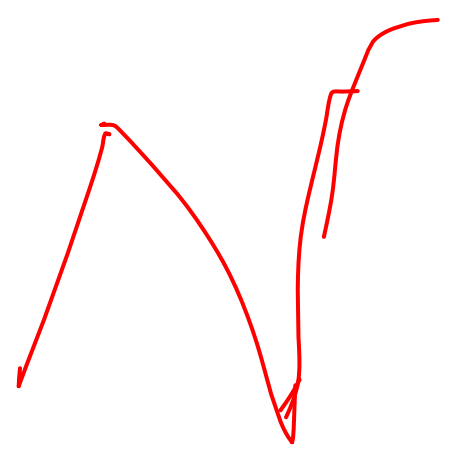
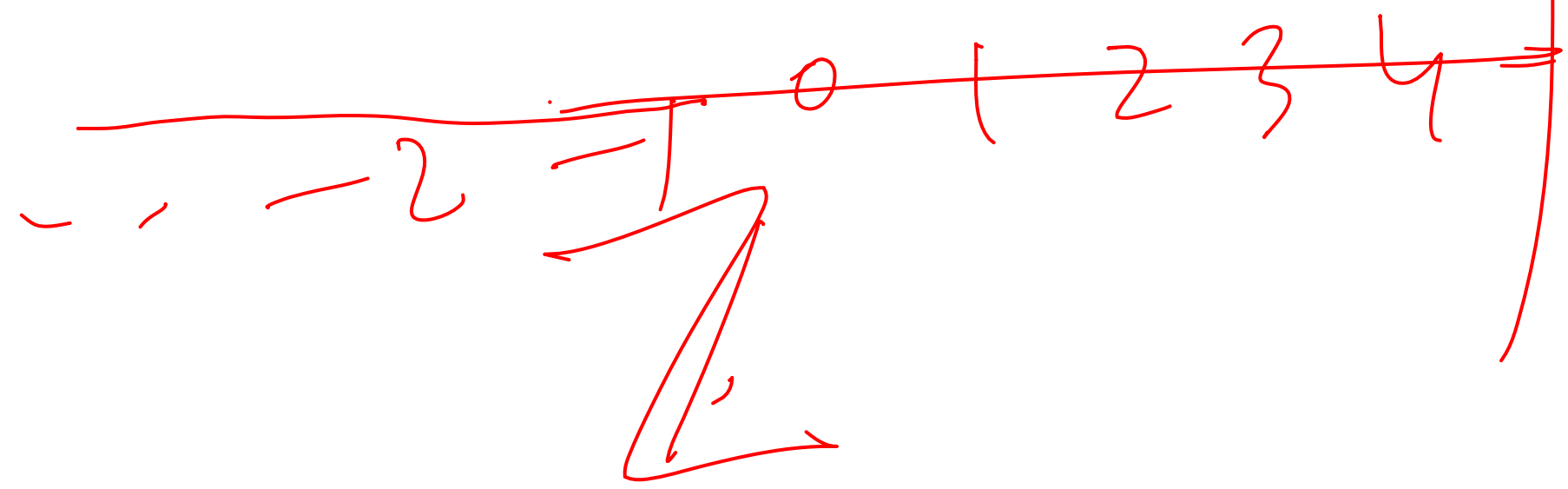


