Exercise Computer graphics

Super Ellipse/Shape

Exercise 1: For which parameters does the equation of the super ellipses found by Gabriel Lamé

$$\left|\frac{x}{a}\right|^n + \left|\frac{y}{b}\right|^n = 1$$

a) yield a circle or

Solution: n=2 and a=b

b) a rectangle?

Solution: n=1 and a, b arbitrary or
n=inf. and a, b arbitrary

c) In which way is the equation useful for vector drawing applications that want to offer rounded rectangles?

Solution: If n converges against infinity, then the ellipse is converging against a rectangle. Intuitively, small values for one component, e.g., x, lead to a value near zero when raised to the power of n. To compensate for that, y has to be near 1, so that the sum can equal 1. This “presses” the circle into the corners of a square.

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Exercise 2: The super-shape (by Johan Gielis) is known to be a generalization of the super-ellipse. For which parameters does the super-shape

$$r=\sqrt[n1]{\left|\frac{1}{a}\cos\left(\frac{m}{4}\phi\right)\right|^{n2}+\left|\frac{1}{b}\sin\left(\frac{m}{4}\phi\right)\right|^{n3}}$$

a) yield a simple ellipse or

Solution: n1=2, n2=n3=2, m=4, a and b according to ellipse scaling

b) a unit circle?

Solution: m=0, n1=n2=n3>0,a=1;b!=0 or
n1=n2=n3=2,a=b=1, m arbitrary

Exercise 3: Compile and run our super shape application under an operation system of your choice. (Hints can be found at www.libSDL.org)

Note that this exercise is mandatory and the precondition for doing other exercises in this lecture.

(You may use Java if you like)