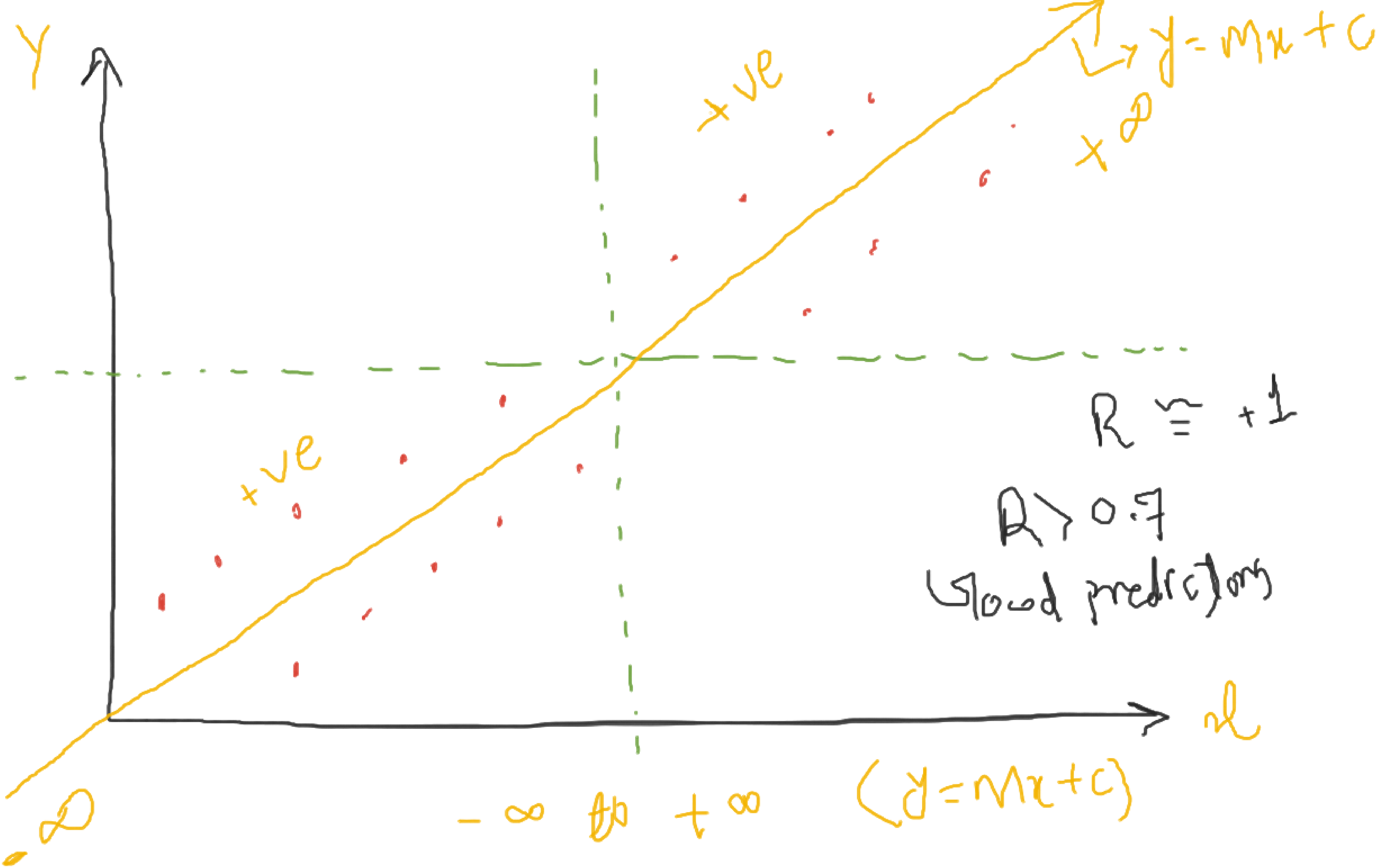
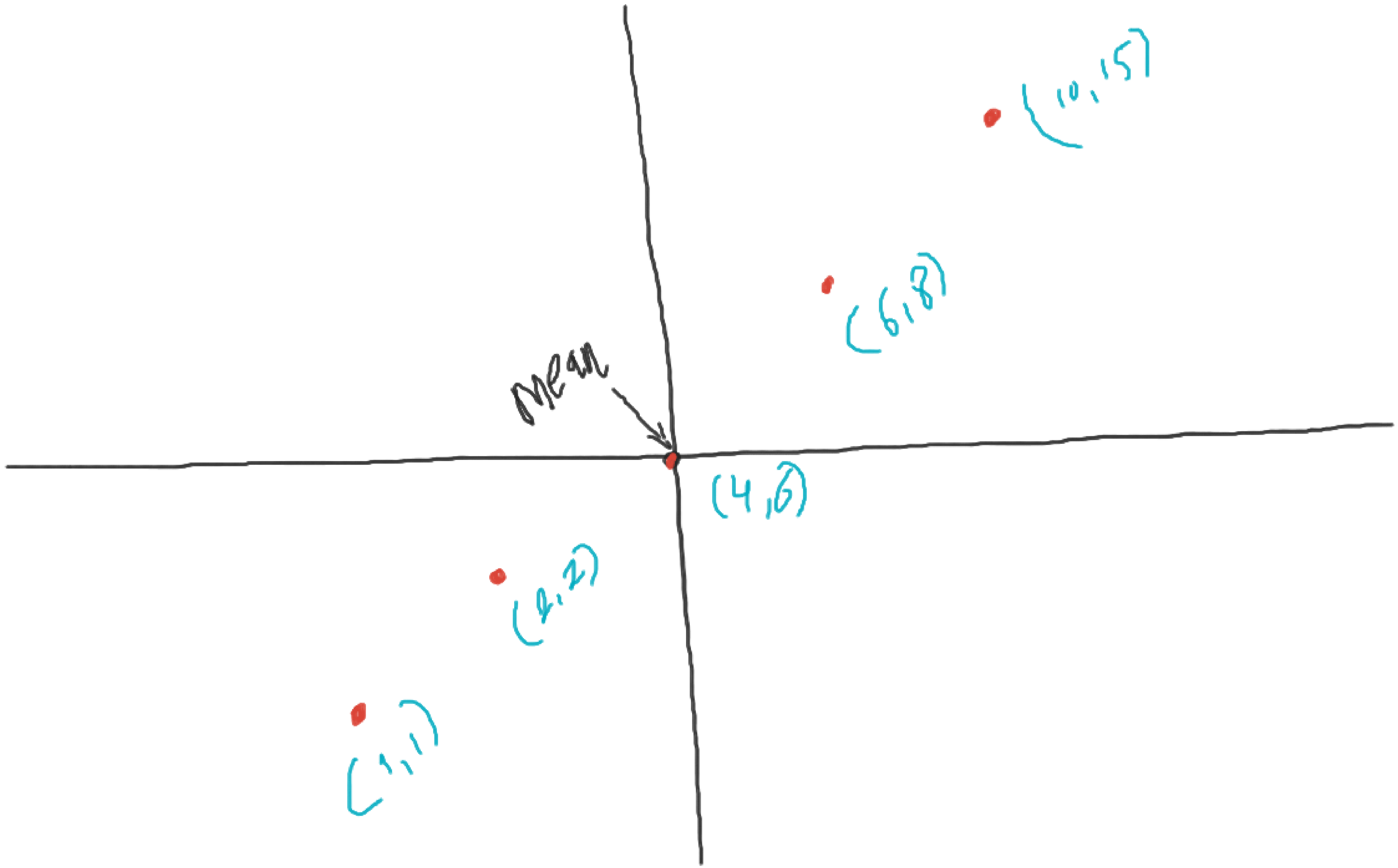
$$r_{xy} = \frac{\sum (x_i - \bar{x}) \cdot (y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \cdot \sum (y_i - \bar{y})^2}} = \frac{\mathrm{cov}}{\mathrm{std}}$$


Y
y = mx + c
+ve
+∞
+ve
R ≅ +1
R > 0.7
Good predictions
x
-∞
-∞ to +∞
(y = mx + c)


(10, 15)
(6, 8)
Mean
(4, 6)
(2, 2)
(1, 1)

$(2,12)$

$(6,8)$

$(10,15)$

$$(1,1) \quad \& \quad (4,6)$$
$$\;\; x_i \;\; y_i \qquad\quad \bar{x} \;\; \bar{y}$$

$$-3 \times 5 = 15$$
$$-2 \times -4 = 8$$
$$2 \times 2 = 4$$
$$6 \times 9 = 54$$

$$\sum \left\{ \underline{(x_i - \bar{x})} \cdot \underline{(y_i - \bar{y})} \right\}$$

$$\Sigma \; ?$$

$$= 81$$

$$\sqrt{\sum(x_i-\bar{x})^2 \cdot \sum(y_i-\bar{y})^2}$$

$$= 9+4+4+36 = 53$$

$$= 25+16+4+81 = 126$$

$$= \sqrt{53}\,\sqrt{126} = 7 \times 12$$

$$= 84$$

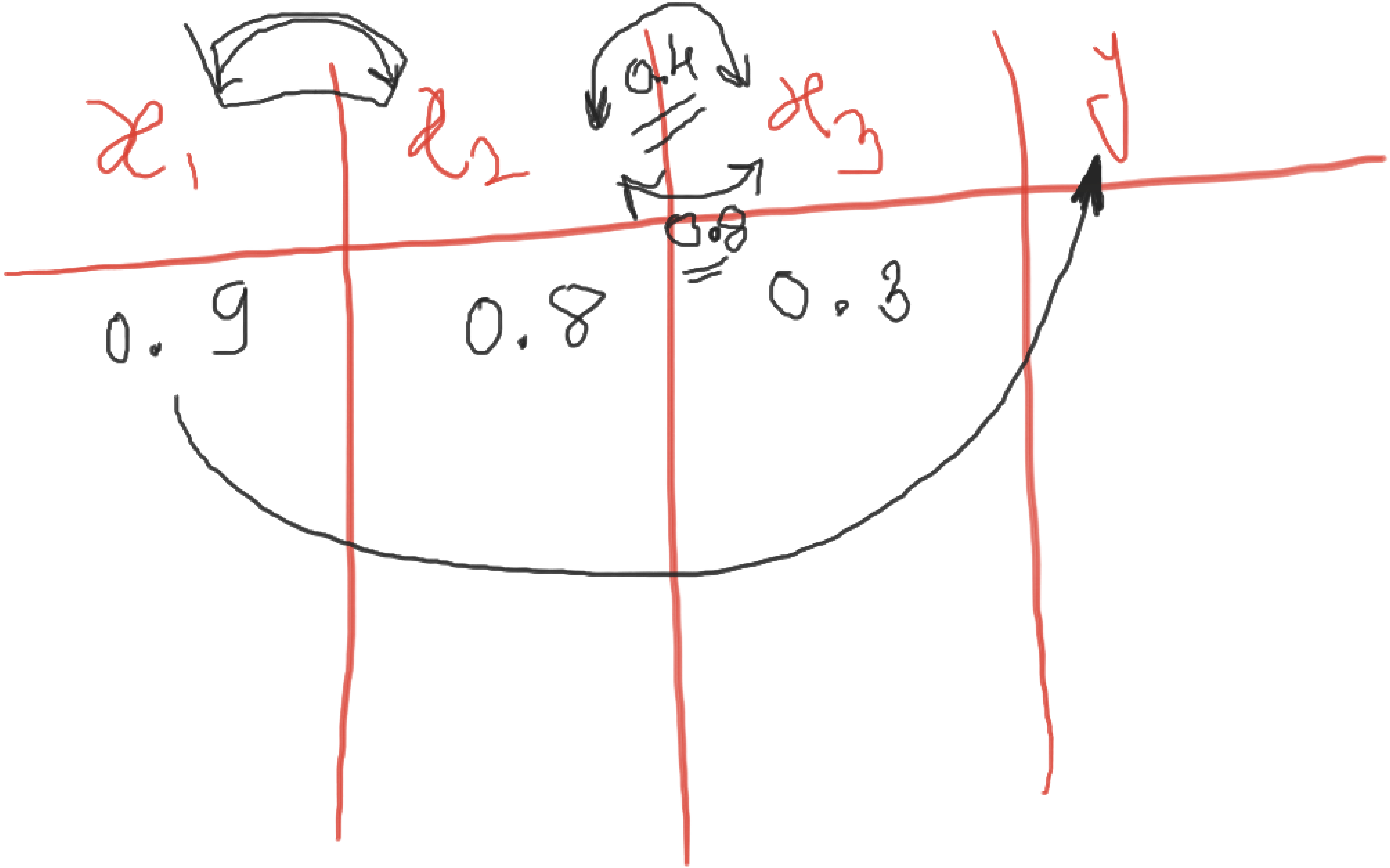
$$r_{xy} = \frac{Cov}{Std} = \frac{81}{84} = \underline{\underline{0.96}}$$

