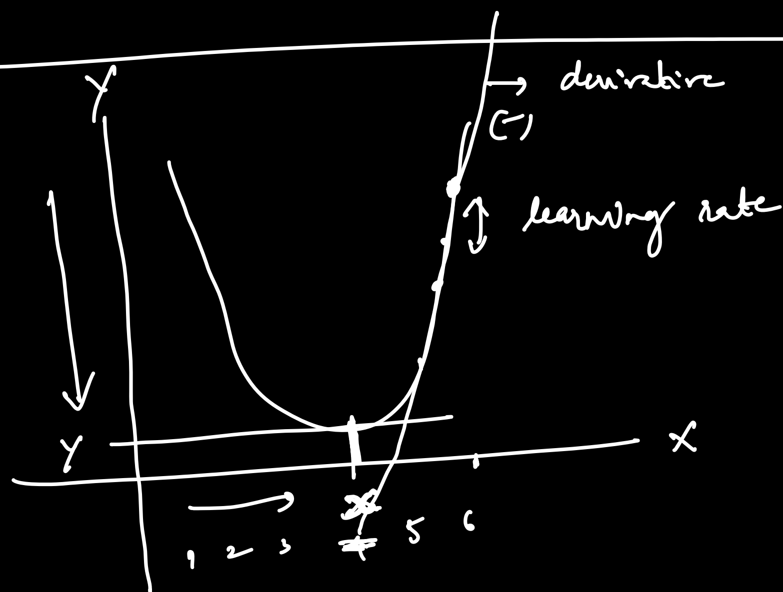
$y = x^2 + 2x + 2$

what is the value of x where y is minimal



$$\boxed{cur\_x = cur\_x - \frac{\partial}{\partial y}(cur\_x) * learning\_rate}$$

