Problem 1. A stone dropped into a still pond sends out a circular ripple whose radius increases at a constant rate of 3 feet per second. How rapidly is the area enclosed by the ripple increasing at the end of 10 seconds?

Solution: The area A and radius r of the ripple are changing with time, and we are given that $dr/dt = 3$. After 10 seconds, the radius r is 30 feet. We may relate A and r via the equation

$$A = \pi r^2.$$

Applying d/dt to both sides yields

$$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}.$$

Substituting in $r = 30$ and $dr/dt = 3$ yields

$$\frac{dA}{dt} = 180\pi \, \frac{\text{ft}^2}{\text{s}}.$$

Problem 2. If x and y are functions of t satisfying the relation

$$x^2 + y^2 = 2x,$$

find dy/dt when $dx/dt = -2$ and $(x, y) = (1, 1)$.

Solution: Applying d/dt to both sides of the equations yields

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 2\frac{dx}{dt}.$$

Substituting $dx/dt = -2$ and $(x, y) = (1, 1)$ and solving for dy/dt yields $dy/dt = 0$.