Coefficient of correlation (r_{xy}) is in a specific range

II Independence :-

x_1	x_2	x_3	x_4	y

$R = 0.9$



x1
x2
x3
y
0.4
0.8
0.9
0.8
0.3

0.98

x_1	x_2	x_3	y

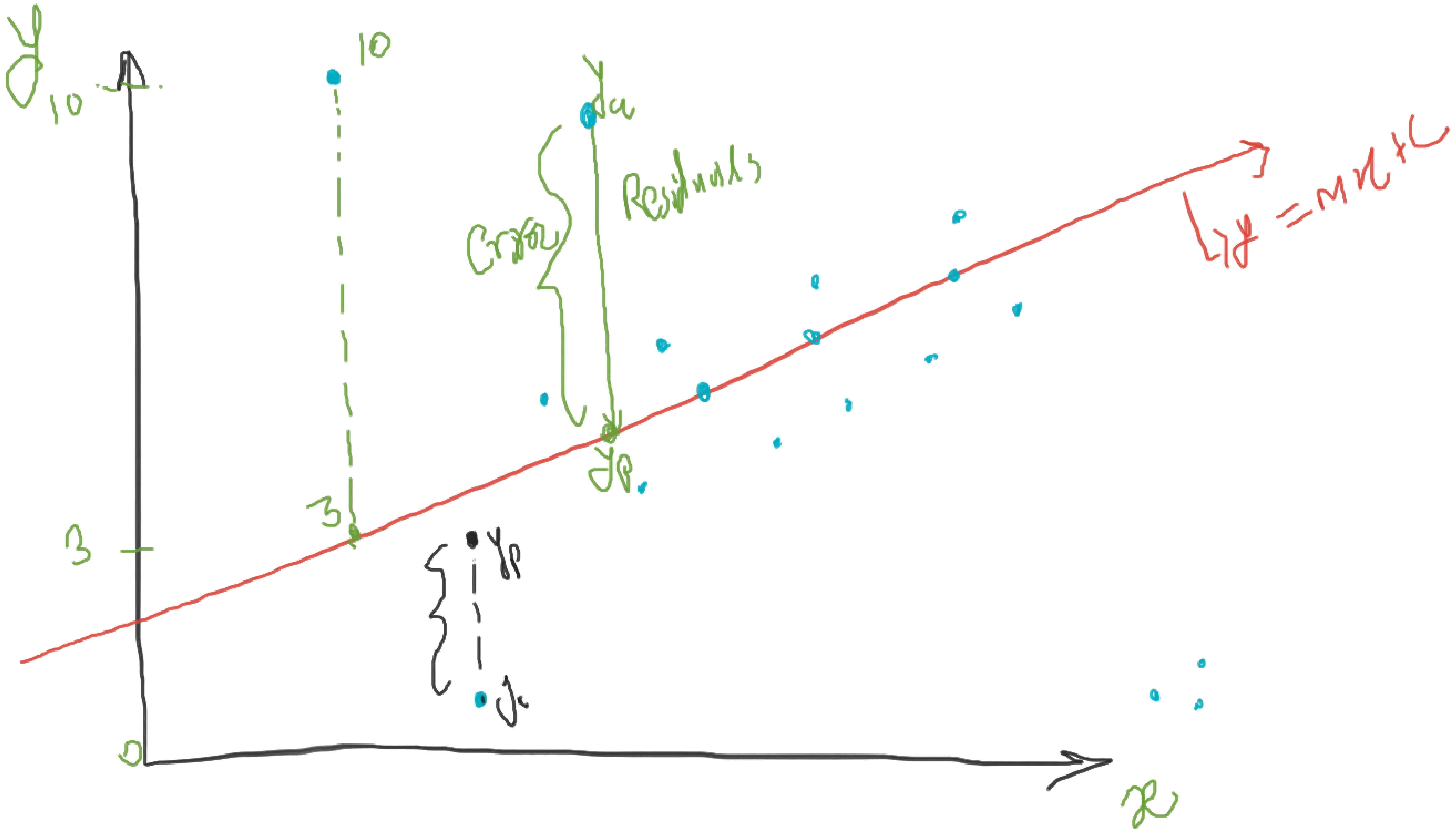
$x = \underline{\underline{x_1 + x_2}}$

x_{11}

x	x_3	y

No Multicolinearity :- Input Variables should not

be highly correlated. to each other



y
10
10
ya
Residuals
Error
y = mx+c
yp
3
3
yp
ya
0
x

Gradient Descent :-

$$f(x) = x^2 y$$

$$\frac{\partial f(x)}{\partial x} = \underline{\underline{2xy}} \rightarrow \text{Constant}$$

