Proxenix Session 2

In [1]:
```
import numpy as np
```

In [3]:
```
import pandas as pd
from matplotlib import pyplot as plt
```

In [6]:
```
data= pd.read_csv('/content/train.csv.zip')
```

In [9]:
```
data= np.array(data)
#m- total no. of images , n- total no. of columns(how many px)
#m= total no. of images , n= 784px + 1(label)=785
#this is divided into testing/dev and train

m,n=data.shape
np.random.shuffle(data)
```

In [11]:
```
data_dev=data[0:1000].T
Y_dev=data_dev[0]
X_dev=data_dev[1:n]
X_dev=X_dev/255
```

In [13]:
```
data_train=data[1000:m].T
Y_train=data_train[0]
X_train=data_train[1:n]
X_train=X_train/255
_,m_train=X_train.shape
```

In [14]:
```
Y_train
```

Out[14]:
```
array([1, 0, 3, ..., 1, 5, 4])
```

In [31]:
```
def init_params():
  #it will create a matrix
  W1=np.random.rand(10,784)-0.5
  b1=np.random.rand(10,1)-0.5
  W2=np.random.rand(10,10)-0.5
  b2=np.random.rand(10,1)-0.5
  return W1,b1,W2,b2
def ReLU(Z):
  return np.maximum(Z,0)
def softmax(Z):
  A=np.exp(Z)/sum(np.exp(Z))
  return A
def forward_prop(W1,b1,W2,b2,X):
  Z1=W1.dot(X)+b1
  A1=ReLU(Z1)
  Z2=W2.dot(A1)+b2
  A2=softmax(Z2)
```

```
  return Z1,A1,Z2,A2
def ReLU_deriv(Z):
  return Z>0
def one_hot(Y):
  one_hot_Y=np.zeros((Y.size,Y.max()+1))
  #first i will crate a matrix of zeros
  one_hot_Y[np.arange(Y.size),Y]=1
  one_hot_Y=one_hot_Y.T
  return one_hot_Y
def backward_prop(Z1,A1,Z2,A2,W1,W2,X,Y):
  one_hot_Y=one_hot(Y)
  dZ2=A2-one_hot_Y
  dW2=1/m*dZ2.dot(A1.T)
  db2=1/m*np.sum(dZ2)
  dZ1=W2.T.dot(dZ2)*ReLU_deriv(Z1)
  dW1=1/m*dZ1.dot(X.T)
  db1=1/m*np.sum(dZ1)
  return dW1,db1,dW2,db2
def update_params(W1,b1,W2,b2,dW1,db1,dW2,db2,alpha):
  W1=W1-alpha*dW1
  b1=b1-alpha*db1
  W2=W2-alpha*dW2
  b2=b2-alpha*db2
  return W1,b1,W2,b2
```

In [35]:
```
def get_predictions(A2):
  return np.argmax(A2,0)
def get_accuracy(predictions, Y):
  print(predictions, Y)
  return np.sum(predictions == Y) / Y.size
```

In [36]:
```
def gradient_descent(X,Y,alpha,iterations):
  W1,b1,W2,b2=init_params()
  for i in range(iterations):
    Z1,A1,Z2,A2=forward_prop(W1,b1,W2,b2,X)
    dW1,db1,dW2,db2=backward_prop(Z1,A1,Z2,A2,W1,W2,X,Y)
    W1,b1,W2,b2=update_params(W1,b1,W2,b2,dW1,db1,dW2,db2,alpha)
    if i%10==0:
      print("Iteration: ",i)
      predictions=get_predictions(A2)
      print(get_accuracy(predictions,Y))
  return W1,b1,W2,b2
```

