ENGINEERING GRAPHICS

SEM 2
PRESENTATION

ARCHIMEDEAN SPIRAL

ACKNOWLEDGEMENTS

PROJECT :

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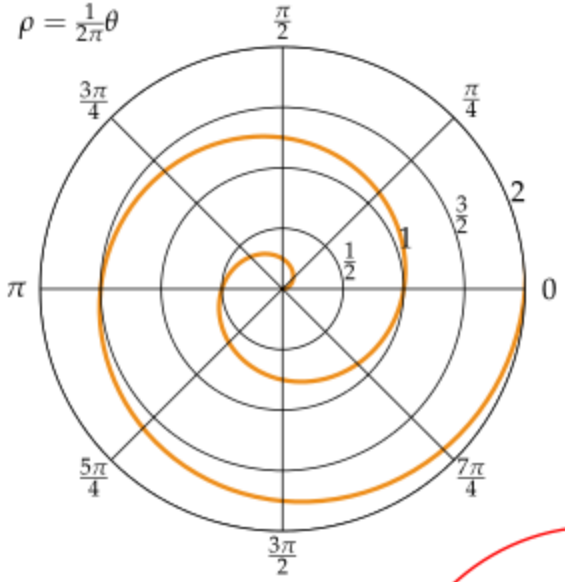
Content Courtesy : www.wikipedia.org
Picture Courtesy : www.wikipedia.org
www.geniusnepal.com
Coding Courtesy : www.openprocessing.org

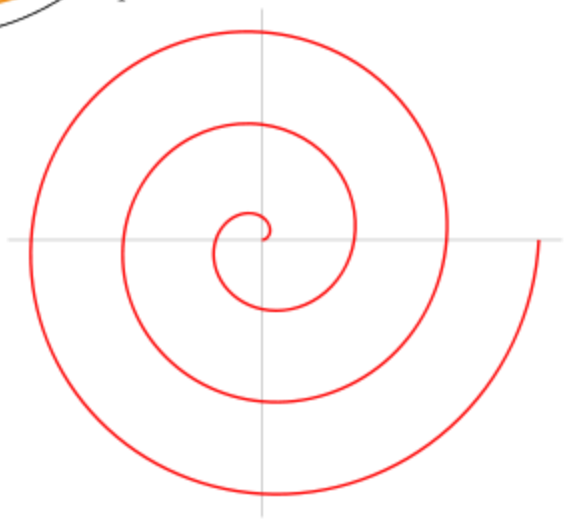
INTRODUCTION

- The Archimedean spiral (also known as the Arithmetic spiral or Spiral of Archimedes) is a spiral named after the 3rd century BC Greek mathematician Archimedes. It is the locus of points corresponding to the locations over time of a point moving away from a fixed point with a constant speed along a line which rotates with constant angular velocity. Equivalently, in polar coordinates (r, ϑ) it can be described by the equation

$$r = a + b\theta$$

with real numbers *a* and *b*. Changing the parameter *a* will turn the spiral, while *b* controls the distance between successive turnings.

