In [1]:

```
import numpy as np
from PIL import Image
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:

```
# Assuming that the image is passed as a numpy array
# Also, the image is cleaned (does not contain NaNs)
def find_correction_angle(binary_image):

    # bounding the rotated rectangle using MBR
    binary_image = binary_image[np.sum(binary_image, axis=1) != 0]
    binary_image = binary_image.T[np.sum(binary_image, axis=0) != 0]

    # Finding the edges of the rectangle in row 0 and column 0 using argmax
    # Then using arctan to find the angle

    if 0 in binary_image.shape:
        return Exception("The image does not contain a rectangle")

    if np.argmax(binary_image[:,0]) == 0:
        return 0 # Handling divide by zero

    return np.degrees(np.arctan(np.argmax(binary_image[0,:])/np.argmax(binary_image[:,0])))
```

In [3]:

```
original_image = np.genfromtxt("rotated.csv", delimiter=',')
find_correction_angle(original_image[1:,:])
```

```
Out[3]: 35.012578424986458
```

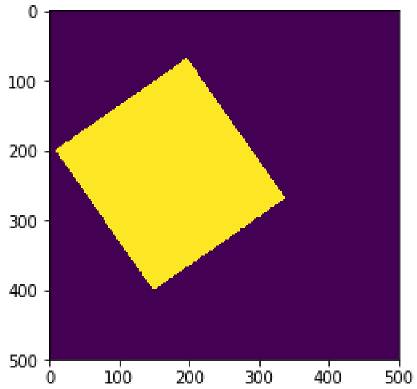
Algorithm

Removing the top row because it contains NaNs

In [4]:

```
image = original_image[1:,:]
plt.imshow(image)
```

```
Out[4]: <matplotlib.image.AxesImage at 0x2c4ea809358>
```

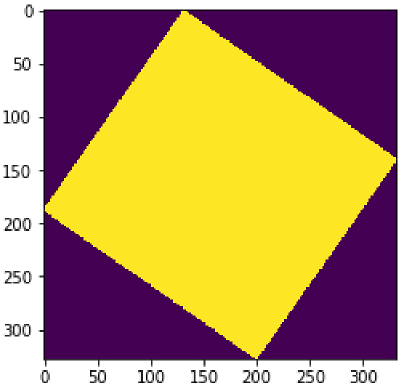


Bounding the rectangle in a box

In [5]:

```
image = image[np.sum(image, axis=1) != 0]
image = image.T[np.sum(image, axis=0) != 0]
plt.imshow(image)
```

```
Out[5]: <matplotlib.image.AxesImage at 0x2c4ea254198>
```



Finding the edges of the rectangle in row 0 and column 0. Then using arctan to find the angle

In [6]:

```
np.degrees(np.arctan(np.argmax(image[0,:])/np.argmax(image[:,0])))
```

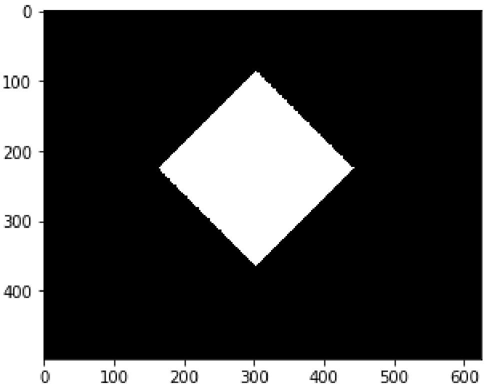
```
Out[6]: 35.012578424986458
```

Working with a tiff image

In [7]:

```
im = Image.open('rect_45.tif')
imarray = np.array(im)
plt.imshow(imarray)
```

```
Out[7]: <matplotlib.image.AxesImage at 0x2c4ea544e48>
```



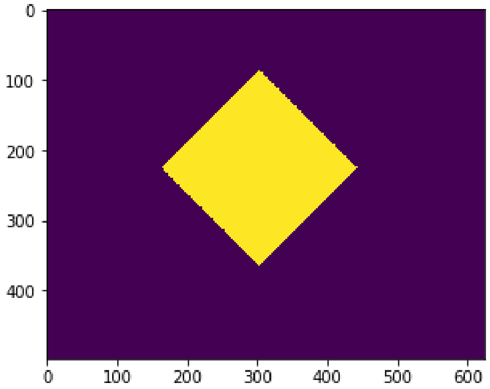
flatenning the image

In [8]:

```
im_flat = imarray.ravel()
im_flat[im_flat < 127] = 0
im_flat[im_flat >= 127] = 1
im_flat = im_flat.reshape(imarray.shape)[:,:,0]
plt.imshow(im_flat)
```

Out[8]:

```
<matplotlib.image.AxesImage at 0x2c4eaea7c88>
```



In [9]:

```
find_correction_angle(im_flat)
```

Out[9]:

```
45.0
```

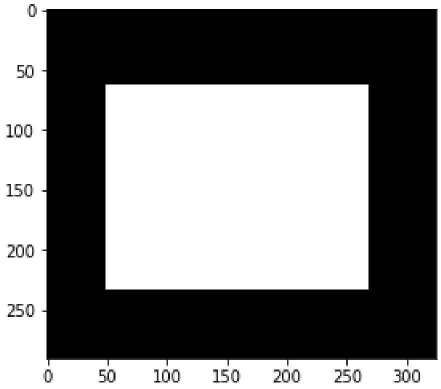
Another example

In [10]:

```
im = Image.open('rect_90.tif')
imarray = np.array(im)
plt.imshow(imarray)
```

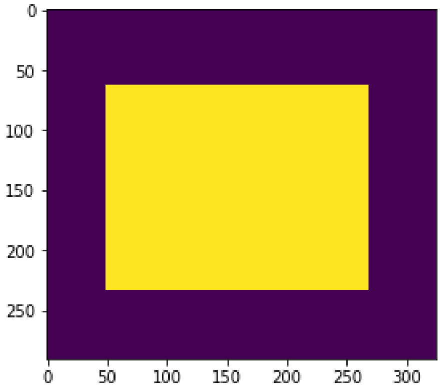
Out[10]:

```
<matplotlib.image.AxesImage at 0x2c4ea5a6358>
```



In [11]:
```
im_flat = imarray.ravel()
im_flat[im_flat < 127] = 0
im_flat[im_flat >= 127] = 1
im_flat = im_flat.reshape(imarray.shape)[:,:,0]
plt.imshow(im_flat)
```

Out[11]:
```
<matplotlib.image.AxesImage at 0x2c4ea602c18>
```



In [12]:
```
find_correction_angle(im_flat)
```

Out[12]:
```
0
```

In [ ]:

In [ ]: