

## 2. Curve parametrization

**Files:** The accompanying files for this assignment are `assignment2.1.html`, `assignment2.2.html`, and `assignment2.3.html`.

**Delivery:** upload the modified HTML files and any other necessary files to the Racó. Include all explanations and/or answers to the problems in the HTML files.

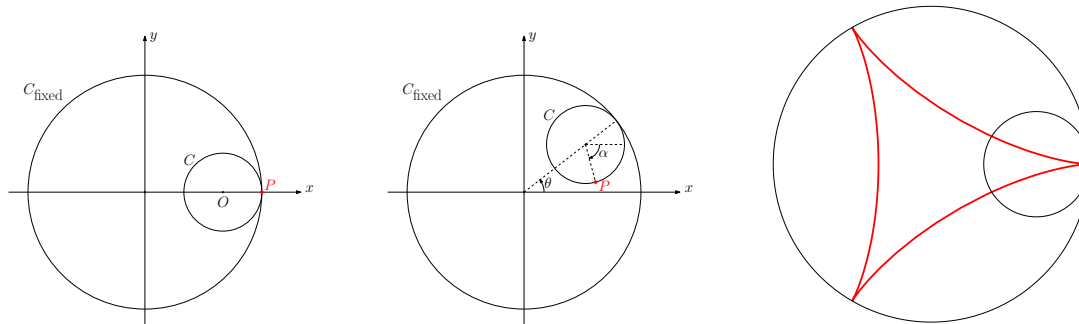
### Problem 1.

Write a program to draw the following curves, allowing the user to modify the curve parameters:

- An elliptical helix (3D).
- A spiral helix (3D).

**Problem 2.** Illustrate the reflection property of the parabola: all rays parallel to the axis of the parabola reflect in the parabola into concurrent rays through the focus of the parabola. For the illustration, consider the parabola  $y = x^2/200$  together with at least half a dozen vertical rays: (i) write a program to compute and show the reflection of the rays; (ii) find the coordinates of the focus and justify your answer.

**Problem 3.** In the plane, let  $C_{\text{fixed}}$  be a circle centered at the origin  $(0,0)$ . The radius of  $C_{\text{fixed}}$  is three times the radius of another circle  $C$ , which is interior to  $C_{\text{fixed}}$  and tangent to it at a point  $P$  belonging to the positive semi-axis  $Ox^+$ , as illustrated in the left figure. Assume that the interior circle  $C$  rolls inside the fix circle  $C_{\text{fixed}}$ . Your goal is to parametrize the curve described by point  $P$  along this rolling movement, and to write a program to show the result on your screen. The result should be similar to the red curve in the rightmost figure.



In order to obtain a parametrization of the curve, please use the parameter  $\theta$ , which is the polar angle of the center  $O$  of the rolling circle  $C$ , as illustrated in the middle figure. Hint: It may become useful for you to compute the value of the angle  $\alpha$  that you can see in the middle figure.

*Important:* In the HTML file that you will deliver, please include a brief description of the strategy you have followed and a **justification** of its correctness.