

Question 10

A certain species of insect is introduced to a new habitat. Its population is modeled by the exponential function:

$$P(t) = 500 \cdot e^{0.6t}$$

where $P(t)$ is the population size after t weeks.

- (a) What will the population be after 5 weeks?
- (b) After how many weeks will the population exceed 10,000?
- (c) How fast is the population growing at $t = 5$ weeks?

Round all answers to two decimal places.

Question 10 - Solution

Use the exact exponential model and keep full precision until the final rounding.

(a)

$$P(5) = 500e^3$$

10042.77 insects

(b)

$$t_* = \ln(10000/500)/0.6$$

4.99 weeks

(c)

$$P'(t) = 300e^{0.6t}, \quad P'(5) = 300e^3$$

6025.66 insects/week

The population equals 10000 at $t = t_*$ and exceeds it precisely when $t > t_*$. The rounded threshold is not an exact inequality boundary.