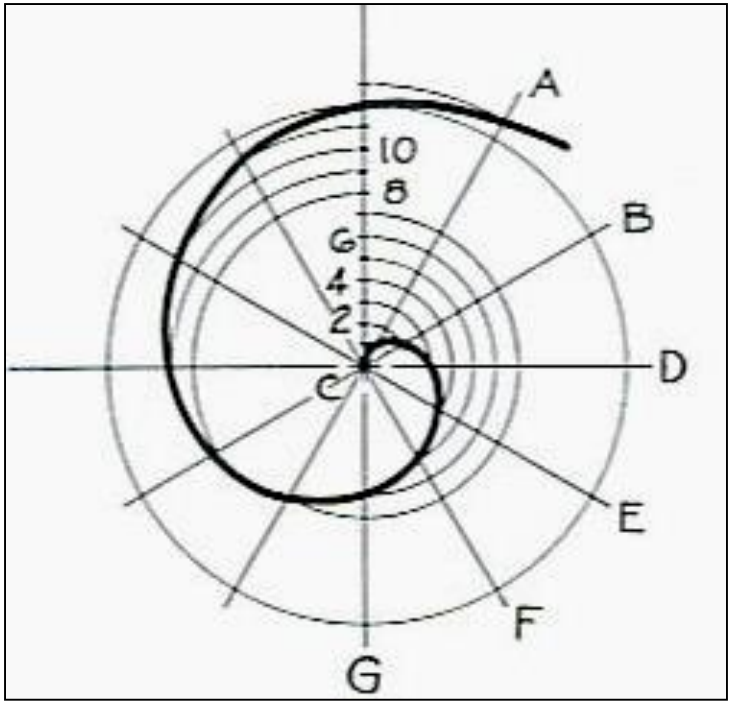




CHARACTERISTICS

- The Archimedean spiral has the property that any ray from the origin intersects successive turnings of the spiral in points with a constant separation distance (equal to $2\pi b$ if ϑ is measured in radians), hence the name "arithmetic spiral".
- In contrast to this, in a logarithmic spiral these distances, as well as the distances of the intersection points measured from the origin, form a geometric progression.
- The Archimedean spiral has two arms, one for $\vartheta > 0$ and one for $\vartheta < 0$. The two arms are smoothly connected at the origin. Only one arm is shown on the accompanying graph. Taking the mirror image of this arm across the *y*-axis will yield the other arm.
- For large ϑ a point moves with well-approximated uniform acceleration along the Archimedean spiral while the spiral corresponds to the locations over time of a point moving away from a fixed point with a constant speed along a line which rotates with constant angular velocity.
- **Separation distance between turns**

Some sources describe the Archimedean spiral as a spiral with a "*constant separation distance*" between successive turns. This is somewhat misleading. The constant distances in the Archimedean spiral are measured along rays from the origin, which do not cross the curve at right angles, whereas a distance between parallel curves is measured orthogonally to both curves. There is a curve slightly different from the Archimedean spiral, the involute of a circle, whose turns have constant separation distance in the latter sense of parallel curves.



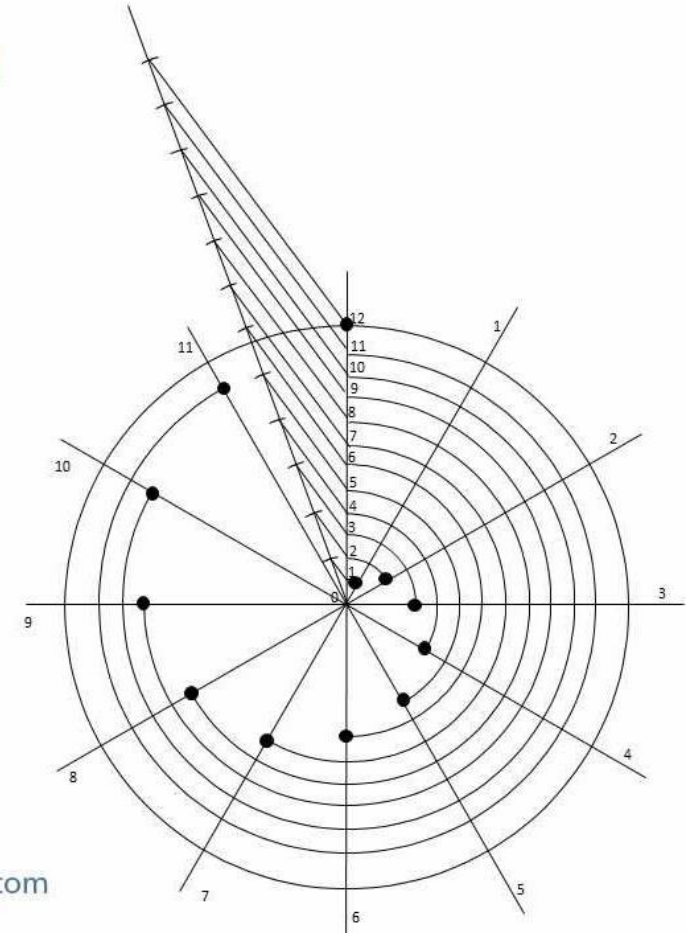
EXAMPLE : USING 12 Points of Intersection

