

## Exercise 30

A bacteria culture starts with 500 bacteria and doubles in size every half hour.

- How many bacteria are there after 3 hours?
- How many bacteria are there after  $t$  hours?
- How many bacteria are there after 40 minutes?
- Graph the population function and estimate the time for the population to reach 100,000.

### Solution

The bacteria population is given by

$$P(t) = 500 \cdot 2^{\frac{t}{0.5}} = 500 \cdot 2^{2t},$$

where  $t$  is the time in hours. If  $t = 3$ , then

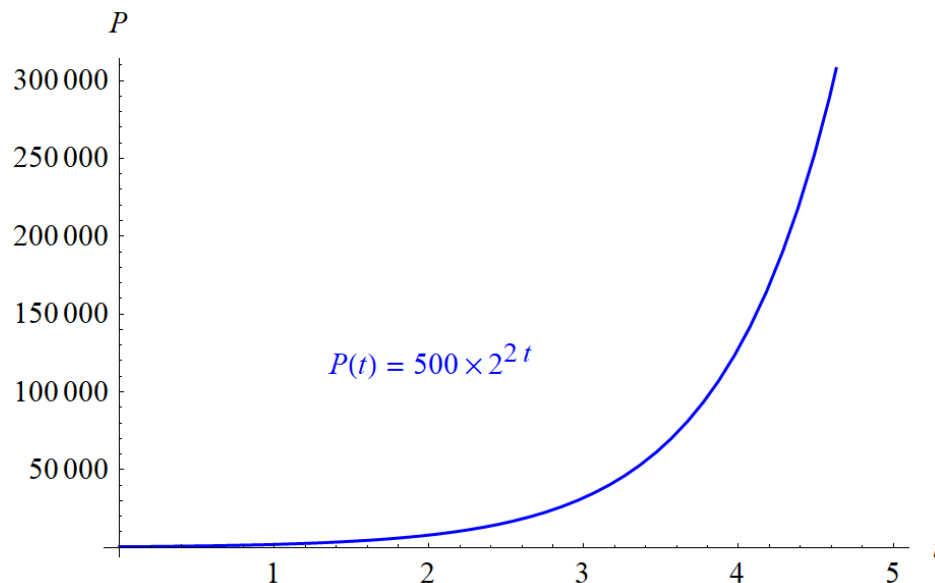
$$P(3) = 500 \cdot 2^6 = 32\,000.$$

If

$$t = 40 \cancel{\text{min}} \times \frac{1 \text{ hr}}{60 \cancel{\text{min}}} = \frac{2}{3} \text{ hr},$$

then

$$P\left(\frac{2}{3}\right) = 500 \cdot 2^{4/3} \approx 1260.$$



Judging from the graph, the population reaches 100,000 at about  $t = 3.8$  hours.