$$f(x) = 100x + 5$$

$$\frac{\partial f(x)}{\partial x} = 100$$

MSE / Cost func $= \sum (y_i - y_p)^2 / N$

N = Number of samples

$y = mx + c$

$y_p = mx + c$

$$= (y_a - y_p)^2 = (y_i - y_p)^2$$

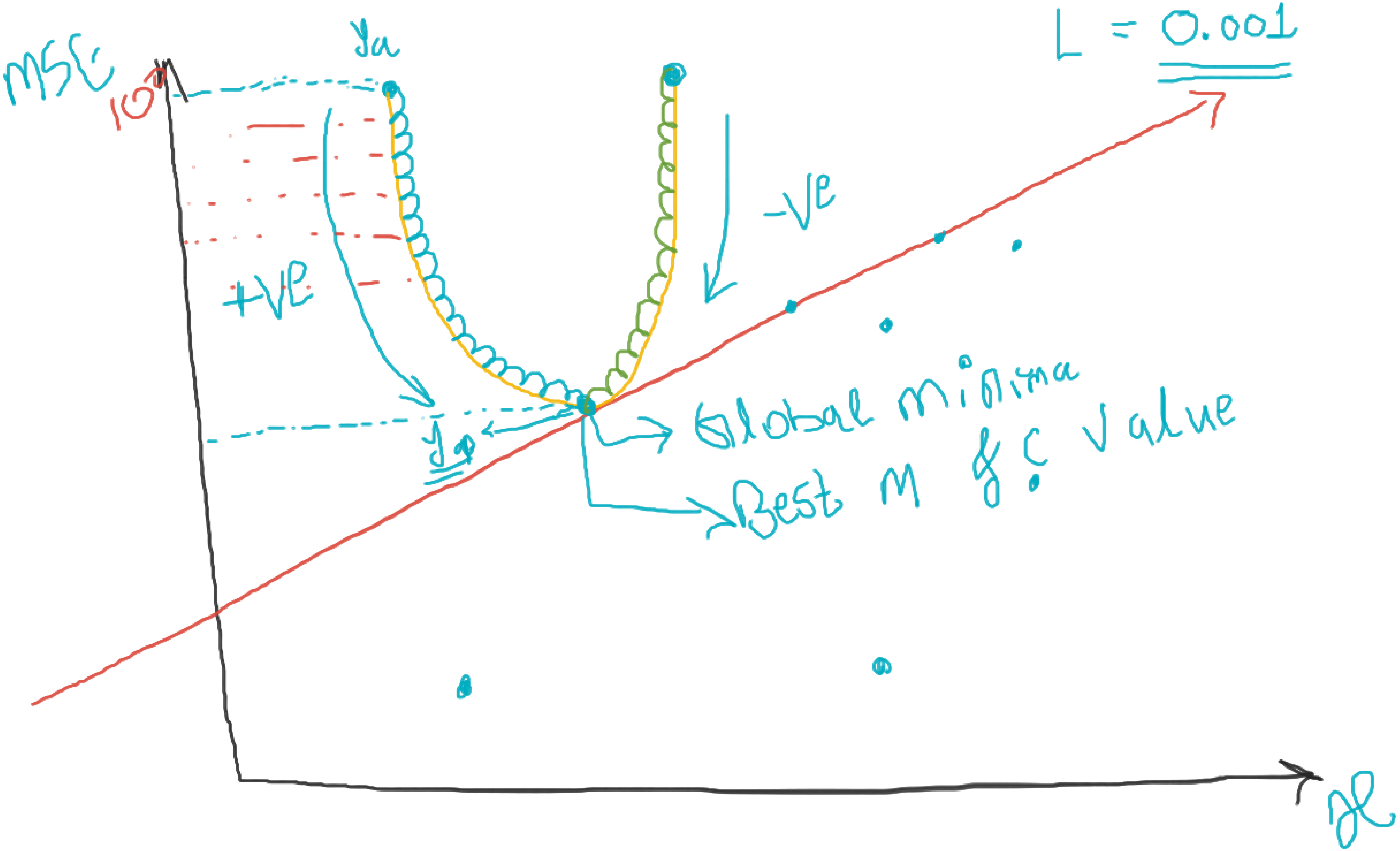
$$= (y_i - y_p)^2 \quad y_p \rightarrow mx + c$$

