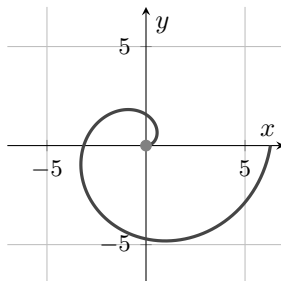
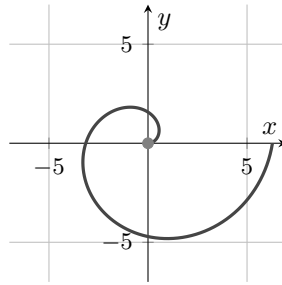


Question 4**Problem**

The spiral $r = \theta$ reaches $\theta = \pi$. Find its tangent slope there.



Question 4 – Solution



Solution

1. Write the polar curve parametrically as

$$x(\theta) = r(\theta) \cos \theta, \quad y(\theta) = r(\theta) \sin \theta.$$

Differentiation gives

$$\frac{dx}{d\theta} = r' \cos \theta - r \sin \theta, \quad \frac{dy}{d\theta} = r' \sin \theta + r \cos \theta.$$

2. Wherever $dx/d\theta \neq 0$, compute

$$\frac{dy}{dx} = \frac{r' \sin \theta + r \cos \theta}{r' \cos \theta - r \sin \theta}.$$

Test numerator and denominator separately when locating horizontal or vertical tangents.

3. With $r' = 1$, the slope is $(\sin \pi + \pi \cos \pi)/(\cos \pi - \pi \sin \pi) = \boxed{\pi}$.