

In this assignment you will “program” an imaginary computer that uses a ruler, compass and pencil on a sheet of paper marked only with an origin. Assume that you have the following primitives available to you and write the programs given below using these primitives. You may also use simple programming constructs like loops etc but only if required.

- `drawline( $l$ )`: Use the ruler to draw a line of  $l$  cm between two arbitrary points on a piece of paper.
- `drawlinewithnames( $l, a, b$ )`: Use the ruler to draw a line of  $l$  cm between two arbitrary points on a piece of paper. Name the two ends of this line  $a$  and  $b$ .
- `drawline( $a, b$ )`: Use the ruler to connect points  $a$  and  $b$ .
- `setcompasswidth( $a, b$ )`: Set the width of the compass by placing its tip on point  $a$  and the pencil end on point  $b$ .
- `drawcircle( $a$ )`: Draw a circle with the compass tip placed at point  $a$ .
- `drawcirclewithnames( $a, b$ )`: Draw a circle with the compass tip placed at point  $a$ . Give the first point at which this circle intersects another circle the name  $b$ .

**Q1.** Write a program for constructing an equilateral triangle of side 5 cms using ruler, compass and pencil.

**Q2.** Let us assume you are given an angle drawn on the piece of paper. This angle is given to you in terms of two line segments  $(a, b)$  and  $(a, c)$  which have one point in common i.e.  $a$  where the angle is formed. Write a program to bisect this angle.

**Q3.** Given an appropriate name to the bisection function you have written for Q2 and use that function to do the following: Given an input  $k$ , write a program to construct an angle of  $\pi/(2^k \cdot 3)$ .

**Q4.** As you know the equation of a spiral in polar coordinates is  $a = r\theta$ . You are given a function `drawangle( $a, b, \gamma$ )` that takes the segment  $(a, b)$  as the base line and returns a point  $c$  which that the angle  $cab$  is equal to  $gamma$ . Write a program to plot the first 20 points of a spiral that are spaced  $\pi/3$  radians apart from each other.