

Workshop and homework

10.1 7,10,15,24

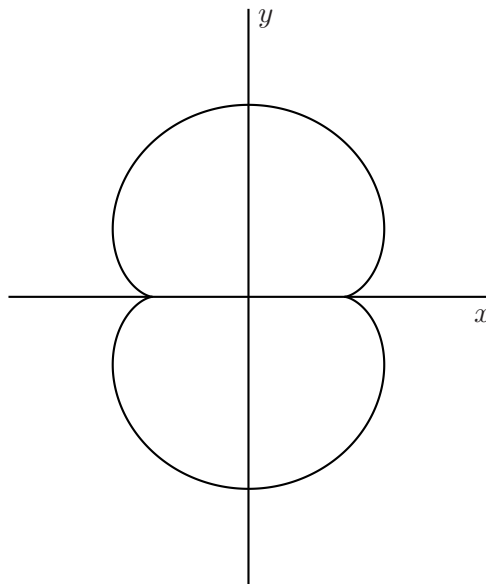
Homework: 10.2 6,12,25,39,41

10.3 3,5,57,61

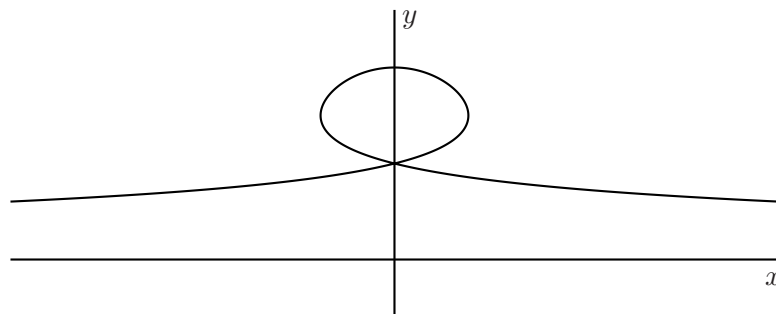
- 1 A nephroid¹ (a special type of epicycloid² first studied by Christiaan Huygens in 1678) is given by the parametric equation³

$$\begin{cases} x(t) = a(3\cos t - \cos 3t) \\ y(t) = a(3\sin t - \sin 3t) \end{cases}$$

for $0 \leq t \leq 2\pi$. The nephroid with $a = 1$ is shown below. Find its x -intercepts⁴, y -intercepts⁵, and area. Also set up – but do not evaluate – an integral giving its arc length.



- 2 Find functions $x(t)$ and $y(t)$ so that the parametric curve $(x(t), y(t))$ looks like the curve shown below.



¹Not to be confused with Freeth's Nephroid, which is actually a type of strophoid.

²Epicycloids are themselves a special type of epitrochoids.

³It can also be given by the Cartesian equation $(x^2 + y^2 - 4a^2)^3 = 108a^4 y^2$.

⁴Hint: $\sin 3t = 3\sin t - 4\sin^3 t$.

⁵Another hint: $\cos 3t = 4\cos^3 t - 3\cos t$.