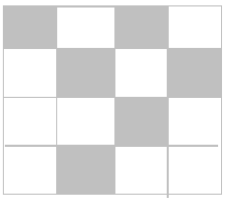
GRAY COLOR IMAGES

In matlab environment image means matrix. For example a 2x2 matrix A=$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ means,

1 white
0 black

In a similar way



A=$\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$

Write the follo wing command in MATLAB and see the results

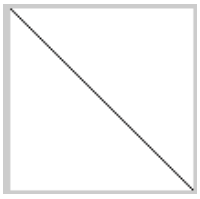
```
>> aa=[ 1 0 1;  0 1 0;  1 0 1];   imshow(aa)
>>aa=[ ones(5,5)   zeros(5,5); zeros(5,5)   ones(5,5); ]
>>imshow(aa)

>>aa=[ ones(5,5)   zeros(5,5)  ones(5,5) ;
   zeros(5,5)   ones(5,5)   zeros(5,5);
   ones(5,5)   zeros(5,5)  ones(5,5) ;
>>imshow(aa)
```

Examples:

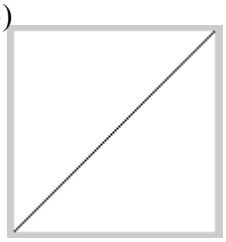
```
>> aa=ones(100,100);   aa(50:50,:) =0;  imshow(aa)
>> aa=ones(100,100);   aa(:,50:50) =0;  imshow(aa)
>> aa=ones(100,100);   aa(50:60,:) =0;  imshow(aa)
>> aa=ones(100,100);   aa(:,40:60) =0;  imshow(aa)
```

Example 511 : Assume the image size 100x100 pixel.



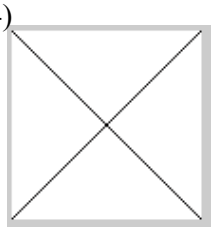
```
>>aa=ones(100,100);
>>for kk=1:100,   aa(kk,kk)=0;  end;   imshow(aa);
```

Ex-513)



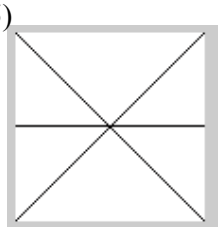
```
aa=ones(100,100);
for kk=1:100,   aa(100-kk+1,kk)=0;  end;   imshow(aa);
```

Ex-514)



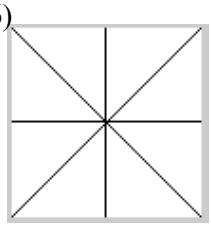
```
aa=ones(100,100);
for kk=1:100,   aa(kk,kk)=0;  end;
for kk=1:100,   aa(100-kk+1,kk)=0;  end;   imshow(aa);
```

Ex-515)



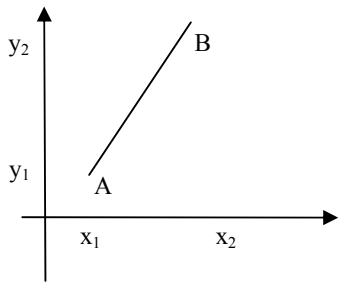
```
aa=ones(100,100);
for kk=1:100,   aa(kk,kk)=0;  end;
for kk=1:100,   aa(100-kk+1,kk)=0;  end;
aa(50:50,:)=0;  imshow(aa);
```

Ex-516)



```
aa=ones(100,100);
for kk=1:100,   aa(kk,kk)=0;  end;
for kk=1:100,   aa(100-kk+1,kk)=0;  end;
aa(50:50,:)=0;  aa(:,50:50)=0;  imshow(aa);
```

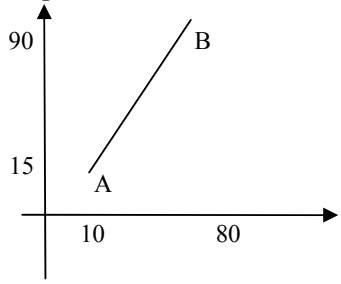
Drawing a line from point A(x1,y1) to point B(x2,y2)



