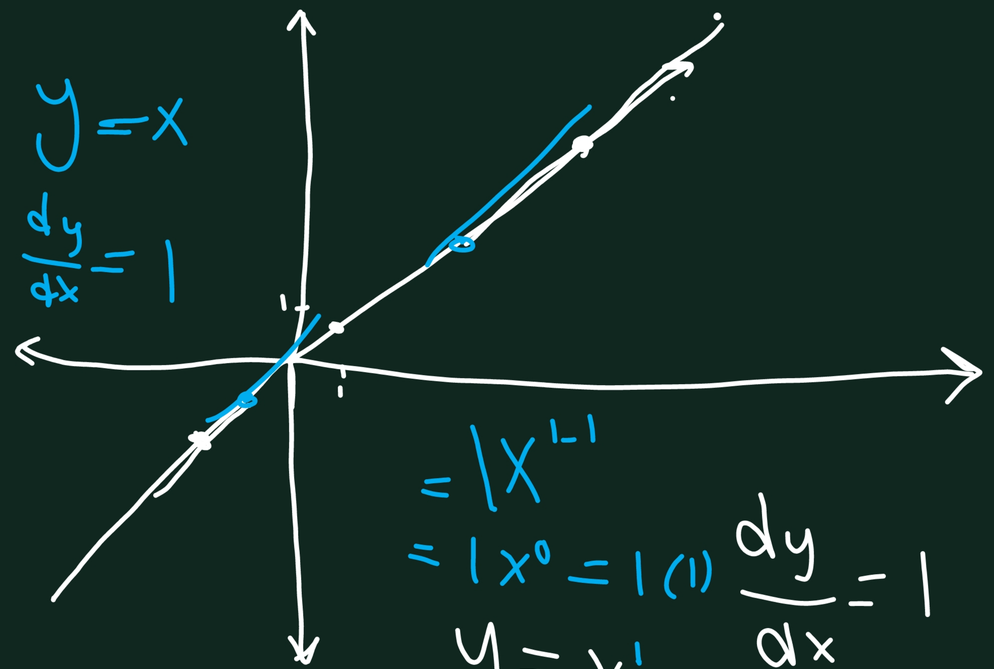
- Derivatives
- How ML Works — ML Structure
- Types of Evaluation in ML
- Forward and Backward Pass
- ML Equations
- Loss Functions

