In [141]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

In [142]:

```
from PIL import Image
```

In [143]:

```
dataset= pd.read_csv('Dataset.csv')
```

In [144]:

```
x= dataset.iloc[:,1:].values
```

In [145]:

```
type(x)
```

Out[145]:

```
numpy.ndarray
```

In [146]:

```
y= dataset.iloc[:,0].values
```

In [147]:

```
np.where(y==3)
```

Out[147]:

```
(array([    7,     9,    13, ..., 41984, 41985, 41990], dtype=int64),)
```

In [148]:

```
x[7,:].reshape(28,28)
```

Out[148]:

```
array([[  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,  21, 130, 190, 254,
        254, 250, 175, 135,  96,  96,  16,   4,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,  26, 102, 186, 254, 254, 248, 222,
        222, 225, 254, 254, 254, 254, 254, 206, 112,   4,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0, 207, 254, 254, 177, 117,  39,   0,
          0,  56, 248, 102,  48,  48, 103, 192, 254, 135,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,  91, 111,  36,   0,   0,   0,   0,
          0,  72,  92,   0,   0,   0,   0,  12, 224, 210,   5,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,  50, 139, 240, 254,  66,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   7, 121, 220, 254, 244, 194,  15,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   8, 107, 112, 112, 112,  87,
        112, 141, 218, 248, 177,  68,  20,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,  77, 221, 254, 254, 254, 254,
        254, 225, 104,  39,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,  10,  32,  32,  32,  32,
        130, 215, 195,  47,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   6, 111, 231, 174,   5,   0,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,  47,  18,   0,   0,   0,   0,   0,   0,
          0,   0,   0,  40, 228, 205,  35,   0,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,  22, 234,  42,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,  56, 212, 226,  38,   0,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,  96, 157,   0,   0,   0,   0,   0,   0,   0,
```

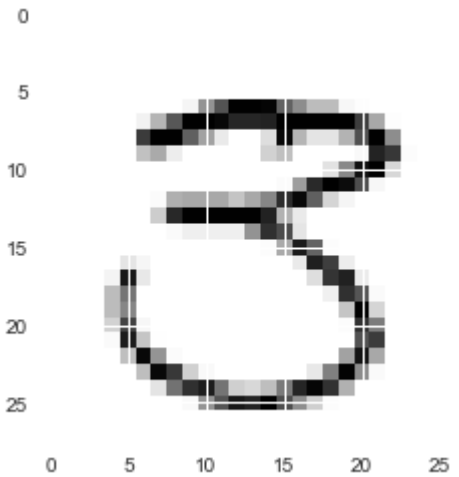
```
       0,   0,   0,   0,   0,  30, 215, 188,   9,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,  96, 142,   0,   0,   0,   0,   0,   0,   0,
       0,   0,   0,   0,   0,   0,  86, 254,  68,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,  71, 202,  15,   0,   0,   0,   0,   0,   0,
       0,   0,   0,   0,   0,   0,   6, 214, 151,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,  10, 231,  86,   2,   0,   0,   0,   0,   0,
       0,   0,   0,   0,   0,   0,   0, 191, 207,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,   0,  93, 248, 129,   7,   0,   0,   0,   0,
       0,   0,   0,   0,   0,   0, 117, 238, 112,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,   0,   0,  94, 248, 209,  73,  12,   0,   0,
       0,   0,   0,   0,  42, 147, 252, 136,   9,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,   0,   0,   0,  48, 160, 215, 230, 158,  74,
      64,  94, 153, 223, 250, 214, 105,   0,   0,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,   0,   0,   0,   0,   0,  11, 129, 189, 234,
     224, 255, 194, 134,  75,   6,   0,   0,   0,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
       0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
       0,   0],
    [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
       0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
       0,   0]], dtype=int64)
```

In [149]:

```
plt.imshow(x[7,:].reshape(28,28))
```

Out[149]:

```
<matplotlib.image.AxesImage at 0x2a4a0a882b0>
```

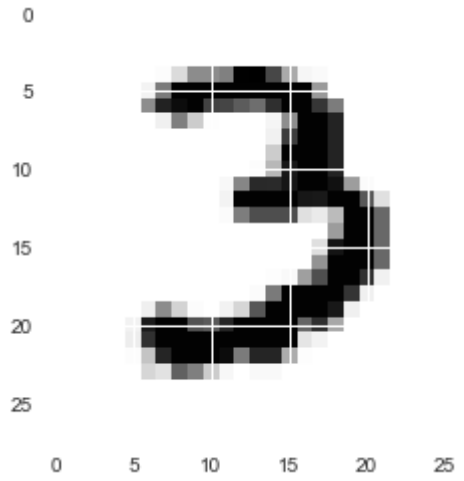


In [150]:

```
plt.imshow(x[9,:].reshape(28,28))
```

Out[150]:

```
<matplotlib.image.AxesImage at 0x2a4a0a4cb38>
```

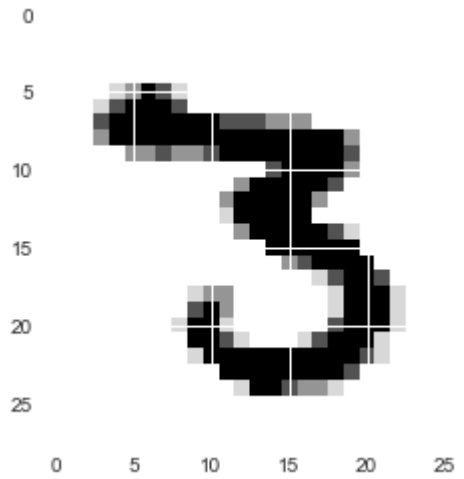


In [151]:

```
plt.imshow(x[13,:].reshape(28,28))
```

Out[151]:

```
<matplotlib.image.AxesImage at 0x2a4a07922e8>
```

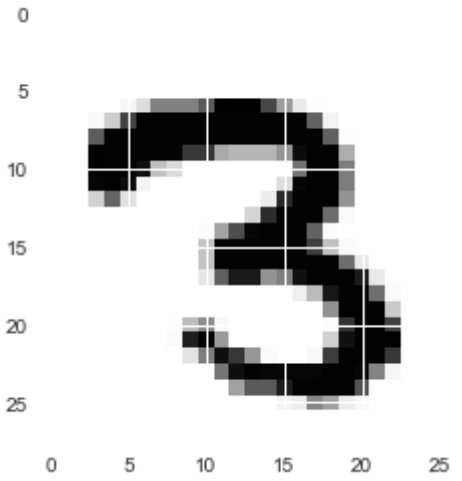


In [152]:

```
plt.imshow(x[41984,:].reshape(28,28))
```

Out[152]:

```
<matplotlib.image.AxesImage at 0x2a4a0821b70>
```

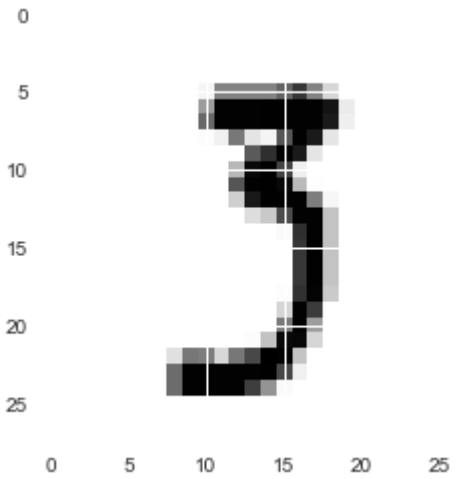


In [153]:

```
plt.imshow(x[41985,:].reshape(28,28))
```

Out[153]:

```
<matplotlib.image.AxesImage at 0x2a4a08b6358>
```



In [154]:

```
np.where(y[1:100]==5)
```

Out[154]:

```
(array([ 7, 18, 50, 61, 79, 98], dtype=int64),)
```

In [155]:

```
np.where(y==5)
```

Out[155]:

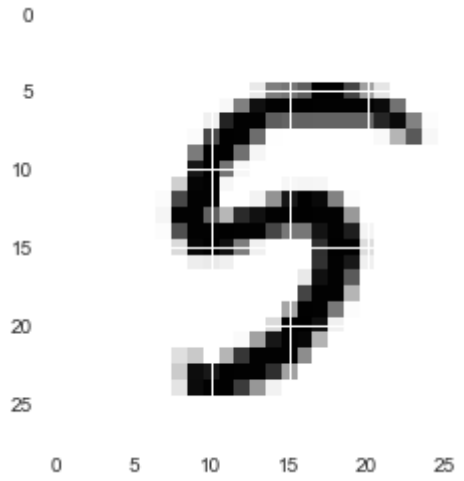
```
(array([    8,    19,    51, ..., 41942, 41987, 41989], dtype=int64),)
```

In [156]:

```
plt.imshow(x[8,:].reshape(28,28))
```

Out[156]:

```
<matplotlib.image.AxesImage at 0x2a4a09b3cc0>
```

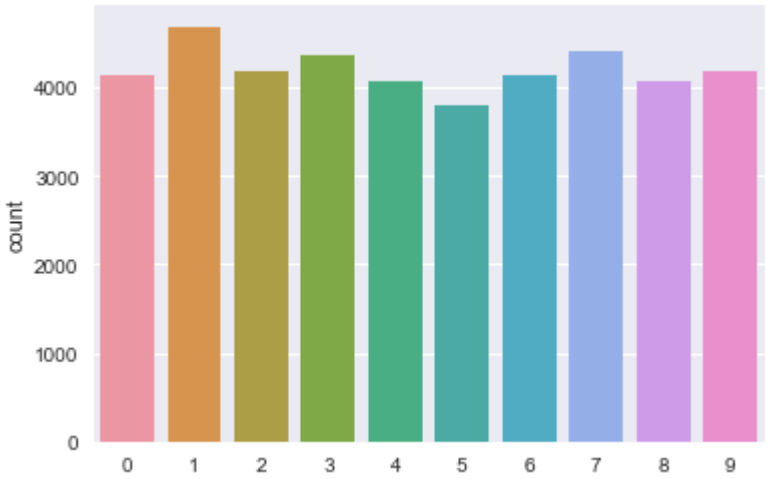


In [157]:

```
sns.countplot(y)
```

Out[157]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x2a4a09d0518>
```



In [158]:

```
from sklearn.model_selection import train_test_split
```

In [159]:

```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.4,random_state=3)
```

In [160]:

```
from sklearn.svm import SVC
```

In [161]:

```
model=SVC(kernel='poly')
```

In [162]:

```
model.fit(x_train,y_train)
```

Out[162]:

```
SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
  decision_function_shape=None, degree=3, gamma='auto', kernel='poly',
  max_iter=-1, probability=False, random_state=None, shrinking=True,
  tol=0.001, verbose=False)
```

In [163]:

```
pred=model.predict(x_test)
```

In [164]:

```
pred
```

Out[164]:

```
array([4, 4, 6, ..., 1, 4, 2], dtype=int64)
```

In [165]:

```
from sklearn.metrics import confusion_matrix,accuracy_score
```

In [166]:

```
confusion_matrix(y_test,pred)
```

Out[166]:

```
array([[1622,    0,    2,    1,    0,    4,    5,    0,    3,    0],
       [   0, 1804,    9,    4,    3,    1,    2,    6,    4,    1],
       [   8,    9, 1584,    3,    7,    2,    4,   10,    5,    0],
       [   2,    5,   22, 1640,    0,   15,    1,    7,   11,    8],
       [   6,    5,    7,    0, 1607,    1,   10,    4,    1,   25],
       [   5,    0,    1,   21,    5, 1519,   14,    1,    8,    5],
       [  11,    4,    2,    0,    2,    6, 1592,    0,    4,    0],
       [   2,    6,   11,    0,    7,    0,    0, 1735,    1,   17],
       [  10,   10,   13,   11,   10,   16,    4,    2, 1568,    8],
       [   6,    2,    2,    6,   16,    5,    1,   17,    7, 1627]])
```

In [167]:

```
accuracy_score(y_test,pred)
```

Out[167]:

```
0.97011904761904766
```

In [168]:

```
Classification=pd.read_csv('C:/Users/HP/Documents/Summer_Intern_Of _ML/Images and Numpy/Cla
```

In [169]:

```
type(Classification)
```

Out[169]:

```
pandas.core.frame.DataFrame
```

In [243]:

```
a=Classification.iloc[3:4,:].values
```

In [244]:

```
pred_a=model.predict(a)
pred_a
```

Out[244]:

```
array([9], dtype=int64)
```

In [245]:

```
plt.imshow(a.reshape(28,28))
```

Out[245]:

```
<matplotlib.image.AxesImage at 0x2a4a17cabe0>
```

In [492]:

```
b=Classification.iloc[6000:6001,:].values
```

In [493]:

```
pred_b=model.predict(b)
pred_b
```

Out[493]:

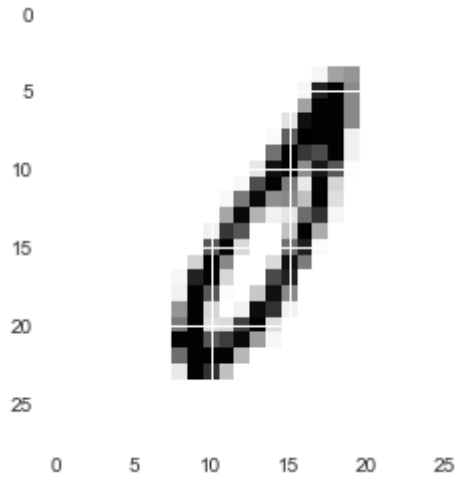
```
array([1], dtype=int64)
```

In [494]:

```
plt.imshow(b.reshape(28,28))
```

Out[494]:

```
<matplotlib.image.AxesImage at 0x2a4a873c390>
```



In [532]:

```
c=Classification.iloc[15000:15001,:].values
```

In [533]:

```
pred_c=model.predict(c)
```

In [534]:

```
pred_c
```

Out[534]:

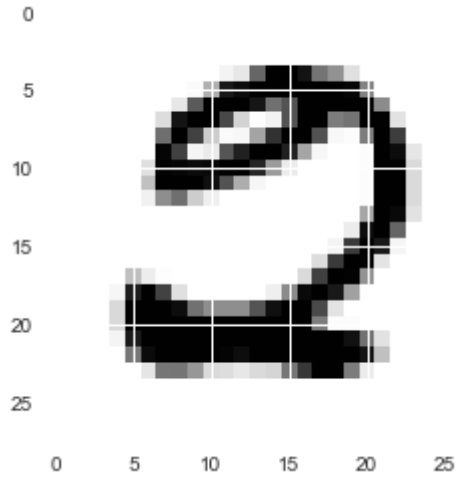
```
array([0], dtype=int64)
```

In [535]:

```
plt.imshow(c.reshape(28,28))
```

Out[535]:

```
<matplotlib.image.AxesImage at 0x2a4a8cfe240>
```



In [545]:

```
d=Classification.iloc[17000:17001,:].values
```

In [546]:

```
pred_d=model.predict(d)
```

In [547]:

```
pred_d
```

Out[547]:

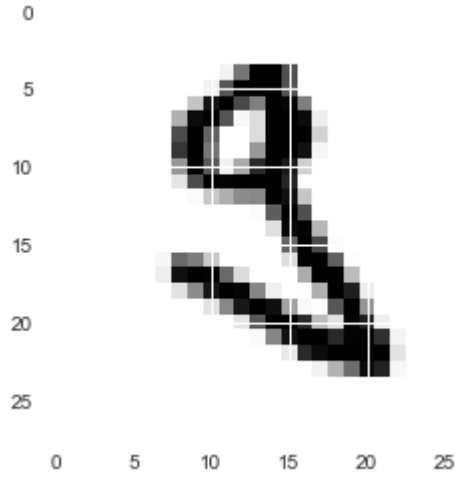
```
array([2], dtype=int64)
```

In [548]:

```
plt.imshow(d.reshape(28,28))
```

Out[548]:

```
<matplotlib.image.AxesImage at 0x2a4a8f49470>
```



In [1190]:

```
e=Classification.iloc[128:129,:].values
```

In [1191]:

```
pred_e=model.predict(e)
```

In [1192]:

