ANSWER on Question 57021 Math. Algebra

The number of people in town of 10,000 who have heard a rumor stated by a small group of people is given by the following function:

$$N(t) = \frac{10000}{5 + 1245e^{-0.97t}}$$

How many people were in the group that started the rumor?
How many people have heard the rumor after 1 day?
How many people have heard the rumor after 5 days?
How long will it be until 1,000 of the people in the town have heard the rumor?

SOLUTION

How many people were in the group that started the rumor?
To answer this question it is necessary to calculate the value $N(0)$

$$N(0) = \left.\frac{10000}{5 + 1245e^{-0.97t}}\right|_{t=0} = \frac{10000}{5 + 1245e^{-0.97*0}} = \frac{10000}{5 + 1245} = \frac{10000}{1250} = 8$$

$$\boxed{N(0) = 8 \ - \ 8 \text{ people were in the group when it started the rumor}}$$

How many people have heard the rumor after 1 day?
To answer this question it is necessary to calculate the value $N(1)$

$$N(1) = \left.\frac{10000}{5 + 1245e^{-0.97t}}\right|_{t=1} = \frac{10000}{5 + 1245e^{-0.97*1}} \approx 20.9662 \approx 21$$

$$\boxed{N(1) \approx 21 \ - \ 21 \text{ people were in the group after one day}}$$

How many people have heard the rumor after 5 days?
To answer this question it is necessary to calculate the value $N(5)$

$$N(5) = \left.\frac{10000}{5 + 1245e^{-0.97t}}\right|_{t=5} = \frac{10000}{5 + 1245e^{-0.97*5}} \approx 678.135 \approx 678$$

$$\boxed{N(5) \approx 678 \ - \ 678 \text{ people were in the group after five days}}$$

How long will it be until 1,000 of the people in the town have heard the rumor?
To answer this question it is necessary to solve the following equation $1000 = N(t)$

$$1000 = \frac{10000}{5 + 1245e^{-0.97t}} \iff 1 = \frac{10}{5 + 1245e^{-0.97t}} \iff 5 + 1245e^{-0.97t} = 10$$

$$e^{-0.97t} = \frac{10 - 5}{1245} = frac1249 \iff -0.97t = \ln\left|\frac{1}{249}\right| \iff -0.97t = -\ln(249)$$

$$t = \frac{249}{0.97} \approx 5.688 \approx 6$$

$\boxed{t \approx 6 \ - \ \text{After 6 days in the group will be a thousand people}}$

ANSWER

How many people were in the group that started the rumor?

$N(0) = 8$ – 8 people were in the group when it started the rumor

How many people have heard the rumor after 1 day?

$N(1) \approx 21$ – 21 people were in the group after one day

How many people have heard the rumor after 5 days?

$N(5) \approx 678$ – 678 people were in the group after five days

How long will it be until 1,000 of the people in the town have heard the rumor?

$t \approx 6$ – After 6 days in the group will be a thousand people