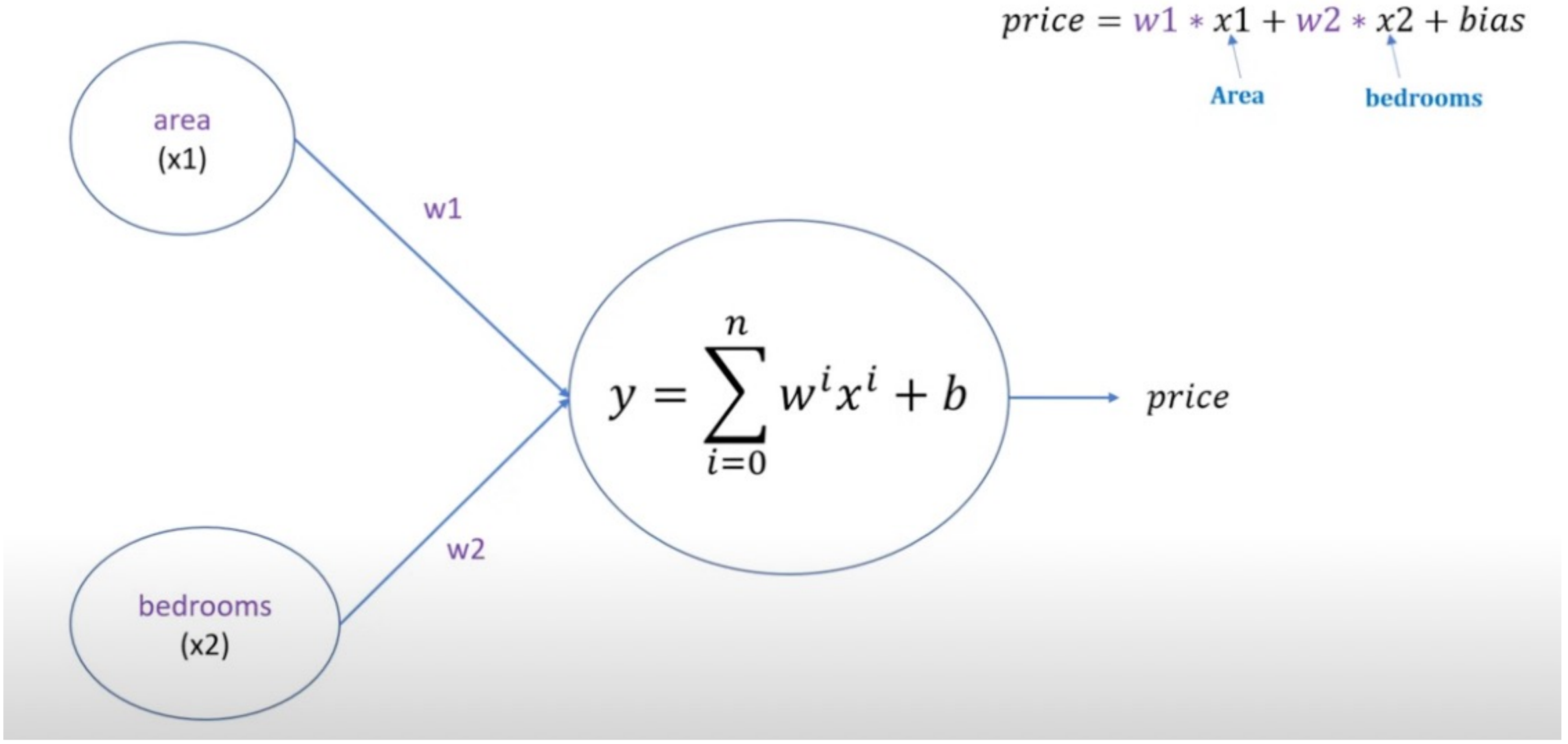
Backpropagation Algorithm

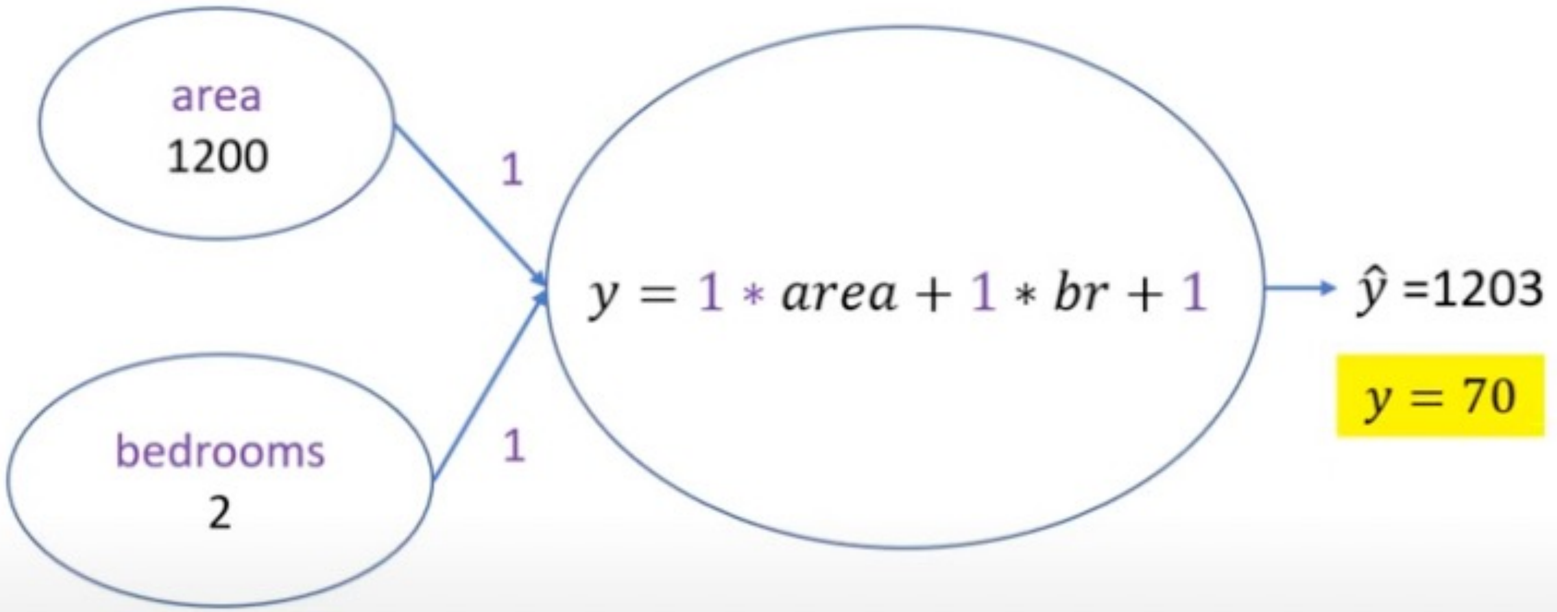
Neural Network

Home price prediction

area	bedrooms	price
1200	2	70
1500	3	120
2100	4	230
1100	3	105
1300	2	90
900	1	55


$price = w1 * x1 + w2 * x2 + bias$
Area
bedrooms
area
(x1)
w1
$y = \sum_{i=0}^{n} w^i x^i + b$
price
w2
bedrooms
(x2)

area	bedrooms	price
1200	2	70
1500	3	120
2100	4	230
1100	3	105
1300	2	90
900	1	55



