1. The Witch of Agnesi curve is known by the parametric equation
   \[ x = at, \quad y = \frac{a}{1 + t^2}, \quad t \in (-\infty, \infty), \quad a \text{ is a fixed constant.} \]
   Find a point where the tangent line is horizontal.

   **SOLUTION** We should have \( \frac{dy}{dx} = 0 \) at some \( t \). The derivatives are
   \[ \frac{dy}{dt} = -2at(1 + t^2)^{-3}, \quad \text{and} \quad \frac{dx}{dt} = a, \]
   and hence
   \[ \frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{-2t}{(1 + t^2)^3} = 0 \quad \text{when} \quad t = 0. \]
   Thus from the parametric equation, the point at \( t = 0 \) is \((0, a)\).

2. The cardioid curve is given by
   \[ x = 2a \cos t - a \cos 2t, \quad y = 2a \sin t - a \sin 2t, \quad t \in [0, 2\pi], \quad a \text{ is a fixed constant.} \]
   Find the parametric form of the tangent line at \( t = \pi/2 \).

   **SOLUTION** Recall that the parametric line equation at a point \( p \) is
   \[ x = x(p) + x'(p)t \quad y = y(p) + y'(p)t. \]
   At \( p = \pi/2 \) we the coordinates of
   \[ x = 2a \cos \pi/2 - a \cos \pi = a, \quad y = 2a \sin \pi/2 - a \sin \pi = 2a \]
   The derivatives are
   \[ x'(t) = \frac{dx}{dt} = -2a \sin t + 2a \sin 2t \bigg|_{t=\pi/2} = -2a, \quad y'(t) = \frac{dy}{dt} = 2a \cos t - 2a \cos 2t \bigg|_{t=\pi/2} = 2a. \]
   Thus the parametric equation of a line passing thorough the point \((a, 2a)\), having the above derivatives is
   \[ x = a - 2at \quad y = 2a + 2at. \]

3. Find the slope of the curve at \( t = 1 \),
   \[ xt = \sqrt{5 - \sqrt{t}}, \quad y(t - 1) = \ln y \]
   if \( x \) and \( y \) are implicitly differentiable functions of \( t \).

   **SOLUTION** Differentiating both sides with respect to \( t \) gives
   \[ \frac{d}{dt}(xt) = \frac{d}{dt}(\sqrt{5 - \sqrt{t}}) \quad \text{and} \quad \frac{dx}{dt} + x = \frac{1}{2\sqrt{5 - \sqrt{t}} \cdot 2\sqrt{t}} \]
   and at \( t = 1 \implies x = 2, \frac{dx}{dt} = -17/8 \). Differentiating both sides of the second implicit function with respect to \( t \) gives
   \[ \frac{d}{dt}(y(t - 1)) = \frac{d}{dt}(\ln y) \quad \text{and} \quad \frac{dy}{dt} + y - \frac{dy}{dt} = \frac{1}{y} \frac{dy}{dt} \]
   and at \( t = 1 \implies y = 1, \frac{dy}{dt} = 1 \). Thus \( \frac{dy}{dx} = -8/17 \).