Polynomial Regression Model:

X	Y
7.6	157
7.1	174

Step 1: Read dataset, $n = 0.1$, epochs $= 1$, $m_1 = 1, m_2 = 1, c = 1$

Step 2: iter $= 1$

Step 3: Sample $i = 1$

Step 4: $y_p' = m_2(x_i)^2 + m_1 i + c$

$y_p' = (1)(7.6)^2 + (1)(7.6) - 1 = 64.36$

Step 5: $E = \frac{1}{2}(y_i - y_i p)^2$

$= \frac{1}{2}(157 - 64.36)^2$

$E = 4291.08$

Step 6: $\frac{\partial E}{\partial m_1} = [y_i - m_2 x_i^2 - m_1 x_i - c]x_i$

$= -[157 - (1)(7.6)^2 - (1)(7.6) + 1](7.6)$

$\frac{\partial E}{\partial m_1} = -704.06$

$\frac{\partial E}{\partial m_2} = -[y_i - m_2 x_i^2 - m_1 x_i - c]x_i^2$

$= [157 - (1)(7.6)^2 - (1)(7.6) + 1](7.6)^2$

$\frac{\partial E}{\partial m_2} = -5350.88$

$\frac{\partial E}{\partial c} = -[y_i - m_2 x_i^2 - m_1 x_i - c]$

$= -[157 - (1)(7.6)^2 - (1)(7.6) + 1]$

$\frac{\partial E}{\partial c} = -92.64$

Step 7: $\Delta m_1 = -\eta \dfrac{\partial E}{\partial m_1} = -(0.1)(-704.08) = 70.4$

$\Delta m_2 = -\eta \dfrac{\partial E}{\partial m_2} = -(0.1)(-5350.88) = 535.08$

$\Delta c = -\eta \dfrac{\partial E}{\partial c} = -(0.1)(-92.64) = 9.26$

Step 8: $m_1 = m_1 + \Delta m_1 = 1 + 70.4 = 71.4$

$m_2 = m_2 + \Delta m_2 = 1 + 535.08 = 536.08$

$c = c + \Delta c = -1 + 9.26 = 8.26$

Step 9: Sample $\Rightarrow i = i + 1 = 1 + 1 = 2$ & $i \leq n$ so $T \to$ Step ④

Step 4 $y_p^i = m_2(x_i)^2 + m_1 x_i + c$

$= (536.08)(7.1)^2 + (71.4)(7.1) + 8.26$

$= 27023.79 + 506.94 + 8.26$

$y_p^i = 27538.99$

Step 5: $E = \dfrac{1}{2}(y_i - y_i^p)^2 = \dfrac{1}{2}(174 - 27538.99)^2$

$E = 374421328.9$

Step 6 $\dfrac{\partial E}{\partial m_1} = -[y_i - m_2 x_i^2 - m_1 x_i - c] x_i;$

$\Rightarrow -[174 - (536.08)(7.1)^2 - (71.4)(7.1) - 8.26](7.1)$

$= -(174 - 27023.79 - 506.94 - 8.26)(7.1)$

$= -(-27364.99)(7.1)$

$\dfrac{\partial E}{\partial m_1} = 194291.429$

$\dfrac{\partial E}{\partial m_2} = -[y_i - m_2 x_i^2 - m_1 x_i - c] x_i^2;$

$= -(-27364.99)(7.1)^2$

$$\frac{\partial E}{\partial m_2} = 1379469.14$$

$$\frac{\partial E}{\partial c} = -\left[y_i - m_2 x_i^2 - m_i x_i - c\right]$$

$$= -(-27364.99)$$

$$\frac{\partial E}{\partial c} = 27364.99)$$

Step 7: $\Delta m_1 = \eta \frac{\partial E}{\partial m_1} = -(0.1)(194291.429) = -19429.14$

$\Delta m_2 = -\eta \frac{\partial E}{\partial m_2} = -(0.1)(1379469.14) = -137946.91$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(27364.99) = -2736.49$

Step 8: $m_1 = m_1 + \Delta m_1 = 71.4 - 19429.14 = -19357.74$

$m_2 = m_2 + \Delta m_2 = 536.08 - 137946.91 = -137410.83$

$c = c + \Delta c = 8.26 - 2736.49 = -2728.23$

Step 9: Sample $i = i + 1 = 2 + 1 = 3$ $\cup$ $\underset{3}{j} \leq \underset{2}{n_s}$ $f \to$ next step

Step 10: iter = iter + 1 = 1 + 1 = 2, $\underset{2}{iter} > \underset{1}{epochs}$ $T \to$ next step

Step 11: End step