$error1 = y - \hat{y}$ = 1133

$squared\ error1$ = 1283689

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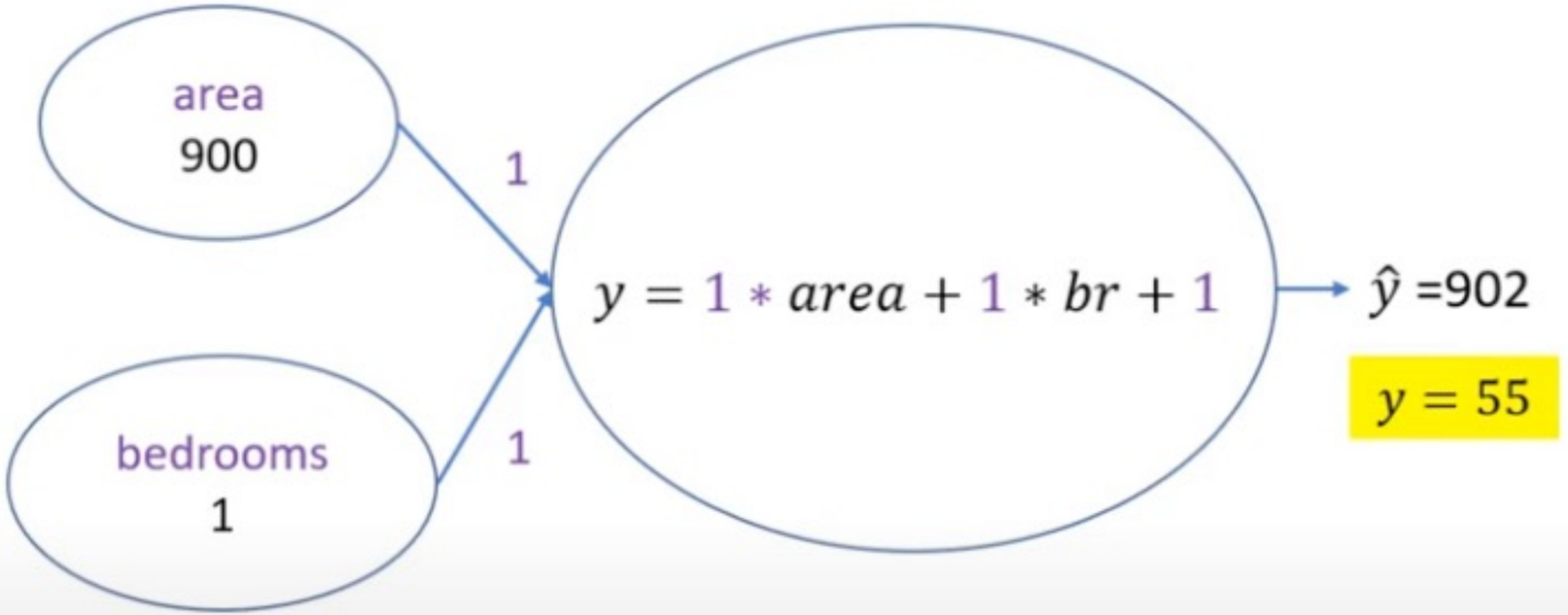


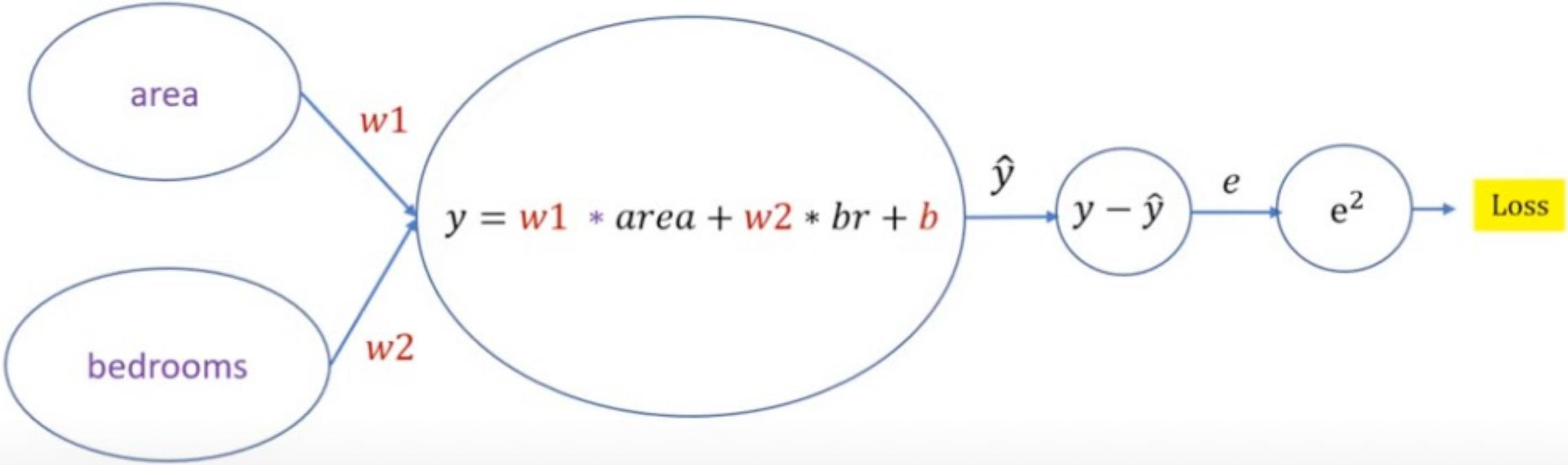
$error6 = y - \hat{y} = 847$

$squared\ error6 = 717409$

Total squared error = $sq\ error_1 + \cdots + \text{sq}\ error_6$

Mean squared error = $(sq\ error_1 + \cdots + \text{sq}\ error_6)$ / 6

$$Loss = Mean\ Squared\ Error$$

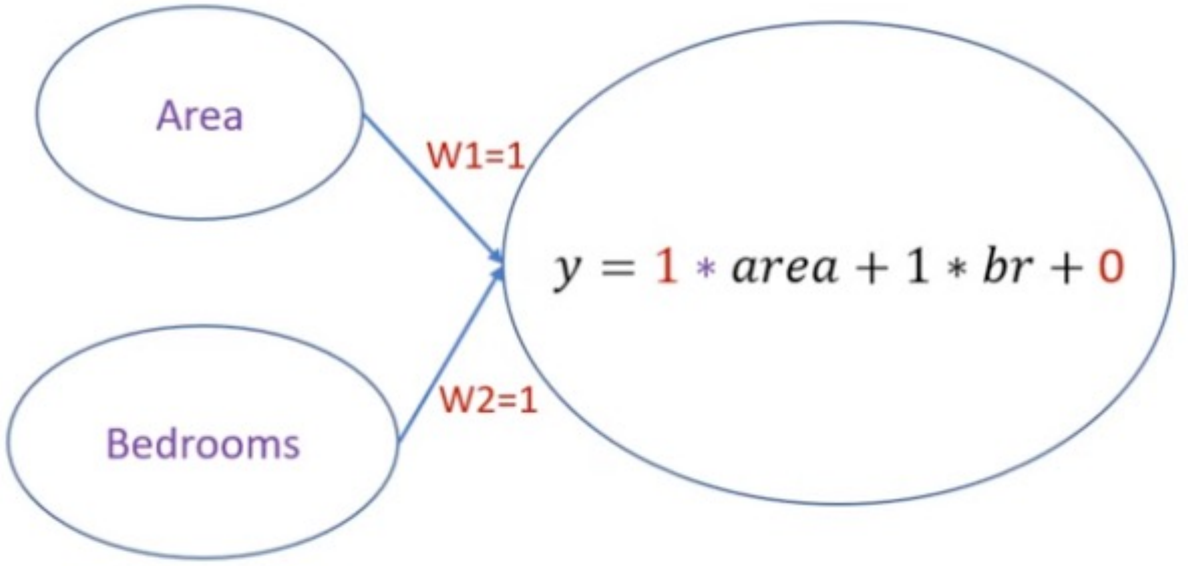

area
bedrooms
w1
w2
$y = w1 * area + w2 * br + b$
$\hat{y}$
$y - \hat{y}$
e
e^2
Loss

