

1. Tell me about vectors.

Vectors are the greatest things ever! We might write them with a little arrow, like \vec{x} , or we might write them boldface like \mathbf{x} . We might even decide to write them with components, like

$$\vec{e}_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} \in \mathbb{R}^4.$$

2. Tell me about matrices.

Matrices are also great! They sure do take up a lot of space on the page though, so it's useful to give them names. For example,

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} -1 & 2 & 3 \\ 4 & -5 & 6 \\ 7 & 8 & -9 \end{bmatrix}.$$

Then we can write matrix equations easily, like $AB\vec{x} = B^{-1}A^T\vec{y}$.

We might want to write row operations:

$$\begin{aligned} & \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \xrightarrow{R_2 \rightarrow R_2 - 4R_1} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 & -6 \\ 7 & 8 & 9 \end{bmatrix} \\ & \xrightarrow{R_3 \rightarrow R_3 - 7R_1} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 & -6 \\ 0 & -6 & -12 \end{bmatrix} \xrightarrow{R_2 \leftrightarrow R_3} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -6 & -12 \\ 0 & -3 & -6 \end{bmatrix}. \end{aligned}$$

3. Show me some *complicated* “notation.”

Well, we can do sums like $\sum_{i=1}^{\infty} x_i$ and fractions like $\frac{4+z}{\sqrt{3}}$. We can also make our brackets scale to fit the contents inside:

$$\left(17\vec{x} - \sum_{i=-10}^{10^9} \frac{4\pi\vec{e}_i}{3} \right).$$

We can also do set notation, but we have to escape our curly braces:

$$V = \{x \in \mathbb{Z} : 5 \leq x \leq 12 \text{ or } x^2 \geq 200\}.$$

There are also special symbols for \mathbb{R} , \mathbb{Z} , and \mathbb{N} and we can pick some fancy fonts if we want others like \mathcal{F} or \mathcal{G} or \mathfrak{W} or \mathfrak{L} . For instance, maybe we want to write $\mathcal{L} : \mathbb{R}^n \rightarrow \mathbb{R}^m$. We can also write fun greek letters like α , β , γ , δ , and their capital letters like Γ and Δ .