(Circle + Square)/Triangle: Using Shape-Based Expressions for Image Creation and Exploration

Supplementary Images

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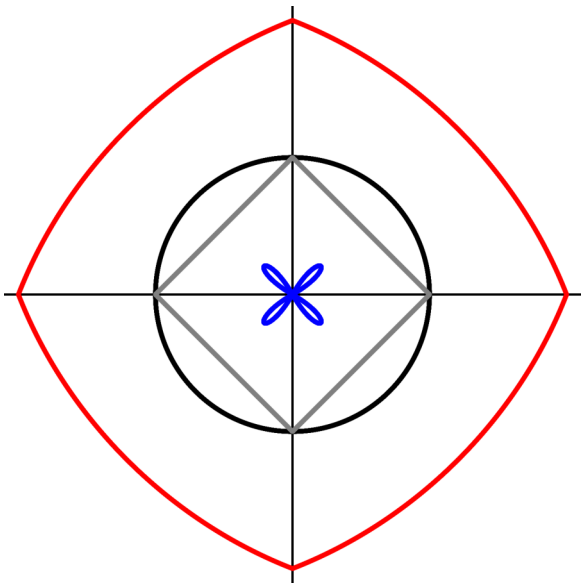
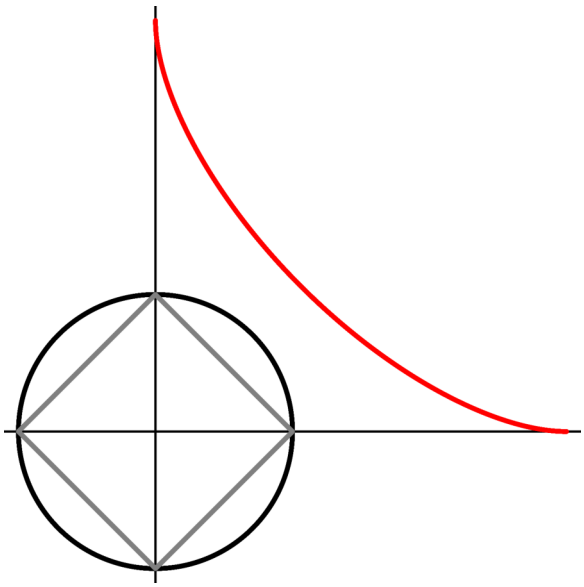
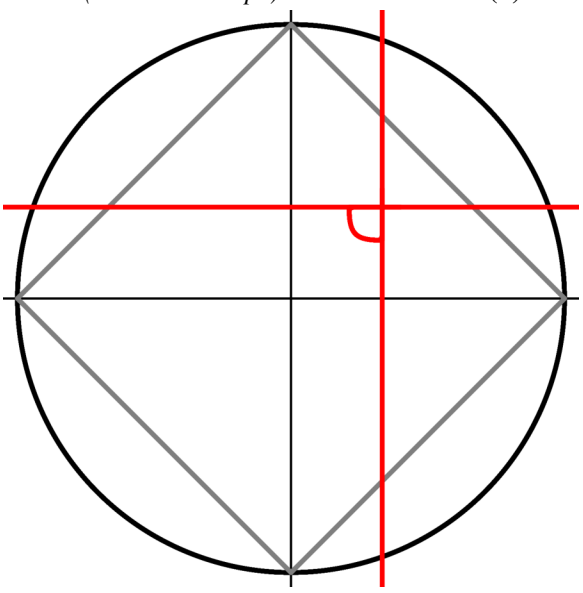
This file contains higher resolution versions of most of the images from the paper, as well as a few additional images added for clarification. Additional images are marked (**Additional**).



(a) $A + B$ *(red outer shape) and* $A - B$ *(blue inner shape).*



(b) $A * B$ *(red curve).*



(c) A/B *(set of red lines).*

Figure 1: *Results of basic operations on square A and circle B where B's radius is 3, A is inscribed in B, and both are centered at the origin.*

(Additional) *Visual representation of the expression used to create the result below.*

