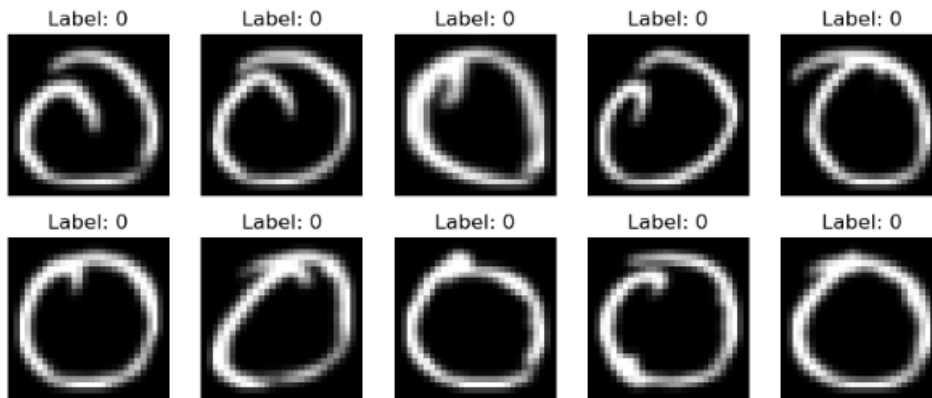


Worksheet 4

Output

Training set: (17000, 28, 28, 1), Labels: (17000, 10)
Testing set: (3000, 28, 28, 1), Labels: (3000, 10)



```
model.summary() # to see the architecture
```

Model: "sequential_2"

Layer (type)	Output Shape	Param #
flatten_2 (Flatten)	(None, 784)	0
dense_8 (Dense)	(None, 64)	50,240
dense_9 (Dense)	(None, 128)	8,320
dense_10 (Dense)	(None, 256)	33,024
dense_11 (Dense)	(None, 10)	2,570

Total params: 94,154 (367.79 KB)

Trainable params: 94,154 (367.79 KB)

Non-trainable params: 0 (0.00 B)

133/133 6s 42ms/step - accuracy: 0.7503 - loss: 0.7499 - val_accuracy: 0.8900 - val_loss: 0.3873
Epoch 4/500
133/133 5s 37ms/step - accuracy: 0.8086 - loss: 0.5835 - val_accuracy: 0.9163 - val_loss: 0.3040
Epoch 5/500
133/133 5s 40ms/step - accuracy: 0.8486 - loss: 0.4812 - val_accuracy: 0.9363 - val_loss: 0.2441
Epoch 6/500
133/133 5s 40ms/step - accuracy: 0.8688 - loss: 0.4030 - val_accuracy: 0.9490 - val_loss: 0.2020
Epoch 7/500
133/133 5s 37ms/step - accuracy: 0.8944 - loss: 0.3363 - val_accuracy: 0.9560 - val_loss: 0.1674
Epoch 8/500
133/133 5s 39ms/step - accuracy: 0.9055 - loss: 0.3013 - val_accuracy: 0.9610 - val_loss: 0.1452
Epoch 9/500
133/133 5s 40ms/step - accuracy: 0.9207 - loss: 0.2599 - val_accuracy: 0.9627 - val_loss: 0.1330
Epoch 10/500
133/133 5s 38ms/step - accuracy: 0.9297 - loss: 0.2331 - val_accuracy: 0.9667 - val_loss: 0.1196
Epoch 11/500
133/133 6s 41ms/step - accuracy: 0.9334 - loss: 0.2160 - val_accuracy: 0.9700 - val_loss: 0.1073
Epoch 12/500
133/133 5s 40ms/step - accuracy: 0.9390 - loss: 0.1926 - val_accuracy: 0.9663 - val_loss: 0.1110
Epoch 13/500
133/133 6s 42ms/step - accuracy: 0.9405 - loss: 0.1888 - val_accuracy: 0.9737 - val_loss: 0.0955
Epoch 14/500
133/133 5s 39ms/step - accuracy: 0.9431 - loss: 0.1780 - val_accuracy: 0.9750 - val_loss: 0.0908
Epoch 15/500
133/133 5s 39ms/step - accuracy: 0.9497 - loss: 0.1663 - val_accuracy: 0.9720 - val_loss: 0.0967
Epoch 16/500
133/133 5s 39ms/step - accuracy: 0.9477 - loss: 0.1642 - val_accuracy: 0.9740 - val_loss: 0.0881
Epoch 17/500
133/133 5s 40ms/step - accuracy: 0.9538 - loss: 0.1597 - val_accuracy: 0.9773 - val_loss: 0.0804
Epoch 18/500
133/133 5s 40ms/step - accuracy: 0.9519 - loss: 0.1517 - val_accuracy: 0.9787 - val_loss: 0.0779
Epoch 19/500
133/133 5s 37ms/step - accuracy: 0.9533 - loss: 0.1444 - val_accuracy: 0.9753 - val_loss: 0.0787
Epoch 20/500
133/133 5s 39ms/step - accuracy: 0.9581 - loss: 0.1283 - val_accuracy: 0.9783 - val_loss: 0.0782
Epoch 21/500
133/133 5s 40ms/step - accuracy: 0.9596 - loss: 0.1255 - val_accuracy: 0.9793 - val_loss: 0.0730