$$MSE = \left[y_i - (mx + c) \right]^2$$

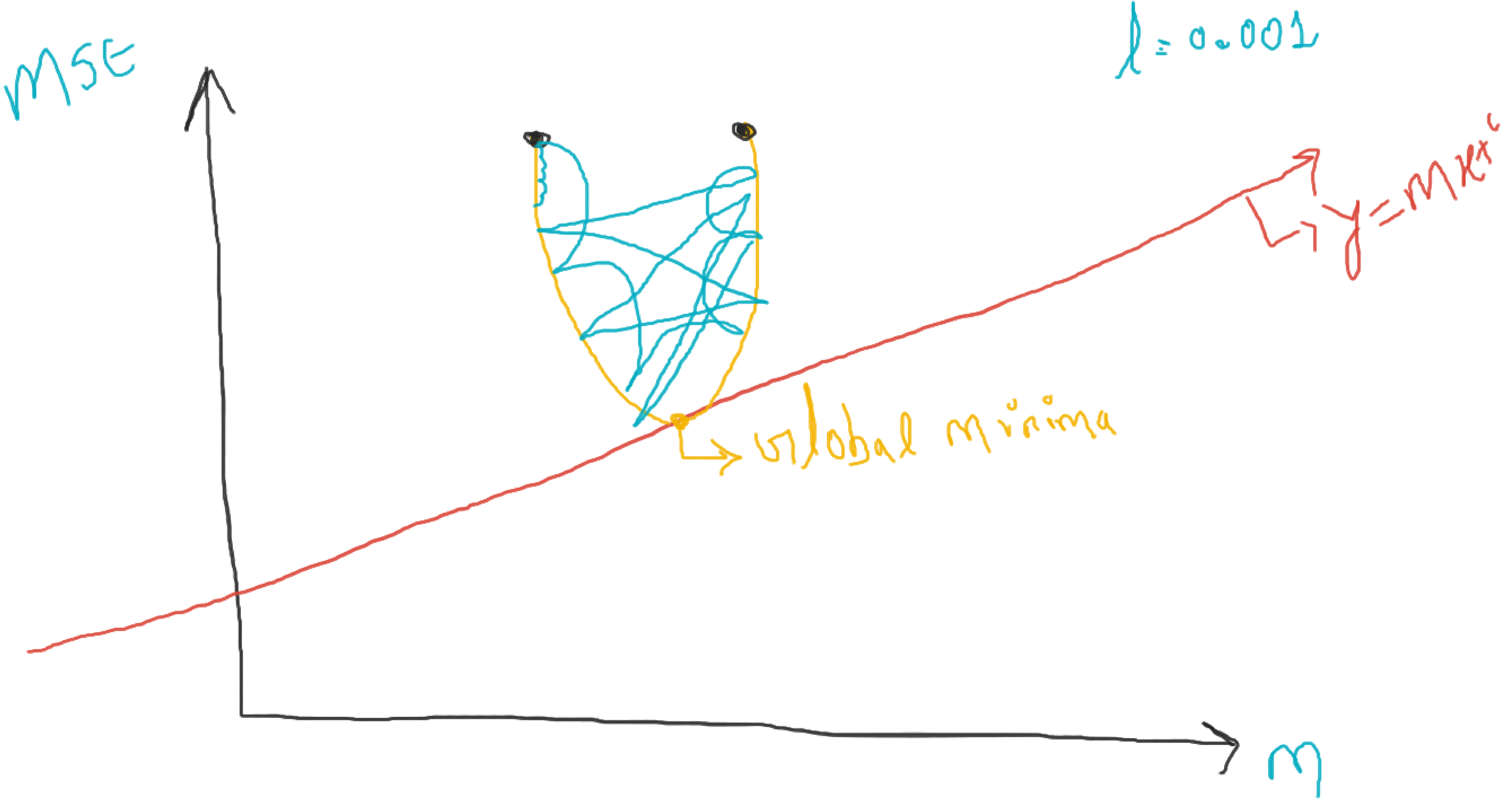
$$\frac{\partial(MSE)}{\partial(m)} = 2 \left[\left(y_i - \left(\underline{mx + c} \right) \right) \left[(-x) \right] \right]$$