random_number = 2

$y = x^2 + 2x + 2$

$\frac{dy}{dx} = 2x + 2$

learning rate $= 0.1$

$x = 2$

$2 - (2(2) + 2) * 0.1$

$2 - (6)0.1$

$2 - 0.6 \Rightarrow \boxed{1.4}$ ✓

$2 - 1.4 = 0.6$

$x = 1.4$

$1.4 - (2(1.4) + 2) * 0.1$

$1.4 - (2.8 + 2) * 0.1$

$1.4 - (4.8 * 0.1)$

$1.4 - 0.48$

$0.9 \ldots$

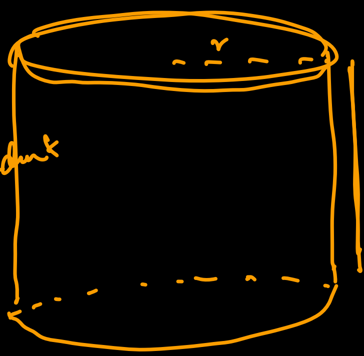
$1.4 - 0.9$

0.5

$$Z = x^2 + 2y + 2x$$

what is the value of x and y where Z is minimal

$$V = \pi r^2 h$$



$r \uparrow \rightarrow h$

$h \uparrow \rightarrow r$

independent

$$Z = x^2 + 2y^2 + 2x$$

$\frac{\partial z}{\partial x}$, $\frac{\partial z}{\partial y}$

assume y as constant

assume x as constant

$2y^2$

$2 \times 2y^{2-1}$

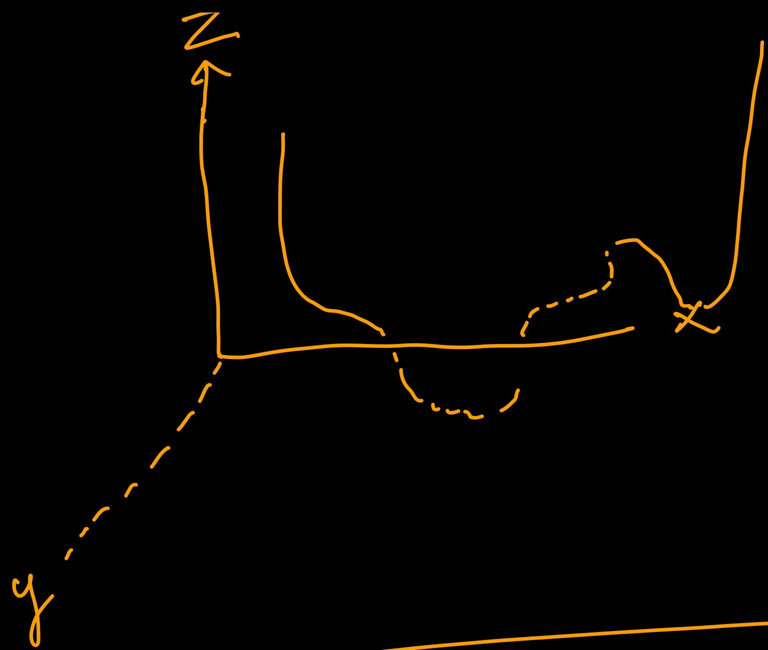
$4y^1$

$$\frac{\partial z}{\partial x} = 2x + 0 + 2$$

$$= 2x + 2$$

$$\frac{\partial z}{\partial y} = 0 + 4y + 0$$

$$= 4y$$



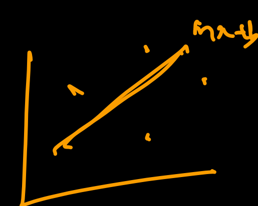
$$\text{New\_x} = \text{New\_x} - \frac{\partial z}{\partial x}(\text{New\_x}) * \text{learning rate}$$

$$\text{New\_y} = \text{New\_y} - \frac{\partial z}{\partial y}(\text{New\_y}) * \text{learning rate}$$

Linear Regression

Find the slope and Intercept where Error is minimal?

$$M.S.E = \frac{\Sigma(y - \hat{y})^2}{n}$$



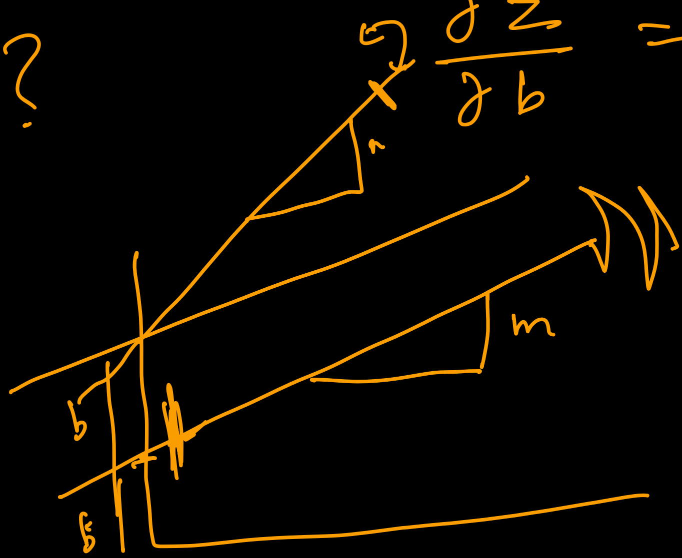
$$\hat{y} = mx + b$$

$$\frac{\Sigma (y - (mx+b))^2}{n}$$

$$\frac{\Sigma (y^2 + (mx+b)^2 - 2(y)(mx+b))}{n}$$

$$Z = \frac{1}{n} \Sigma (y^2 + m^2x^2 + b^2 + 2mxb - 2ymx - 2yb)$$

$$\frac{\partial Z}{\partial m} = ? \qquad \frac{\partial Z}{\partial b} = ?$$



$$Z = \frac{1}{n} \sum (y^2 + m^2x^2 + b^2 + 2mxb - 2ymx - 2yb)$$

$$\frac{\partial Z}{\partial m} = \frac{1}{n} \sum (0 + 2mx^2 + 0 + 2xb - 2yx - 0)$$

$$= \frac{1}{n} \sum (2mx^2 + 2xb - 2yx)$$

$$= \frac{1}{n} \sum (x\,(2mx + 2b - 2y))$$

$$= \frac{1}{n} \sum 2x(mx+b-y)$$

$$= \frac{2}{n} \sum -x\,(-(mx+b)+y)$$

$$\frac{\partial Z}{\partial m} \Rightarrow \boxed{\frac{2}{n} \sum -x\,(y-(mx+b))}$$

$$\frac{\partial z}{\partial x} = 4x^0$$

$$= 0$$

$$\frac{\partial z}{\partial m} = y^2 + m^2 + 2yb$$

$$= y^2 m^0 + m^2 + 2yb\,m^0$$

$$= 0 * m^{0-1} * y^2 + 2m^{2-1} + 2yb * 0 * m^{0-1}$$

$$= 0 + 2m^1 + 0$$

$$= 2m$$

$$b^0 = 1$$

$$Z = \frac{1}{n}\sum\left(\boxed{y^2} + m^2x^2b^0 + b^2 + 2mxb^1 - 2ymx - 2yb\right)$$

$$\frac{\partial Z}{\partial b} = \frac{1}{n}\sum\left(0 + 0 + 2b + 2mx - 0 - 2y\right)$$

$$= \frac{1}{n}\sum 2\left(b + mx - y\right)$$

$$= \frac{2}{n}\sum\left(b + mx - y\right)$$

$$\frac{\partial Z}{\partial b} = \boxed{\frac{2}{n}\sum -\left(y - (mx + b)\right)}$$

