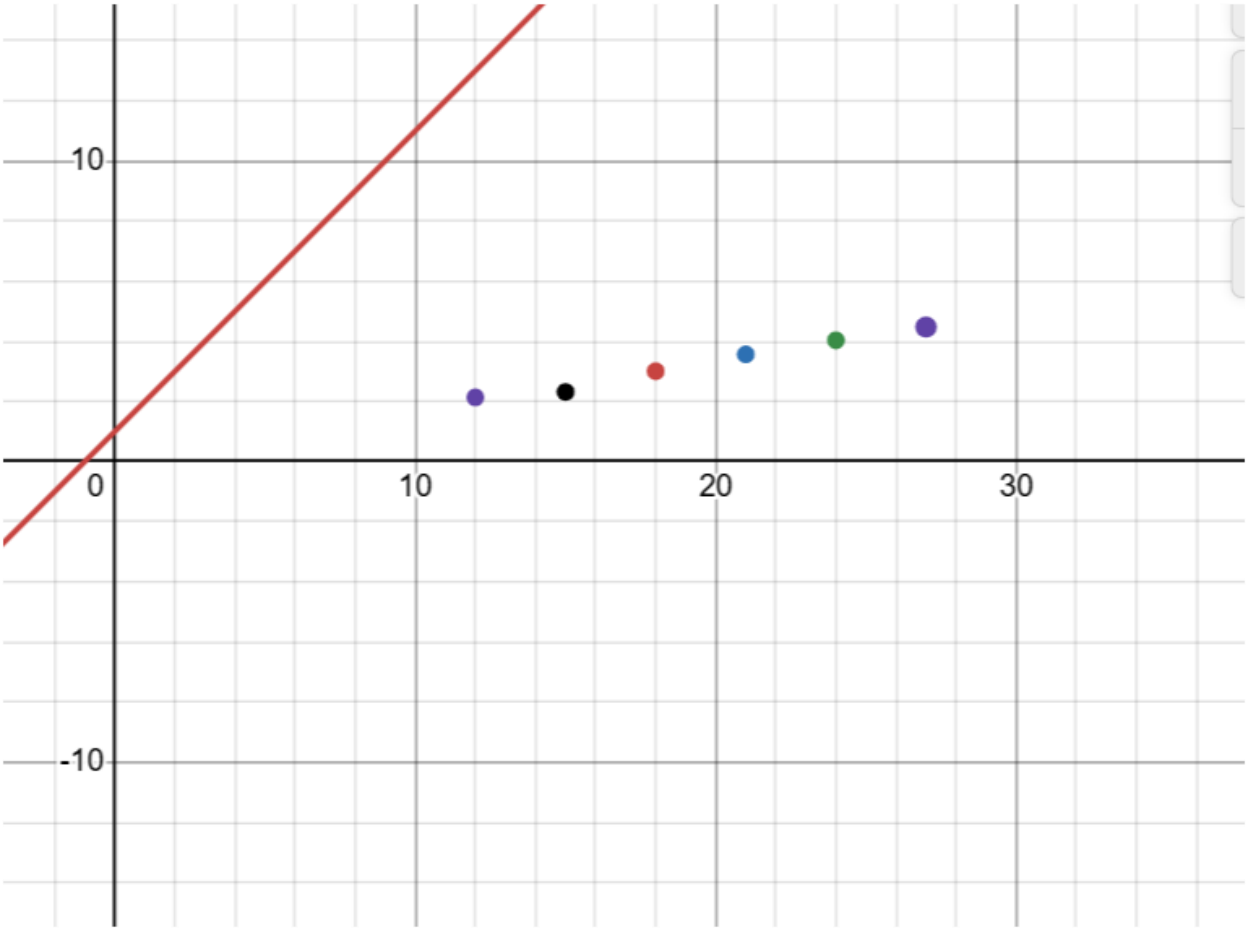
ACTIVITY 01 (Muhammad Anas)

The x and y points are x = [12, 15, 18, 21, 24, 27]

