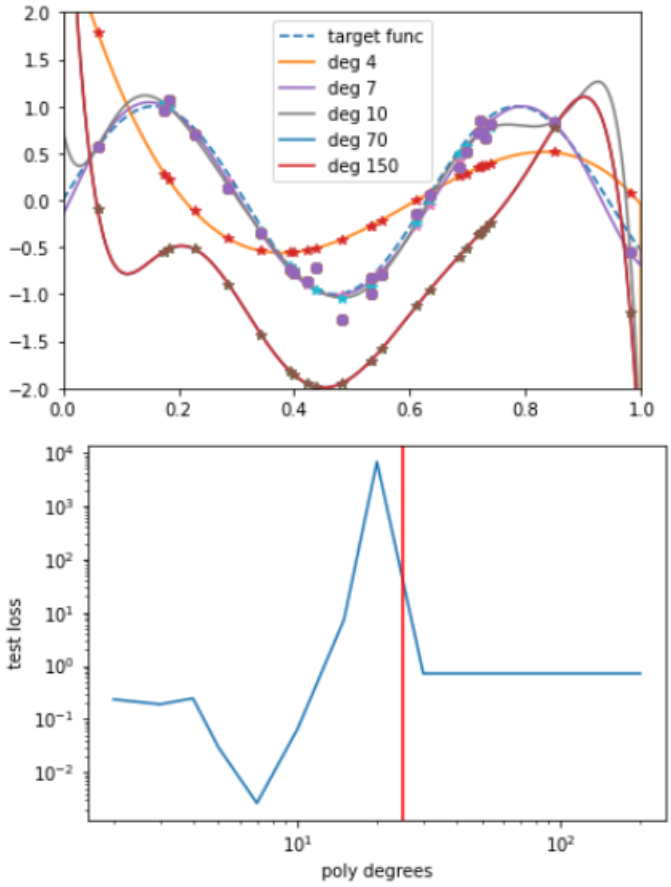
Question 3 -5:

```
# to be implemented; fill in the derived solution for the unc

def fit_poly(X, d, t):
    X_expand = poly_expand(X, d=d, poly_type=poly_type)
    if d > n:
        W = X_expand.T@np.linalg.inv(X_expand@X_expand.T)@t
    else:
        W = np.linalg.inv(X_expand.T@X_expand)@X_expand.T@t
    return W
```

```
2 0.23473638175555447
3 0.19020505096352716
4 0.24537346900180165
5 0.02963124207539845
7 0.002650135078807432
10 0.06635344938407685
15 7.3835492062768155
20 6706.8570800068255
30 0.7170381150111599
50 0.7170381150111599
70 0.7170381150111599
100 0.7170381150111599
150 0.7170381150111599
200 0.7170381150111599
```



No, overparameterization does not always lead to overfitting. Here, overparameterization give stable and better performance than the medium range of parameters (9-35). Implicit regularization induced by gradient descent is reason for this trend.