1. *Find the area of the region between the curve $y = 2^{1-x}$ and the interval $-1 \le x \le 1$.*

2. *Find the global maximum of $f(x) = x^{1/x}$ in the domain $x > 0$.*

3. *A colony of bacteria is grown under ideal conditions in a laboratory so that the population increases exponentially with time. At the end of 2 hours there are 10,000 bacteria. At the end of 5 hours there are 70,000. How many bacteria were present initially?*

4. *Suppose the rate at which a rumor spreads - that is, the number of people who have heard the rumor over a period of time - increases with the number of people who have heard it. If y is the number of people who have heard the rumor, then*

$$\frac{dy}{dt} = ky,$$

   where t is the time in days.

   a. *If y is 1 when $t = 0$ and y is 5 when $t = 2$, find k.*

   b. *Using the value of k from (a), find y when $t = 3$.*

5. *Prove or disprove:*

   a. *$x^{-2}3^x$ grows slower than $x2^x$.*

   b. *$\log_2 3x^2$ grows at the same rate as $(x + 7)^2$.*