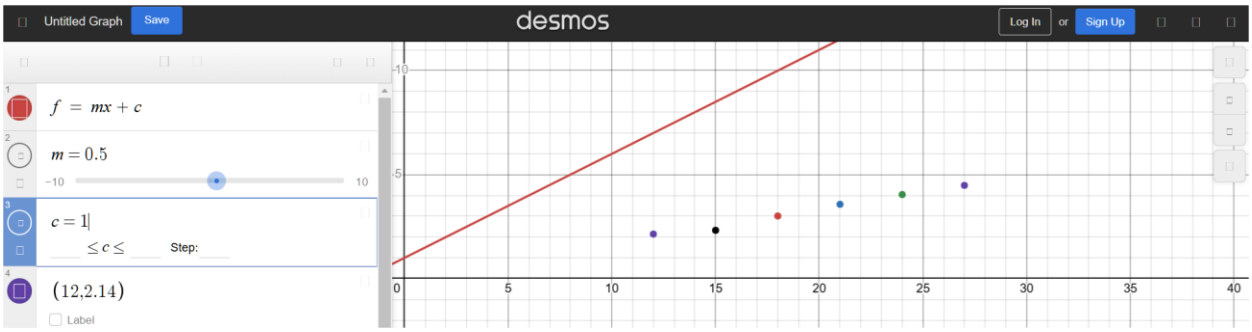
y = [2.14, 2.32, 3.01, 3.57, 4.04, 4.48]

Plot the above points and an equation of function y = mx +c using online plotting tool.

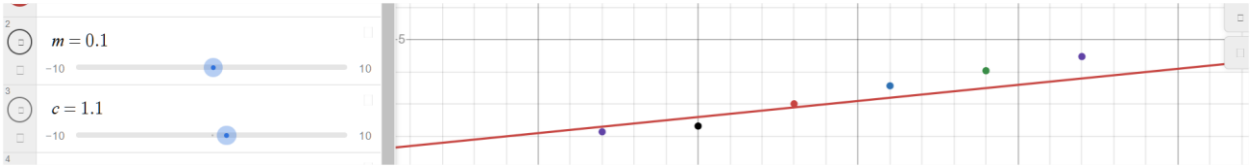


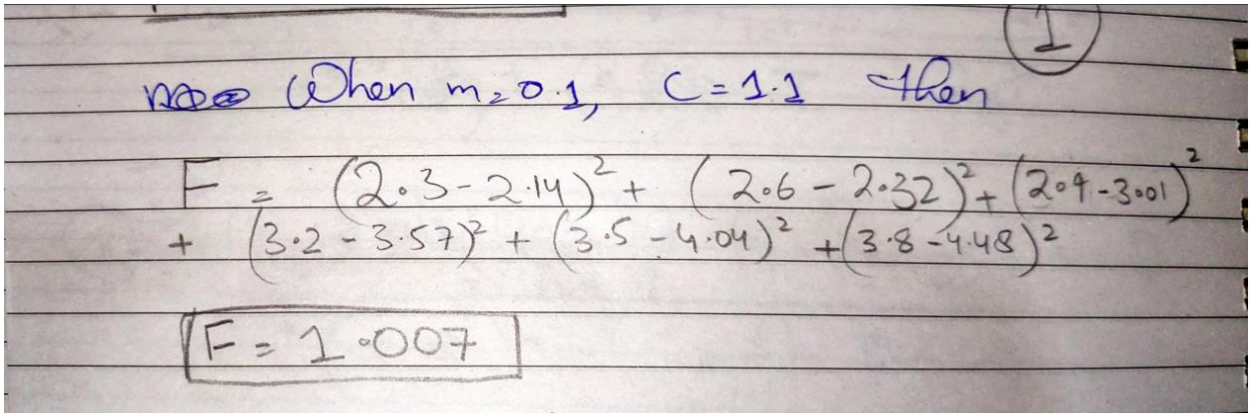
When we tweak the slope from 1 to 0.5 to be more inclined towards the points :

Then we observe slightly better approximation:

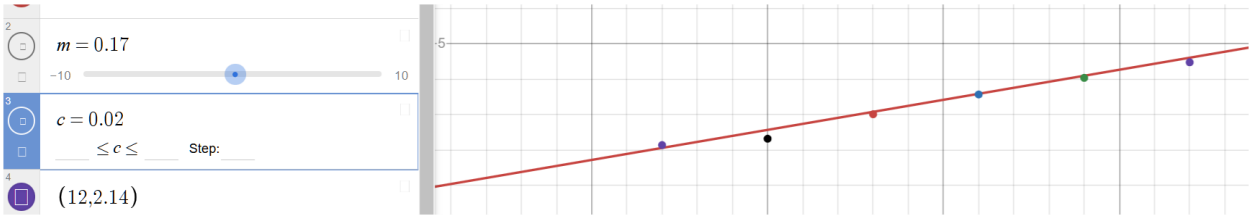


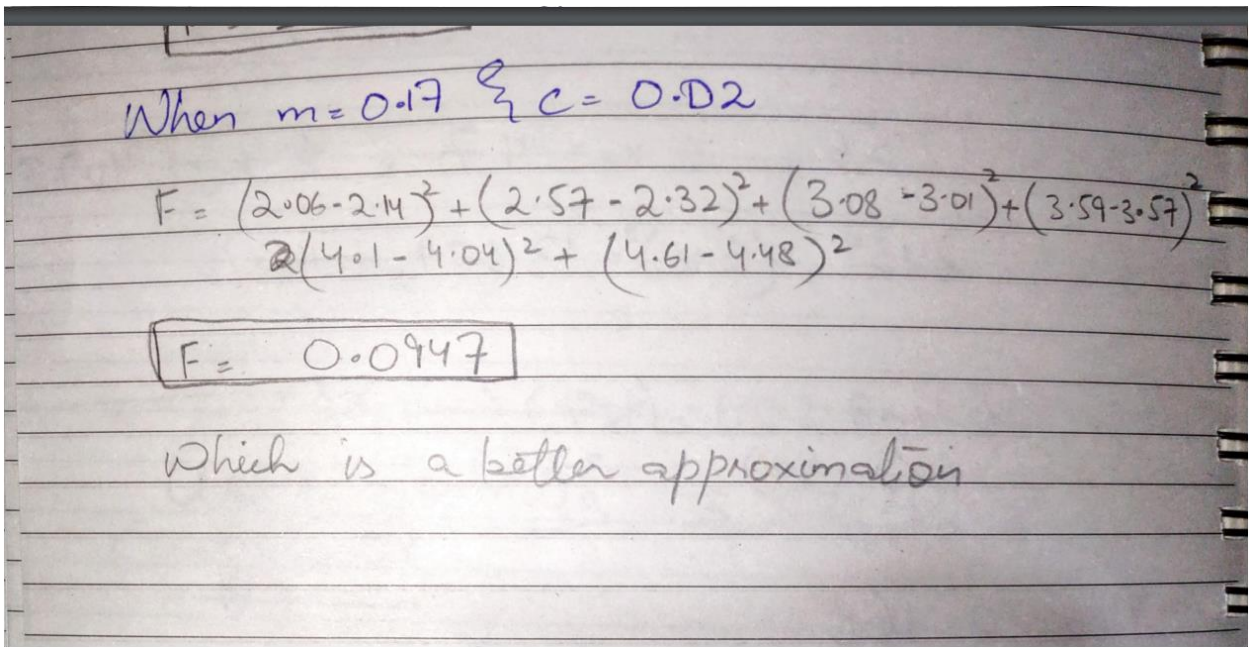
Clearly we need to decrease the y-intercept and slope few points so the line better coincides with the above dots, when after observing different values try with m = 0.1 and c = 1.1 I get loss(F) =



