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Section : 3
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Essintial class:

```java
import java.awt.*;
import java.awt.geom.*;

@SuppressWarnings("unused")
public class My2d {
    Graphics2D g2d ;
 public My2d(Graphics2D g2d){
        this.g2d =g2d;

    }


    /*
    how to use ?
    put this at the top

     My2d g2d = new My2d((Graphics2D) g);


    g2d.fun....
     */
    /*
    * add this to your class help with animation
    *    @SuppressWarnings("unused")
    public int [] shift_points(int [] points , int
shift){

        int[] newArray = new int[points.length];
        for (int i = 0; i < points.length; i++) {
```

```java
            newArray[i]=points[i]+shift;
        }
        return newArray;
    }
    *
    * */
    public void draw_2d_polygon (double [] x ,
double [] y  ){
        GeneralPath gp = new GeneralPath();
        gp.moveTo(x[0],y[0]);


        for (int i = 1; i < x.length; i++) {
            gp.lineTo(x[i],y[i]);
        }
        gp.closePath();
        g2d.draw(gp);
    }


    public void fill_2d_polygon (double [] x ,
double [] y  ){
        GeneralPath gp = new GeneralPath();
        gp.moveTo(x[0],y[0]);
        for (int i = 1; i < x.length; i++) {
            gp.lineTo(x[i],y[i]);
        }
        gp.closePath();
        g2d.fill(gp);
    }
```

```java
    public void  draw_2d_line (double x1,double y1 ,
double x2 ,double y2 ){
        Line2D l = new Line2D.Double(x1,y1,x2,y2);
        g2d.draw(l);
    }


    public void  draw_2d_rect (double x1,double y1 ,
double width ,double height ){
        Rectangle2D rec = new
Rectangle2D.Double(x1,y1,width,height);
        g2d.draw(rec);
    }
    public void  fill_2d_rect (double x1,double y1 ,
double width ,double height ){
        Rectangle2D rec = new
Rectangle2D.Double(x1,y1,width,height);
        g2d.fill(rec);
    }


    public void  draw_2d_ellipse (double x1,double
y1 , double width ,double height ){
        Ellipse2D ellipse2D = new
Ellipse2D.Double(x1,y1,width,height);
        g2d.draw(ellipse2D);
    }
    public void  fill_2d_ellipse (double x1,double
y1 , double width ,double height ){
```

```java
        Ellipse2D ellipse2D = new
Ellipse2D.Double(x1,y1,width,height);
        g2d.fill(ellipse2D);
    }
    public void  draw_2d_arc (double x1,double y1 ,
double width ,double height,double
startAngel,double endAngle, int  type  ){
        Arc2D arc2D = new
Arc2D.Double(x1,y1,width,height
,startAngel,endAngle,type);
        g2d.draw(arc2D);
    }
    public void  fill_2d_arc (double x1,double y1 ,
double width ,double height,double
startAngel,double extent, int  type  ){
        Arc2D arc2D = new
Arc2D.Double(x1,y1,width,height
,startAngel,extent,type);
        g2d.fill(arc2D);
    }
}
```

Q1:

```java
import java.applet.Applet;
import java.awt.*;
import java.awt.geom.*;

public class q1  extends Applet {

    public void paint(Graphics g) {
        My2d g2d = new My2d((Graphics2D) g);
        //face
        g.setColor(Color.yellow);
        //center (750,350)
        g2d.fill_2d_ellipse  (500 ,100 ,500,500);

        //mouth
        g.setColor(Color.black);
        g2d.fill_2d_arc(600,250,300,300,0,-180,
Arc2D.OPEN);
        g.setColor(Color.yellow);

g2d.fill_2d_arc(620,270,260,260,0,-180,Arc2D.OPEN);

        //eyes
        //white
        g.setColor(Color.white);