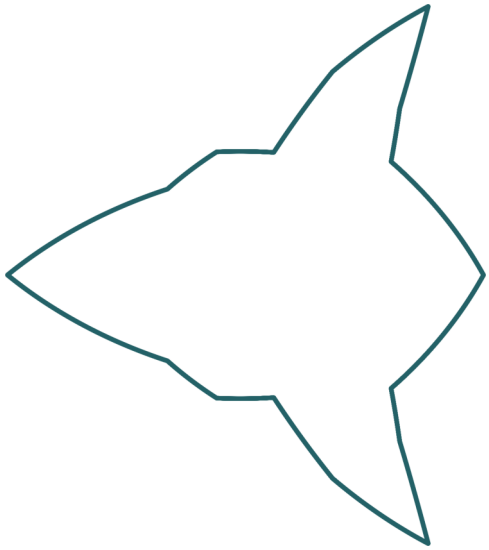
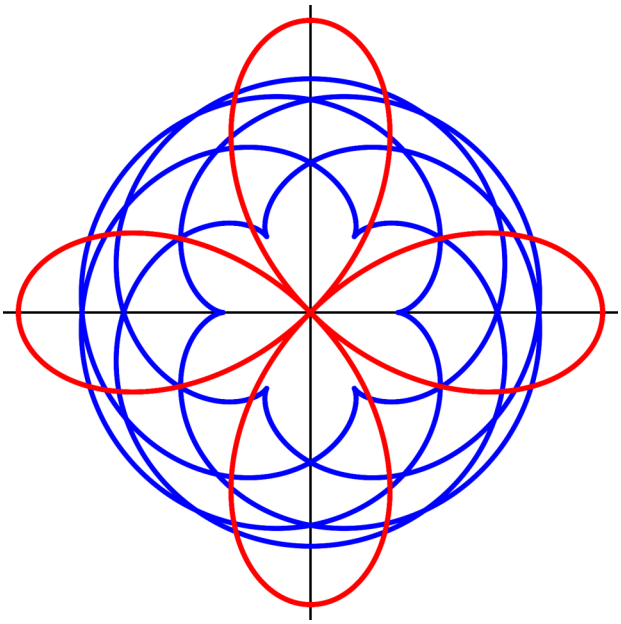
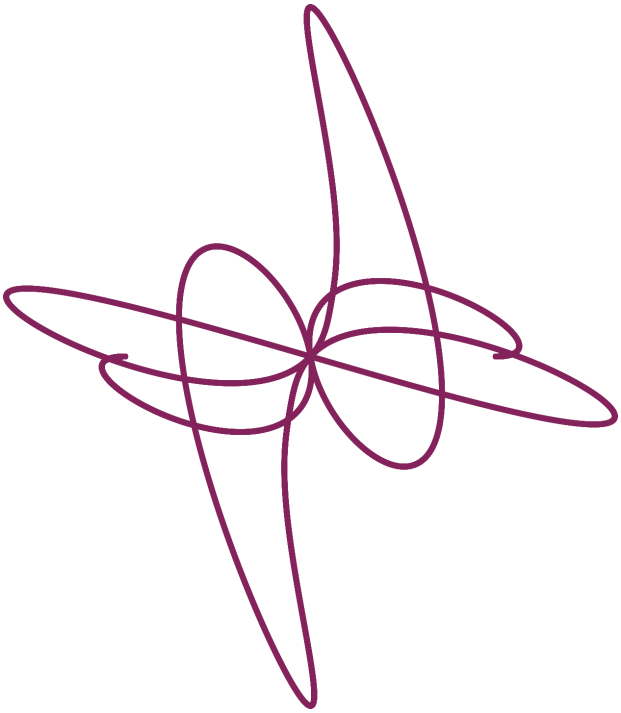


Figure 2: *Spaceship-like result of adding and subtracting multiple shapes.*



(a) *Epicycloid (blue) and rose curve (red) centered at the origin.*



(b) *epicycloid* $*$ *rose curve.*

Figure 3: *Multiplying more complex curves.*

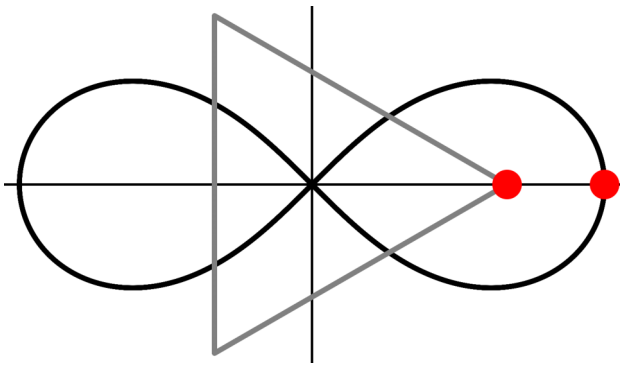
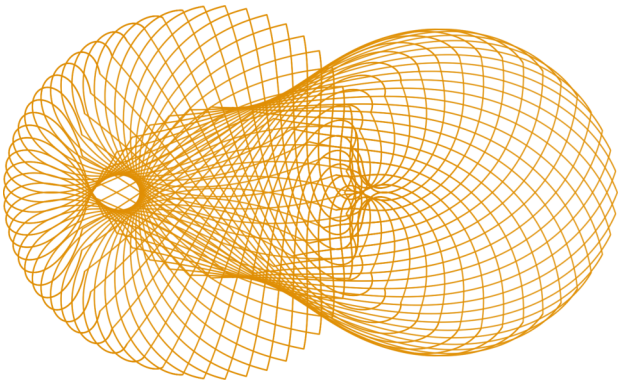
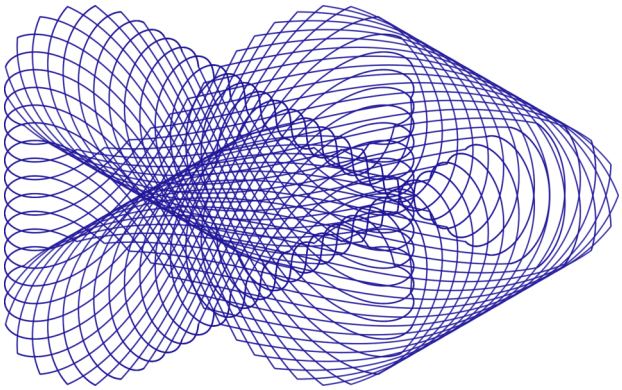


