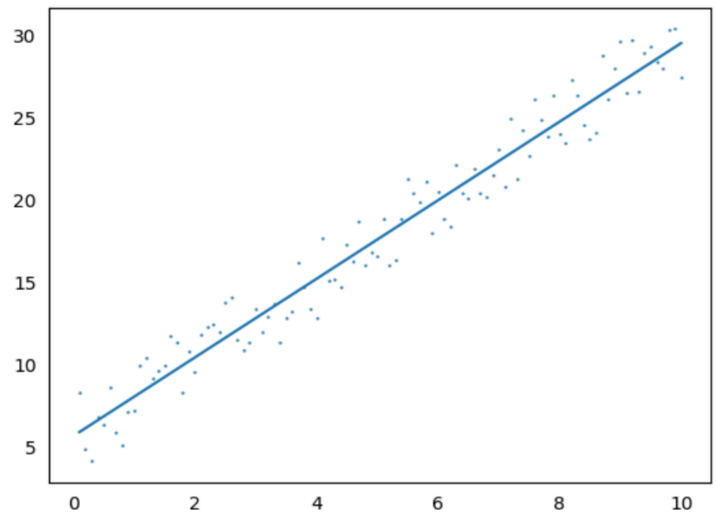
Linear Regression & Gradient descent report

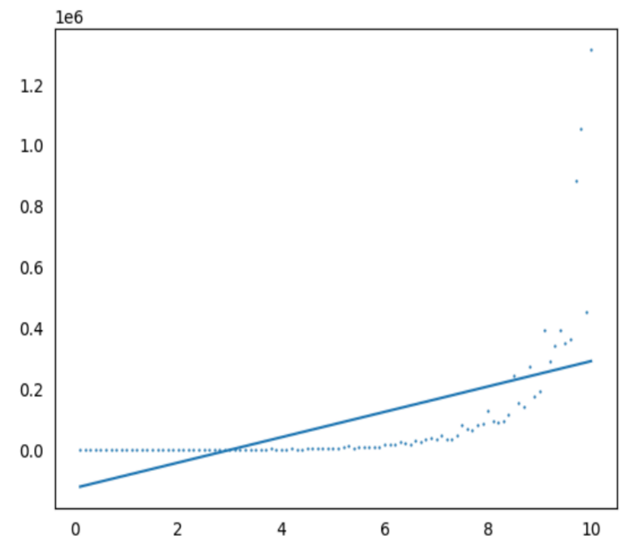
Dataset-1

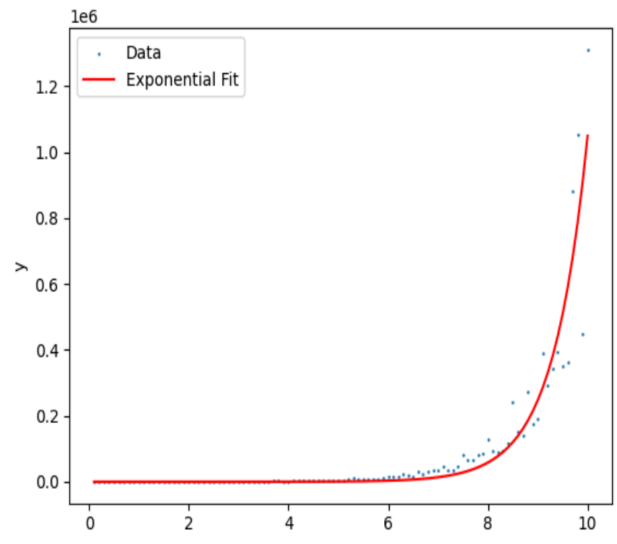


Results	MSE	MAE	RMSE	R^2
mine	2.0785254017773274	1.2805559784291467	1.4417091945941551	0.9579571905586357
sklearn	2.0785254017773265	1.2805559784291467	1.4417091945941547	0.9579571905586357
GD	16.261964320368037	3.4712954118132653	4.032612592398139	0.6710655224714244

R^2 is almost approaching 1, the high value of R^2 indicates that our modeled curve is significantly following the data points and is closer to the best fit curve. This dataset follows a linear curve. Although gradient descent results are diversing from other results, this can be due to my lack of robustness of implementation of gradient descent. We can see in the above figure that the curve is fitting on this dataset. Also our MSE, MAE and RMSE are lower which supports our argument of linear hyperplane.

Dataset-2





Results	MSE	MAE	RMSE	R^2
mine	27577785853.164066	99929.78329714174	166065.60707492707	0.34338909644390136
sklearn	27577785853.164074	99929.78329714174	166065.6070749271	0.34338909644390125
GD	20387553639.474777	71671.1027460834	142784.9909460892	0.514584307536855

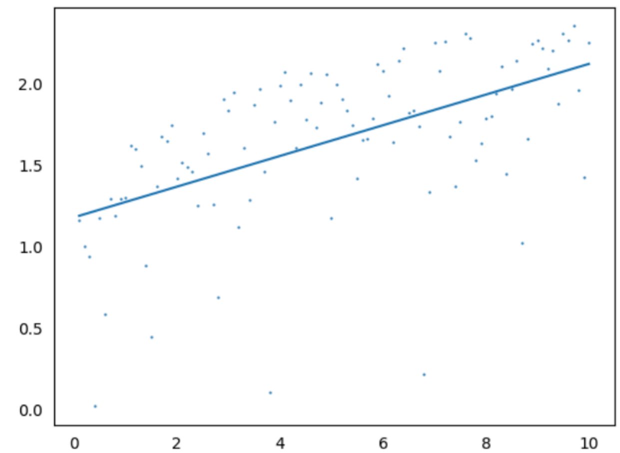
The high values of MAE, MSE and RMSE indicate that the modeled curve is much farther than the actual best fit curve. So the usual linear regression will not work in this case and we need to find out the function for the best fit curve. So we plot the data as shown in the above first figure.

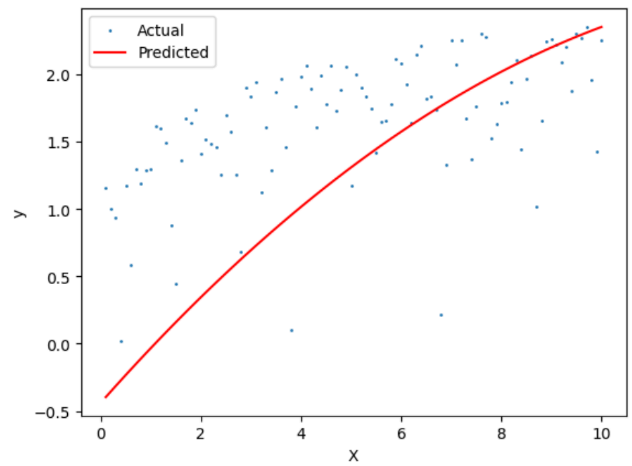
In the above graph we can see the data points follow an exponential path. We will use exponential regression for this.

$$y = ae^{bx}$$

If we put $a = 0.5499898103356$ & $b = 1.4461636010212$, in the above equation we can find a best fit curve for the dataset.
After plotting with the above function with parameters *a* and *b* we found our exponential curve that exactly fits on the data and minimizes the error.

Dataset-3





Results	MSE	MAE	RMSE	R^2
mine	0.1617304414308856	0.2946779330131035	0.4021572347116058	0.3136973226728073
sklearn	0.1617304414308855	0.2946779330131033	0.4021572347116058	0.3136973226728078
GD	0.6365619789682871	0.6422309923146006	0.7978483433386868	-1.701248983094667

The low values of R^2 indicates that the curve is not modeled good enough and is diverging from the data points. The points are spread widely in the plane, hence to find a best fit curve this needs a non-linear transformation of input features. The second figure from gradient descent represents what the curve should look like. On an average this will minimize the errors.

Dataset-4

Results	MSE	MAE	RMSE	R^2
mine	34.62048082924354	5.155505630377052	5.883917133104743	0.9841749058943147
sklearn	34.62048082924355	5.155505630377052	5.883917133104744	0.9841749058943147

As R^2 from both(sklearn & my own analysis) yields the same value $R^2 \simeq 1$, indicates that the data points follow a multivariate regression. This high R^2 suggests that our model explains a significant portion of the variability in the data. Also lower MAE indicates that on an average our modeled curve is closer to the best fit curve.