        g2d.fill_2d_ellipse(650-35,150,70,100);
        g2d.fill_2d_ellipse (850-35,150,70,100);
```

```java
//black
g.setColor(Color.black);
g2d.fill_2d_ellipse(670-35,150,40,60);
g2d.fill_2d_ellipse(870-35,150,40,60);


//legs


//midle bottom (750 ,600)
double [] x_leg_left ={650,670,670,650};
double [] y_leg = {530,530,620,620};
double [] y_leg_black = {620,620,660,660};
//left
g.setColor(Color.yellow);
g2d.fill_2d_polygon(x_leg_left,y_leg);
g.setColor(Color.black);
g2d.fill_2d_polygon(x_leg_left,y_leg_black);


//right
g.setColor(Color.yellow);

g2d.fill_2d_polygon(shift_points(x_leg_left,180),y_leg);
g.setColor(Color.black);

g2d.fill_2d_polygon(shift_points(x_leg_left,180),y_leg_black);


//arms
```

```java
        //left edge (500,350)
        double [] x_arm_left
={510,510,510-90,510-90};
        double [] y_arm_left =
{335,365,365+120,335+120};
        g.setColor(Color.yellow);
        g2d.fill_2d_polygon(x_arm_left,y_arm_left);
        g.setColor(Color.black);
        g2d.fill_2d_ellipse(400,335+120+5,25,25);
        //right edge (1000,350)
        double [] x_arm_right
={990,990,990+90,990+90};
        double [] y_arm_right
={335,365,365+120,335+120};
        g.setColor(Color.yellow);

g2d.fill_2d_polygon(x_arm_right,y_arm_right);
        g.setColor(Color.black);

g2d.fill_2d_ellipse(990+90-5,335+120+5,25,25);
    }


    @SuppressWarnings("unused")
    public double [] shift_points(double [] points ,
double shift){

        double[] newArray = new
double[points.length];
```

```
        for (int i = 0; i < points.length; i++) {
            newArray[i]=points[i]+shift;
        }
        return newArray;
    }



}
```

Q2 :

```java
import java.applet.Applet;
import java.awt.*;

public class q2  extends Applet {
//      x=(int)(100+100 *Math.cos((i*3.14/180.0)));
//         y=(int)(100+100
*Math.sin((i*3.14/180.0)));
   public void paint(Graphics g) {
        My2d g2d = new My2d((Graphics2D) g);

        //outer
        //800 ,400
        g.setColor(Color.MAGENTA);
        g2d.fill_2d_ellipse(600,200,400,400);
```

```java
    //left_upper
    double [] x = {(800+200
*Math.cos((-145*3.14/180.0))),(800+200
*Math.cos((-130*3.14/180.0))),(800+250
*Math.cos((-130*3.14/180.0))),(800+250
*Math.cos((-145*3.14/180.0)))};
    double [] y = {(400+200
*Math.sin((-145*3.14/180.0))),(400+200
*Math.sin((-130*3.14/180.0))),(400+250
*Math.sin((-130*3.14/180.0))),400+250
*Math.sin((-145*3.14/180.0))};
    g2d.fill_2d_polygon(x,y);
    //left lower
    x = new double[]{(800 + 200 * Math.cos((145
* 3.14 / 180.0))), (800 + 200 * Math.cos((130 *
3.14 / 180.0))), (800 + 250 * Math.cos((130 * 3.14
/ 180.0))), (800 + 250 * Math.cos((145 * 3.14 /
180.0)))};
  y = new double[]{(400 + 200 * Math.sin((145 *
3.14 / 180.0))), (400 + 200 * Math.sin((130 * 3.14
/ 180.0))), (400 + 250 * Math.sin((130 * 3.14 /
180.0))), 400 + 250 * Math.sin((145 * 3.14 /
180.0))};
    g2d.fill_2d_polygon(x,y);
    //right_upper
    x = new double[]{(800 + 200 * Math.cos((-35
* 3.14 / 180.0))), (800 + 200 * Math.cos((-50 *
```

```java
3.14 / 180.0))), (800 + 250 * Math.cos((-50 * 3.14
/ 180.0))), (800 + 250 * Math.cos((-35 * 3.14 /
180.0)))};
        y = new double[]{(400 + 200 * Math.sin((-35
* 3.14 / 180.0))), (400 + 200 * Math.sin((-50 *
3.14 / 180.0))), (400 + 250 * Math.sin((-50 * 3.14
/ 180.0))), 400 + 250 * Math.sin((-35 * 3.14 /
180.0))};
        g2d.fill_2d_polygon(x,y);
        //righr  lower