In [37]:
```
W1,b1,W2,b2 = gradient_descent(X_train,Y_train,0.10,500)
```

```
Iteration:  0
[6 6 6 ... 6 6 6] [1 0 3 ... 1 5 4]
0.11139024390243903
Iteration:  10
[6 0 6 ... 6 6 6] [1 0 3 ... 1 5 4]
0.20341463414634145
Iteration:  20
[6 0 6 ... 6 6 6] [1 0 3 ... 1 5 4]
0.2873170731707317
Iteration:  30
[6 0 6 ... 1 6 6] [1 0 3 ... 1 5 4]
0.35324390243902437
Iteration:  40
[6 0 6 ... 1 0 9] [1 0 3 ... 1 5 4]
0.40187804878048783
Iteration:  50
[6 0 6 ... 1 0 9] [1 0 3 ... 1 5 4]
0.44521951219512196
Iteration:  60
[6 0 6 ... 1 0 4] [1 0 3 ... 1 5 4]
0.48741463414634145
Iteration:  70
[6 0 3 ... 1 0 4] [1 0 3 ... 1 5 4]
0.5262926829268293
Iteration:  80
[6 0 3 ... 1 0 4] [1 0 3 ... 1 5 4]
0.5559512195121952
Iteration:  90
[1 0 6 ... 1 5 4] [1 0 3 ... 1 5 4]
0.5802926829268292
Iteration:  100
[1 0 6 ... 1 5 4] [1 0 3 ... 1 5 4]
0.6029024390243902
Iteration:  110
[1 0 6 ... 1 5 4] [1 0 3 ... 1 5 4]
0.6231951219512195
Iteration:  120
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.6422682926829268
Iteration:  130
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.6594146341463415
Iteration:  140
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.6754634146341464
Iteration:  150
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.6905365853658536
Iteration:  160
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7036585365853658
Iteration:  170
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7166585365853658
```

```
Iteration:  180
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7291219512195122
Iteration:  190
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7396341463414634
Iteration:  200
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7494878048780488
Iteration:  210
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7574390243902439
Iteration:  220
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7650487804878049
Iteration:  230
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7714878048780488
Iteration:  240
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7779024390243903
Iteration:  250
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7824146341463415
Iteration:  260
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7880243902439025
Iteration:  270
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7934146341463415
Iteration:  280
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.7976341463414635
Iteration:  290
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8020243902439025
Iteration:  300
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8058536585365854
Iteration:  310
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8089756097560976
Iteration:  320
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8123414634146342
Iteration:  330
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8155365853658536
Iteration:  340
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8188292682926829
Iteration:  350
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8222926829268292
```

```
Iteration:  360
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8248292682926829
Iteration:  370
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8274878048780487
Iteration:  380
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8294390243902439
Iteration:  390
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8317073170731707
Iteration:  400
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8335853658536585
Iteration:  410
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8358048780487805
Iteration:  420
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8374146341463414
Iteration:  430
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8393414634146341
Iteration:  440
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8408536585365853
Iteration:  450
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8427317073170731
Iteration:  460
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8442195121951219
Iteration:  470
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8457317073170731
Iteration:  480
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8469268292682927
Iteration:  490
[1 0 5 ... 1 5 4] [1 0 3 ... 1 5 4]
0.8483414634146341
```

In [39]:

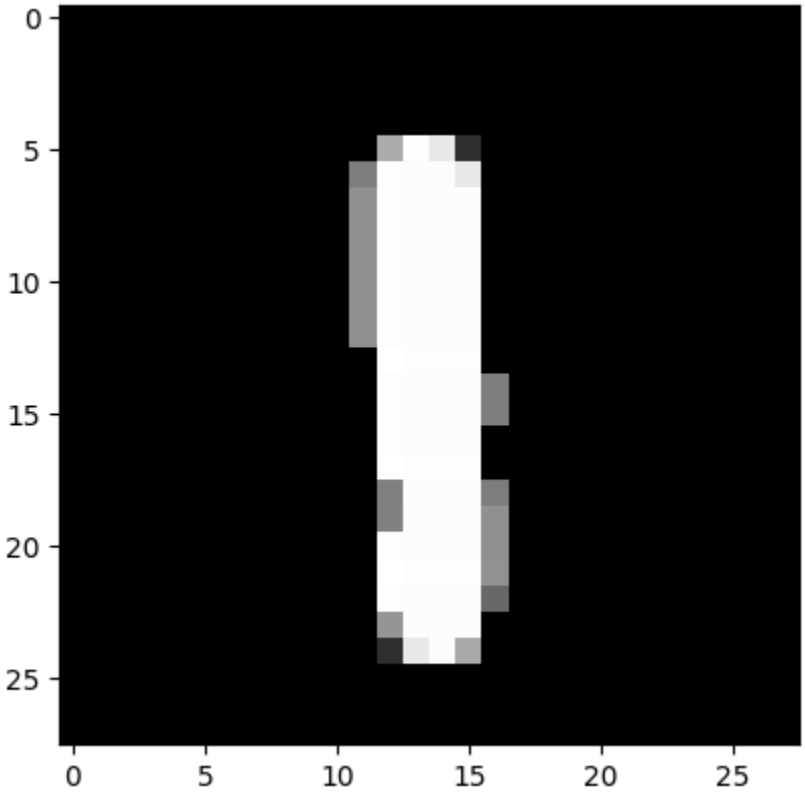
```python
def make_predictions(X,W1,b1,W2,b2):
  _,_,_,A2 = forward_prop(W1,b1,W2,b2,X)
  predictions = get_predictions(A2)
  return predictions

def test_prediction(index,W1,b1,W2,b2):
  current_image = X_train[:,index,None]
  prediction = make_predictions(X_train[:, index, None],W1,b1,W2,b2)
  label = Y_train[index]
  print("Prediction: ", prediction)
  print("Label: ", label)
```

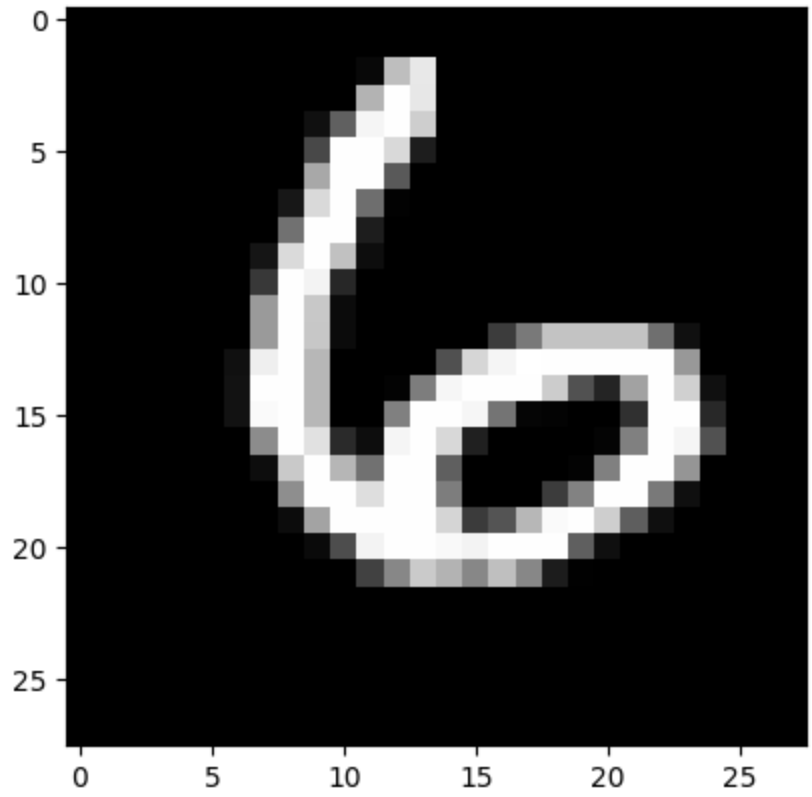
```
    current_image = current_image.reshape((28, 28)) * 255
    plt.gray()
    plt.imshow(current_image, interpolation='nearest')
    plt.show()
```

In [41]:
```
test_prediction(0,W1,b1,W2,b2)
test_prediction(3,W1,b1,W2,b2)
test_prediction(5,W1,b1,W2,b2)
test_prediction(6,W1,b1,W2,b2)
test_prediction(22,W1,b1,W2,b2)
```

