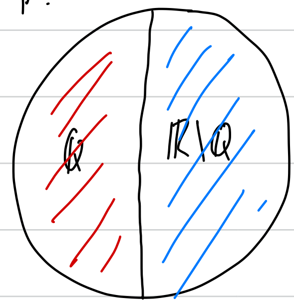
#2 $\mathbb{R}\setminus\mathbb{Q}$ $\mathbb{R}$:



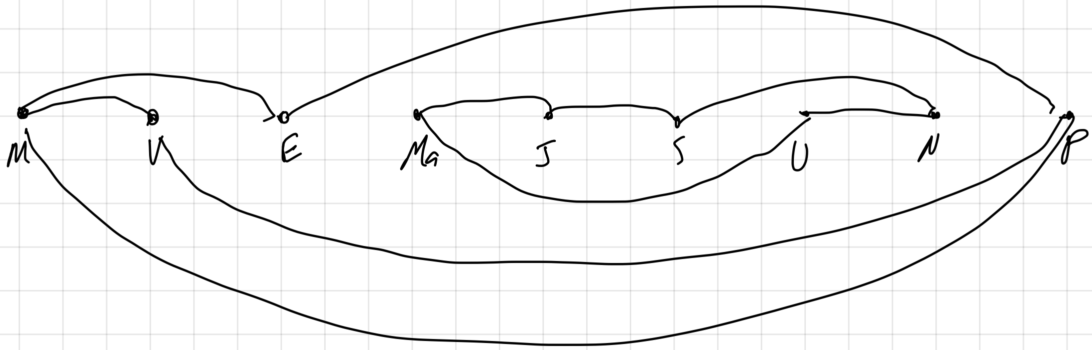
Hint: Proceed by contradiction,
- assume the statement holds, and
show that irrational = rational

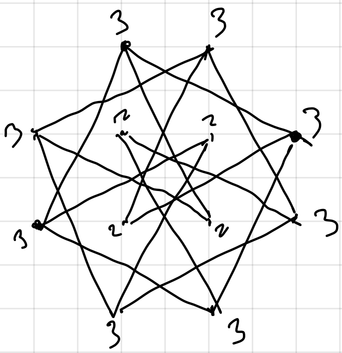
Claim: There is no smallest positive rational number.

Proof: Proceed by contradiction. Assume N is the smallest positive rational.
We know that $N \in \mathbb{Q}$, $N > 0$, $N < r \ \forall r \in \mathbb{Q}$, $r \neq N$. $\boxed{1}$ (definitions)
However, $\frac{1}{2} \cdot N < N$, and $\frac{1}{2} \cdot N \in \mathbb{Q}$. $\lightning$ $\boxed{2}$ (contradiction)

Claim: The sum of a rational and an irrational cannot be rational. (is irrational)

Let $x \in \mathbb{Q}$, $y \in \mathbb{R}\setminus\mathbb{Q}$. Assume $x + y = z$, where $z \in \mathbb{Q}$. $\boxed{1}$ (definitions)
$\Rightarrow y = z - x$. Since $z \in \mathbb{Q}$, $x \in \mathbb{Q}$ $\boxed{2}$ (manipulation)
$\boxed{\text{But, } z - x \in \mathbb{Q}}$, a contradiction $\lightning$. $\boxed{3}$ (contradiction)





$2E = D$

$V = \{A, B, C \ldots\}$

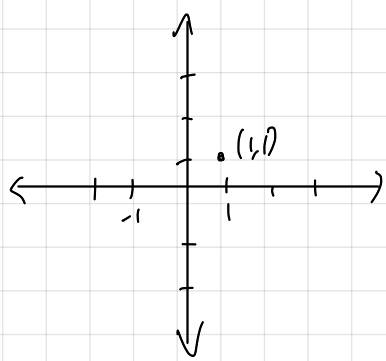
$V \times V \quad = (A, B)$

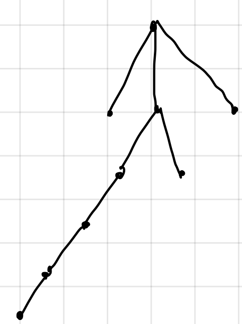
$\mathbb{N} \times \mathbb{N}$

$\boxed{\mathbb{R} \times \mathbb{R}}$ $\underline{(x, y)}$, $x \in \mathbb{R}$, $y \in \mathbb{R}$

$(1, 1) \in \mathbb{R} \times \mathbb{R}$

$\in \mathbb{N} \times \mathbb{N}$





$$
\begin{array}{ccccccccccc}
 & & & & & 1 & & & & & \\
 & & & & 1 & & 1 & & & & \\
 & & & 1 & & 2 & & 1 & & & \\
 & & 1 & & 3 & & 3 & & 1 & & \\
 & 1 & & 4 & & 6 & & 4 & & 1 & \\
1 & & 5 & & 10 & & 10 & & 5 & & 1
\end{array}
$$

$$\leftarrow \binom{3}{0} \; \binom{3}{1} \; \binom{3}{2} \; \binom{3}{3}$$

$$\binom{4}{0} \; \binom{4}{1} \; \binom{4}{2} \; \binom{4}{3} \; \binom{4}{4}$$

$$\frac{n!}{(n-k)!k!}$$

$$(x+y)^3 = (x^2+2xy+y^2)(x+y)$$

$$(x^3+2x^2y+y^2x+x^2y+2xy^2+y^3)$$

$$(x^3+3x^2y+3xy^2+y^3)(x+y)$$

N

what's the coefficient of x^3y^6 of

$\binom{n}{k}$ nCr(n,k)

$2^2 \cdot 3 \cdot 5$ $(2x+6y)^{27}$

$$\binom{n}{k}$$

$$\binom{n}{0} \to 0 \qquad \binom{n}{n}$$

$$\frac{n!}{(n-(n-k))!\,(n-k)!}$$

$$\binom{n}{k} = \binom{n}{n-k}$$

$$k!\,(n-k)!$$