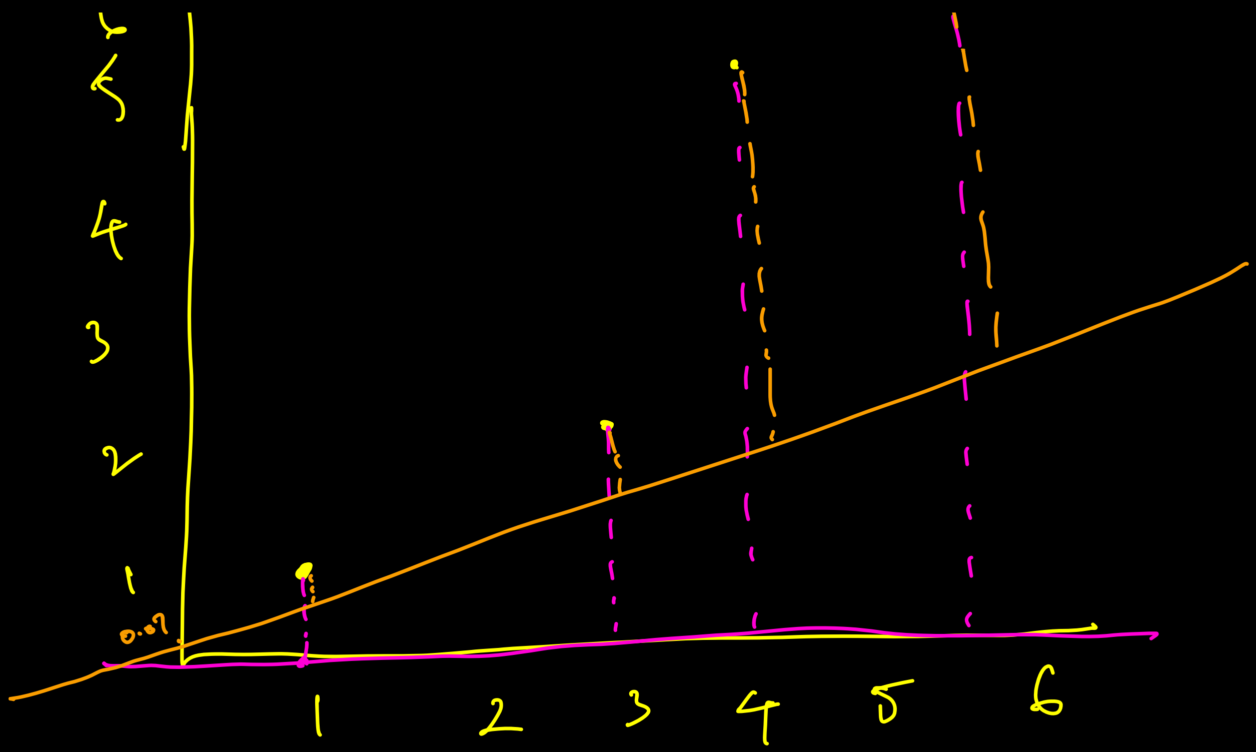
$$\frac{\partial Z}{\partial m} \Rightarrow \boxed{\frac{2}{n}\sum -x\left(y - (mx + b)\right)}$$

$$\frac{\partial z}{\partial m} \qquad \frac{\partial z}{\partial b}$$

initial_m = 0

$$\boxed{\text{new\_m} = \text{initial\_m} - \frac{\partial z}{\partial m}(\text{initial\_m}) * (\text{learning rate})}$$

$$\boxed{\text{new\_b} = \text{initial\_b} - \frac{\partial z}{\partial b}(\text{initial\_b}) * \text{learning rate}}$$



$m = 0 \quad b = 0 \Rightarrow$ error 16.5

$m = 0.31 \quad b = 0.07 \Rightarrow$ error 7.78 ✓