```
pred_e
```

Out[1192]:

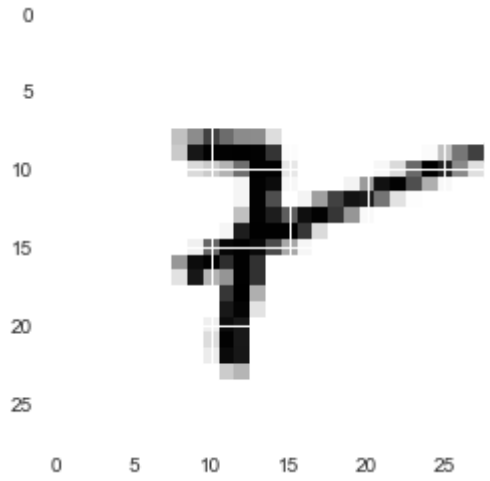
```
array([8], dtype=int64)
```

In [1193]:

```
plt.imshow(e.reshape(28,28))
```

Out[1193]:

```
<matplotlib.image.AxesImage at 0x2a4ae88a438>
```



In [1253]:

```
f=Classification.iloc[138:139,:].values
```

In [1254]:

```
pred_f=model.predict(f)
```

In [1255]:

```
pred_f
```

Out[1255]:

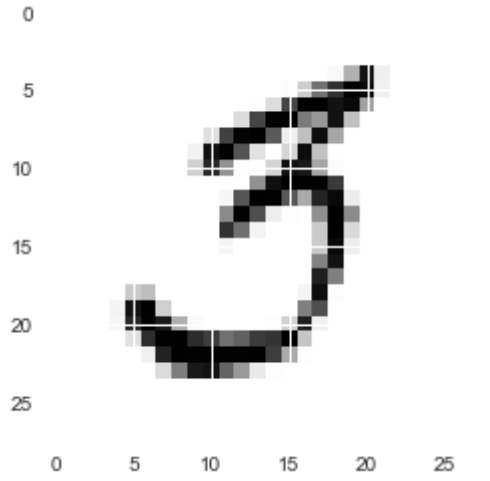
```
array([5], dtype=int64)
```

In [1256]:

```
plt.imshow(f.reshape(28,28))
```

Out[1256]:

```
<matplotlib.image.AxesImage at 0x2a4af1b89b0>
```



In [1260]:

```
g=Classification.iloc[139:140,:].values
```

In [1261]:

```
pred_g=model.predict(g)
pred_g
```

Out[1261]:

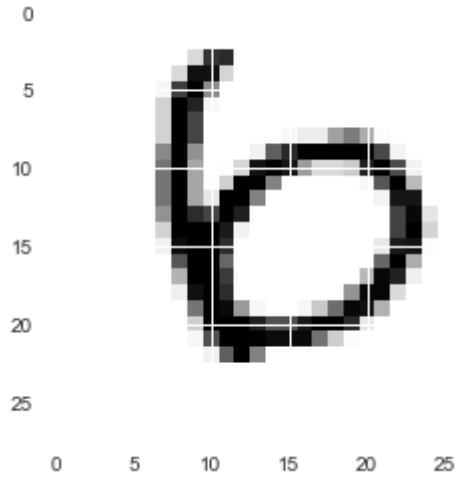
```
array([0], dtype=int64)
```

In [1262]:

```
plt.imshow(g.reshape(28,28))
```

Out[1262]:

```
<matplotlib.image.AxesImage at 0x2a4af2dfb00>
```



In [1435]:

```
h=Classification.iloc[165:166,:].values
```

In [1436]:

```
pred_h=model.predict(h)
pred_h
```

Out[1436]:

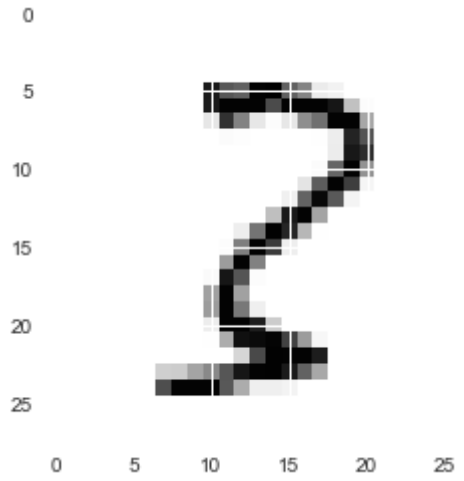
```
array([2], dtype=int64)
```

In [1437]:

```
plt.imshow(h.reshape(28,28))
```

Out[1437]:

```
<matplotlib.image.AxesImage at 0x2a4ef88d978>
```



In [1611]:

```
i=Classification.iloc[341:342,:].values
pred_i=model.predict(i)
pred_i
```

Out[1611]:

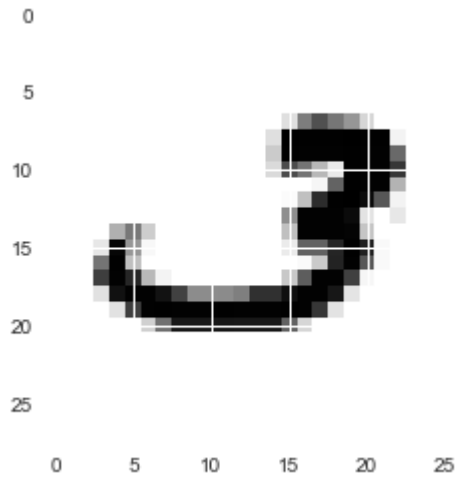
```
array([2], dtype=int64)
```

In [1612]:

```
plt.imshow(i.reshape(28,28))
```

Out[1612]:

```
<matplotlib.image.AxesImage at 0x2a520b11128>
```



In [1746]:

```
j=Classification.iloc[408:409,:].values

pred_j=model.predict(j)
pred_j
```

Out[1746]:

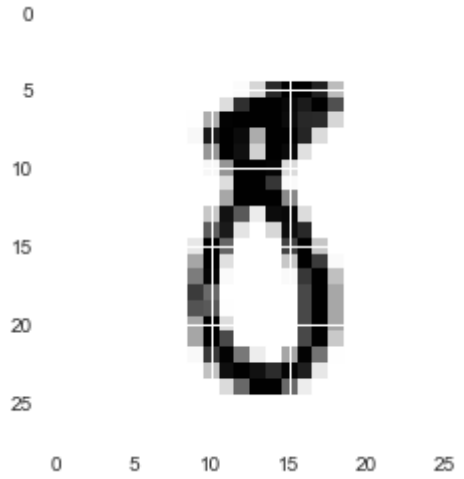
```
array([5], dtype=int64)
```

In [1747]:

```
plt.imshow(j.reshape(28,28))
```

Out[1747]:

```
<matplotlib.image.AxesImage at 0x2a523192278>
```



In [1804]:

```
k=Classification.iloc[509:510,:].values
pred_k=model.predict(k)
pred_k
```

Out[1804]:

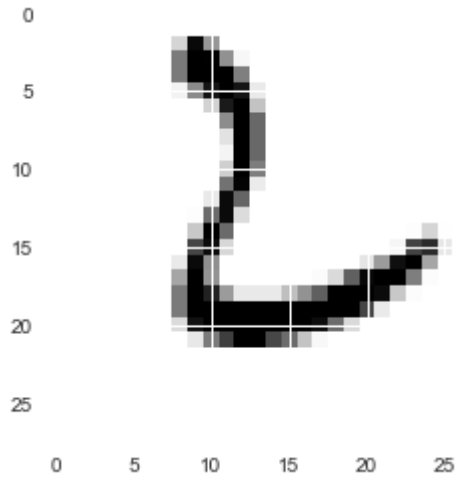
```
array([6], dtype=int64)
```

In [1805]:

```
plt.imshow(k.reshape(28,28))
```

Out[1805]:

```
<matplotlib.image.AxesImage at 0x2a524236780>
```



In [1812]:

```
l=Classification.iloc[511:512,:].values
pred_l=model.predict(l)
pred_l
```

Out[1812]:

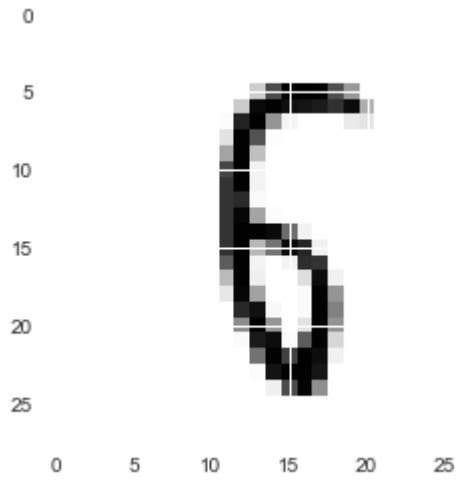
```
array([5], dtype=int64)
```

In [1813]:

```
plt.imshow(l.reshape(28,28))
```

Out[1813]:

```
<matplotlib.image.AxesImage at 0x2a52447ea90>
```



In [1895]:

```
m=Classification.iloc[626:627,:].values
pred_m=model.predict(m)
pred_m
```

Out[1895]:

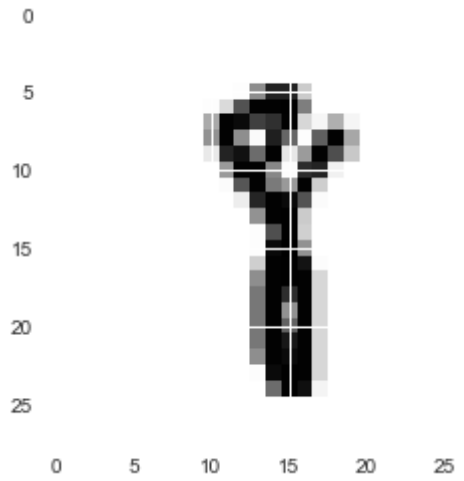
```
array([1], dtype=int64)
```

In [1896]:

```
plt.imshow(m.reshape(28,28))
```

Out[1896]:

```
<matplotlib.image.AxesImage at 0x2a525c9fcc0>
```



In [1988]:

```
n=Classification.iloc[710:711,:].values
pred_n=model.predict(n)
pred_n
```

Out[1988]:

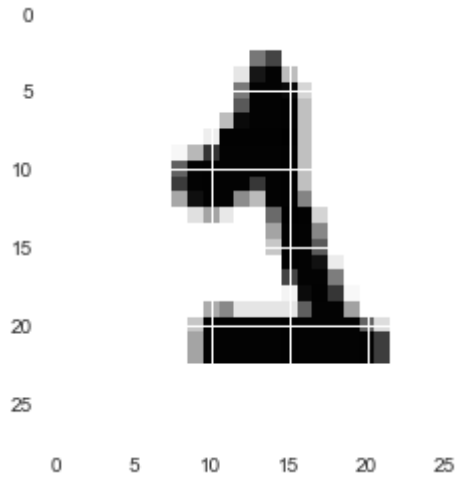
```
array([5], dtype=int64)
```

In [1989]:

```
plt.imshow(n.reshape(28,28))
```

Out[1989]:

```
<matplotlib.image.AxesImage at 0x2a5277a2860>
```



In [2311]:

```
o=Classification.iloc[2816:2817,:].values
pred_o=model.predict(o)
pred_o
```

Out[2311]:

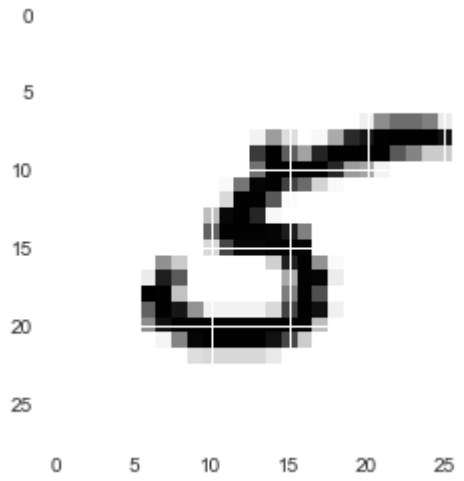
```
array([1], dtype=int64)
```

In [2310]:

```
plt.imshow(o.reshape(28,28))
```

Out[2310]:

```
<matplotlib.image.AxesImage at 0x2a53b682eb8>
```



In [ ]:

In [ ]:

```
```