In [45]:
```
# M Gopi Chandu
# Done in Kaggle provided jupyter notebook

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))
```

```
/kaggle/input/mnist-digit-recognizer/train.csv
```

In [2]:
```
df = pd.read_csv('/kaggle/input/mnist-digit-recognizer/train.csv')
```

In [3]:
```
df.sample(5)
```

Out[3]:

	label	pixel0	pixel1	pixel2	pixel3	pixel4	pixel5	pixel6	pixel7	pixel8	...	pixel774	pixel775	pixel776
19830	2	0	0	0	0	0	0	0	0	0	...	0	0	0
31481	1	0	0	0	0	0	0	0	0	0	...	0	0	0
18407	1	0	0	0	0	0	0	0	0	0	...	0	0	0
7834	4	0	0	0	0	0	0	0	0	0	...	0	0	0
38248	5	0	0	0	0	0	0	0	0	0	...	0	0	0

5 rows × 785 columns

In [4]:
```
df.shape
```

Out[4]:
```
(42000, 785)
```

In [5]:
```
df.describe()
```

Out[5]:

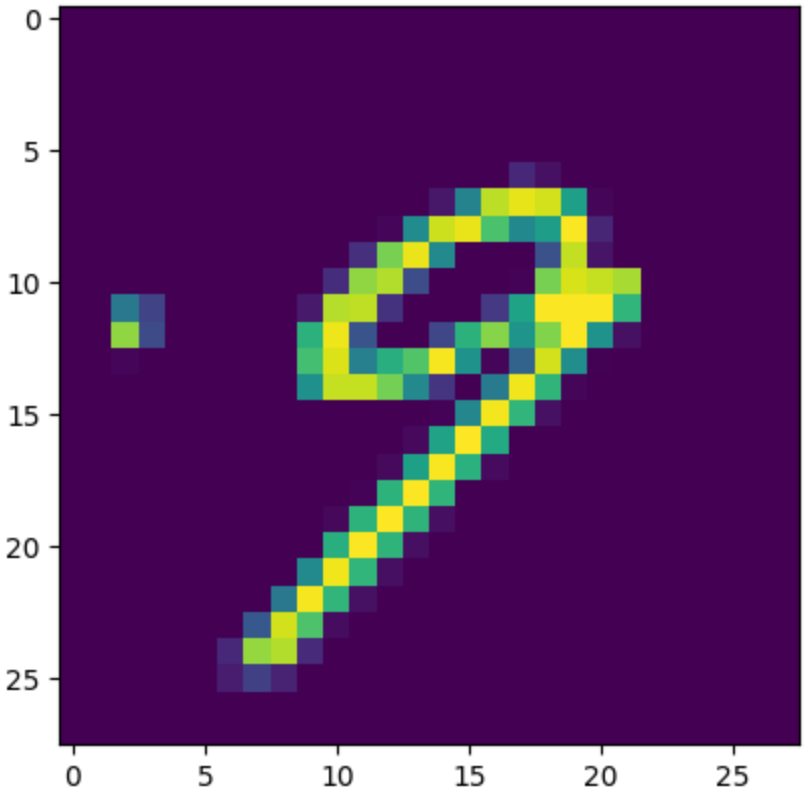
	label	pixel0	pixel1	pixel2	pixel3	pixel4	pixel5	pixel6	pixel7	pixel8	...	p
count	42000.000000	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	42000.0	...	42000
mean	4.456643	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0
std	2.887730	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	6
min	0.000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0
25%	2.000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0
50%	4.000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0
75%	7.000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0
max	9.000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	254

8 rows × 785 columns

In [7]:
```
import matplotlib.pyplot as plt
```

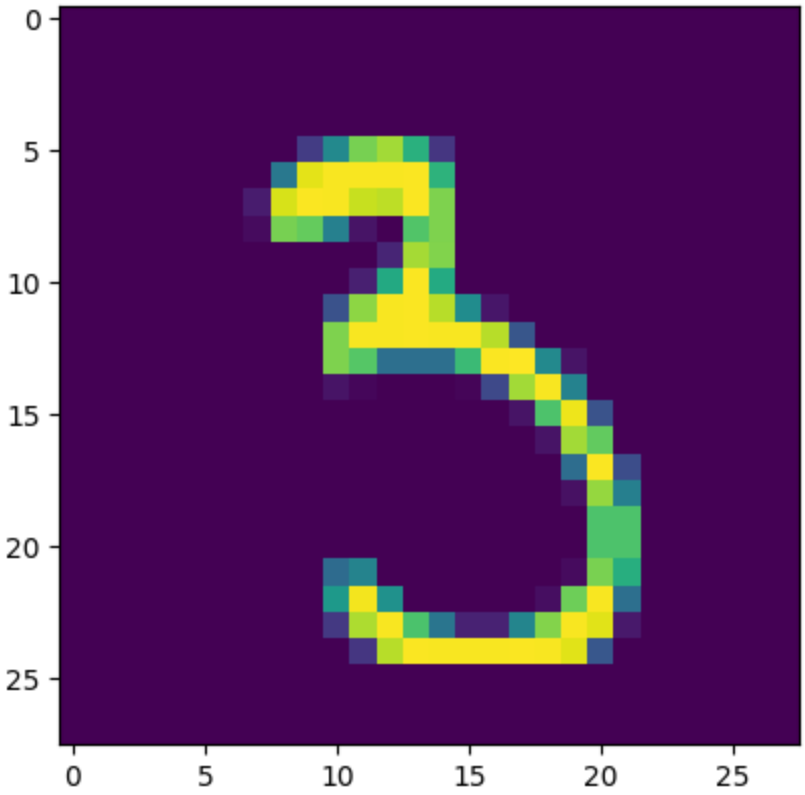
In [8]:
```
plt.imshow(df.iloc[26287,1:].values.reshape(28,28))
```

