Object representation-using Class

```java
import java.io.*;
import java.lang.*;
class complex
{  float real,img;
   public complex(float a,float b){real=a;img=b;}
   public complex(){}
   public void st(float x,float y){ real=x; img=y; }
   public void print1() { System.out.println(real+"-"+img+"i"); }
   public void duble() { real=2*real; img=2*img;}
   public void ktimes(int k) {real=k*real;img=k*img;}
   private float magsq(){ return real*real+img*img;}
   public float magnitude(){float t;t=(float)Math.sqrt(this.magsq()); return(t);}
   public static void print2(complex a)
          { System.out.println(a.real+" +  "+a.img+"i"); }  or a.print1()
   public void add(complex x){ real=real+x.real;img=img+x.img; }
   public void add(complex x,complex y)
          { real=x.real+y.real;img=x.img+y.img; }  or { real=x.real; img=x.img: this.add(y);}
   public complex add3(complex x)
          { complex c;float a,b;c=new complex();
            a=real+x.real;b=img+x.img;c.st(a,b);  or c.add(this.x): or c=complex.add4(this.x):
            return(c); }
   public static complex add4(complex x,complex y)
          { complex c;float a,b;a=x.real+y.real;b=x.img+y.img;
            c=new complex();c.st(a,b);return(c); }
   public float getreal() { return(real);}
   private float getimaginary() { return(img);}
}
class hari
{  public static void main( String args[])
   {    complex t,s,r,m;float j;
        t=new complex();s=new complex();r=new complex();
        t.st(4,2);t.duble();t.print1();
        t.st(4,2);t.ktimes(10);t.print1();
        t.st(4,3);j=t.magnitude();System.out.println(j);
        t.st(4,2);t.print1();s.print2(t);complex.print2(t);
        s.st(2,7);t.st(4,2);s.add(t);s.print1();
        s.st(2,7);t.st(4,3);r.add(s,t);r.print1();
        s.st(2,7);t.st(4,23);r=s.add3(t);r.print1();
        s.st(2,7);t.st(4,2);r=complex.add4(s,t);r.print1();
        System.out.println(s.getreal());
        m=new complex(23,-45);m.print1();
   }
}
```

Since getreal( ) is public s.getreal( ) can be written in class hari. However s.getimaginary( ) can not be written.

s.add(t) means s+=t; r.add(s,t) means r=s+t; Two definitions show function overloading.

r=s.add3(t) means r=s+t; Same meaning is with add4.

In add4 current object (real and img) is not used hence it is declared static. In calling add4 the name of class (not that of object is passed).

To implement a=a*b as a.mul(b) a temporary variable is needed.

a=b*c can be implemented as a=b.mul(c) or a=complex.mul(a,b) without using temporary variable.

But when it is implemented as a.mul(b,c) a temporary variable should be used otherwise a=a*c will give wrong result.

1. Define a class vector. Define dotproduct of vectors so that a v.dot(w) computes the dot product of vectors v and w. Dotproduct of 2i+3j+1k and 5i+2j+3k is 19.

2. Define magnitude such that a v.mag() computes the magnitude of vector v. To compute the magnitude, use the function of dot product defined above. Magnitude 4i+3j+12k is 13. [Hint: a (float)Math.sqrt(b) can be used to find square root of b]

3. Define cross product such that v.cross(w,h) performs v wxh. Also define suitable function for printing a vector. Cross product of 2i+3j+1k and 5i+2j+3k is 7i-j-11k

4. Define divide such that v.divide(float k) divides vector v by k. Let vector v be 4i+3j+12k then after v.divide(2) it will become 2i+1.5j+6k.

5. Define unit vector such that v.unit() will modify the vector v so that it becomes a vector of unit magnitude in the same direction. Use the functions magnitude and divide defined above. Unit vector for 4i+3j+12k is 0.31i+0.23j+0.92k.

6. Define another class point. In that class define function to compute mid point of two given points. p=point.mid(q,r) should find p as mid point of q and r. Define suitable function to print point.

7. Define function direction such that v=point.dir(p,q) finds vector v in the direction of given points p and q. If points are (2,3,1) and (6,2,8) then direction is 4i-j+7k.

8. Define function direction such that v.direction(p,q) will find vector v. Use above function.

9. Define function to compute area. a=point.area(p,q,r) should find the area of triangle PQR. [Find direction corresponding to PQ and PR. Now call cross product and magnitude]. Area of the triangle with end points (3,4,5), (7,3,6) and (6,2,3) is 6.36.

10. In a separate file define class point (in 2 dimensional space, components x and y). Now define a function to find mid point. p.mid(q) will find p as mid point of p and q. Define suitable function to print point.

11. In the same file define another class line. It has 3 components a, b and c. ax+by+c=0 is equation of a line. Define function to find equation of a line. g.eq(p,q) will find the equation of the line (g) passing through p and q. Define suitable function to print the equation of line. Let P=(2,3) and Q=(4,7) then line is 2x-y-1=0. Hence a=2 b=-1 and c=-1. The line may be printed as 2x+-1y+-1=0.

12. Define intersection. p.intersection(g,h) finds the point of intersection of the line g and h. Input 2x+3y-26=0 and 4x+7y-54=0 output (10,2).

13. Define intersection. p.intersection(a,b,c,d) finds the point of intersection of line joining points a and b with the line joining points c and d. Use above function. Let input points be (4,6), (-2,10), (10,2) and (3,6) then the point of intersection is (10,2).

14. Define distance. k=line.distsance(p,l) finds the distance of the point 'p' from the line 'l'. e.g. input point (2,3) and line 8x+6y-12=0 distance $= (8*2+6*3-12)/(8^2+6^2)^{1/2} = 2.2$.

15. In the same file define another class circle. It has two components c and r. c(point) is centre of the circle. r(float) is radius of the circle. Define a function to print the equation of the circle. Let there is a circle (x) whose radius is 7 and centre is (2,3) then x.print() will print $x^2+y^2-4x-6y-36=0$. [It may be printed as $x^2+y^2+-4x+-6y+-36=0$]

16. Define a function form. a.form(g,h,k) will form a circle whose equation is $x^2+y^2+gx+hy+k=0$. a.form(-4,-6,-36) will make centre and radius of circle 'a' as (2,3) and 7 respectively. Define a function to print the circle. a.pt() will print centre and radius of the circle 'a'.

17. Define a function chord. a.chord(b) will return the chord length. Here 'a' is a circle and 'b' is a line. If a circle has centre (1,2) and radius 5 and the line is 5x+12y+10z=0 then chord length is 8. [Method: find d=line.distance(c,b) and use $(r^2-d^2)^{1/2}$.]

18. Define a function intersection. y=s.intersection(b) returns the y-coordinate of point of intersection of circle (s) and line (x=b). Let a circle (s) has centre (7,2) and radius 5. y=intersection(s,10) will make y as 6 (or -2). It is because circle $(x-7)^2+(y-2)^2=5^2$ intersects with the line x=10 at points (10,6) and (10,-2).