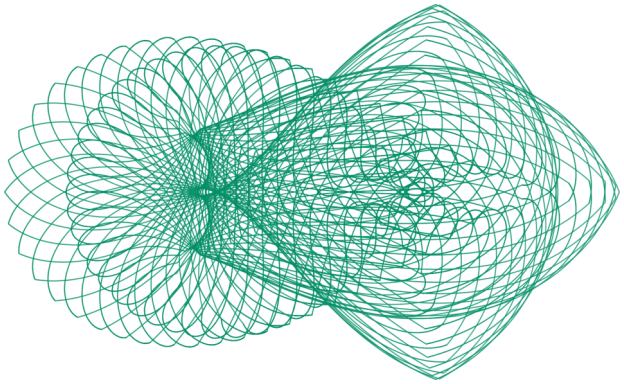
Figure 4: *Lemniscate A and triangle B. Red dots represent the initial starting point for drawing the shapes.*



(a) *Result for when B rotates around the origin.*

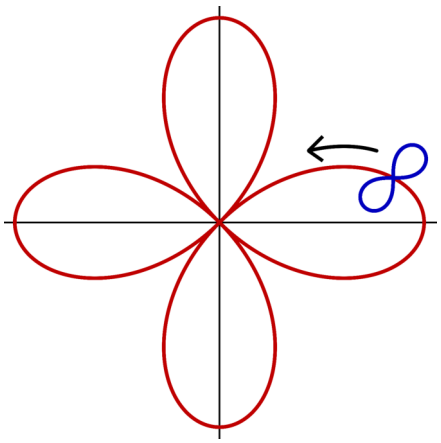


(b) *Result for when B's offset moves around the perimeter of the triangle.*

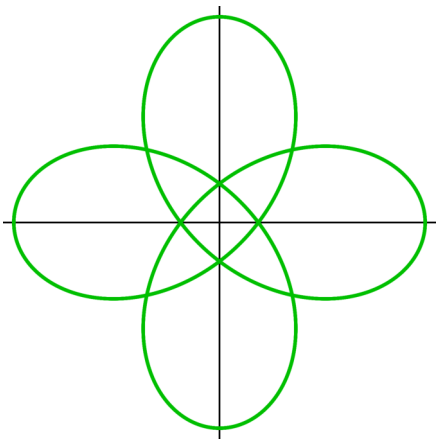


(c) *Result for when B rotates around the origin while the offset simultaneously moves along B's path.*

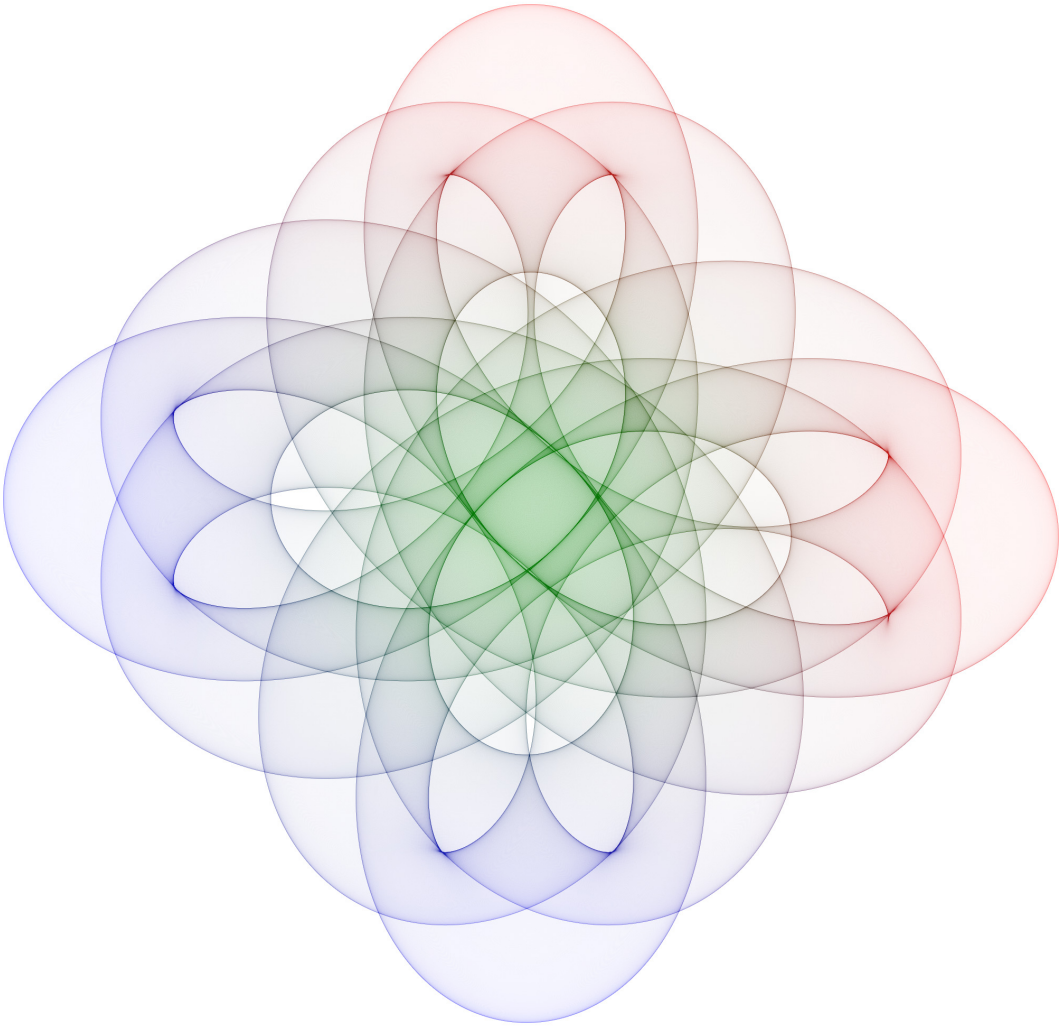
Figure 5: *Results for the shapes in Figure 4 using 40 discrete steps for offset motion and rotation.*