        x = new double[]{(800 + 200 * Math.cos((35 *
3.14 / 180.0))), (800 + 200 * Math.cos((50 * 3.14 /
180.0))), (800 + 250 * Math.cos((50 * 3.14 /
180.0))), (800 + 250 * Math.cos((35 * 3.14 /
180.0)))};
        y = new double[]{(400 + 200 * Math.sin((35 *
3.14 / 180.0))), (400 + 200 * Math.sin((50 * 3.14 /
180.0))), (400 + 250 * Math.sin((50 * 3.14 /
180.0))), 400 + 250 * Math.sin((35 * 3.14 /
180.0))};
        g2d.fill_2d_polygon(x,y);
        //hail hitler :D

        //inner part
        g.setColor(Color.white);
        g2d.fill_2d_ellipse(620,220,360,360);
        g.setColor(Color.black);
        for (int i = 0; i < 360; i+=5) {
```

```java
            double lower_point = 400 + 170 *
Math.sin((i * 3.14 / 180.0));
            double upper_point = 800 + 170 *
Math.cos((i * 3.14 / 180.0));
            if (i%30==0) {
                g2d.draw_2d_line(upper_point,
lower_point,(800 + 140 * Math.cos((i * 3.14 /
180.0))),(400 + 140 * Math.sin((i* 3.14 /
180.0))));
            }else
            g2d.draw_2d_line(upper_point,
lower_point,(800 + 150 * Math.cos((i * 3.14 /
180.0))),(400 + 150 * Math.sin((i* 3.14 /
180.0))));
        }
        //inner inner part
        //800 ,400
        g2d.fill_2d_rect(797.5,400-2.5,5,145);
        g.setColor(Color.cyan);
        g2d.fill_2d_rect(790,300,20,100);
        g2d.fill_2d_rect(800,400-5,140,10);
        g2d.fill_2d_ellipse(800-20,400-20,40,40);
        g.setColor(Color.white);
        g2d.fill_2d_ellipse(800-10,400-10,20,20);

    }
}
```

Q3 :

```java
import java.applet.Applet;
import java.awt.*;
import java.awt.geom.Arc2D;

public class q3 extends Applet {
    //      x=(int)(100+100
*Math.cos((i*3.14/180.0)));
    //      y=(int)(100+100
*Math.sin((i*3.14/180.0)));
    public void paint(Graphics g) {
        My2d g2d = new My2d((Graphics2D) g);
        //train
        //body
        //first car
            g.setColor(Color.blue);
          g2d.fill_2d_rect(200,200,400,200);
          g2d.fill_2d_rect(200+400+100,200,400,200);
         //window
          g.setColor(Color.WHITE);
        for (int i = 0; i < 4; i++) {

g2d.fill_2d_rect(200+400/5+400/5*i,240,40,40);

g2d.fill_2d_rect(200+400+100+400/5+400/5*i,240,40,4
0);
```

```java
        }
        //chain
        g.setColor(Color.BLACK);
        g2d.fill_2d_rect(200+400,400-40,100,20);
        //front
        double []x_triangle ={1100,1150,1100};
        double [] y_triangle = {400,400,400-100};
        g2d.fill_2d_polygon(x_triangle,y_triangle);

g2d.fill_2d_arc(700+400-20,240,40,40,-90,180,Arc2D.
PIE);

g2d.fill_2d_rect(200+400+100+400/5+400/5*3-20,200-4
0,20,40);
      g2d.fill_2d_rect(0,400+40,getWidth(),20);
        //wheels
          //bottom line middle point at (400,400)

draw_wheel(400-100-40,400-40,40,0,g2d,g);

draw_wheel(400+100-40,400-40,40,0,g2d,g);
          //bottom middle point at ( 900,400)



draw_wheel(900-100-70,400-70-30,70,0,g2d,g);


draw_wheel(900+100-40,400-40,40,0,g2d,g);
    }
```

```java
    public void  draw_wheel(double x,double y,double
r,double start_angle,My2d g2d ,Graphics g){
        Color oldColor = g.getColor();
        g.setColor(Color.yellow);
        g2d.fill_2d_ellipse(x,y,r*2,r*2);
        g.setColor(Color.black);
        for (int i = 0; i < 4; i++) {
            g2d.fill_2d_arc(x, y, r * 2, r * 2,
start_angle +90*i, 30 , Arc2D.PIE);
        }
     g.setColor(oldColor);
        }


    }
```