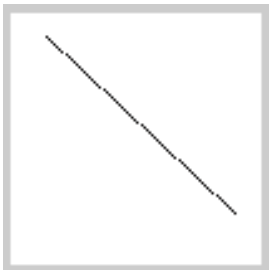
Line equation $\frac{y - y_1}{y_1 - y_2} = \frac{x - x_1}{x_1 - x_2}$

$$y = (y_1 - y_2)\frac{x - x_1}{x_1 - x_2} + y_1$$

Example 531 Draw a line from A to B. A(10,15) B(80,90), x1=10, x2=80, y1=15, y2=90

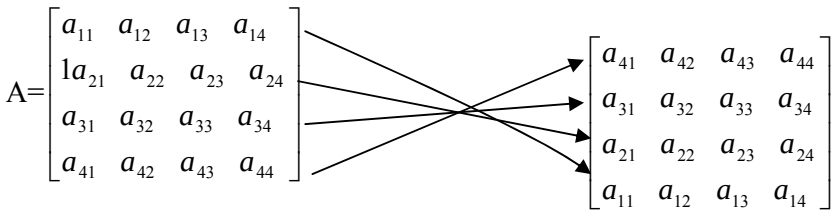



```
   x1=10,  x2=80,     y1=15,  y2=90
aa=ones(100,100);
   for kk=x1:x2,
      xx(kk)=kk;
      yy(kk)=(y1-y2)*(kk-x1)/ (x1-x2) + y1;
      yy(kk)=round(yy(kk))
      aa(yy(kk),xx(kk))=0;
end;
imshow(aa);
```

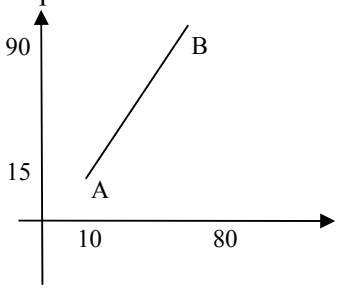


MATLAB RESULT

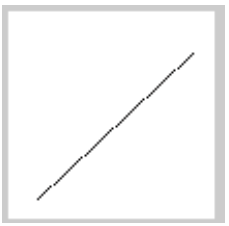
The reason is direction of y coordinate is in the **opposite direction** in MATLAB.
Solution: Change the rows of the aa matrix as follows



Example 533 Draw a line from A to B. A(10,15) B(80,90), x1=10, x2=80, y1=15, y2=90



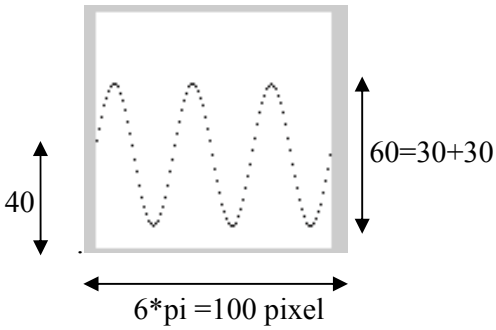

```
aa=ones(100,100);
x1=10,  x2=80,     y1=15,  y2=90
 for kk=x1:x2,
    xx(kk)=kk;
    yy(kk)=(y1-y2)*(kk-x1)/ (x1-x2) + y1;
    yy(kk)=round(yy(kk))
    aa(yy(kk),xx(kk))=0;
end;
for kk=1:100, anew(kk,:)=aa(100-kk+1,:);
end;
imshow(anew);
```



MATLAB RESULT

Example 541 Draw y=sin(x)

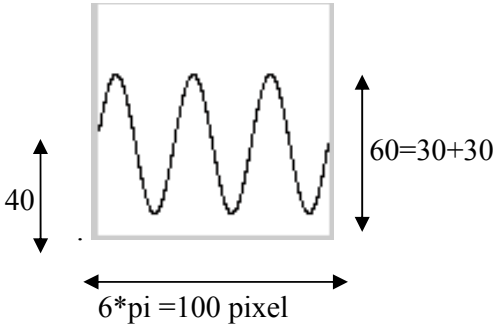
```
aa=ones(100,100);
for kk=1:100,
   xx(kk)=kk;
   yy(kk)=40+30*sin(kk*6*pi/100);
   yy(kk)=round(yy(kk))
   aa(yy(kk),xx(kk))=0;
end;
for kk=1:100, anew(kk,:)=aa(100-kk+1,:);
end;
imshow(anew);
```



We have drawn y(x)=40+30 sin(6πx)

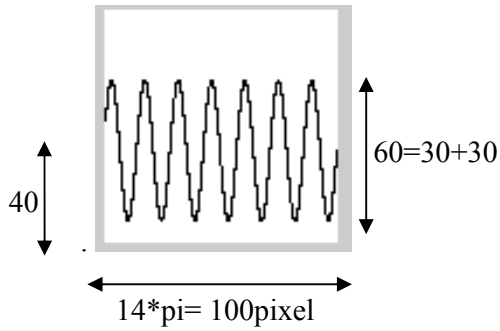
Example 543 Draw y=sin(x). include more points. Be careful about indexes.

```
aa=ones(100,100);
for kk=1:0.1:100,
   rkk=round(kk)
   xx(rkk)=round(kk);
   yy(rkk)=40+30*sin(kk*6*pi/100);
   yy(rkk)=round(yy(rkk))
   aa(yy(rkk),xx(rkk))=0;
end;
for kk=1:100, anew(kk,:)=aa(100-kk+1,:);
end;
imshow(anew);
```



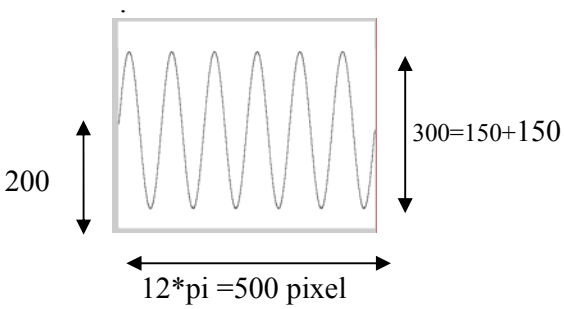
Example 545 Draw y=sin(x). include more periods. Be careful about indexes.

```
aa=ones(100,100);
for kk=1:0.01:100,
   rkk=round(kk)
   xx(rkk)=round(kk);
   yy(rkk)=40+30*sin(kk*14*pi/100);
   yy(rkk)=round(yy(rkk))
   aa(yy(rkk),xx(rkk))=0;
end;
for kk=1:100, anew(kk,:)=aa(100-kk+1,:);
end;
imshow(anew);
```



Example 547 Draw y=sin(x). increase resolution

```
NN=500
aa=ones(NN,NN);
for kk=1:0.002:NN,
   rkk=round(kk);
   xx(rkk)=round(kk);
   yy(rkk)=200+150*sin(kk*12*pi/NN);
   yy(rkk)=round(yy(rkk));
   aa(yy(rkk),xx(rkk))=0;
end;
for kk=1:NN, anew(kk,:)=aa(NN-kk+1,:);
end;
imshow(anew);
```



551 write a function to draw a line from A(x1,y1) to B(x2,y2).
Solution: Use (example 533)

```
%******************
 function [anew]=line_equ(aa,x1,y1,x2,y2)
for kk=x1:x2,
   xx(kk)=kk;
   yy(kk)=(y1-y2)*(kk-x1)/ (x1-x2) + y1;
   yy(kk)=round(yy(kk));
   aa(yy(kk),xx(kk))=0;
end;
anew=aa;
```

```
%****To call the function
aa=ones(100,100);
x1=10,  x2=80,     y1=15,  y2=90
a2=line_equ(aa,x1,y1,x2,y2);
anew=a2;
for kk=1:100, anew(kk,:)=a2(100-kk+1,:); end;
imshow(anew);
```

553, draw different lines using line_eq function.

555 **The corrected line_eq function are below.**

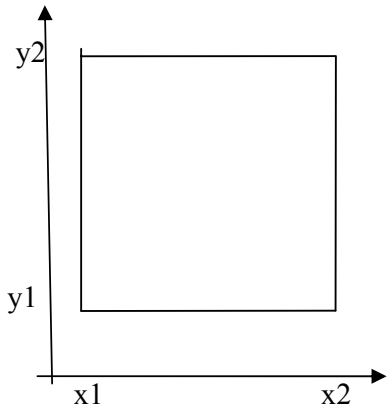
```
function [anew]=line_equ(aa,x1,y1,x2,y2)
   if x1>x2, xq=x1; x1=x2; x2=xq; end;
   if y1>y2, yq=y1; y1=y2; y2=yq; end;
 if abs(x1-x2)<0.0000000001,
    disp('zero slope');
    aa(y1:y2,x1)=0;
    anew=aa;
    return;
 end;

 for kk=x1:x2,
    xx(kk)=kk;
    yy(kk)=(y1-y2)*(kk-x1)/ (x1-x2) + y1;
    yy(kk)=round(yy(kk));
    aa(yy(kk),xx(kk))=0;
end;
anew=aa;
```

