Programming Assignment 0: LaTeX Practice

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Collaborators: None

Resources: None

Problem 1: I cannot live without...

"I've Seen Things You People Wouldn't Believe. Attack Ships On Fire Off The Shoulder Of Orion. I Watched C-Beams Glitter In The Dark Near The Tannhauser Gate. All Those Moments Will Be Lost In Time, Like Tears In Rain."

Problem 2: Express yourself (mathematically)

The main reason for using LaTeXthis semester is to present math more neatly and clearly. There are two main ways to include math in your documents. The first is inline math, which you use when you want to include math among regular English text. This is done by putting your math between $ symbols. For example, the statement "if $x \in \mathbb{N}$ then $S \neq \emptyset$" is produced using inline text. For each line below, add on the mathematical symbol/expression we've described using inline text. The first two are done for you.

– The symbol for set membership: $\in$

– The fraction one half: $\frac{1}{2}$

– The expression square root of 2: $\sqrt{2}$

– The fraction 1 divided by the square root of 2:$\frac{1}{\sqrt{2}}$

– The mathematical symbol pi:Π

– The expression "S is a subset of the real numbers":$S \subseteq \mathbb{R}$

– The expression "the empty set is a proper subset of the rational numbers":$\varnothing \subset \mathbb{Q}$

Problem 3: The Finest Gambit

> *Reductio ad absurdum*, which Euclid loved so much, is one of a mathematician's finest weapons. It is a far finer gambit than any chess play: a chess player may offer the sacrifice of a pawn or even a piece, but a mathematician offers the game. [Excerpt from *A Mathematician's Apology*, G.H. Hardy, 1940, p. 94]

Learn how to write math and construct proofs by reproducing the proof that $\sqrt{2}$ is irrational. Try to make it look exactly like the example proof. You will need to use the “align” environment, as well as the “align*” environment.

Definition 1 A rational number is a fraction ab where a and b are integers.

Show $\sqrt{2}$ is irrational
Proof.
For a rational number $\frac{a}{b}$, without loss of generality we may suppose that a and b are integers which share no common factors, as otherwise we could remove any common factors (i.e. suppose $\frac{a}{b}$ is in simplest terms). To say $\sqrt{2}$ is irrational is equivalent to say that 2 cannot be expressed in the form $(\frac{a}{b})^2$. Equivalently, this says that there are no integer values for a and b satisfying

$$a^2 = 2b^2 \tag{1}$$

We argue by reductio ad absurdum (proof by contradiction). Assume toward reaching a contradiction that Equation 1 holds for a and b being integers without any common factor between them. It must be that a^2 is even, since $2b^2$ is divisible by 2, therefore a is even. If a is even, then for some integer c

$$\begin{align} a &= 2c \tag{2}\\ a^2 &= (2c)^2 \tag{3}\\ 2b^2 &= 4c^2 \tag{4}\\ b^2 &= 2c^2 \tag{5} \end{align}$$

therefore, b is even. This implies that a and b are both even, and thus share a common factor of 2. This contradicts our hypothesis, therefore our hypothesis is false.

Problem 4: Vanity

Learn how to include drawings in your documents with the “`\includegraphics {image}`” command by submitting a caricature of Professor Brunelle. (Any image will do, but the best caricatures will receive special recognition...and fun!)