Archemedian's spiral

Steps:

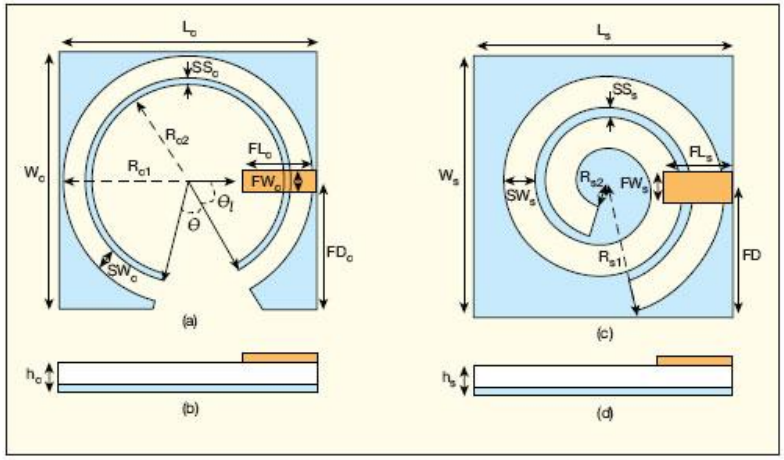
1. Draw a circle of given diameter/radius
2. Divide a circle in 12 division and name the divisions (for detail refer to http://geniusnepal.com/)
3. Divide a radii in 12 division and name them. (for detail refer to http://geniusnepal.com/)
4. Point the needle of compass at the canter and draw arc up to corresponding lines as.....
5. Find out the point of intersection as.....
6. Draw the curve through the intersecting point using French curve.

Genius Nepal.com



APPLICATIONS

- Spiral UHF Antennas
  - (A spiral antenna transmits EM waves having a circular polarization. It will receive linearly polarized EM waves in any orientation, but will attenuate signals received with the opposite circular polarization. A spiral antenna will reject circularly polarized waves of one type, while receiving perfectly well waves having the other polarization.
  - One application of spiral antennas is wideband communications. Another application of spiral antennas is monitoring of the frequency spectrum. One antenna can receive over a wide bandwidth, for example a ratio 5:1 between the maximum and minimum frequency. Usually a pair of spiral antennas are used in this application, having identical parameters except the polarization, which is opposite (one is right-hand, the other left-hand oriented). Spiral antennas are useful for microwave direction-finding.
  - (Reference : http://mwrf.com/passive-components/compare-compact-uhf-antennas)



2. These views show (a) top and (b) side views of a hollow central annular slot antenna (HCASA) along with (c) top and (d) side views for a spiral slot antenna (SSA).