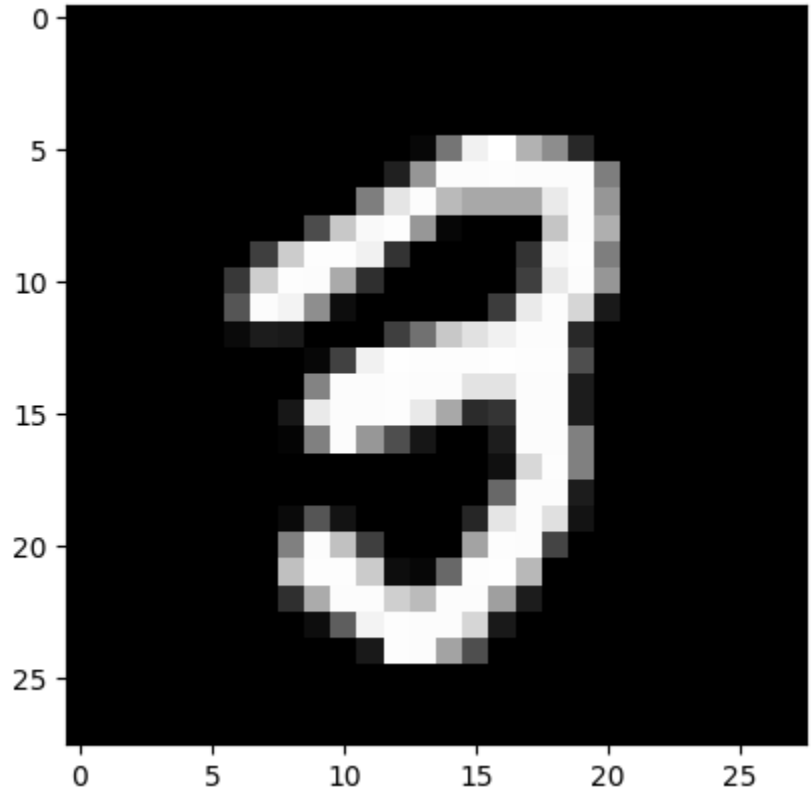
```
Prediction:  [1]
Label:  1
```



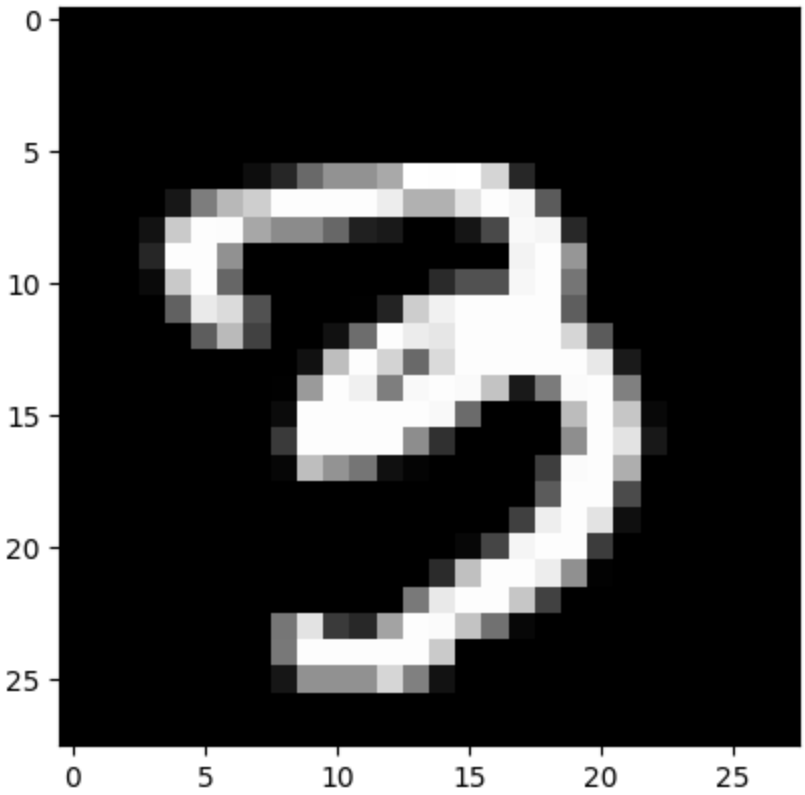

```
Prediction:  [6]
Label:  6
```



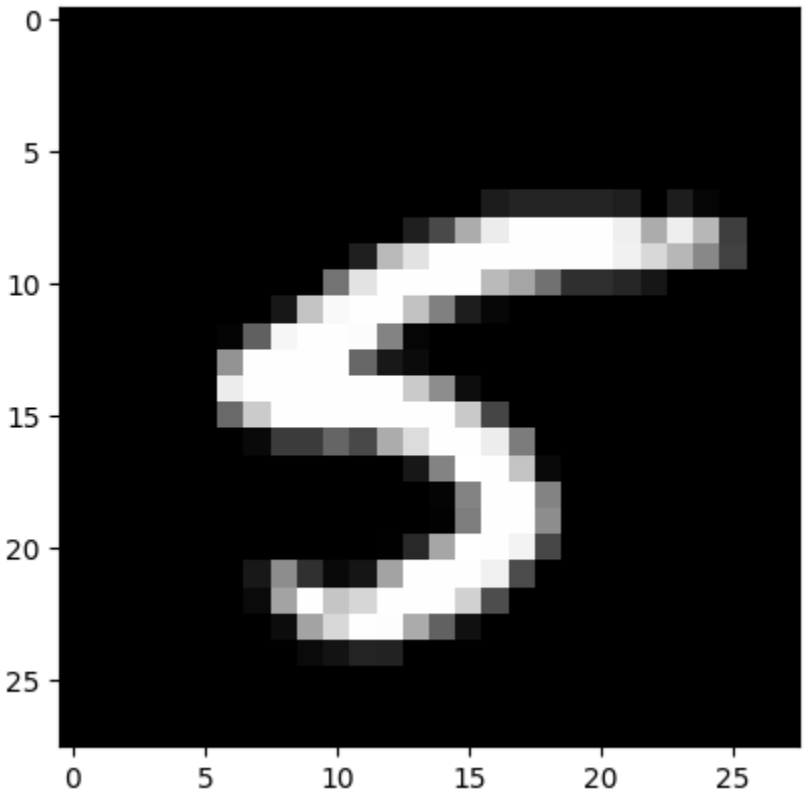

```
Prediction:  [8]
Label:  3
```




```
Prediction:  [3]
Label:  3
```