(a) *A lemniscate moving along a rose curve path.*

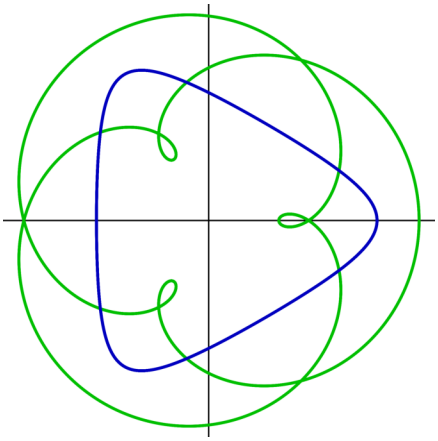


(b) *Hypotrochoid.*



(c) *lemniscate + hypotrochoid.*

Figure 6: *Example of adding a moving shape, a lemniscate (a), to a static shape, a hypotrochoid (b).*



(Additional) *Epitrochoid (green) and hypotrochoid (blue). For the result below, the epitrochoid is rotating counter-clockwise and the hypotrochoid is rotating clockwise. The shapes are rotating at different speeds.*

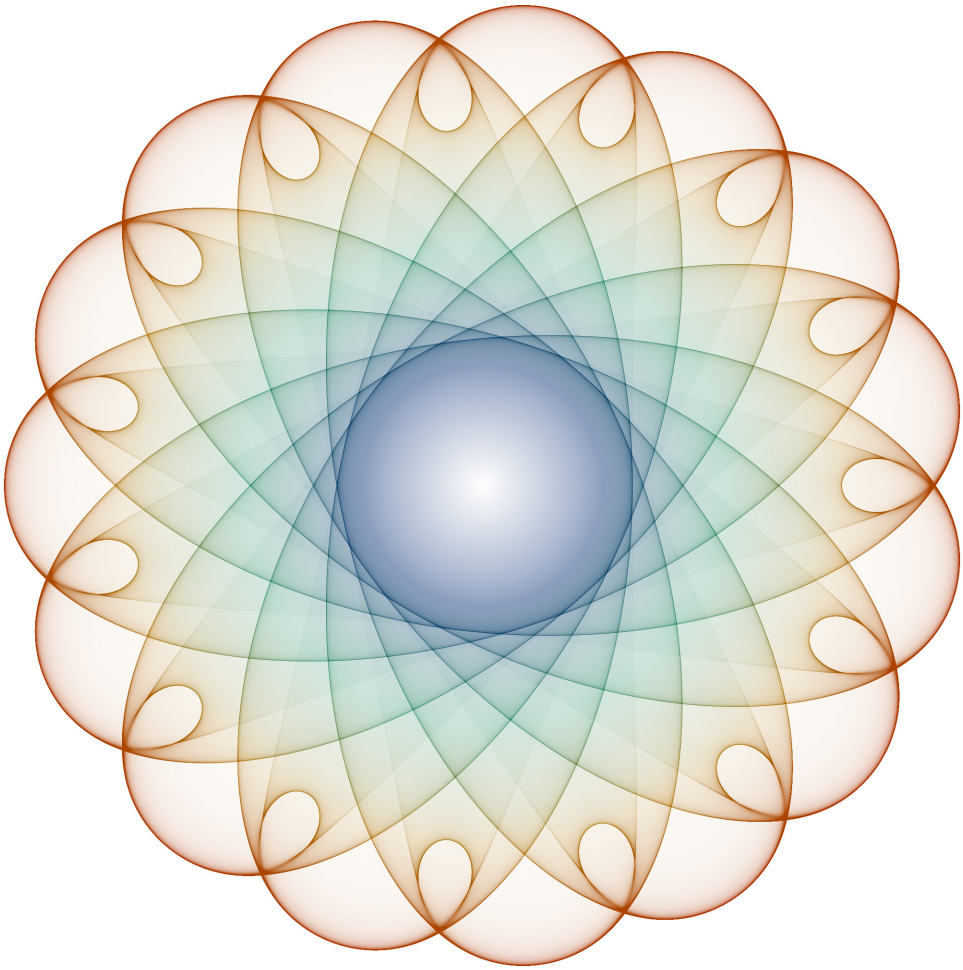
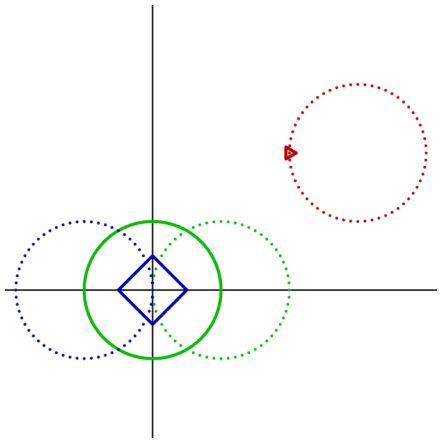


