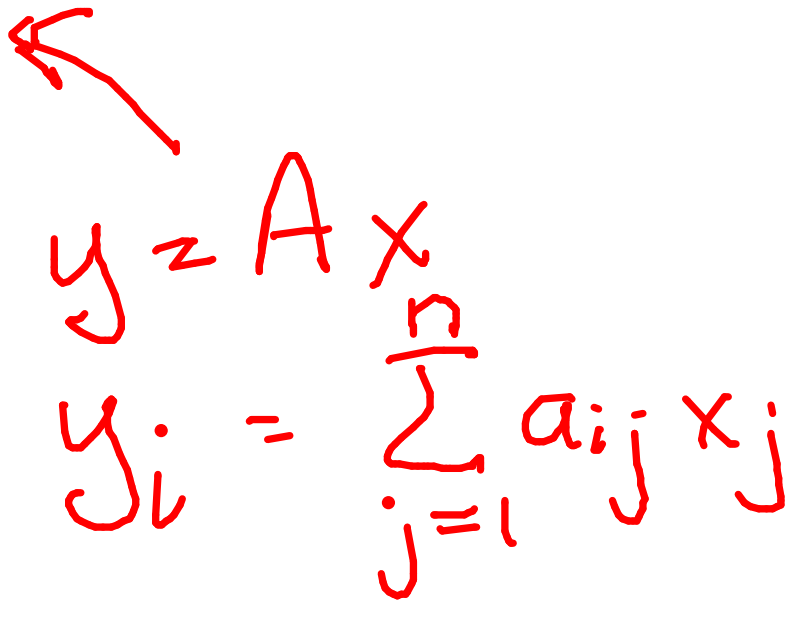
Implementation

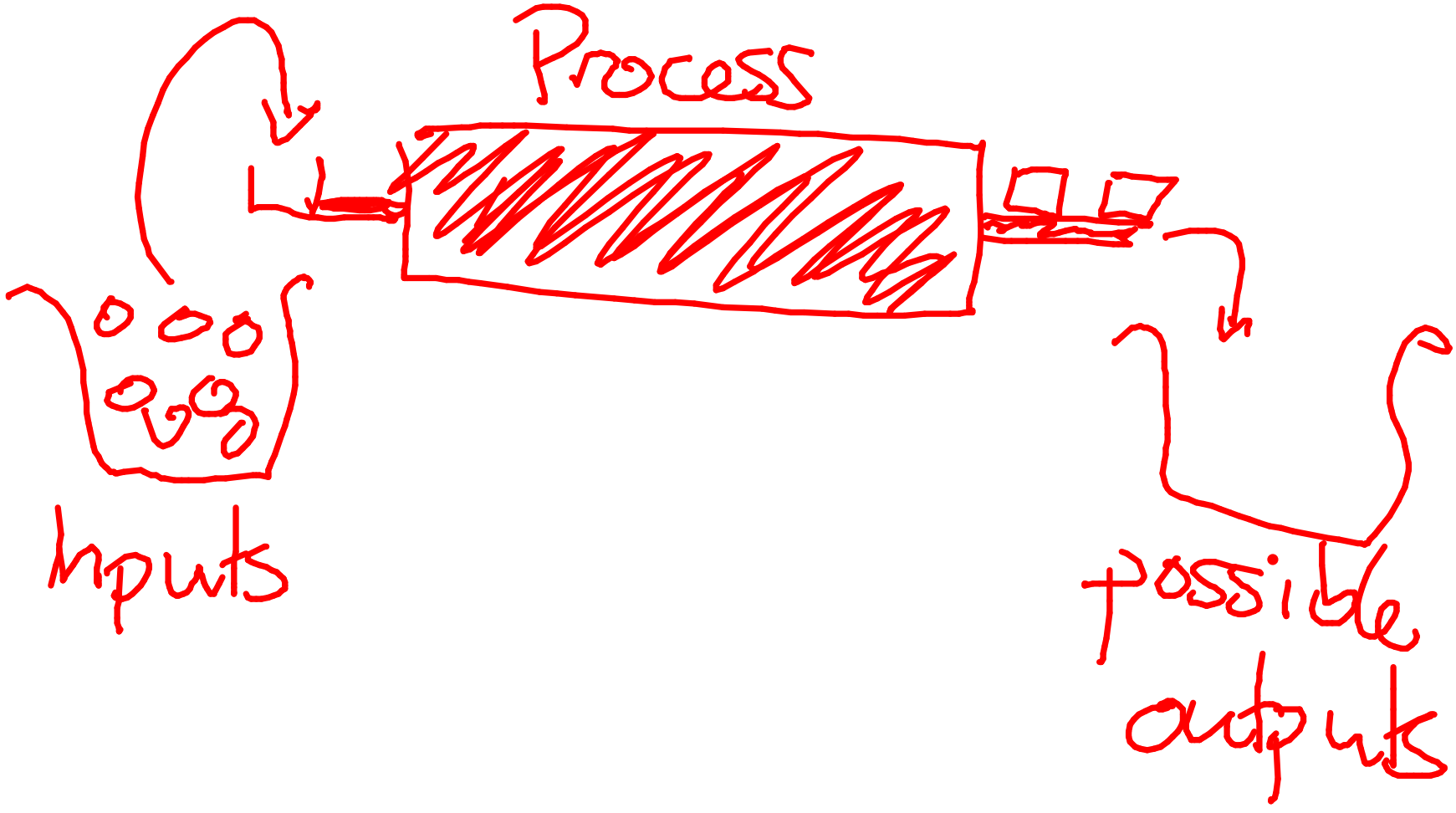
```
apply_matrix_A (x)
{

  for (i=1; i<=m; i++) {
     y.i = 0;
     for (j=1; j<=n; j++) {
       y.i += A.i.j*x.j;
       }
     }
  }
  return y;
}
```



Implementation

```
vector apply_matrix_A (vector x)
{
  vector y;
  for (i=1; i<=m; i++) {
     y.i = 0;
     for (j=1; j<=n; j++) {
       y.i += A.i.j*x.j;
       }
     }
  }
  return y;
}
```


Process
Inputs
possible
outputs

Structure Reveals Structure

Idea

Use structure of $\mathbb{R}^n$ to study matrices.

Structure on $\mathbb{R}$

Add
Subtract
Multiply
Divide
Modulo Stuff
Exponentiate

Logs
Roots
Compare

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} + \begin{bmatrix} \pi \\ e \\ e^{\pi} \end{bmatrix} = \begin{bmatrix} 1+\pi \\ 2+e \\ 3+e^{\pi} \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 2 \end{bmatrix} + \begin{bmatrix} 3 \\ 4 \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \end{bmatrix} = \begin{bmatrix} 3+1 \\ 4+2 \end{bmatrix}$$

$$= \begin{bmatrix} 3 \\ 4 \end{bmatrix} + \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$