$y = x$

$\frac{dy}{dx} = 1$



$= 1x^{1-1}$

$= 1x^0 = 1(1)$ $\frac{dy}{dx} = 1$

$y = x^1$

$f(x) = x$

$y = x^2$

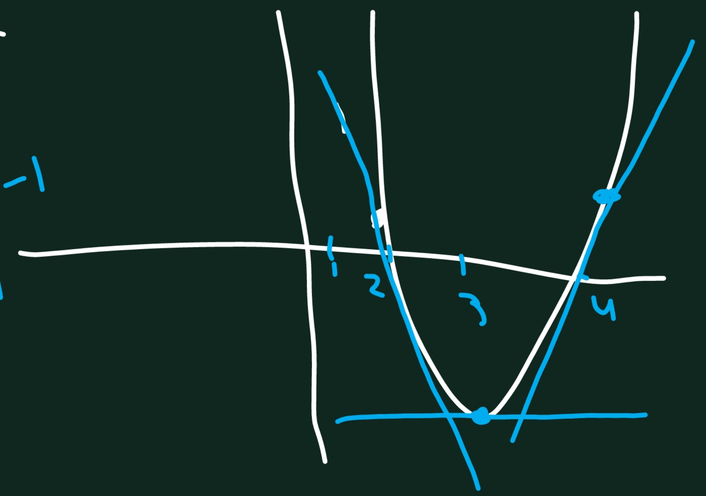
$\frac{dy}{dx} = 2x^{2-1}$

$= 2x^1$

$= 4$

$y = x^4$

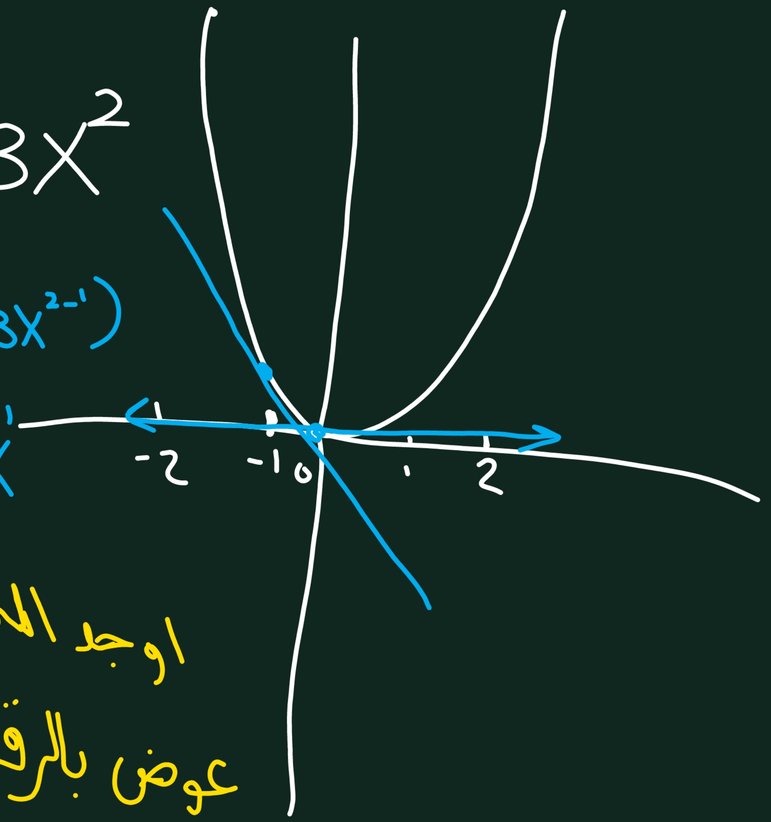
$dy = x\,dx$



$y = 3x^2$

$\frac{dy}{dx} = 2(3x^{2-1})$

$\frac{dy}{dx} = 6x^1$



1- اوجد المشتقة

2- عوض بالرقم

