**Lab 2 Report:**

**92/100**

Question 1:

Raster graphics are a collection of color dots called pixel and arranged in row and columns, while vector graphics made up of points through mathematical formulae and calculation to connect those point by some path or line to form the graphics.

Also, for the file size, raster graphics usually have larger file size, and it depends on the image quality, while vector graphics usually have a smaller file size than raster graphics as it only consists of some line and it is independent of the quality.

Furthermore, if we enlarge the raster graphics, the image will become blurred and appear some zigzag. However, for the vector graphics, even after the magnification, the image is still clear and without loss of quality.

For the application, we usually use raster graphics for detailed image and vector graphics for less detailed images such as some logo, text or some simple illustration.

Question 2:

For the geometric transformation, we have a matrix for different transformation and by computing the matrix-vector multiplication: where is the original vector with coordinate (x , y) and is the vector that after transformation.

Translation:

For translation, we have where a is the x-coordinate and b is the y-coordinate for another vector that we want to translate a point (x , y) to a new point by adding this vector. Then we compute will be equal to which is means the point has been translated from (x , y) to (x+a , y+b).

Scaling:

For scaling, we have where is a scalar for scaling the x coordinate, is another scalar for scaling the y coordinate. Then we compute: will be equal to , which means the point (x , y ) has been scaling about the origin when the origin is fixed.

Rotation:

For rotation, we have which is define that the angle for rotation and this matrix is for anticlockwise rotation, we can transpose it for clockwise if needed. Then we compute so we will have a vector which (x’ , y’) is the new coordinates after the rotation by .

Reflection:

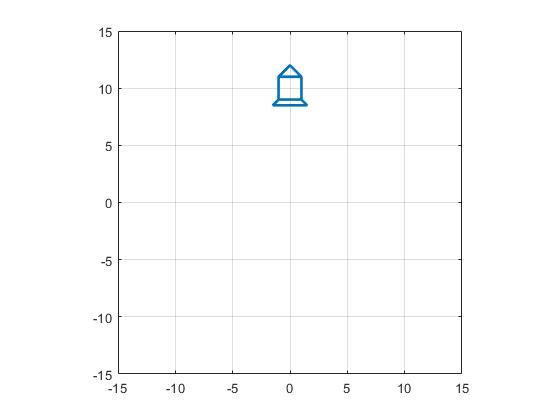
For reflection, can be different for different cases as below:

x-axis: , y-axis: , origin: , y=x: and y=-x: . Then if we compute the matrix-vector multiplication, we will get a vector where (x’ , y’) is the new coordinate that after the reflection of vector **.**

**Section 2:**

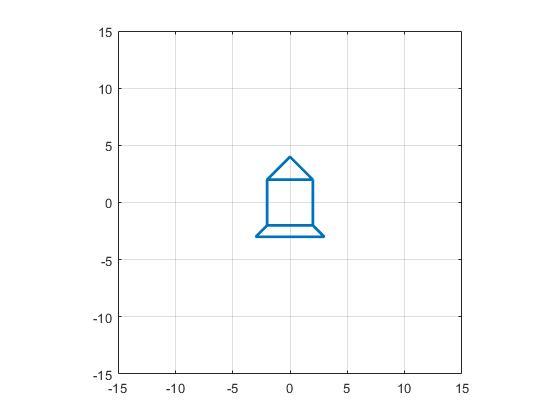
1. In order to move the object from to , we add a column vector . As i will be equal to 200 at the end of the for loop. Therefore, we need to divide by 20 to make sure that the value of i is 10 and move the object to finally.

| MATLAB program (Animation for the movement) |
| --- |
| x=[1 1 -1 -1 1 0 -1 -1 -1.5 1.5 1;  1 -1 -1 1 1 2 1 -1 -1.5 -1.5 -1];    N=200;  for i=1:N  xx=x+[0 i]'/20;  plot(xx(1,:),xx(2,:),'Linewidth',2);  axis([-15, 15, -15, 15]);  daspect([1 1 1])  grid on  drawnow  end |



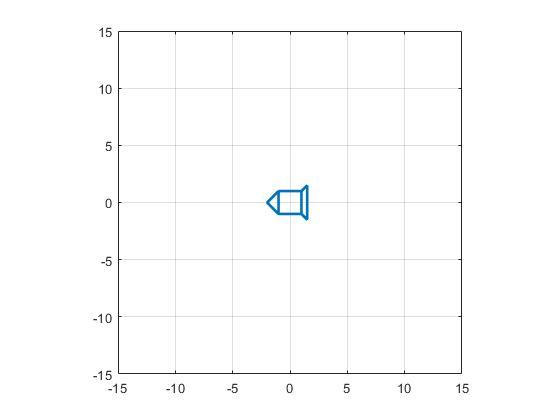
1. For magnification, let say we enlarge the object 2 times, we can multiply x by i/100 as i will be equal to 200 at the end of the for loop. Therefore, we need to divide I by 100 to get 2 for magnify the object 2 times at the end of the animation.

| MATLAB program (Animation for the magnification) |
| --- |
| x=[1 1 -1 -1 1 0 -1 -1 -1.5 1.5 1;  1 -1 -1 1 1 2 1 -1 -1.5 -1.5 -1];  N=200  for i=1:N  xx=x\*i/100;  plot(xx(1,:),xx(2,:),'Linewidth',2);  axis([-15, 15, -15, 15]);  daspect([1 1 1])  grid on  drawnow  end |



1. For rotate the object for anticlockwise 90 degree, we need to define a rotation matrix R = and let equal to (pi/2)\*(i/200) in order to exactly get pi/2 at the end of the for loop. Then, we compute for rotation.

| MATLAB program (Animation for the rotation) |
| --- |
| x=[1 1 -1 -1 1 0 -1 -1 -1.5 1.5 1;  1 -1 -1 1 1 2 1 -1 -1.5 -1.5 -1];  N=200  for i=1:N  theta = pi/2\*(i/200);  R = [cos(theta) -sin(theta); sin(theta) cos(theta)];  xx=R\*x;  plot(xx(1,:),xx(2,:),'Linewidth',2);  axis([-15, 15, -15, 15]);  daspect([1 1 1])  grid on  drawnow  end |



| MATLAB program (Animation for the circular orbit with radius=10) |
| --- |
| x=[1 1 -1 -1 1 0 -1 -1 -1.5 1.5 1;  1 -1 -1 1 1 2 1 -1 -1.5 -1.5 -1];  N=200  angle=2\*pi\*[0:1:N-1]/N;  x1=10\*cos(angle)  x2=10\*sin(angle)  while true  for i=1:N  theta = 2\*pi\*i/200  R = [cos(theta) -sin(theta);sin(theta) cos(theta)];  R = R\*x  xx=R + [x1(i) x2(i)]';    plot(xx(1,:),xx(2,:),'Linewidth',2);  axis([-15, 15, -15, 15]);  daspect([1 1 1])  grid on  drawnow  end  end |

