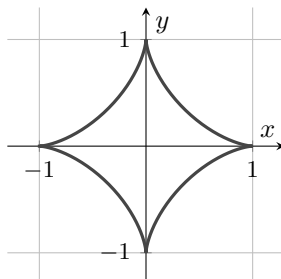
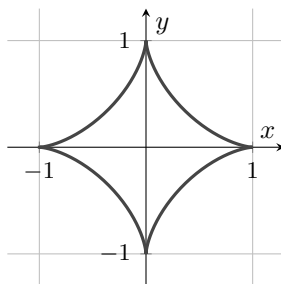


Question 2**Problem**

The curve $x = \cos^3 t$, $y = \sin^3 t$, $0 \leq t \leq 2\pi$, looks almost circular. Eliminate t and identify the four points where its shape is least circle-like.



Question 2 – Solution



Solution

1. Begin with

$$x = \cos^3 t, \quad y = \sin^3 t.$$

Taking each coordinate to the power $2/3$ gives

$$x^{2/3} = \cos^2 t, \quad y^{2/3} = \sin^2 t.$$

Here $x^{2/3}$ means $(\sqrt[3]{x})^2$, so the calculation is valid even when a coordinate is negative.

2. Add the two equations and use $\cos^2 t + \sin^2 t = 1$:

$$\boxed{x^{2/3} + y^{2/3} = 1}.$$

This curve is an *astroid*.

3. The curve is least circle-like where it has cusps. These occur when one trigonometric coordinate is 0 and the other is ± 1 .
4. Evaluating the parametrization at the corresponding parameter values gives

t	(x, y)
0	(1, 0)
$\pi/2$	(0, 1)
π	(-1, 0)
$3\pi/2$	(0, -1)

5. Therefore, the four sharp points are

$$\boxed{(1, 0), (0, 1), (-1, 0), (0, -1)}.$$