Problem 36 in Section 1.1. In a city with a fixed population of P persons, the time rate of change of the number N of those persons infected with a certain contagious disease is proportional to the product of the number who have the disease and the number who do not.

Solution. In this problem $N(t)$ is the number of sick people at time t, $P - N(t)$ is the number of healthy people at time t. The problem states that $\frac{dP}{dt}$ is "proportional to" $N(t)(P - N(t))$. Two functions are proportional if one is a constant times the other. It follows that $N(t)$ is a solution of the Differential Equation

$$\boxed{\frac{dN}{dt} = kN(P - N).}$$