Figure 7: *epitrochoid + hypotrochoid.*



(Additional) *Circle (green), square (blue), and a small triangle (red). For the result below, the circle is following the green-dot path in a clockwise direction. The square is following the blue-dot path in a counter-clockwise direction. The triangle is following the red-dot path in a clockwise direction. The shapes are rotating at different speeds.*

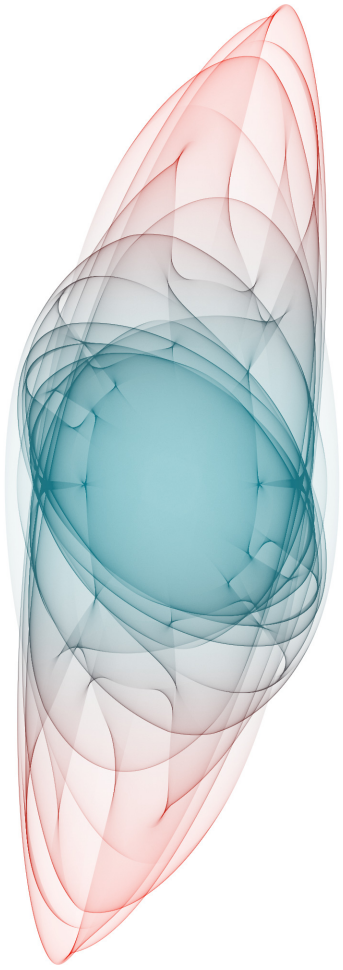
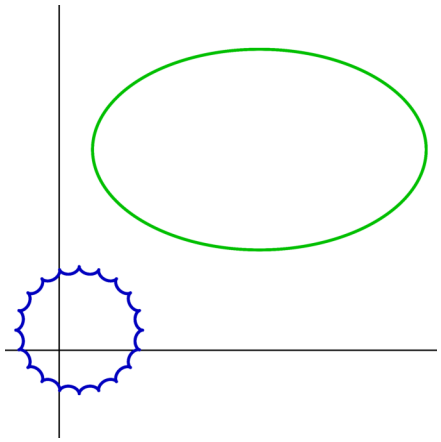


Figure 8: $(circle + square)/triangle$.



(Additional) *Oval (green) and hypotrochoid (blue). For the result below, the oval's starting point is moving counter-clockwise along the edge of the oval, and the hypotrochoid is rotating counter-clockwise. The oval's starting point is moving at twice the hypotrochoid's rotation rate.*

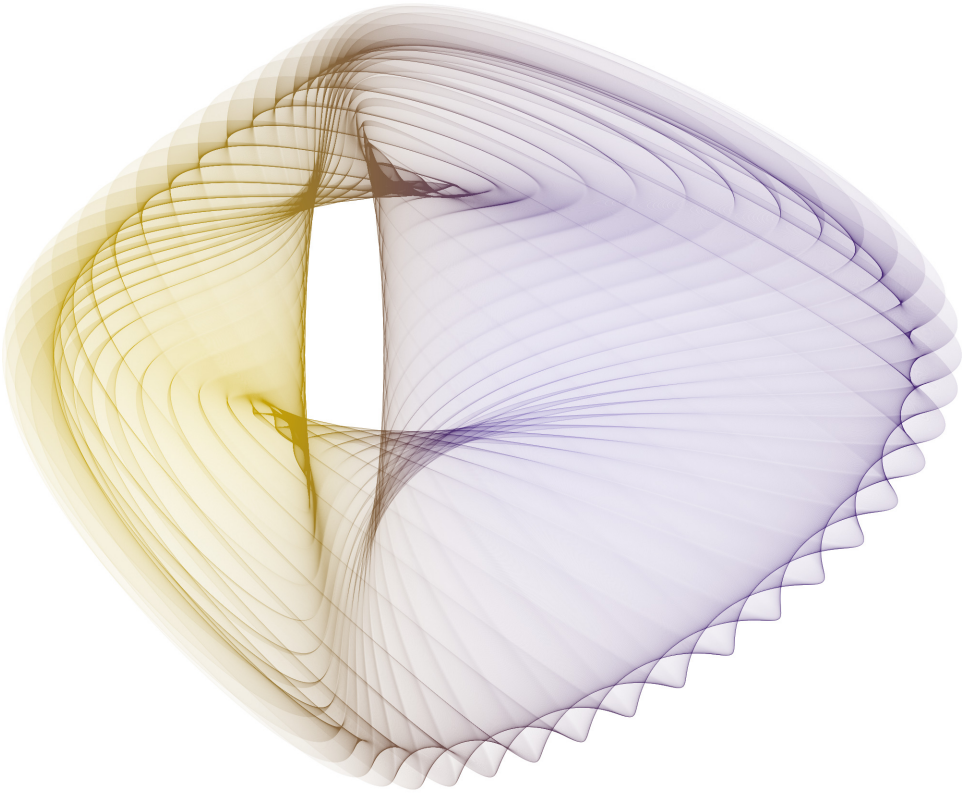
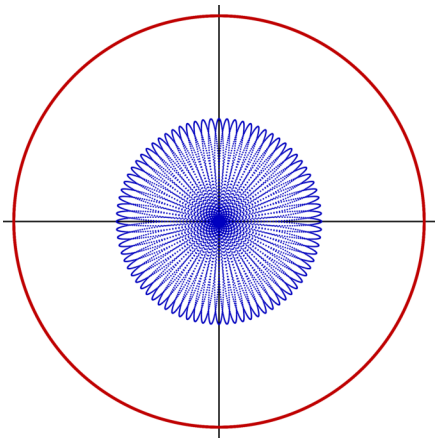


Figure 9: *hypotrochoid $*$ oval.*



(Additional) *Circle (green) and rose curve (red). For the result below, the circle and rose curve are stationary. However, in the animation, the rose curve rotates which causes the final result to be animated.*

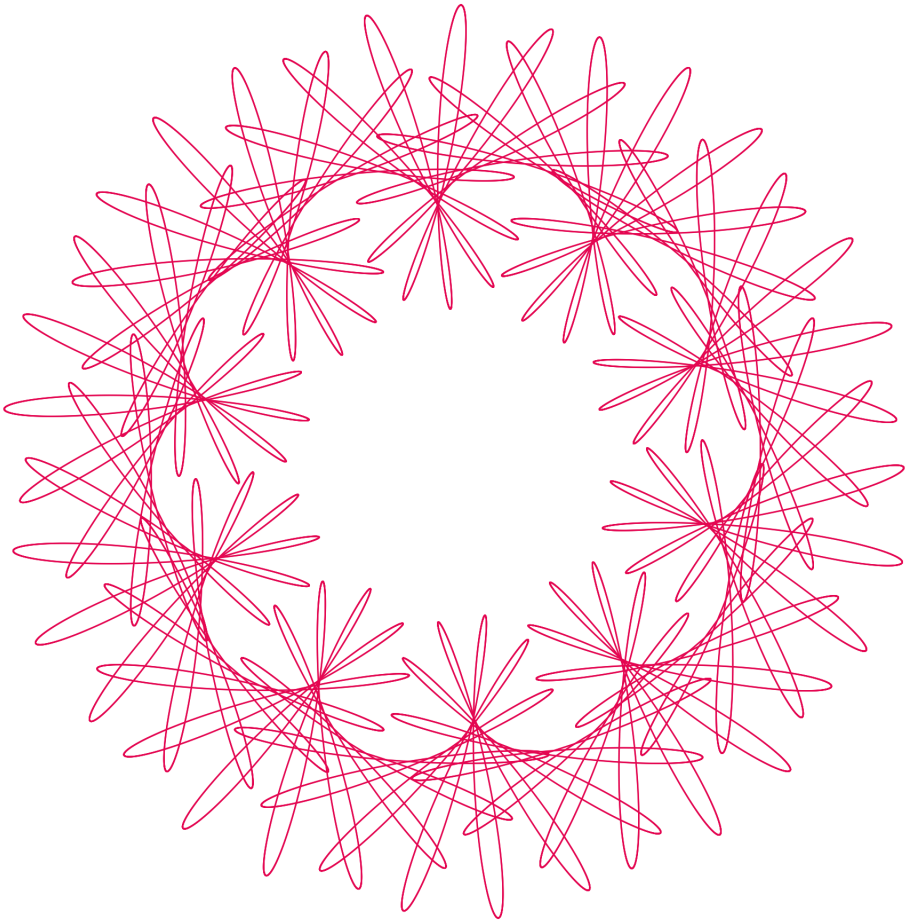
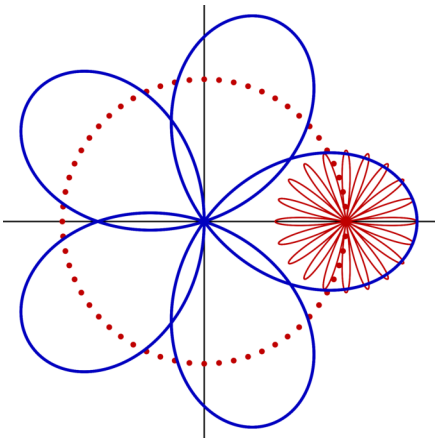


Figure 10: ***(Additional)*** *Frame from animation for circle + rose curve.*



(Additional) *Rose curve 1 (red) and rose curve 2 (blue). For the result below, the curve 1 is rotating counter-clockwise. Curve 2 is rotating counter-clockwise at twice the rate of curve 1 and moving along the red-dot path in a clockwise direction.*

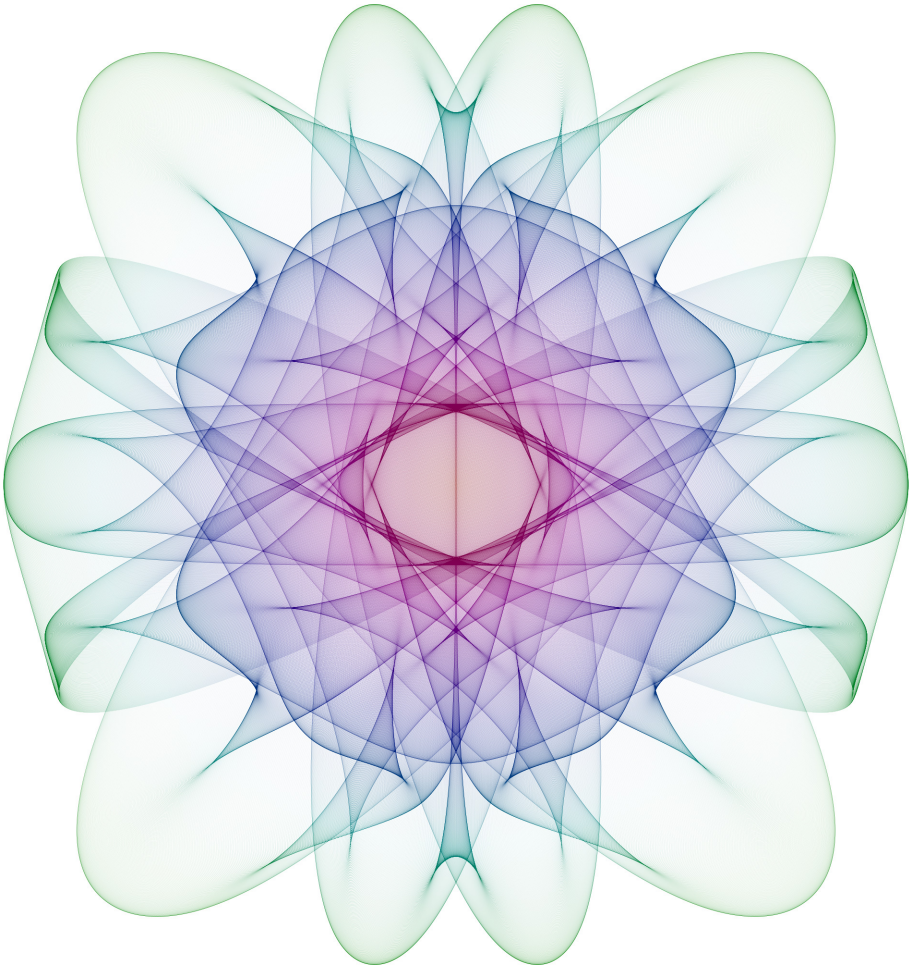
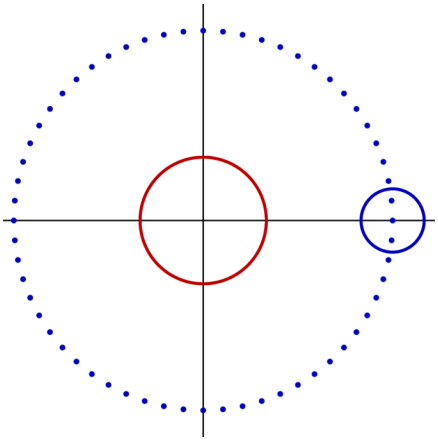


Figure 11: ***(Additional)*** *rose curve 1 − rose curve 2.*



(Additional) *Circle 1 (red) and circle 2 (blue). For the result below, the circle 1 is rotating counter-clockwise. Circle 2 is following the blue-dot path in a clockwise direction.*

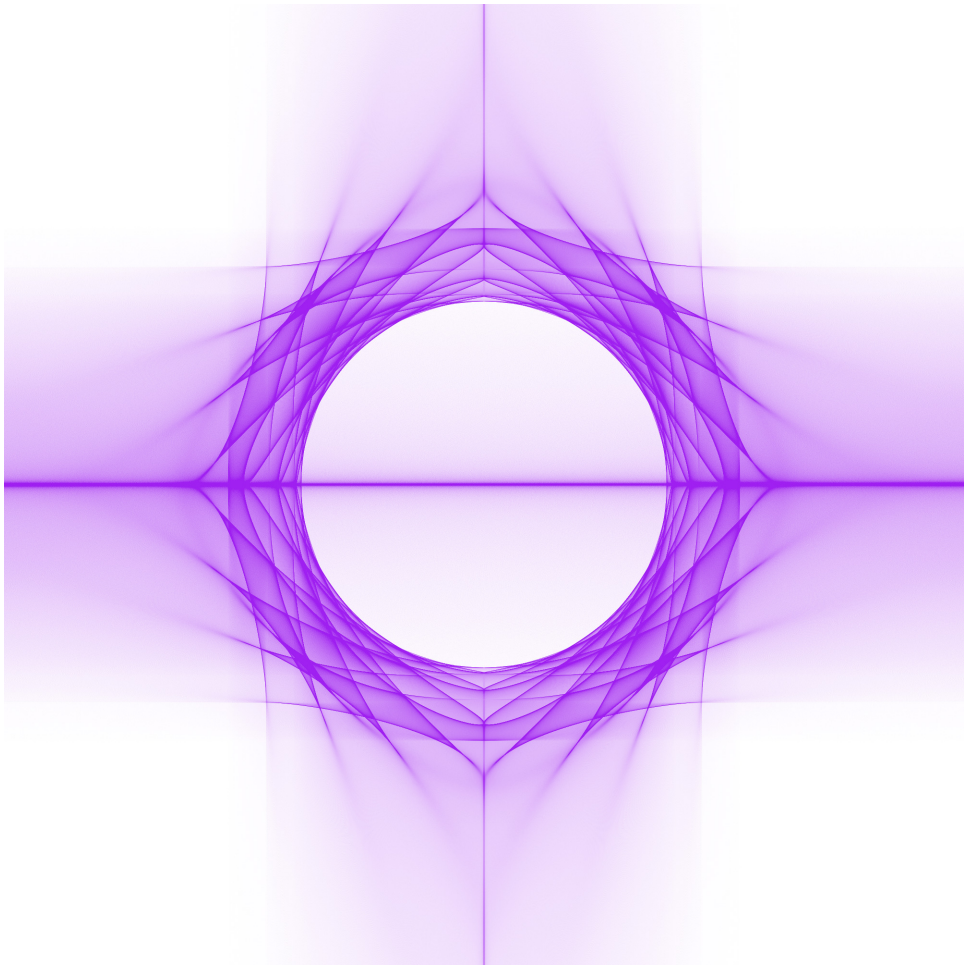
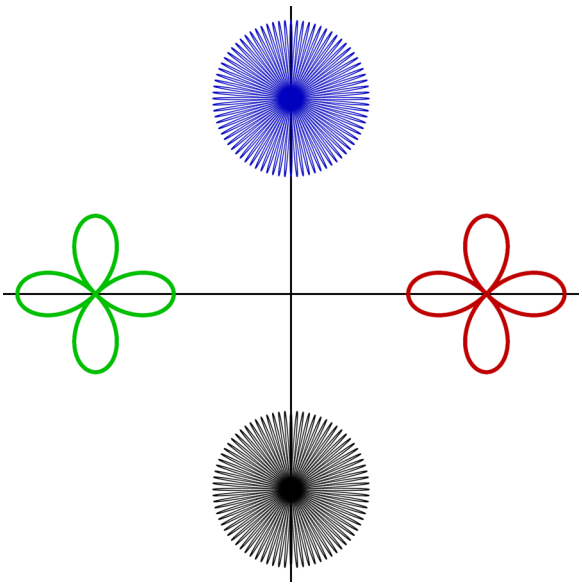


Figure 12: ***(Additional)*** $(circle1 * circle1)/circle2$.



(Additional) *Four rose curves. Each one is moving back and forth along the axes while rotating.*

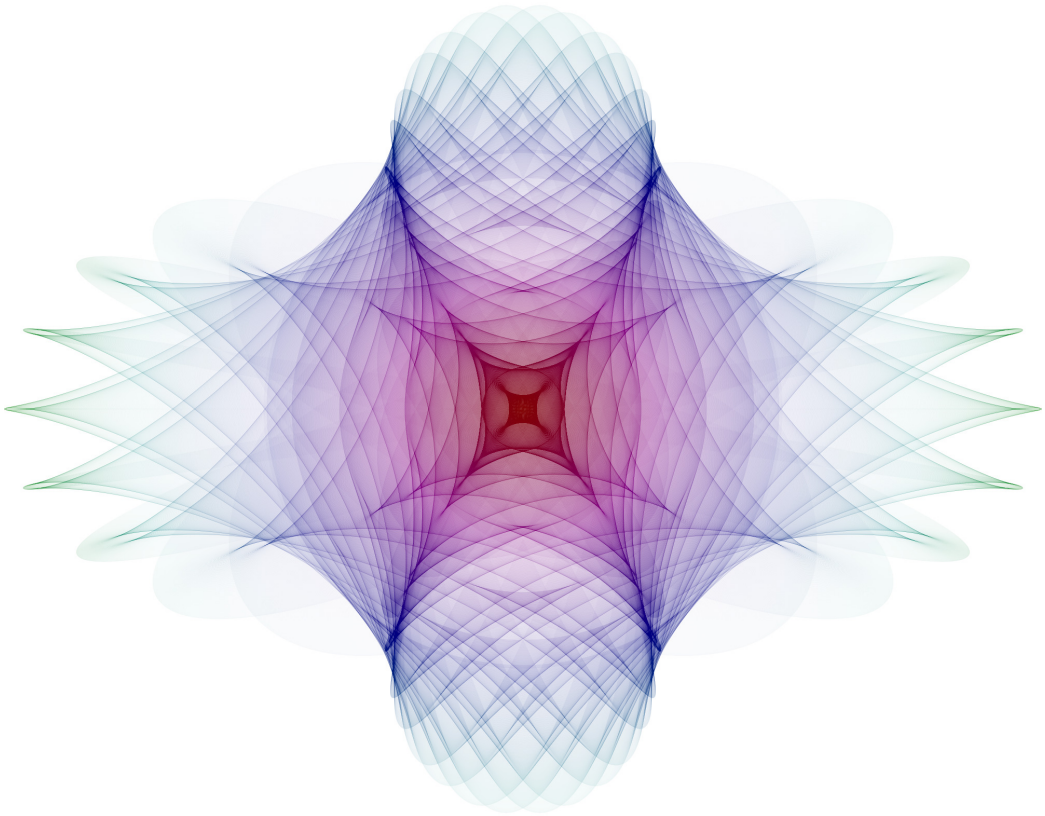


Figure 13: ***(Additional)*** *Adding four rose curves.*