1. Find parametric equations for the path of a particle that moves along the circle

\[(x - 1)^2 + y^2 = 4\]

(a) three times around counterclockwise, starting at (1, 2);
(b) halfway around clockwise, starting at (3, 0).

2. For the parametric equations

\[x = e^t - t, \quad y = e^{-t} + t,\]

find \(\frac{dy}{dx}\) and \(\frac{d^2y}{dx^2}\). For which values of \(t\) is the curve concave upward?

3. Find the points on the curve defined by the parametric equations

\[x = \sin t \cos t, \quad y = \cos t\]

where the tangent is horizontal or vertical.

4. Show that the curve defined by the parametric equations

\[x = \sin 2\theta, \quad y = 2 \cos \theta\]

has two tangents at the origin and find their equations. Sketch the curve.

5. Find the area of the region enclosed by the astroid

\[x = a \cos^3 \theta, \quad y = a \sin^3 \theta.\]

6. Find the length of the curve defined by the parametric equations

\[x = e^t \cos t, \quad y = e^t \sin t, \quad 0 \leq t \leq \pi.\]

7. Find the distance traveled by a particle with position

\[(x, y) = (\cos^2 t, -\sin^2 t)\]

for \(0 \leq t \leq 2\pi\). Compare with the length of the curve.