Out[8]:
```
<matplotlib.image.AxesImage at 0x7ebac0845ed0>
```



In [9]:
```
plt.imshow(df.iloc[29998,1:].values.reshape(28,28))
```

Out[9]:
```
<matplotlib.image.AxesImage at 0x7ebac0b62fb0>
```



In [10]:
```
X = df.iloc[:,1:]
y = df.iloc[:,0]
```

In [11]:
```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.2,random_state=42)
```

Out[12]: (33600, 784)

In [13]:
```
from sklearn.neighbors import KNeighborsClassifier
```

In [14]:
```
knn = KNeighborsClassifier()
knn.fit(X_train,y_train)
```

Out[14]:
```
▾ KNeighborsClassifier
KNeighborsClassifier()
```

In [15]:
```
y_pred = knn.predict(X_test)
```

In [16]:
```
from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred)
```

Out[16]: 0.9648809523809524

In [17]:
```
result = pd.DataFrame({'Actual':y_test,'Predicted':y_pred})
result
```

Out[17]:

	Actual	Predicted
5457	8	8
38509	1	1
25536	9	9
31803	9	9
39863	8	8
...	...	...
8388	4	4
29359	9	9
40276	3	3
18421	0	0
4335	9	9

8400 rows × 2 columns

Reducing the Dimensions for better performance using Priciple Component Analysis (PCA)

In [21]:
```
#Step1: Centering the mean using standardization technique
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

In [30]:
```
#Step2 : Reducing the dimensions using PCA
from sklearn.decomposition import PCA
for i in range(1,785,100):
    pca = PCA(n_components=i)
    X_train_trf = pca.fit_transform(X_train)
```

```
    X_test_trf = pca.transform(X_test)
    knn=KNeighborsClassifier()
    knn.fit(X_train_trf,y_train)
    y_pred = knn.predict(X_test_trf)
    print(f"For PCA's = {i} accuracy score = {accuracy_score(y_test,y_pred)}")
    i+=100
```

```
For PCA's = 1 accuracy score = 0.25976190476190475
For PCA's = 101 accuracy score = 0.9534523809523809
For PCA's = 201 accuracy score = 0.9513095238095238
For PCA's = 301 accuracy score = 0.9463095238095238
For PCA's = 401 accuracy score = 0.9435714285714286
For PCA's = 501 accuracy score = 0.9411904761904762
For PCA's = 601 accuracy score = 0.9398809523809524
For PCA's = 701 accuracy score = 0.9391666666666667
```

Threfore the optinum number of priciple components are 101 from 101 the accuracy is droping.

In [32]:
```
pca = PCA(n_components=101)
X_train_trf = pca.fit_transform(X_train)
X_test_trf = pca.transform(X_test)
```

In [33]:
```
X_train_trf,X_train_trf.shape
```

Out[33]:
```
(array([[-2.71863124, -0.48982659,  1.13548631, ...,  0.5411492 ,
          1.53309624,  1.69681353],
        [-0.67697862, -6.7536243 , -2.33589044, ...,  0.83696835,
         -0.45314634,  0.42567727],
        [-3.03323522,  6.50981435,  7.49182864, ...,  2.17419238,
         -1.41900983,  0.87423911],
        ...,
        [ 2.14883758,  0.78080613, -0.74737694, ...,  1.50467189,
         -0.98804782, -0.31557254],
        [ 1.05956941,  0.94766469,  3.94972954, ..., -0.60647423,
         -1.52247279, -0.02300828],
        [17.7025805 ,  1.9618635 , -4.94353895, ...,  0.46740797,
          1.39446792, -0.94140502]]),
 (33600, 101))
```

In [39]:
```
knn = KNeighborsClassifier()
knn.fit(X_train_trf,y_train)
```

Out[39]:
```
▼ KNeighborsClassifier

KNeighborsClassifier()
```

In [41]:
```
y_pred = knn.predict(X_test_trf)
```

In [42]:
```
accuracy_score(y_test,y_pred)
```

Out[42]:
```
0.9534523809523809
```

In [43]:
```
result_trf = pd.DataFrame({'Actual':y_test,'Predicted':y_pred})
result_trf
```

Out[43]:

	Actual	Predicted
5457	8	8
38509	1	1
25536	9	9
31803	9	7
39863	8	8
...	...	...
8388	4	4
29359	9	9
40276	3	3
18421	0	0
4335	9	9

8400 rows × 2 columns