Problem 1

Report the following four numbers:

1. Training accuracy of **linear** regression on **Dataset A**

   ```
   Accuracy of linear regression on dataset A: 0.92
   ```

2. Training accuracy of **logistic** regression on **Dataset A**
3.
   ```
   Accuracy of logistic regression on dataset A: 0.9175
   ```

4. Training accuracy of **linear** regression on **Dataset B**

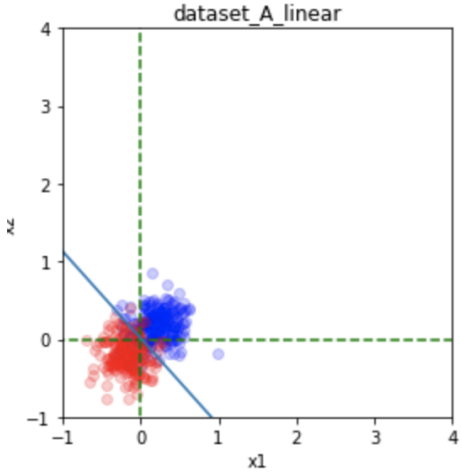
   ```
   Accuracy of linear regression on dataset B: 0.75
   ```

5. Training accuracy of **logistic** regression on **Dataset B**

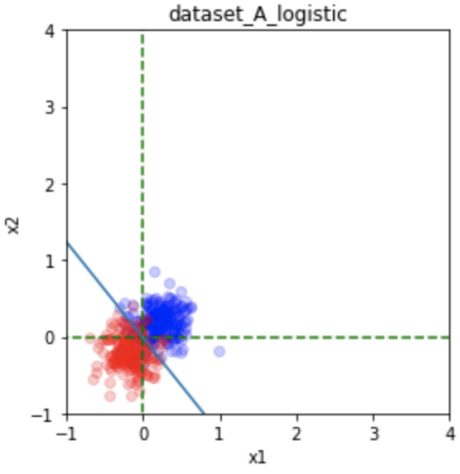
   ```
   Accuracy of logistic regression on dataset B: 0.915
   ```

Plot four decision boundaries:

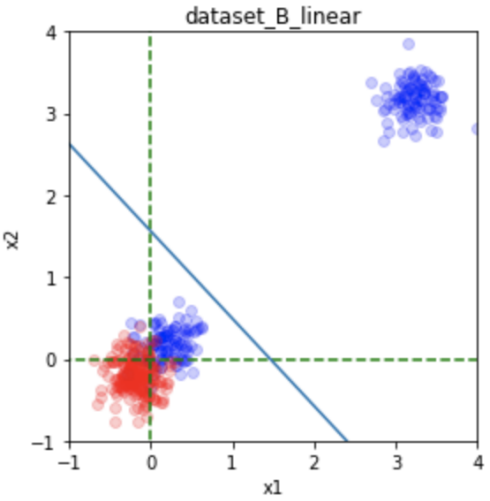
1. Decision boundary plot of **linear** regression on **Dataset A**



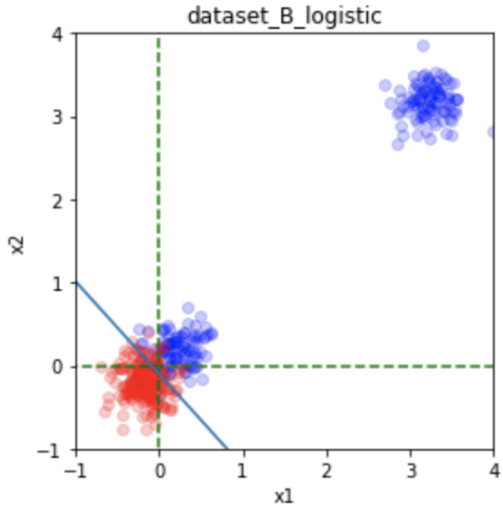
2. Decision boundary plot of **logistic** regression on **Dataset A**



3. Decision boundary plot of **linear** regression on **Dataset B**



4. Decision boundary plot of **logistic** regression on **Dataset B**



Problem 2

the default hyperparameters:

```
alpha    = 0.1       # learning rate
batch_size    = 100     # batch size
MaxEpoch = 50         # Maximum epoch
decay = 0.           # weight decay
```

Without changing the default hyperparameters, we report three numbers:

1. The number of epoch that yields the best validation performance

```
The number of epoch that yields the best validation performance is  48
```

2. The validation performance (accuracy) in that epoch

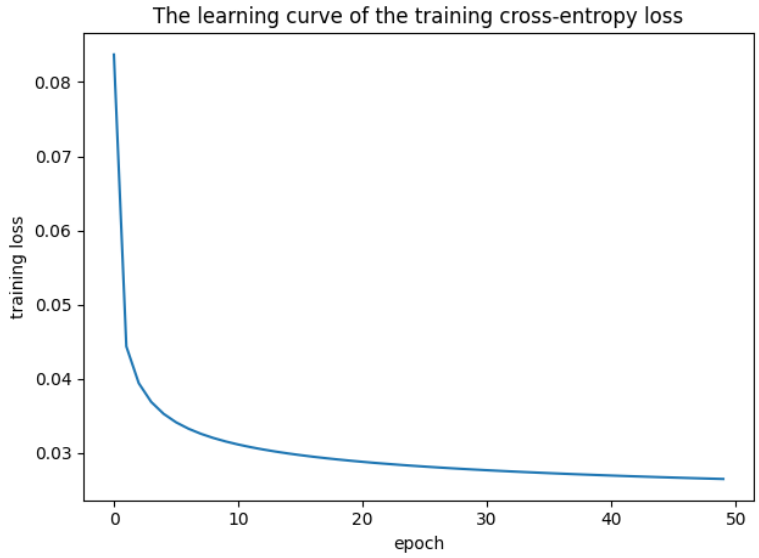
```
The validation performance (accuracy) in that epoch is  0.9157
```

3. The test performance (accuracy) in that epoch

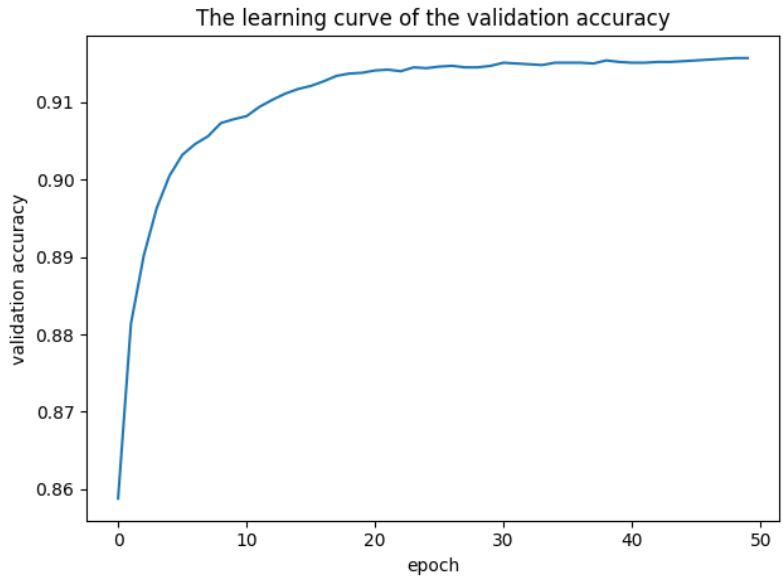
```
The test performance (accuracy) in that epoch is  0.9227
```

and two plots:

1. The learning curve of the training cross-entropy loss



2. The learning curve of the validation accuracy



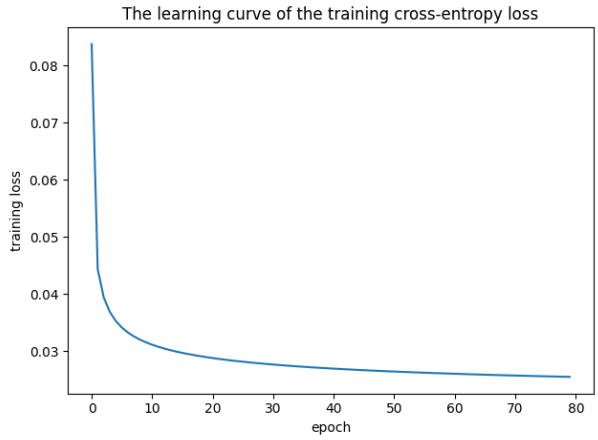
Ask one meaningful scientific question:

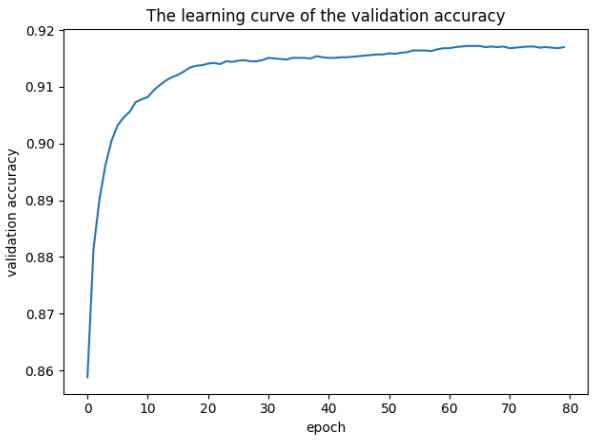
Question: We can explore when the value of MaxEpoch increases, if it will affect the performance of linear regression.

Design: We can let MaxEpoch increase to 80, without changing any other hyperparameters, then report three numbers and two plots.

Results:

```
The number of epoch that yields the best validation performance is  63
The validation performance (accuracy) in that epoch is  0.9172
The test performance (accuracy) in that epoch is  0.9232
```





Conclusion: Comparing the results to the results of MaxEpoch=50, we can find that when MaxEpoch=80, all three numbers have increased. So we can conclude that when the value of MaxEpoch increases, it will affect the performance of linear regression.