Question 1: Polynomial Regression

1. degree = 1

```
coefficient: 0.679  intercept: 18.91
rmse: 9.011604038845757  R2: 0.6011529068691401
```

2. degree = 2

```
coefficient: [[0.367 0.002]]  intercept: 29.737
rmse: 9.00283756834421  R2: 0.6019285247450423
```

4.

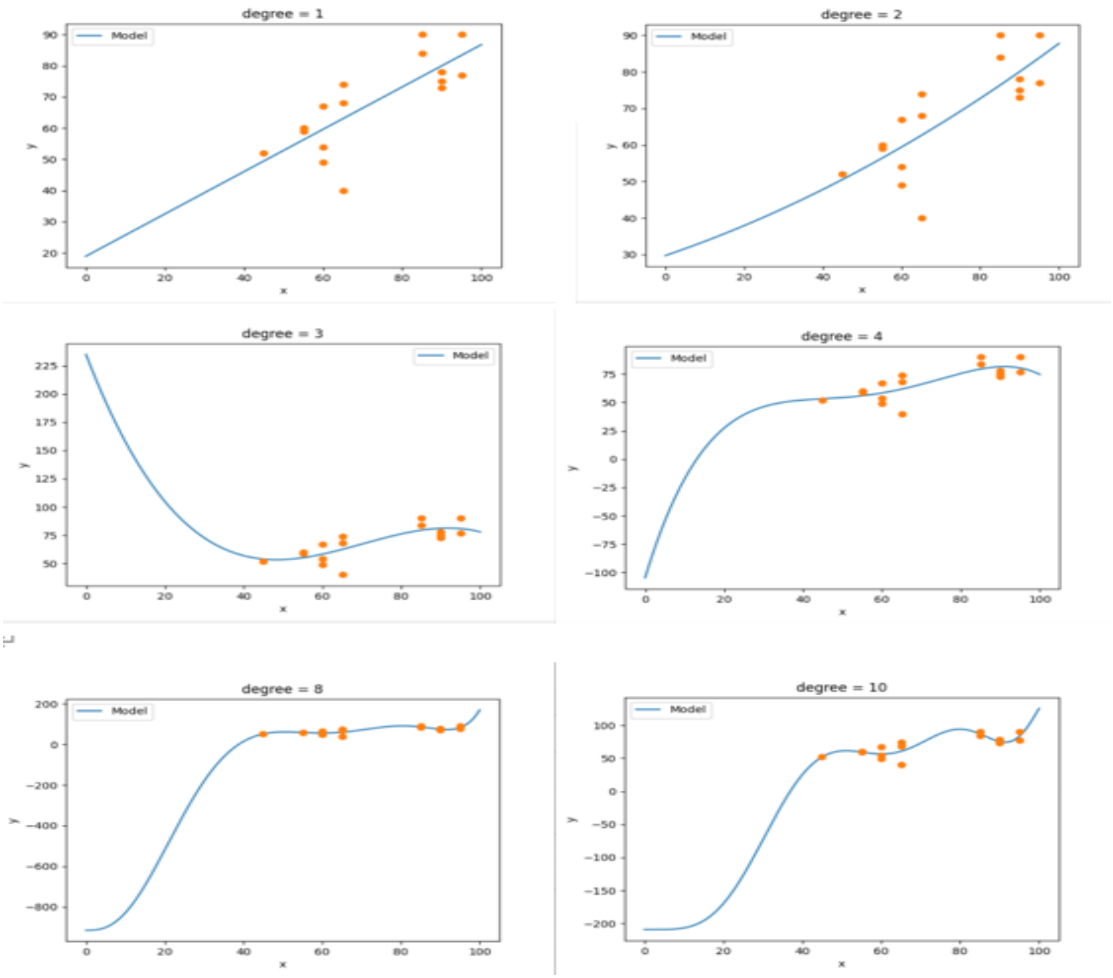
```
degree is: 2
coefficient: [[0.367 0.002]]  intercept: 29.737
rmse: 9.00283756834421  R2: 0.6019285247450423

degree is: 3
coefficient: [[-9.108e+00  1.440e-01 -1.000e-03]]  intercept: 235.052
rmse: 8.793154403317539  R2: 0.6202553818527137

degree is: 4
coefficient: [[ 1.1494e+01 -3.1200e-01  4.0000e-03 -0.0000e+00]]  intercept: -104.661
rmse: 8.77868581531134  R2: 0.6215040459509857

degree is: 8
coefficient: [[ 0.     0.008  0.142 -0.007  0.    -0.     0.    -0.   ]]  intercept: -915.895
rmse: 7.693342940125137  R2: 0.7093084461637718

degree is: 10
coefficient: [[ 0.  0.  0.  0.  0. -0.  0. -0.  0. -0.]]  intercept: -209.127
rmse: 7.693341276947939  R2: 0.7093085718494497
```

It can be seen that the RMSE decreases as the degree increases, and R2 shows the opposite trend.

It can be seen from the figure that the linear model(degree=1) is underfitting.

A polynomial of degree 2 seems to be the most generalized model.

However, for higher degrees the model will overfit the training data.



6.

```
Full,degree = 1
coefficient: [[0.588 0.156]]  intercept: 15.454
rmse: 8.858207696435857  R2: 0.6146157631828326

Full,degree = 2
coefficient: [[ 1.33  -1.635  0.005 -0.023  0.026]]  intercept: 45.89
rmse: 8.421161631613572  R2: 0.6517058056596826
```

When using ordinary linear regression, there is no need for normalization. The result of linear regression will not be affected. And the metrics of "MCQ1" and "MCQ2" are the same.