

## Assignment: Gradient Descent Example

In this assignment, you will implement the gradient descent algorithm to optimize a simple cost function, by filling out a table of values. You will start with a random value for the parameter. You will determine the value of the cost function, and you will update the parameters using gradient descent.

### Cost function

$$C(w) = \frac{1}{2}(w - 4)^2$$

### Derivative

$$\frac{dC(w)}{dw} = (w - 4)$$

### Gradient Decent Formula

$$w_{k+1} = w_k - \eta \frac{dC(w_k)}{dw}$$

$$\eta = 0.5$$

### Initialize Parameter

$$w_0 = -2$$

Fill out the table here is the first two elements.

### First iteration k=1

### Gradient Decent Formula

$$w_1 = w_0 + \eta \frac{dC(w_0)}{dw}$$

$$= -2 - 0.5(-2 - 4)$$

$$= -2 - 0.5(-6)$$

$$= -2 + 3$$

$$= 1$$

Cost

$$C(1) = \frac{1}{2}(1 - 4)^2$$

$$= \frac{1}{2}(-3)^2 = 4.5$$

Second iteration k=2

Gradient Decent Formula

$$w_2 = w_1 + \eta \frac{dC(w_1)}{dw}$$

$$= 1 - 0.5(1 - 4)$$

$$= 1 - 0.5(-3)$$

$$= 1 + 1.5$$

$$= 2.5$$

Cost

$$C(1) = \frac{1}{2}(2.5 - 4)^2$$

$$= \frac{1}{2}(1.5)^2 = 1.125$$

Fill in the rest of the table

k	1	2	3	4	5
$C(w_k)$	4.5	1.125	0.28125	0.0703125	0.017578125
$w_k$	1.0	2.5	3.25	3.625	3.8125