1. Tell me about vectors.

   Vectors are the greatest things ever! We might write them with a little arrow, like $\vec{x}$, we might write them boldface like $\mathbf{x}$, or we might write them with hats $\hat{x}$. 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,

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

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

   We might want to write row operations:

   $$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \xrightarrow{R_2 \to R_2 - 4R_1} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 & -6 \\ 7 & 8 & 9 \end{bmatrix}$$

   $$\xrightarrow{R_3 \to R_3 - 7R_1} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 & -6 \\ 0 & -6 & -12 \end{bmatrix} \xrightarrow{R_2 \leftrightarrow R_3} \begin{bmatrix} 1 & 2 & 3 \\ 0 & -6 & -12 \\ 0 & -3 & -6 \end{bmatrix}.$$

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 $\mathcal{L} : \mathbb{R}^n \to R^m$. We can also write fun greek letters like α, β, γ, δ, and their capital letters like Γ and Δ.