{2.0.2.2}$$

$$\xleftrightarrow{R_2\leftarrow\frac{-(a-b)R_2}{2b}} \begin{pmatrix}1 & \frac{a+b}{a-b} & \frac{a^2-2ab-b^2}{a-b}\\ 0 & 1 & \frac{-2ab}{a+b}\end{pmatrix} \tag{2.0.2.3}$$

$$\xleftrightarrow{R_1\leftarrow R_1-R_2} \begin{pmatrix}1 & 0 & a+b\\ 0 & 1 & \frac{-2ab}{a+b}\end{pmatrix} \tag{2.0.2.4}$$

$$\therefore \mathbf{x} = \begin{pmatrix}a+b\\ \frac{2ab}{a-b}\end{pmatrix} \tag{2.0.2.5}$$

The following Python code generates Fig. **??**

codes/triangle_ex/triangle_linearalg.py