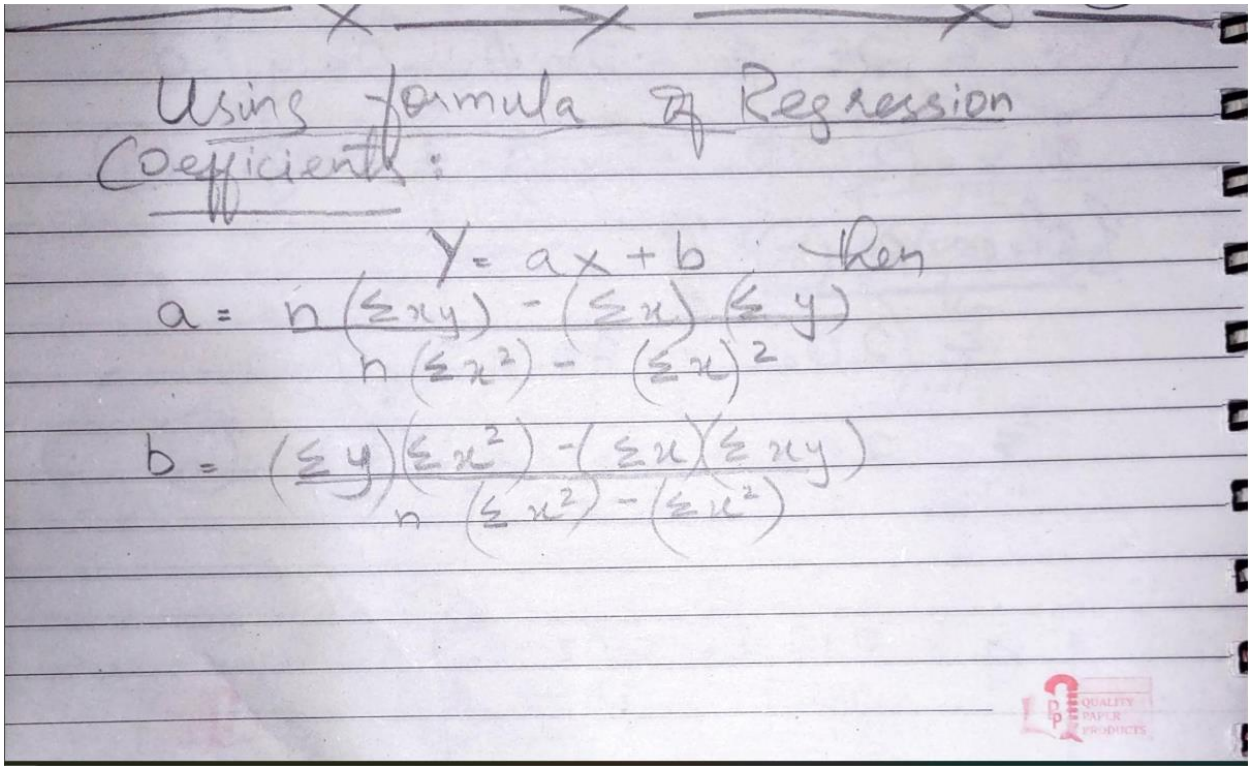


Now tweaking down the y-intercept we get a better approximation:





We can also confirm our loss functions output by determining the optimized values of m and c using the Regression Coefficients formula:



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$F = \phi_0 x + \phi_1$

$$\phi_0 = \frac{I\left(\sum_{i=1}^{I} x_i y_i\right) - \sum_{i=1}^{I} x_i \sum_{i=1}^{I} y_i}{I\sum(x_i^2) - (\sum x_i)^2} \quad \text{(i)}$$

$$\phi_1 = \frac{(\sum y)(\sum x_i^2) - \left(\sum_{i=1}^{I} x\right)\left(\sum(x_i y_i)\right)}{I\left(\sum_{i=1}^{I} x^2\right) - \left(\sum_{i=1}^{I} x\right)^2} \quad \text{(ii)}$$

$\sum y = 19.56$, $\sum x = 117$, $\sum xy = 407.55$

$\sum x^2 = 2439$, $(\sum x)^2 = 13689$,

$$\phi_0 = \frac{6(407.55) - (117)(19.56)}{6(2439) - 13689}$$

$\phi_0 = 0.166$

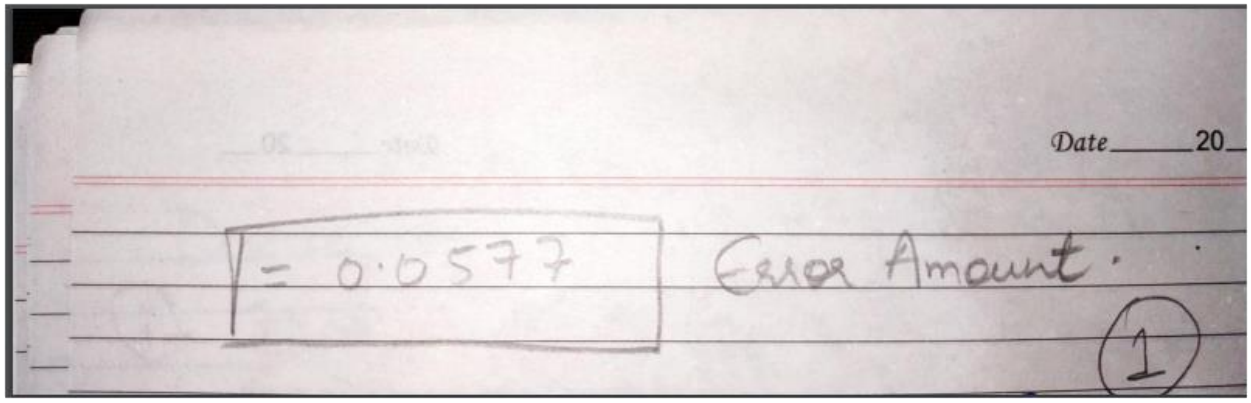
Similarly $\phi_1 = 0.02$

So Cost Fn is $F = 0.166x + 0.02$

Now $\sum_{i=1}^{I} \left[(0.166x_i + 0.02) - y_i\right]$

$= (2.012 - 2.14)^2 + (2.51 - 2.32)^2 + (3.006 - 3.01)^2$
$+ (3.506 - 3.57)^2 + (4.004 - 4.04)^2 + (4.502 - 4.5)^2$

$= 0.016 + 0.0361 + 4 \times 10^{-6} + 4.096 \times 10^{-3} + 1.089 \times 10^{-3} + 4 \times 10^{-4}$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