$$w1 = w1 - something$$

$$w1 = w1 - learning\ rate * {}^{\partial}/_{\partial w1}$$

$$w2 = w2 - learning\ rate * {}^{\partial}/_{\partial w2}$$

$$b = b - learning\ rate * {}^{\partial}/_{\partial b}$$



$$w1 = w1 - learning\ rate * {}^{\partial}/_{\partial w1}$$

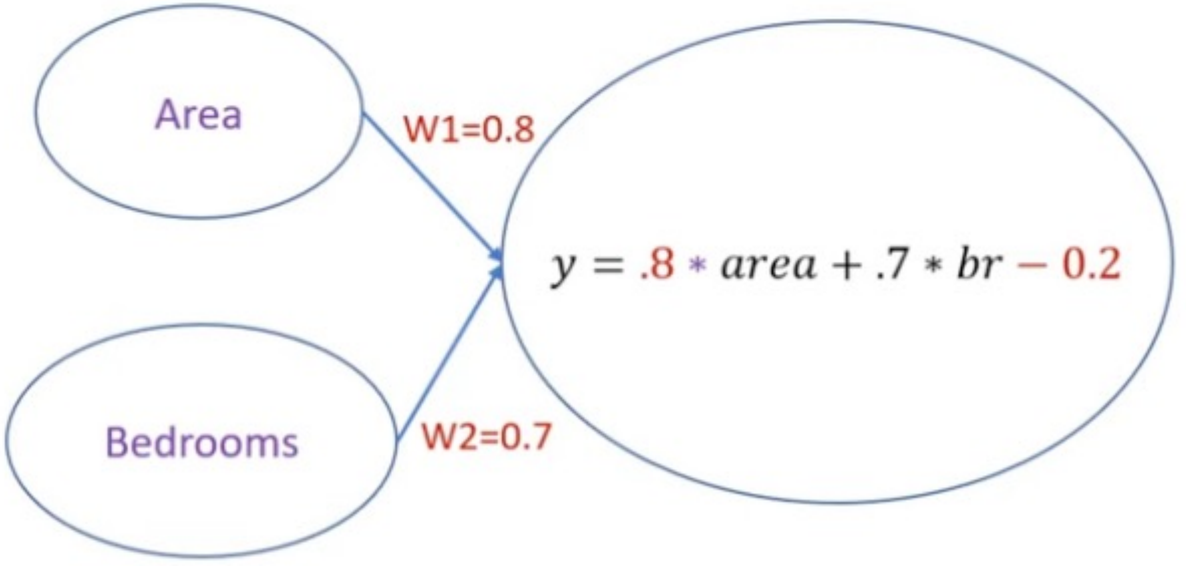
W1 = 1- 0.2 = 0.8

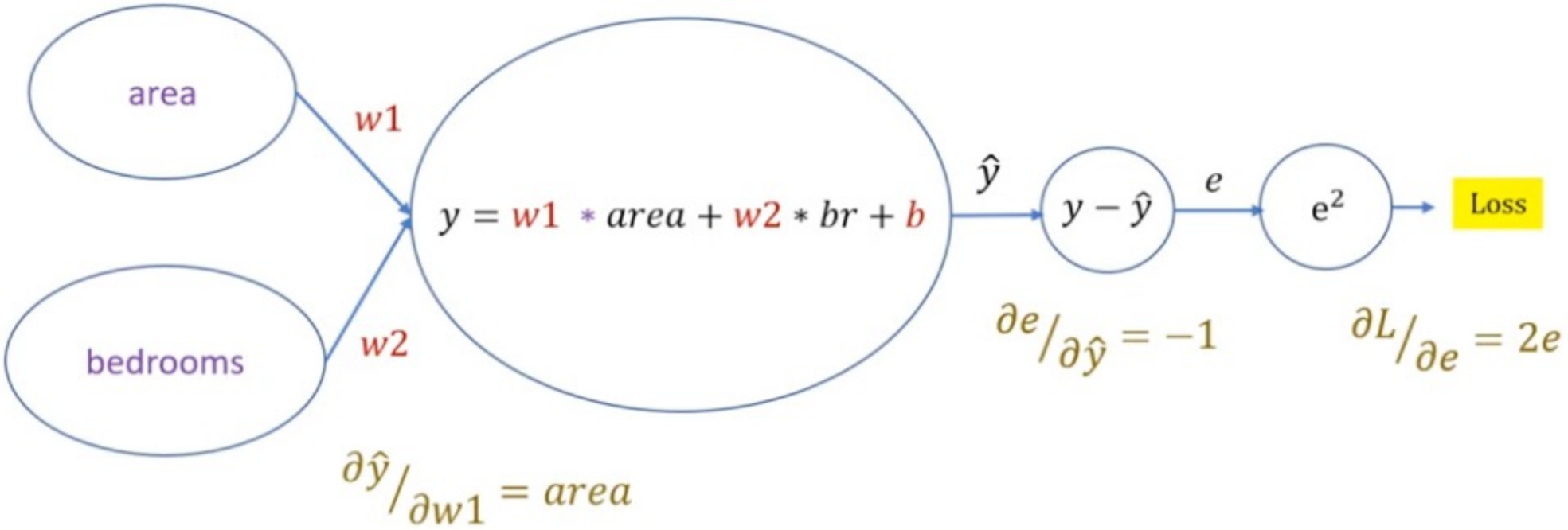
$$w2 = w2 - learning\ rate * {}^{\partial}/_{\partial w2}$$