559, draw the following rectangle using line_eq function.

```
   aa=ones(100,100);
   x1=60, y1=50; x2=90; y2=80
    aa=line_equ(aa,x1,y1,x2,y1);
    aa=line_equ(aa,x2,y1,x2,y2);
    aa=line_equ(aa,x2,y2,x1,y2);
    aa=line_equ(aa,x1,y2,x1,y1);
   anew=aa;

    for kk=1:100, anew(kk,:)=aa(100-kk+1,:); end;
    imshow(anew);
```

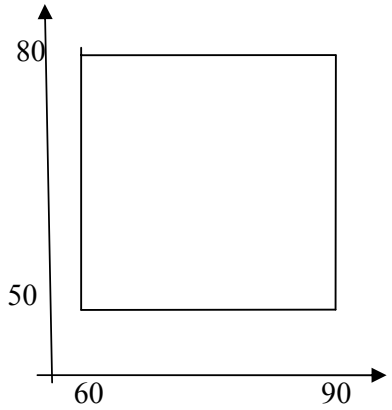


561)Write a function to draw a rectangle.

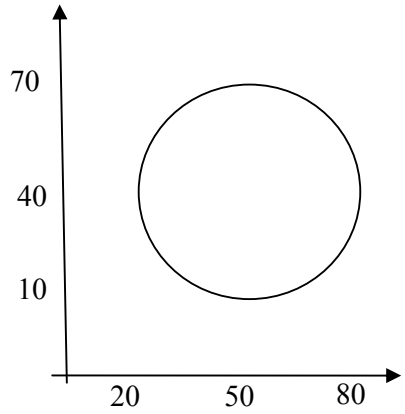
```
function anew=rect_draw(aa,x1,y1,x2,y2);
 aa=line_equ(aa,x1,y1,x2,y1);
 aa=line_equ(aa,x2,y1,x2,y2);
 aa=line_equ(aa,x2,y2,x1,y2);
 aa=line_equ(aa,x1,y2,x1,y1);
anew=aa;
```

563)Draw the following rectangle using rect_draw function

```
aa=ones(100,100);
aa=rect_draw(aa,60,50,90,80);
anew=aa;
 for kk=1:100, anew(kk,:)=aa(100-kk+1,:); end;
 imshow(anew);
```



571)Draw the following circle




```
aa=ones(100,100);
rr=30; x1=50;  y1=40;
for kk=20:80,
    xx(kk)=kk;
    yqq=sqrt(rr^2-(kk-x1)^2  );
    yupper(kk)=round( yqq+y1 );
    ylower(kk)=round(-yqq+y1 );
    aa(yupper(kk),xx(kk))=0;
    aa(ylower(kk),xx(kk))=0;
end;
anew=aa;
for kk=1:100, anew(kk,:)=aa(100-kk+1,:); end;
 imshow(anew);
```

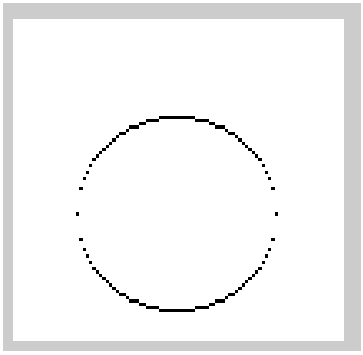
$(x-x1)^2+ (y-y1)^2= r^2$

$y= \sqrt{r^2 - (x - x1)^2} + y1$

$yupper= y= \sqrt{r^2 - (x - x1)^2} + y1$ $\quad ylower= - \sqrt{r^2 - (x - x1)^2} + y1$

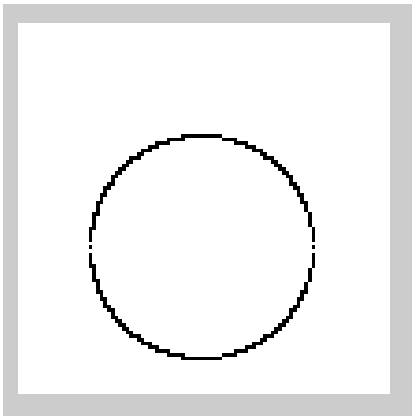
573)Draw the above circle

```
aa=ones(100,100);
rr=30; x1=50;  y1=40;
for kk=20:80,
    xx(kk)=kk;
    yqq=sqrt(rr^2-(kk-x1)^2  );
    yupper(kk)=round( yqq+y1 );
    ylower(kk)=round(-yqq+y1 );
    aa(yupper(kk),xx(kk))=0;
    aa(ylower(kk),xx(kk))=0;
end;
anew=aa;
for kk=1:100, anew(kk,:)=aa(100-kk+1,:); end;
 imshow(anew);  );
```

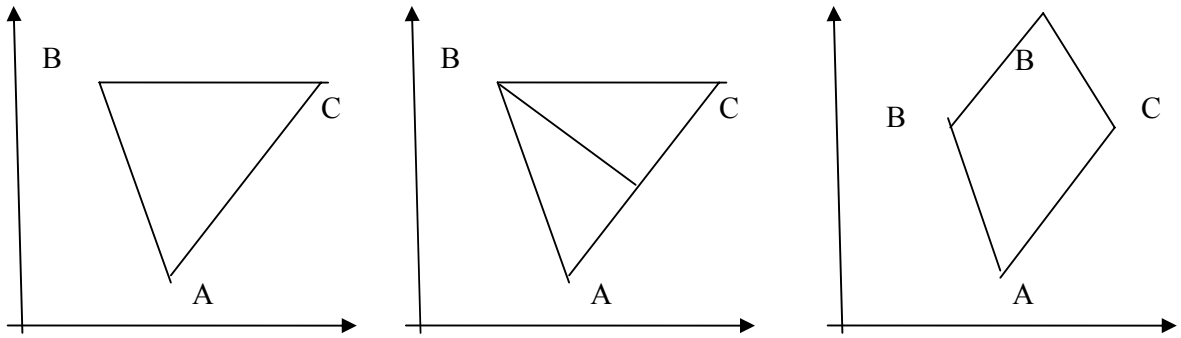


573)Draw the above circle. Increase the resolution

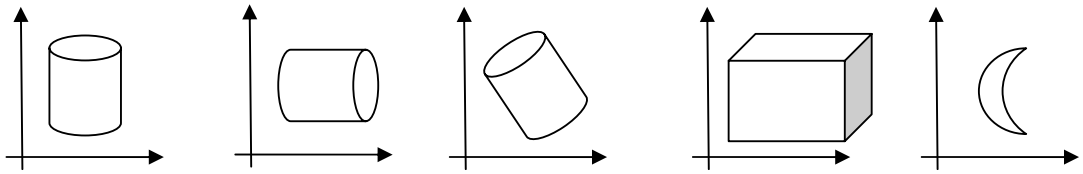
```
aa=ones(100,100);
rr=30; x1=50;  y1=40;
for kk=20:0.05:80,
     rkk=round(kk);
    xx(rkk)=rkk;
    yqq=sqrt(rr^2-(kk-x1)^2  );
    yupper(rkk)=round( yqq+y1 );
    ylower(rkk)=round(-yqq+y1 );
    aa(yupper(rkk),xx(rkk))=0;
    aa(ylower(rkk),xx(rkk))=0;
end;
anew=aa;
for kk=1:100, anew(kk,:)=aa(100-kk+1,:); end;
 imshow(anew);
```



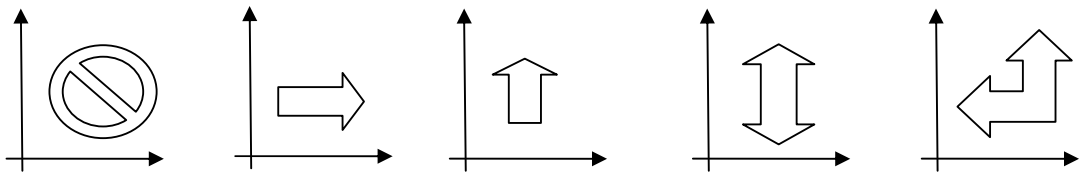
581 Draw the following figures using imshow.



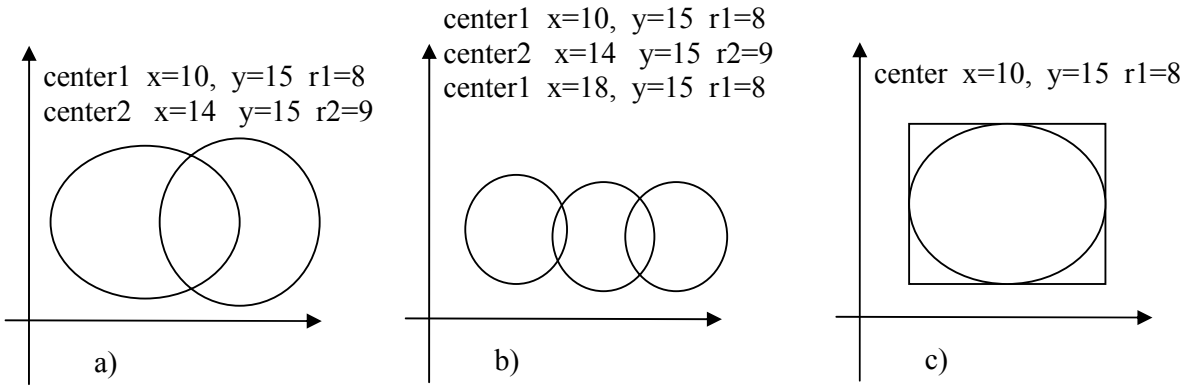
582 Draw the following figures using imshow.



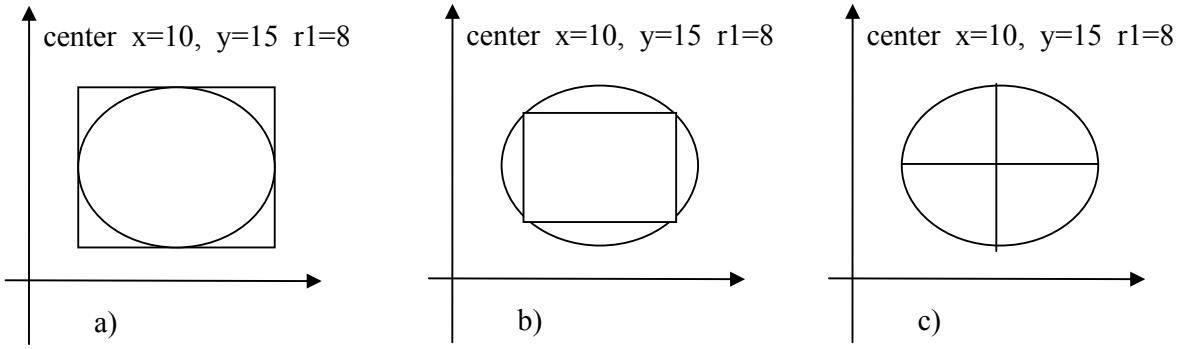
583 Draw the following figures using imshow.



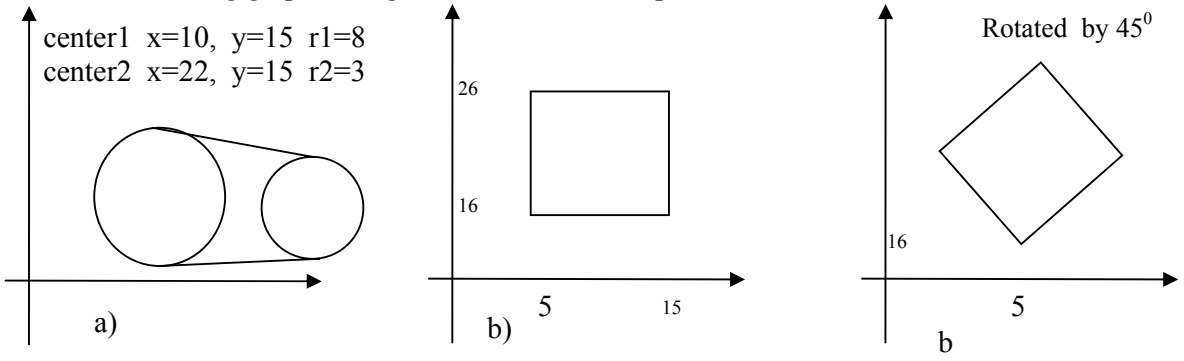
584)Draw the following graphs using imshow. Do not use plot



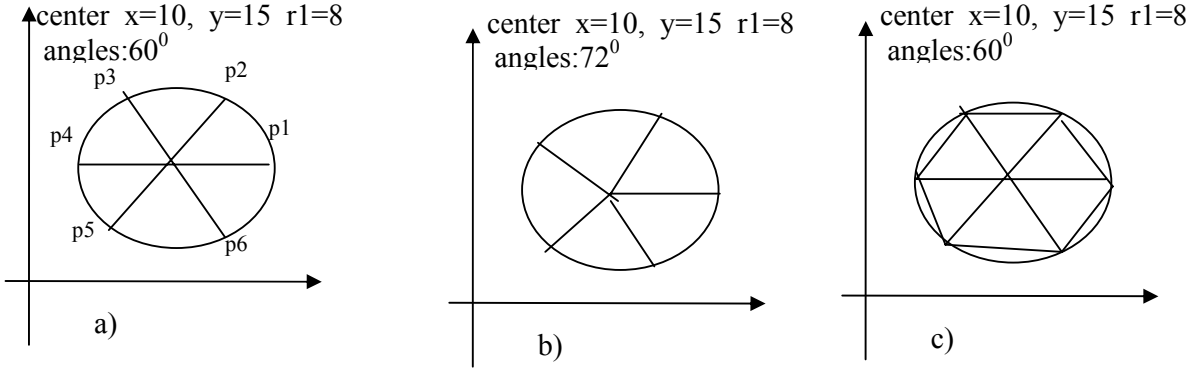
585)Draw the following graphs using imshow. Do not use plot



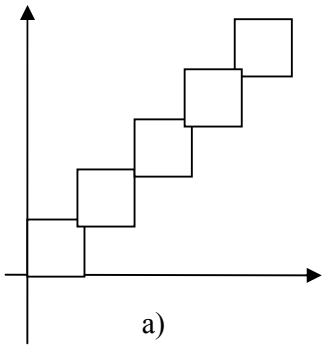
586)Draw the following graphs using imshow. Do not use plot



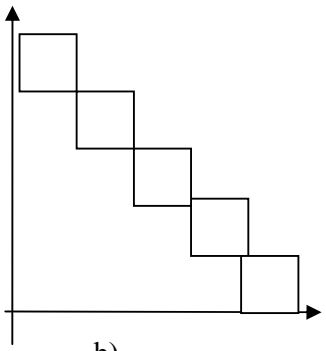
587



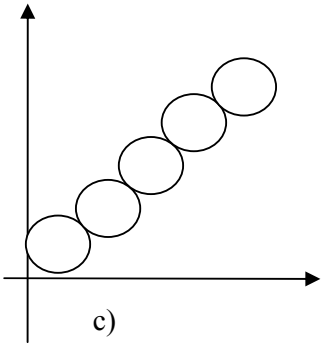
589



a)

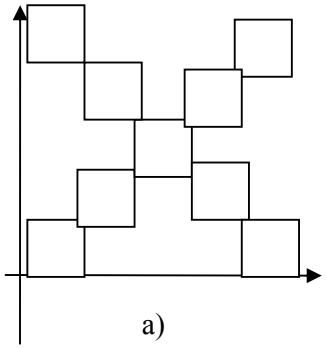


b)

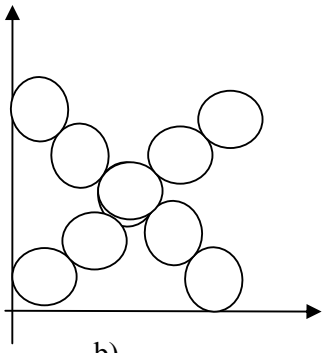


c)

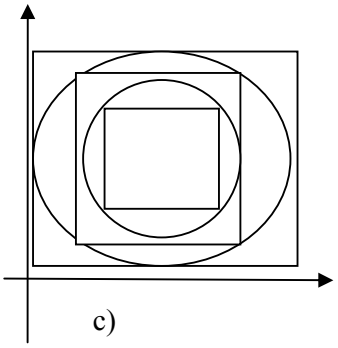
591



a)