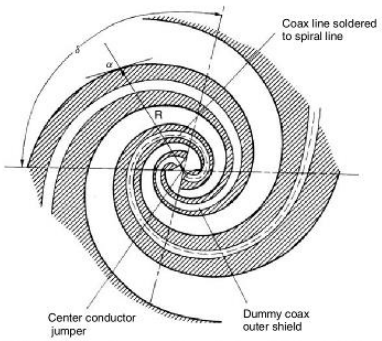
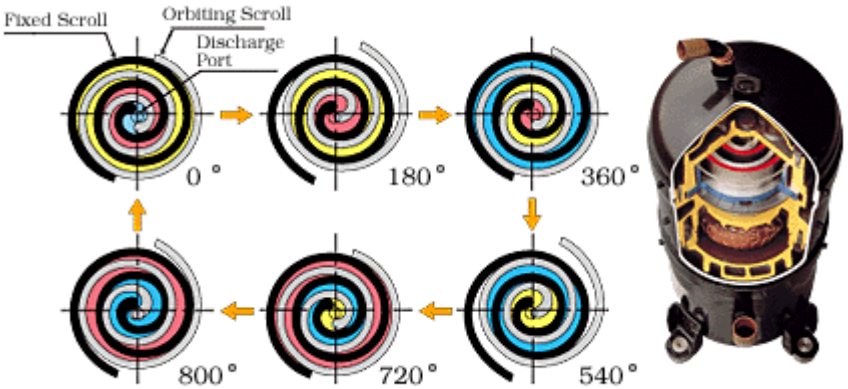
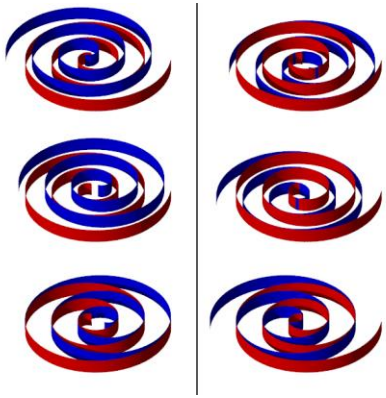


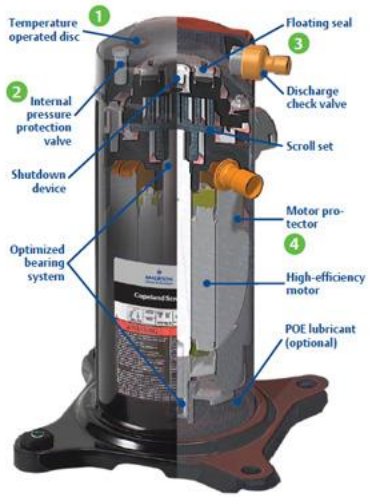
FIGURE 11-4 Equiangular spiral (RHC) with an infinite balun feeder.

Scroll Compressor

- A **scroll compressor** (also called *spiral compressor*, **scroll pump** and **scroll vacuum pump**) is a device for compressing air or refrigerant. It is used in air conditioning equipment, as an automobile supercharger (where it is known as a scroll-type supercharger) and as a vacuum pump.
- A scroll compressor operating in reverse is known as a **scroll expander**, and can be used to generate mechanical work from the expansion of a fluid, compressed air or gas. Many residential central heat pump and air conditioning systems and a few automotive air conditioning systems employ a scroll compressor instead of the more traditional rotary, reciprocating, and wobble-plate compressors.
- (Reference : http://en.wikipedia.org/wiki/Scroll_compressor)