W2 = 1- 0.3 = 0.7

$$b = b - learning\ rate * {}^{\partial}/_{\partial b}$$

b = 0 – 0.2 = -0.2



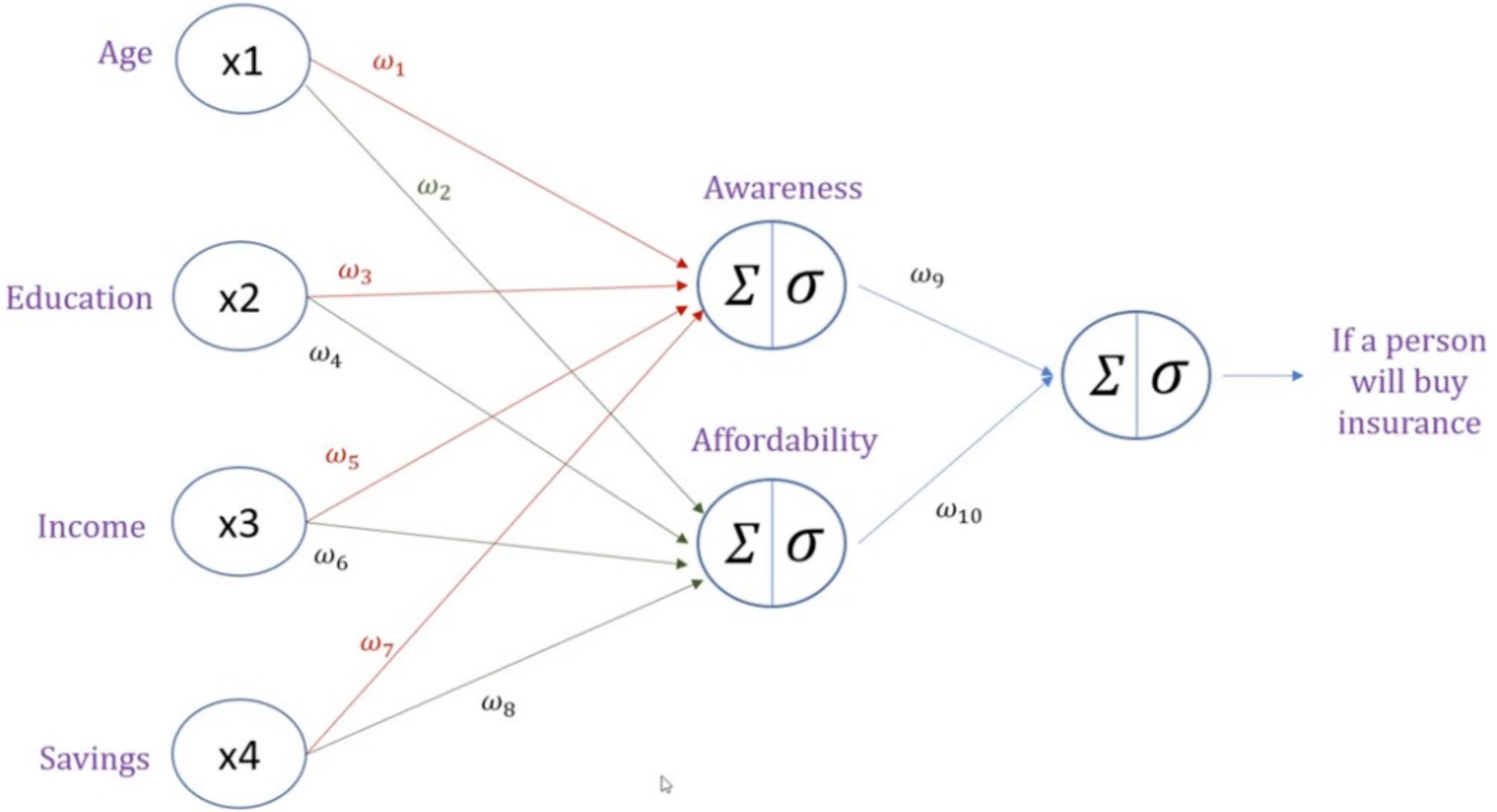


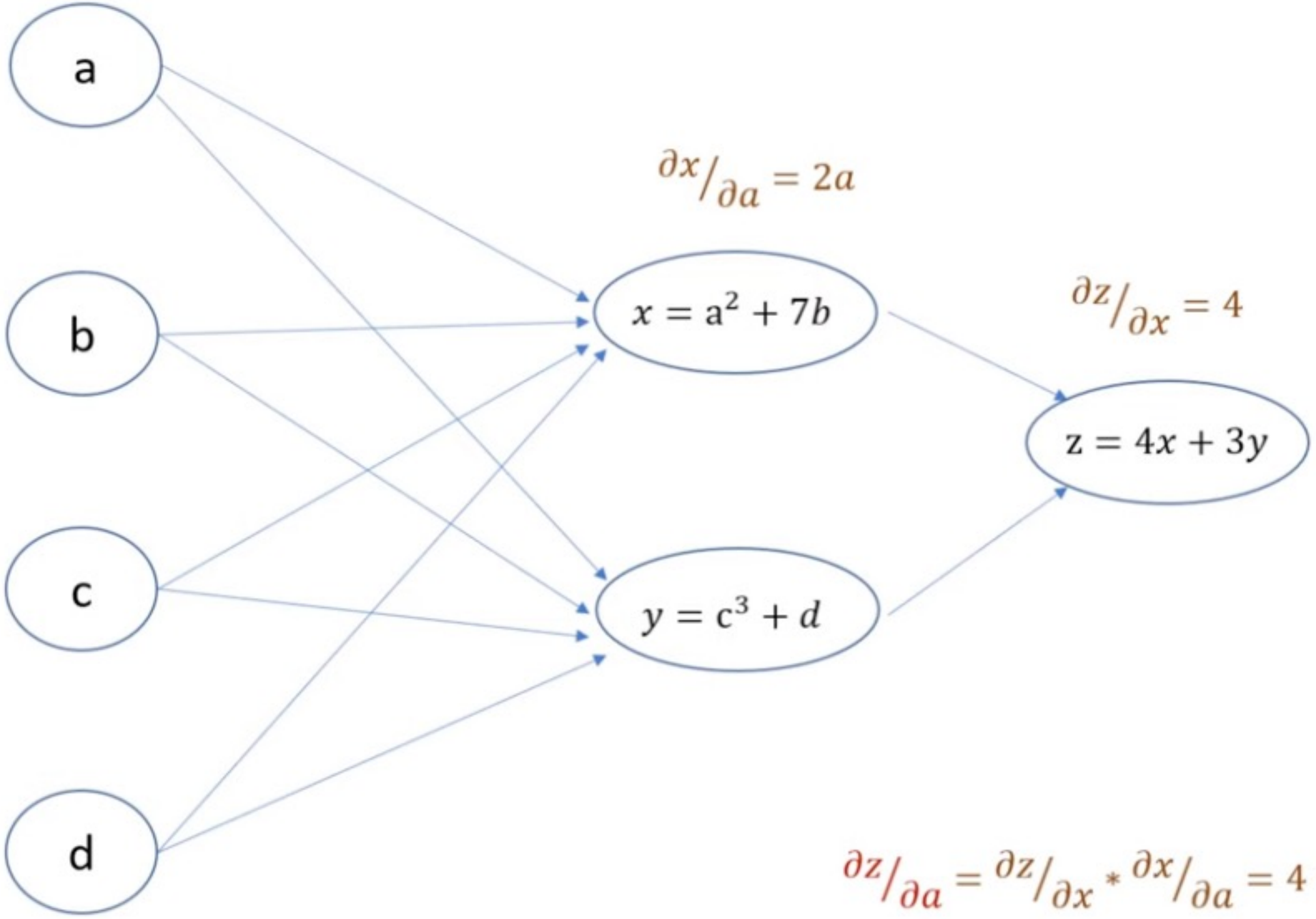
$$\partial L/\partial w1 = ?$$

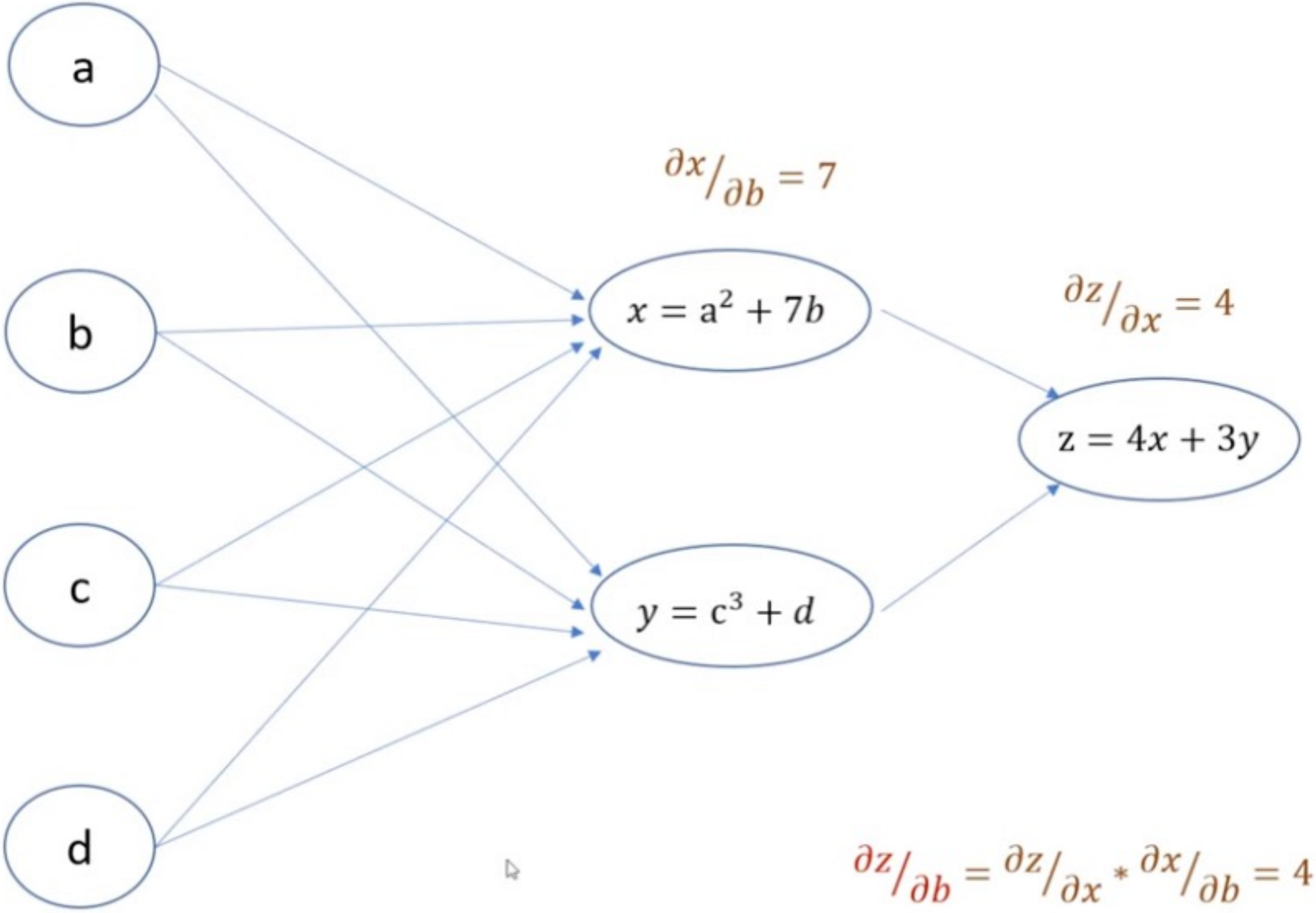
$$\partial L/\partial w1 = \partial L/\partial e * \partial e/\partial \hat{y} * \partial \hat{y}/\partial w1$$

$$\partial L/\partial w1 = -2e * area$$

Chain Rule


Age
x1
ω_1
ω_2
Awareness
Education
x2
ω_3
ω_4
Σ σ
ω_9
Σ σ
If a person will buy insurance
ω_5
Affordability
Income
x3
ω_6
Σ σ
ω_{10}
ω_7
ω_8
Savings
x4


a
b
c
d
$x = a^2 + 7b$
$y = c^3 + d$
$z = 4x + 3y$
$\partial x/\partial a = 2a$
$\partial z/\partial x = 4$
$\partial z/\partial a = \partial z/\partial x * \partial x/\partial a = 4 * 2a = 8a$


a
b
c
d
$x = a^2 + 7b$
$y = c^3 + d$
$z = 4x + 3y$
$\partial x/\partial b = 7$
$\partial z/\partial x = 4$
$\partial z/\partial b = \partial z/\partial x * \partial x/\partial b = 4 * 7 = 28$