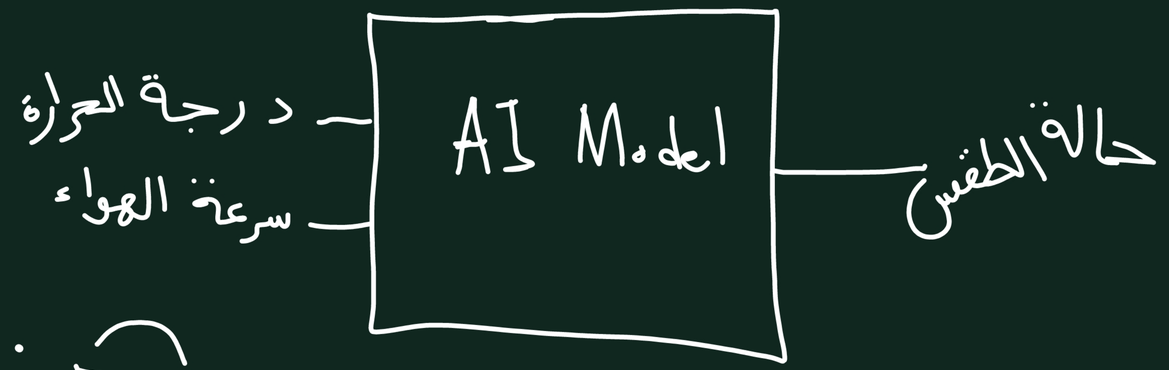
$\frac{dy}{dx}(0) = 0$

-1

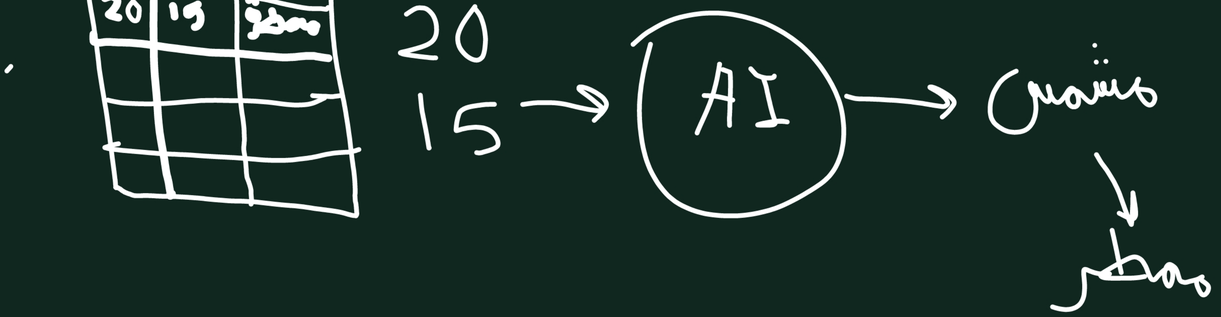
$\frac{dy}{dx} = f'(x) = 6(-1) = -6$

1

$= 6$



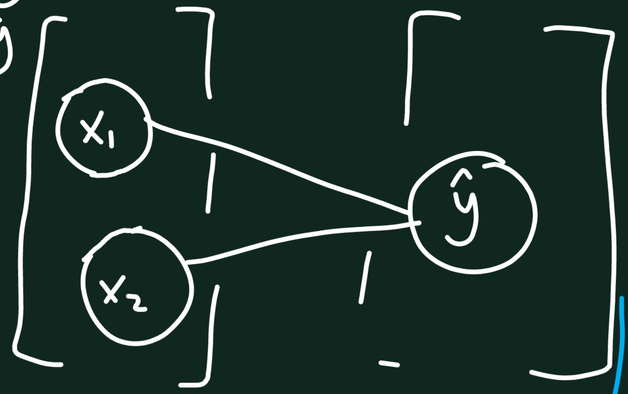
c°	s	y
20	15	ممطر



100%

$y = 1 \quad 2$

$\hat{y}$



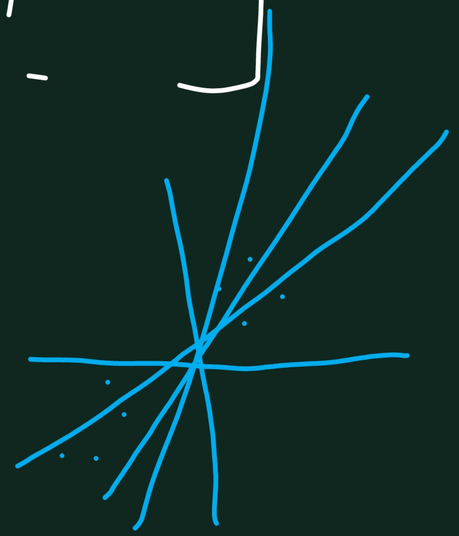
$M = 10^6$

y سعر البيت	x_2 عدد الطوابق	x_1 مساحة البيت
1.5M	2	300 m^2
1M	1.5	250 m^2
0.9M	1	190 m^2

