Let us consider a sample dataset have one
input (x_i^a) and one output (y_i^a) and
number of samples 4. Develop a simple.
linear regression model using BGD.

Sample (i)	x_i^a	y_i^a
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

Do manual calculations for two iterations
with first two samples.

Step 1! $[X, Y]$, $m = 1$, $c = -1$, $\eta = 0.1$, epochs $= 2$;

$$ns = 2$$

Step - 2! itr $= 1$

step - 3! $\dfrac{\partial E}{\partial m} = \dfrac{-1}{ns} \sum\limits_{i=1}^{ns} (y_i - mx_i - c)x_i$

$$= \dfrac{-1}{2} \{ (3.4 - (1)(0.2) + 1) 0.2$$
$$+ (3.8 - (1)(0.4) + 1)$$
$$0.4 \}$$

$$= -1.34$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2}\{(3.4 - 0.2 + 1) + (3.8 - 0.4 + 1)\}$$

$$= -4.3$$

Step-4! $\Delta m = -\eta \cdot \frac{\partial E}{\partial m}$

$$= -0.1 \times -1.34$$

$$= 0.134$$

$$\Delta c = -\eta \cdot \frac{\partial E}{\partial c}$$

$$= -0.1 \times -4.3 = 0.43$$

Step 5! $m = m + \Delta m$

$$= 1 + 0.134$$

$$= 1.134$$

$$c = c + \Delta c$$

$$= -0.1 \times -4.3$$

$$= 0.43$$

step-6! itr + = 1

$$1 + 1 = 2$$

Step-7! if (itr > epochs)

goto step 8

$$2 > 3$$

else

goto step 3

step-3? $\frac{\partial E}{\partial m} = -\frac{1}{2}[(3.4 - (1.134)(0.2) + 0.53)$

$$(0.2) + (3.8 - (1.134)(0.4)$$

$$+ 0.53)(0.4)]$$

$$= -1.157$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2}\{(3.4 - (1.134)(0.2) + 0.53)$$

$$[(-2.0 + (3.8 - (1.134)(0.4) + 0.52)]$$

$$= -3.829.$$

Step-4! $\Delta m = -0.1 \times -1.157 = 0.1157$

$$\Delta c = -0.1 \times 3.829 = 0.3829.$$

Step-5! $m = m + \Delta m$

$$= 1.134 + 0.1157$$

$$= 1.2497$$

$$c = c + \Delta c$$

$$= -0.57 + 0.3829$$

$$= -0.187$$

Step-6! $itr + 1$

$$2 + 1 = 3$$

Step-7! if ($itr >$ epoch)

$$3 > 2$$

goto step-8

else

goto step-3

Step-8! $m = 1.2497,$ $c = -0.187.$