1, 2, 3, 1, 1, 5



$$ax + by = c$$

$$a, b, c \in \mathbb{N}$$



$$\mathbb{Q} = \left\{ \frac{p}{q} \mid p, q \in \mathbb{Z}, q \neq 0 \right\}$$

$$\mathbb{R} = \mathbb{Q} \cup \mathbb{Q}$$

$n^2 + 1 = 0$

$$\mathbb{C} = \left\{ a + ib \mid a, b \in \mathbb{R} \right\}$$

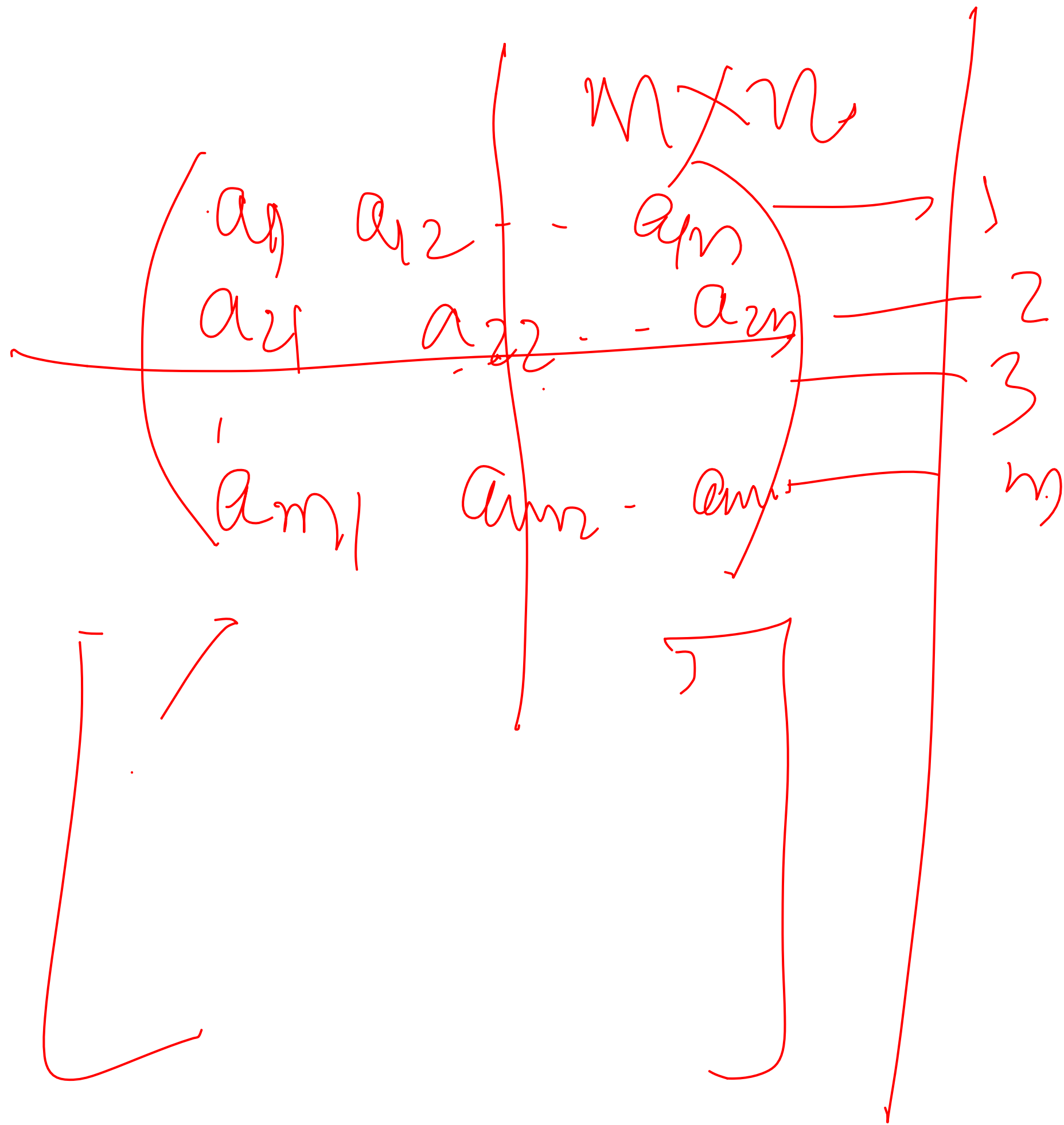
$$\mathbb{N} \subseteq \mathbb{Z} \subseteq \mathbb{Q} \subseteq \mathbb{R} \subseteq \mathbb{C}$$

$a \in \mathbb{N}$ $b \in \mathbb{N}$

$$b = \frac{1}{a} \quad a + b = 0 \quad a + by = c$$

$a \in \mathbb{Z}$ $b \in \mathbb{Z}$ $b = -a$

$a - b = 1$



a_{ij}

$$A = (a_{ij})_{m \times n}$$

$\alpha \in \mathbb{R}$

$$\alpha A = (\alpha a_{ij})$$

αA

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ \vdots & \vdots & & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}$$
$$\alpha A = \begin{pmatrix} \alpha a_{11} & \alpha a_{12} & \dots & \alpha a_{1n} \\ \vdots & \vdots & & \vdots \\ \alpha a_{m1} & \alpha a_{m2} & \dots & \alpha a_{mn} \end{pmatrix}$$

A
 $m \times n$

B
 $m \times n$

$C = (c_{ij})$
 $c_{ij} = a_{ij} b_{ij}$

$A = (a_{ij})$
 $m \times n$

$B = (b_{ij})$
 $m \times n$

$AB =$

$(a_{1B}, a_{2B}, \dots, a_{nB})$
 $(a_{mB}, a_{nB}, \dots, a_{nB})$

$A_{m \times n}$

$B_{n \times k}$

$$C = A \cdot B = (c_{ij})$$

$c_{ij} = \sum_{k=1}^n a_{ik} b_{kj}$

c_{ij} is the dot product of row i of A and column j of B .

A, B, C

$$(A+B)+C = A+(B+C)$$

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \quad 2 \times 3$$

$$B = \begin{pmatrix} a \\ b \\ c \end{pmatrix} \quad 3 \times 1$$

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \quad A$$

$$\begin{pmatrix} 2 & 3 \\ 0 & 0 \end{pmatrix} \quad B$$

$$\begin{pmatrix} a+2b+3c \\ 4a+5b+6c \end{pmatrix}$$

$$\begin{matrix} A+B & = & 20 \\ A \cdot B & = & 20 \end{matrix} \quad ?$$

$$A \cdot (B + C)$$

A, B, C

$$= A \cdot B + A \cdot C$$

$$\begin{pmatrix} 0 & p & r \\ 0 & q & s \end{pmatrix}$$

$$A = (a_{ij})_{m \times m}$$

Square matrix

$$A = (a_{ij})_{m \times m}$$

upper triangular

$$A = (a_{ij})_{m \times n}$$

$$A = (a_{ij})_{m \times m}$$

$$B = A^T = (b_{ij})_{n \times m}$$

called symmetric

$$b_{ij} = a_{ji}$$
$$B^T = A$$

$$A = A^T$$

Skew-symmetric

$$A = -A^T$$