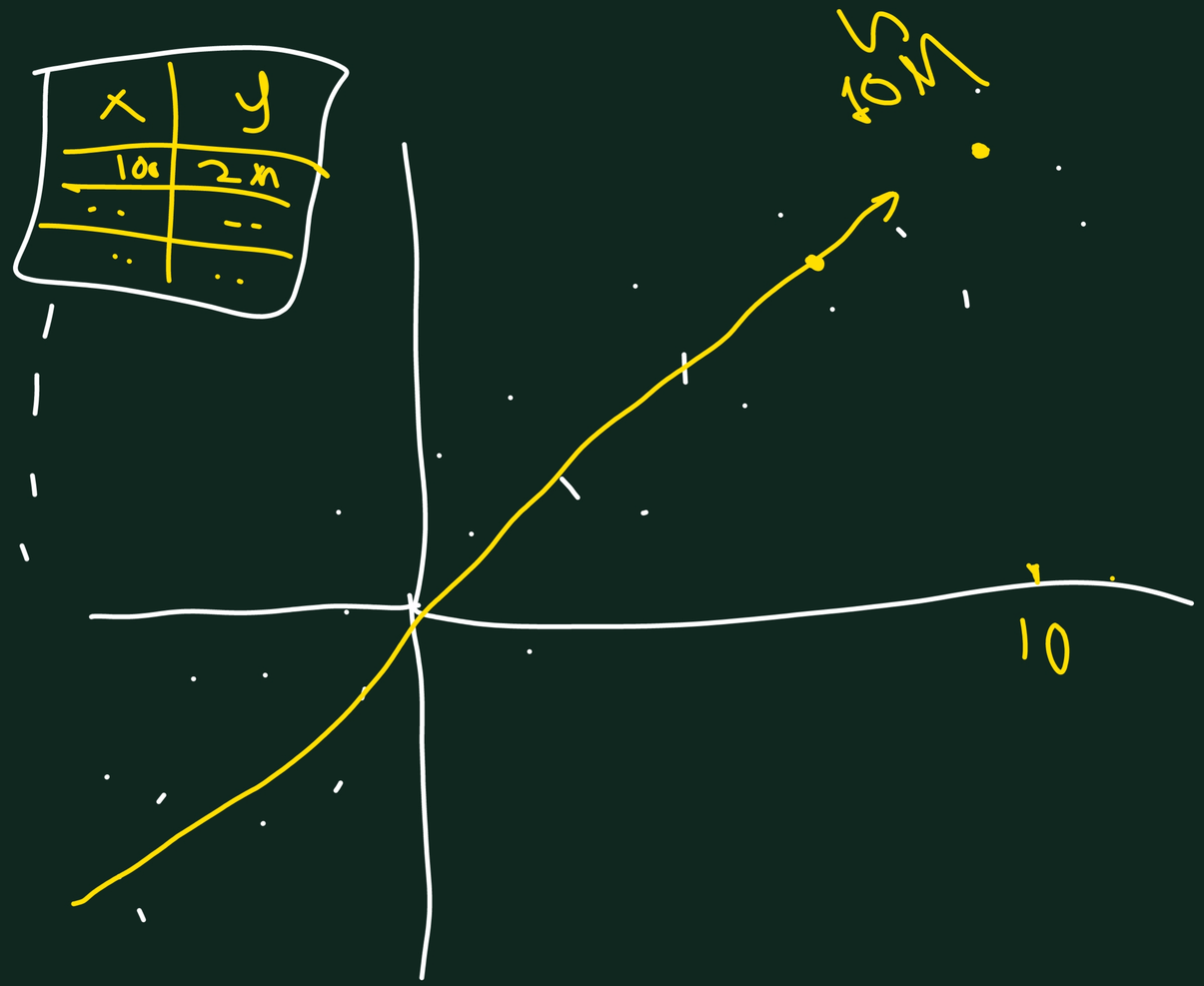
$y = mx + b$

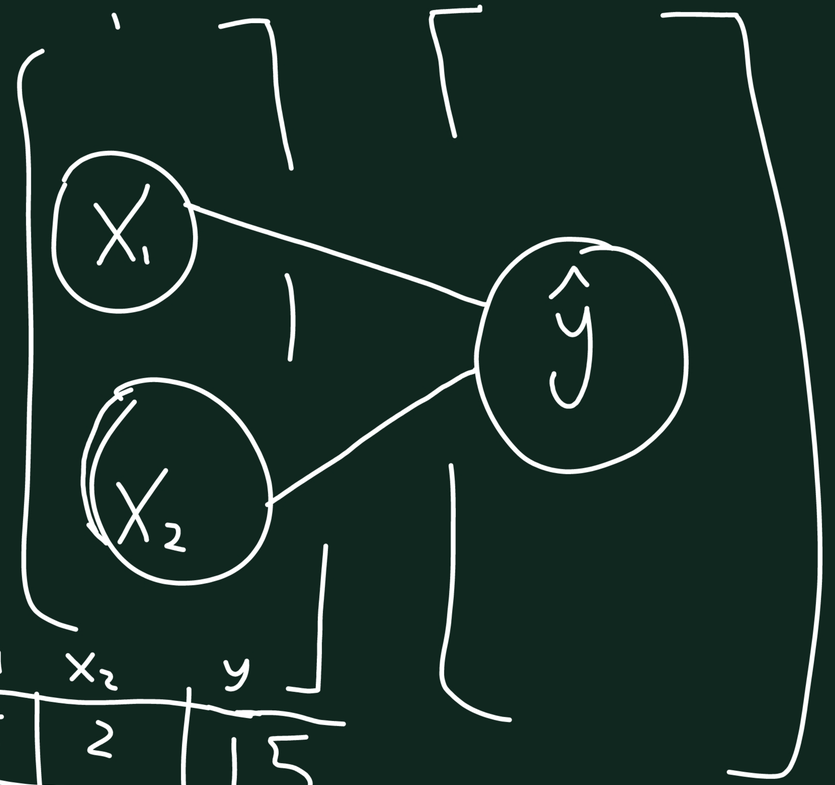
m ← ميل

b ← القاطع



x	y
10	2m
..	..
..	..