$$= -\frac{2}{N} \left[\sum (y_i - y_p) \cdot x \right]$$

$$\frac{\partial(MSE)}{\partial m} = \frac{-2}{N} \sum x(y_i - y_p)$$

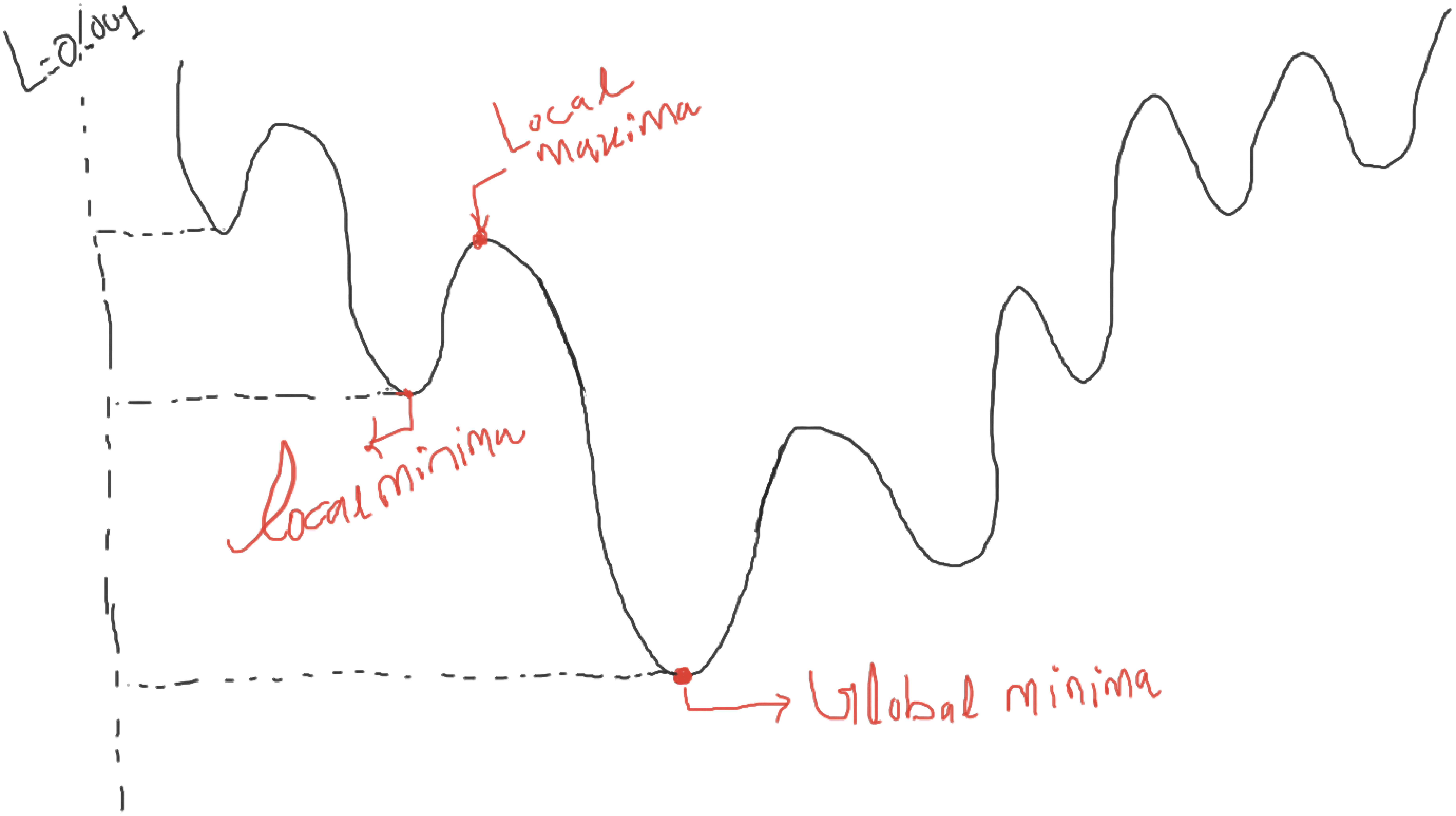


MSE
10
ya
L = 0.001
-ve
+ve
yp
Global minima
Best M & C value
x



MSE
l = 0.001
y = mx+c
global minima
m

M	C	error
m_1	c_1	100
m_2	c_2	90
m_3	c_3	70
m_4	c_4	40
$\boxed{m_5}$	$\boxed{c_5}$	$\boxed{20}$


L=0.001
Local maxima
local minima
Global minima

$$M_{new} = M_{old} - L \times \frac{\partial (MSE)}{\partial M}$$

$$C_{new} = C_{old} - L \times \frac{\partial (MSE)}{\partial C}$$