SIMULATION USING C-PROGRAM

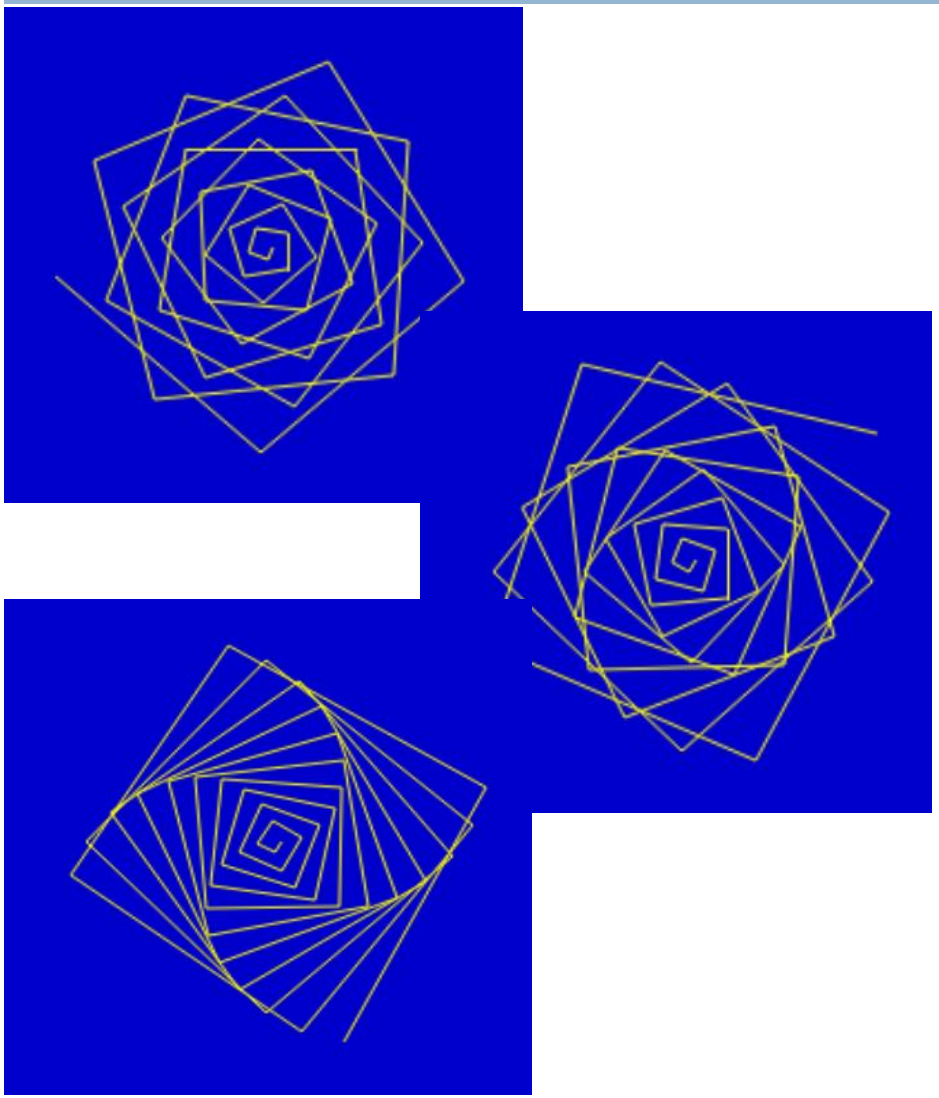
```
/*
Animated archimedean spiral
Translated from Pascal into processing by Silvia Rothen, Switzerland
Special Thanks to Max Kleiner and his maXbox
*/
int myHeight = 700;
int myWidth = 700;
int cx = 0;
int cy = 0;
float FValueA = 3.0;
float FValueB = 1.4;
float angle = 0.0;
float x1 = 0.0;
float x2 = 0.0;
float y1 = 0.0;
float y2 = 0.0;
int myDelay = 25;
int lastTime = 0;
boolean odd = false;
int refresh = 0;
boolean continued = true;


void setup() {
  size(myWidth, myHeight);
  strokeWeight(1);
  fill(255, 255, 255);
  stroke(255, 255, 255, 5);
  background(0, 0, 0);
  cx = myWidth / 2;
  cy = myHeight / 2;
  frameRate(1000/myDelay);
}

/* toggle drawing with left mouse button
   restart drawing with right mouse button
*/
void mousePressed() {
  if ( mouseButton == LEFT) {
    continued = !continued;
  }
  if ( mouseButton == RIGHT) {
    FValueB = 1.4;
    background(0, 0, 255);
    stroke(255);
    x1 = 0.0;
    x2 = 0.0;
    y1 = 0.0;
    y2 = 0.0;
    continued = true;
  }
}


void draw() {
  if (continued) {
    FValueB = FValueB + 0.001;
    refresh = refresh + 1;
    background(0, 0, 204);

    stroke(255, 255, 0);
    for (int i = 42; i >= 0; i = i-1) {
      angle = FValueB * i;
      x2 = cx + (FValueA + FValueB * angle) * cos(angle);
      y2 = cy + (FValueA + FValueB * angle) * sin(angle);
      if (i == 42) {
        x1 = x2;
        y1 = y2;
      } else {
        line(x1,y1,x2,y2);
        x1 = x2;
        y1 = y2;
      }
    }
  }
}
```



THANK YOU