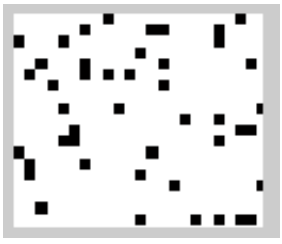


b)

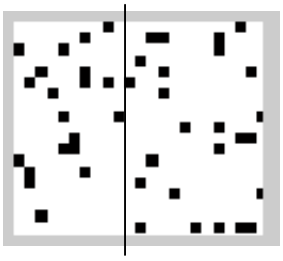


c)

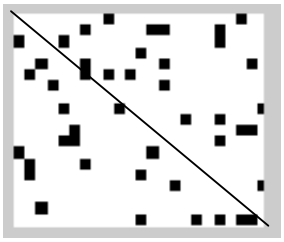
593 Find the number of black pixels in a), Find the number of number of black pixels in each half of b) . Find the number of black pixels in each part of



a)

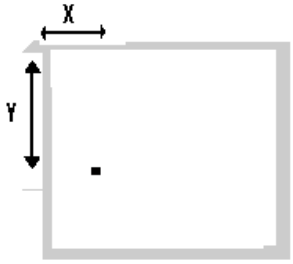


b)

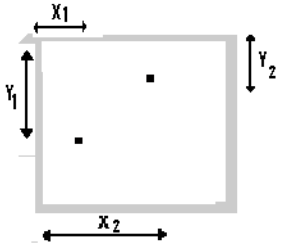


c)

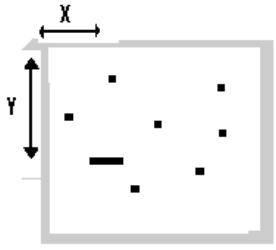
595 In figure a) only one pixel is black. All other pixels are white. Find X and Y. In figure b) there are two black pixels.. Find X1,Y1, X2, Y2. In figure c) three pixels are combined, find X and Y



a)



b)

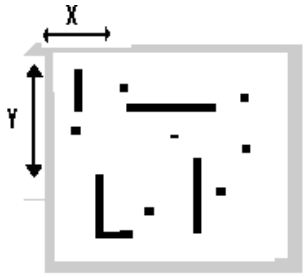


c)

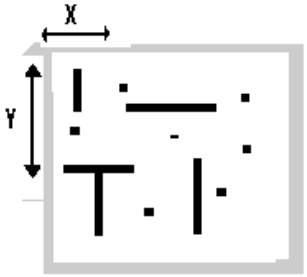
Solution of 595 a)
Assume aa has 100x100 size.

```
for kk=1:100,
   for   jj=1:100,
      if aa(kk,jj)==0, x_location=jj,   y_location=kk,  end;
   end
end;
```

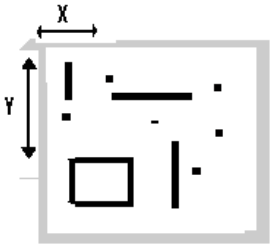
597 In figure a) Find X,Y location of the letter **L**. In figure b) Find X,Y location of the letter **T**. In figure c) Find X,Y location of the square.



a)

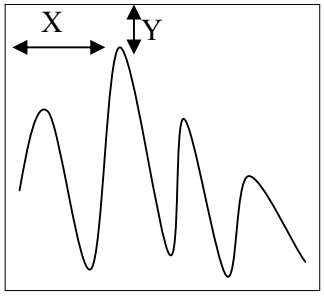


b)

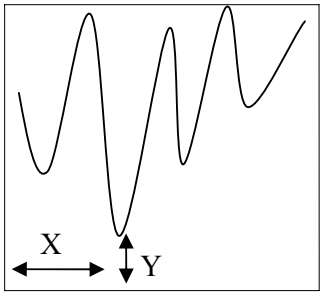


c)

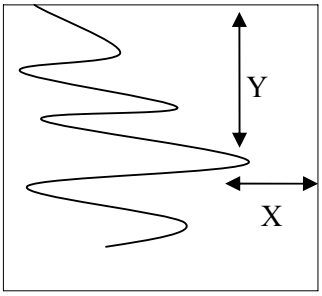
599 In figure a) Find X,Y maximum of the graph. In figure b) Find X,Y minimum of the graph. In figure c) Find X,Y maximum distance from Y axis.



a)



b)



c)