)
Epoch 18/500
133/133 5s 40ms/step - accuracy: 0.9519 - loss: 0.1517 - val_accuracy: 0.9787 - val_loss: 0.0779
Epoch 19/500
133/133 5s 37ms/step - accuracy: 0.9533 - loss: 0.1444 - val_accuracy: 0.9753 - val_loss: 0.0787
Epoch 20/500
133/133 5s 39ms/step - accuracy: 0.9581 - loss: 0.1283 - val_accuracy: 0.9783 - val_loss: 0.0782
Epoch 21/500
133/133 5s 40ms/step - accuracy: 0.9596 - loss: 0.1255 - val_accuracy: 0.9793 - val_loss: 0.0730
Epoch 22/500
133/133 5s 38ms/step - accuracy: 0.9592 - loss: 0.1295 - val_accuracy: 0.9803 - val_loss: 0.0720
Epoch 23/500
133/133 5s 39ms/step - accuracy: 0.9597 - loss: 0.1317 - val_accuracy: 0.9753 - val_loss: 0.0745
Epoch 24/500
133/133 5s 41ms/step - accuracy: 0.9607 - loss: 0.1270 - val_accuracy: 0.9817 - val_loss: 0.0667
Epoch 25/500
133/133 5s 38ms/step - accuracy: 0.9609 - loss: 0.1223 - val_accuracy: 0.9800 - val_loss: 0.0689
Epoch 26/500
133/133 5s 39ms/step - accuracy: 0.9664 - loss: 0.1106 - val_accuracy: 0.9820 - val_loss: 0.0667
Epoch 27/500
133/133 6s 42ms/step - accuracy: 0.9642 - loss: 0.1128 - val_accuracy: 0.9800 - val_loss: 0.0675
Epoch 28/500
133/133 5s 38ms/step - accuracy: 0.9666 - loss: 0.1070 - val_accuracy: 0.9820 - val_loss: 0.0626
Epoch 29/500
133/133 5s 39ms/step - accuracy: 0.9640 - loss: 0.1114 - val_accuracy: 0.9820 - val_loss: 0.0628
Epoch 30/500
133/133 5s 40ms/step - accuracy: 0.9645 - loss: 0.1122 - val_accuracy: 0.9817 - val_loss: 0.0614
Epoch 31/500
133/133 5s 38ms/step - accuracy: 0.9666 - loss: 0.1106 - val_accuracy: 0.9817 - val_loss: 0.0678
Epoch 32/500
133/133 5s 38ms/step - accuracy: 0.9633 - loss: 0.1166 - val_accuracy: 0.9830 - val_loss: 0.0616
Epoch 33/500
133/133 6s 43ms/step - accuracy: 0.9660 - loss: 0.1038 - val_accuracy: 0.9833 - val_loss: 0.0607
Epoch 34/500
133/133 5s 39ms/step - accuracy: 0.9671 - loss: 0.1039 - val_accuracy: 0.9850 - val_loss: 0.0626
Epoch 35/500
133/133 5s 39ms/step - accuracy: 0.9678 - loss: 0.1043 - val_accuracy: 0.9827 - val_loss: 0.0624
Epoch 36/500

