A bacteria culture starts with 1,000 bacteria and doubles in size every 3 hours. Find an exponential model for the size of the culture as a function of time t in hours.

Solution: Use the formula $y = Ab^t$ (example 4 on p. 636 is similar). The starting amount of bacteria is 1000, so $A = 1000$. To find b, plug in 3 for t and 2000 for y (since the population doubles in 3 hours): $2000 = 1000b^3$, divide both sides by 1000 to get $2 = b^3$. Raise both sides to the $1/3$ power to get

$$2^{1/3} = (b^3)^{1/3}, \text{ so } b = 2^{1/3}.$$

Thus, the function is $y = 1000\left(2^{1/3}\right)^t$, or

$$y = 1000\left(2^{t/3}\right).$$

Use the model to predict how many bacteria there will be after 2 days.

Solution: Time t is measured in hours in this problem, and 2 days is 48 hours. So, plug in 48 for t:

$$y = 1000\left(2^{48/3}\right) = 1000(2^{16}) = 65{,}536{,}000.$$

There will be about $65{,}536{,}000$ bacteria after 2 days.