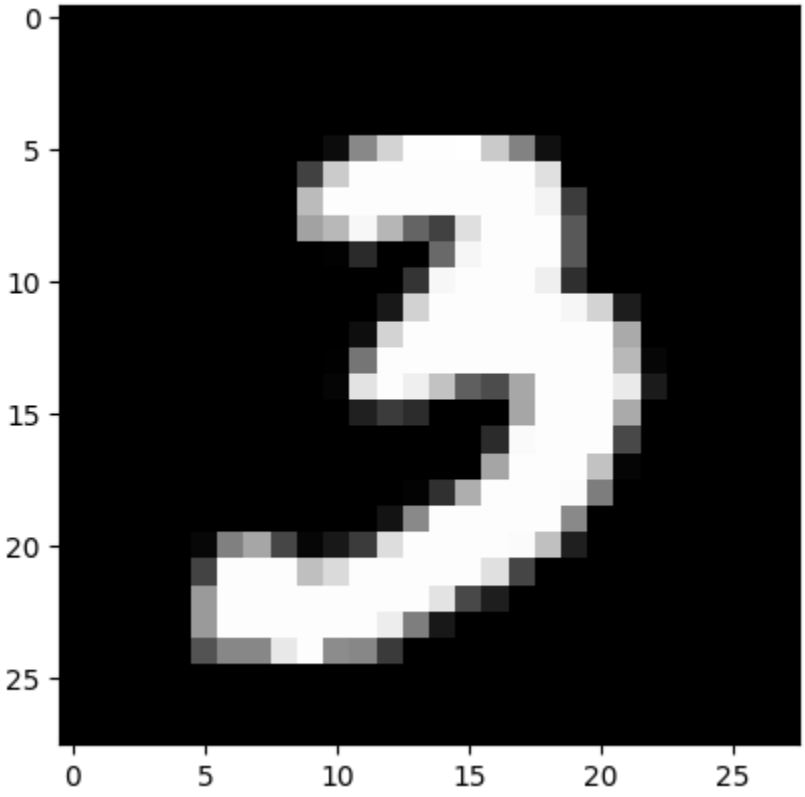



```
Prediction:  [5]
Label:  5
```



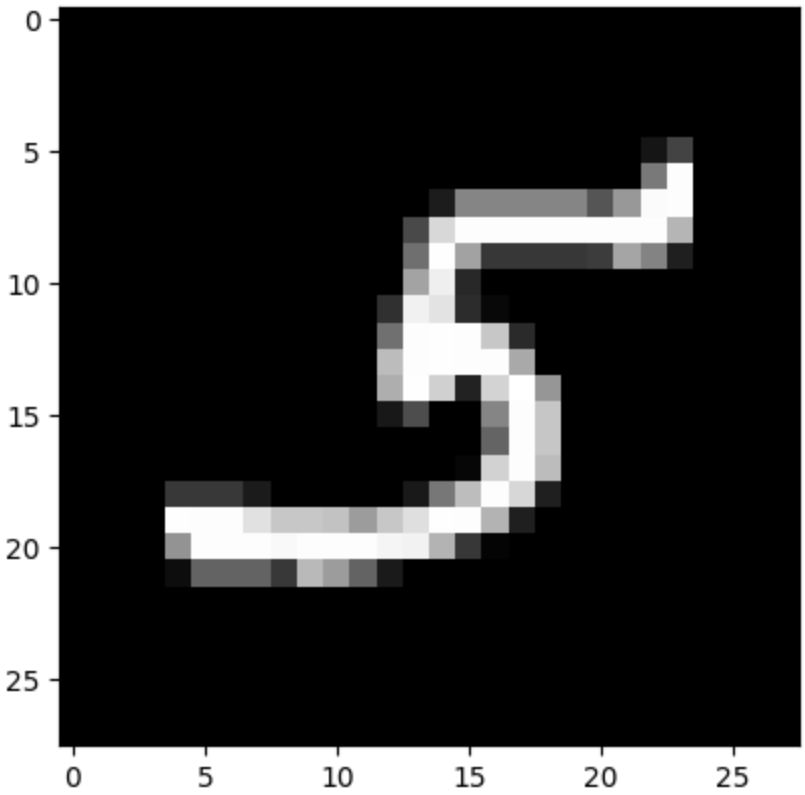
In [43]:
```
test_prediction(33,W1,b1,W2,b2)
```

```
Prediction:  [3]
Label:  3
```



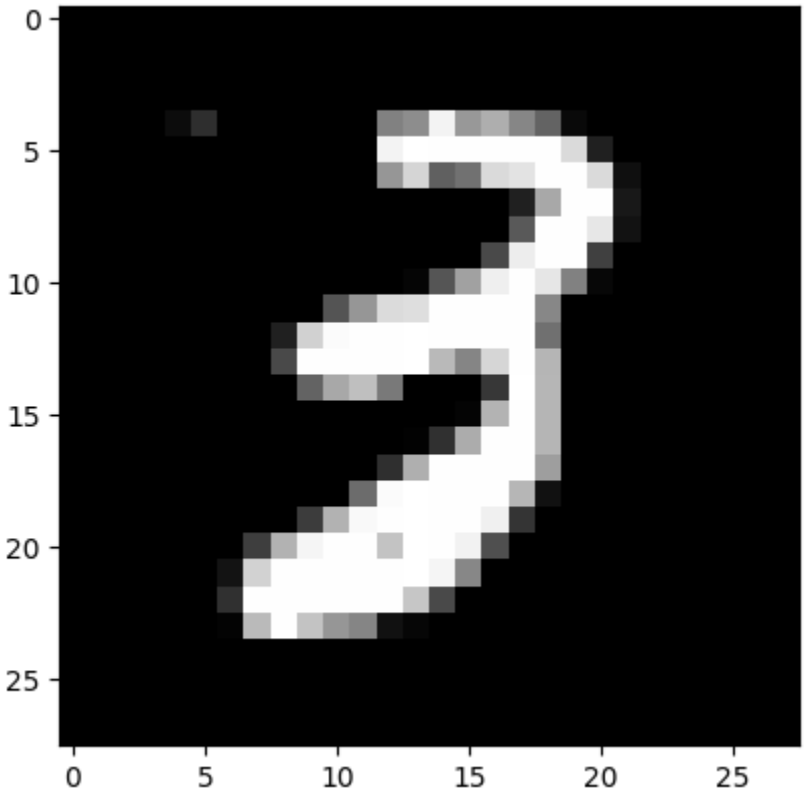
In [44]:
```
test_prediction(12,W1,b1,W2,b2)
```

```
Prediction:  [3]
Label:  5
```



In [45]:
```
test_prediction(34,W1,b1,W2,b2)
```

```
Prediction:  [3]
Label:  3
```



In [ ]: