

30.07.2025

SOLVING LINEAR EQUATIONS

1. Substitution (Method 1)

a. $x + y = 6 \rightarrow x = 6 - y$

$$2x + 3y = 16$$

$$2(6 - y) + 3y = 16$$

$$12 - 2y + 3y = 16$$

$$y = 16 - 12 = 4$$

$$x = 6 - y = 6 - 4 = 2$$

$$(x, y) = (2, 4)$$

b. $-x + 4y = 0 \rightarrow x = 4y$

$$2x - 5y = -6$$

$$2(4y) - 5y = -6$$

$$8y - 5y = -6$$

$$3y = -6$$

$$y = -2$$

$$x = 4y = 4(-2) = -8$$

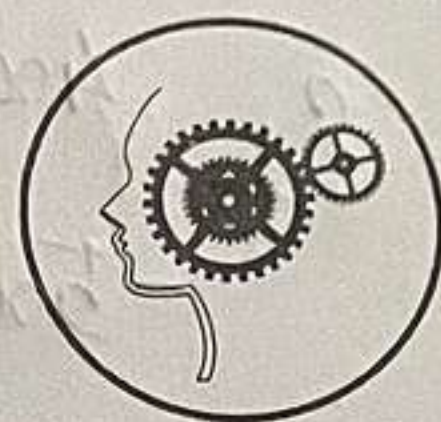
$$(x, y) = (-8, -2)$$

$$c. \quad y = 4x + 1$$

$$-4x + y = 2$$

$$-4x + (4x + 1) = 2$$

$$1 = 2 \quad \left(\begin{array}{l} \text{No Solution} \\ \text{Parallel lines} \end{array} \right)$$



2. Elimination (Method 2)

$$a. \quad \begin{array}{rcl} 4x - 3y = 25 & \rightarrow & 12x - 9y = 75 \\ -3x + 8y = 10 & \rightarrow & + -12x + 32y = 40 \end{array}$$

$$23y = 115$$

$$y = 5$$

$$4x - 3y = 25$$

$$4x - 3(5) = 25$$

$$x = \frac{25 + 15}{4} = 10$$

$$(x, y) = (10, 5)$$

$$b. \quad \begin{array}{rcl} -9x - 15y = -15 & \rightarrow & -9x - 15y = -15 \\ 3x + 5y = -10 & \rightarrow & + 9x + 15y = -30 \end{array}$$

$$0 = -45$$

Ans: No Solution

Jill designs solar panels as a hobby.

On April 1st, Jill's "Mark I" design begins generating power: 1 kJ/day.

On May 1st, her "Mark II" design begins generating 4 kJ of power per day.

1. What day is it when Jill's Mark II design has generated as much total energy as the Mark I design?
2. How much total energy have both generated by that day?
3. What would the solutions to (1.) and (2). be if Mark II design generated 1kJ of power per day?

$$\begin{array}{rcl}
 \text{c. } 4x + 2y = 4 & \rightarrow & 20x + 10y = 20 \\
 -5x - 3y = -7 & \rightarrow & -20x - 12y = -28 \\
 \hline
 & & -2y = -8 \\
 & & y = 4
 \end{array}$$

$$\begin{array}{l}
 4x + 2y = 4 \\
 4x + 2(4) = 4
 \end{array}$$

$$x = \frac{4 - 8}{4} = -1$$

$$(x, y) = (-1, 4)$$

31.07.2025

Question: Energy generation by solar panels

Answer:

Let, E_1 & E_2 be the total energy generated by 'Mark I' & Mark 'II' design.

Let D be the no. of days energy generated

$$1. \quad E_1 = 30 + D$$

$$E_2 = 4D$$

$$E_1 = E_2$$

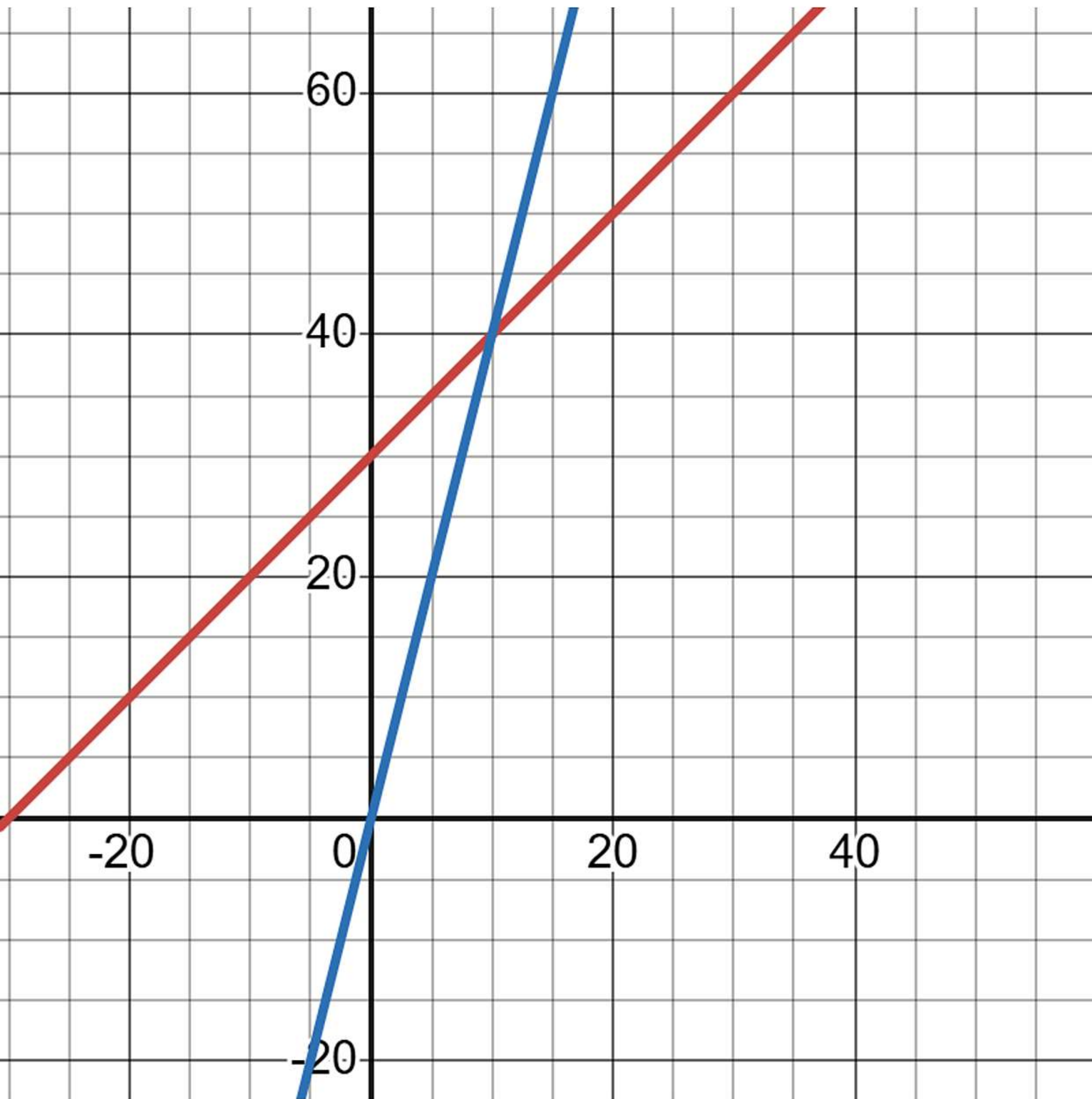
$$30 + D = 4D$$

$$D = 10 \text{ days}$$

\therefore Starting from April 1st

$$E_2 = 4D = 40 \text{ days}$$

Ans 1: May 10th



Exercises

1. What is the transpose of this vector?

$$\begin{bmatrix} 25 \\ 2 \\ -3 \\ -23 \end{bmatrix}$$

2. Using algebraic notation, what are the dimensions of this matrix Y ?

$$Y = \begin{bmatrix} 42 & 4 & 7 & 99 \\ -99 & -3 & 17 & 22 \end{bmatrix}$$

3. Using algebraic notation, what is the position of the element in this matrix Y with the value of 17?

$$\begin{aligned}
 2. \text{ Total Energy} &= E_1 + E_2 \\
 &= (30 + D) + 4D \\
 &= (30 + 10) + 4(10) \\
 &= 40 + 40 \\
 &= \boxed{80 \text{ KJ}}
 \end{aligned}$$



$$\begin{aligned}
 3. \text{ The equation for } E_2, \\
 E_2 &= D
 \end{aligned}$$

$$\therefore E_1 = E_2$$

$$30 + D = D$$

$$30 \neq 0 \quad \text{No Solution}$$

\therefore Mark I & Mark II will never generate the same amount of energy.

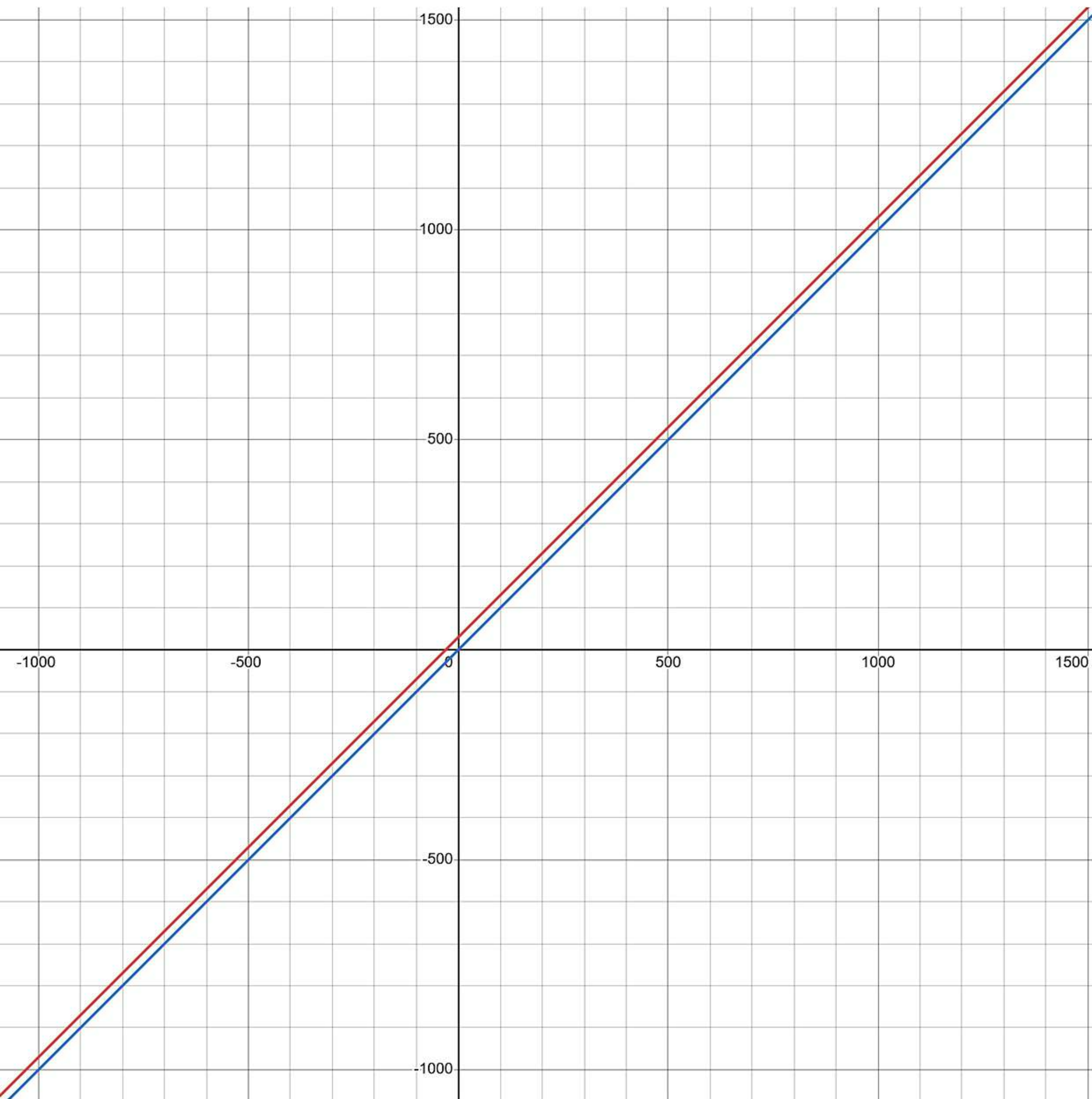
04.08.2025.

$$1. [25 \quad 2 \quad -3 \quad -23]$$

$$2. Y = \begin{bmatrix} 42 & 4 & 7 & 99 \\ -99 & -3 & 17 & 22 \end{bmatrix}$$

Dimensions = $Y_{2 \times 4}$

$$3. \text{ Position of } 17 \rightarrow Y_{23}$$



Exercises

1. What is Y^T ?

$$Y = \begin{bmatrix} 42 & 4 & 7 & 99 \\ -99 & -3 & 17 & 22 \end{bmatrix}$$

2. What is the Hadamard product of these matrices?

$$\begin{bmatrix} 25 & 10 \\ -2 & 1 \end{bmatrix} \odot \begin{bmatrix} -1 & 7 \\ 10 & 8 \end{bmatrix}$$

08.08.2025

$$1. Y = \begin{bmatrix} 42 & 4 & 7 & 99 \\ -99 & -3 & 17 & 22 \end{bmatrix}$$

$$Y^T = \begin{bmatrix} 42 & -99 \\ 4 & -3 \\ 7 & 17 \\ 99 & 22 \end{bmatrix}$$

$$2. \begin{bmatrix} 25 & 10 \\ -2 & 1 \end{bmatrix} \cdot \begin{bmatrix} -1 & 7 \\ 10 & 8 \end{bmatrix} = \begin{bmatrix} -25 & +70 \\ -20 & 8 \end{bmatrix}$$