	x_1	x_2	y
1	5	2	15
2	1	1	5
3	10	4	50

$m_1 = 1 \quad b_1 = 0$

$m_2 = 2 \quad b_2 = 1$

$$\hat{y} = (m_1 x_1 + b_1) + (m_2 x_2 + b_2)$$

$$\hat{y} = ((1)(5) + (0)) + (2(2) + (1))$$

$$\hat{y} = 5 + 5$$

$$\hat{y} = 10 \qquad y = 15$$

$$\text{Loss} = (y - \hat{y})^2$$

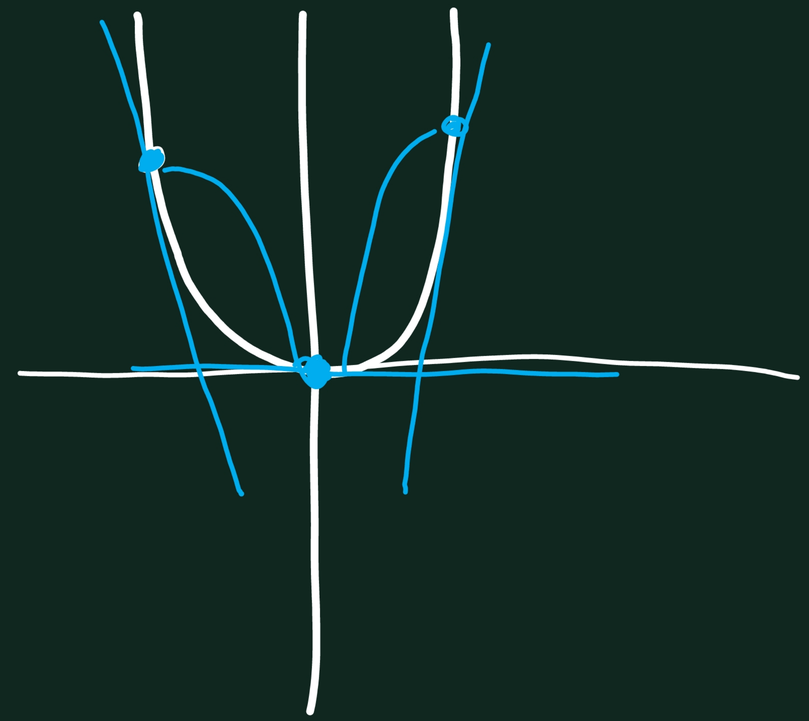
$$\text{loss} = (10 - 15)^2 = 25$$

$$Loss = (y - \hat{y})^2$$

$$Loss = 25$$

$$W = (m_1, b_1)$$

$$\frac{dLoss}{dm_1} = -1$$



$$m_1 = m_1 - \frac{dLoss}{dm_1} \frac{dLoss}{db_1} = 2$$

خطوات تدريب نموذج الذكاء الاصطناعي:

١ - نجهز البيانات

٢ - نضع قيم عشوائية للميل (m) و القاطع (b)

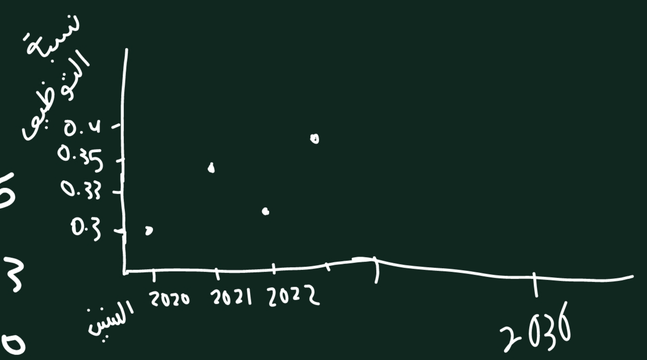
٣ - نجهز المعادلة

٤ - التعويض بالبيانات وحساب نسبة الخطأ (Forward Pass)

٥ - نحدث قيم (m,b) بناء على قيمة المشتقة (Backward Pass)

٦ - اختبار النموذج

السنة	نسبة التوظيف	
2020	0.3	30
2021	0.35	35
2022	0.33	33
2023	0.4	40
2024	0.39	
2050	0.45	



$\hat{y} = mx + b$

السنة x → نسبة التوظيف y

$m = 2$

$b = 1$

① $\hat{y} = 2(2020) + 1$

$\hat{y} = 4040 + 1$

$\hat{y} = 4041$

$y = 30$

$Loss = (y - \hat{y})^2$

$(30 - 4041)^2$

$(-4011)^2$

$$m = m - lr\left(\frac{dLoss}{n}\right)$$

$$b = b - lr\left(\frac{dLoss}{db}\right)$$

lr = مقدار التعلم

80% تدريب

20% اختبار

الراتب	الوظيفة
14000	مدرس
50000	دكتور
15000	عسكري
10000	مدرس
30000	عسكري
	مهندس

التدريب

الاختبار

الدقة

$$\frac{1}{2}$$

$$\frac{\text{عدد التوقعات الصحيحة}}{\text{عدد نماذج الاختبار}} = \frac{1}{2}$$

$$= 0.5$$

$$= 50\%$$

① مهندس ② عسكري