

Drawing Flowers

You may want to watch again the video by Vi Hart in which she talks about the spirals that are formed in flowers, pinecones, and other plants (see the course website). This process has a fancy name, *spiral phyllotaxis* and it is a characteristic arrangement of leaves, petals, scales or seeds that is seen in a variety of plants including daisies, sunflowers, pine cones and cauliflower.

It works as follows: At the growth tip of a plant (called the meristem), small protusions called primordia emerge at regular intervals and move away radially from the center. Eventually these primordia go on to develop into various features of the plant such as its petals or seeds.

One model of growth for the primordia is to assume that each primordium emerges from the meristem at a fixed angle relative to the previous primordium. The angle separating neighbouring primordia is called the *divergence angle*.

To try out what happens with this, you will explore several different divergence angles, and plot points that would represent the tip of the leaf or pedal representing the primordial on graph paper.

1. Plot the first dot at angle 0° and make the dot one unit away from the center (radius = 1).
2. Plot the second dot increasing the angle by the chosen divergence angle A , keeping the dot one unit away from the center. Continue to plot one unit away from the center until you have gone around once and the next dot would be between two previous dots. For the angle 50° , you would be putting dots one unit away at $50^\circ, 100^\circ, 150^\circ, 200^\circ, 250^\circ, 300^\circ$, and 350°
3. For your next dot, and move the dot one unit out (increase the radius by one unit). Then continue to go around until you have been all the way around at two units. In the example of the angle 50° , you would have stopped at 350° in the previous step, then you would switch up to putting a dot two units from the center at $350^\circ + 50^\circ = 400^\circ$, but note that since 360° is all the way around the circle, the next dot actually goes in at 40° .
4. Repeat the whole process, until you start to see the spiral! These spirals (sometimes they are just lines) emerge as our eyes make connections between nearest neighbor dots. These spirals are called *parastichies*.

Your task:

1. **Draw the dots for each of the following divergence angles and then sketch in the the parastichies.** The angles are $50^\circ, 95^\circ, 125^\circ$. Plot enough points so that the parastichies become evident (you will sometimes need a lot) and in pencil connect the dots along each parastichy.
2. These dots form the “backbone” of the flowers, and each dot represents the tip of a petal. **Choose one of the forms and draw in the resulting flower, pinecone, or whatever.**