

Analysis

Math Problem #1 Solution

$x(t) = 10 \cdot x(t - 1) + x(t - 1)$     The population at discrete time  $t$  assumes that each member of the previous generation had ten children and that no member of the previous generation dies.

$x(t) = 11 \cdot x(t - 1)$     Just a bit of simplification

Standard Form     $x(t) = a \cdot x(t - 1) + b$

$a := 11$      $b := 0$      $x_0 := 1$     Only one tribble at the start

$$x(t) := a^t \cdot \left( x_0 - \frac{b}{1 - a} \right) + \frac{b}{1 - a} \rightarrow 11^t$$

Standard solution for a first-order difference eqn.

In a 72 hour period, there will be 6 generations of tribbles. We can compute the total number of tribbles by substituting in  $t = 6$ .

$x(6) = 1771561$     This is the answer that Spock obtained.

Math Problem #2 Solution

tribbles := 1

Problem #2 is different than Problem #1 because there is not sufficient information to ensure a unique solution. I am going to make some assumptions.

- Total number of tribbles to be cleaned up is given by the solution to Problem #1.
- The tribbles are all dead from eating the poisoned grain.
- Cyrano Jones is going to work every weekday for 8 hours per day.
- He takes two weeks off for vacation every year.
- I know that Spoke says that Cyrano will take 17.9 years to cleanup all the tribbles.
- I am going to estimate the number of tribbles per hour that Cyrano must cleanup every hour.

N := 1771561 · tribbles    Number of dead tribbles.

T := 17.9 · yr    Spock's cleanup time estimate in calendar time.

T<sub>W</sub> := T ·  $\frac{1\text{yr} - 14\text{day}}{\text{yr}}$  ·  $\frac{8\text{hr}}{\text{day}}$     Work time

Let r be the rate of tribble cleanup.

r · T<sub>W</sub> = N

$r := \frac{N}{T_W} = 35.22138 \cdot \frac{\text{tribbles}}{\text{hr}}$