We said 1 robot making 10 copies means there are 10 robots at the end of day

Math 120 A Quiz 5 (20 minutes) July 26, 2018

Name:

Answer the questions in the spaces provided. Show all necessary work. If you run out of space, use the back side and leave a message to indicate that you have done so. If you have any questions, raise your hand and I will come try to answer.

1. In a scientific marvel, Will has built a small self replicating robot. One of these robots can create ten copies of itself in a day! Therefore the number of robots grows at an exponential rate.

   (a) (8 points) Write a function $R(t)$ for the number of robots there are after t days.

$R(t) = R_0 b^t$

$R(0) = 1 = R_0 b^0 = R_0$

$R(1) = 10 = R_0 b = b$

$R_0 = 1$

$R(t) = 10^t$

   (b) (4 points) The robots are relatively small, covering only $25mm^2$ of ground space. Write $A(t)$, a function for the total area covered by robots after t days.

$A(t) = 25 \cdot R(t) = 25 \cdot 10^t$

   (c) (8 points) The earth has a total surface area of 510.1 million km^2. How long does it take for the robots to cover the entire surface of the globe. (KEEP AN EYE ON UNITS!)

510.1 million km^2

$= 5.101 \times 10^8 \, km^2$

$= 5.101 \times 10^{20} \, mm^2$

(+2)

$25 \cdot 10^t = 5.101 \cdot 10^{20}$

$10^t = 2.0404 \times 10^{19}$

$t = \log_{10}(2.0404 \times 10^{19})$

$= \frac{\ln(2.0404 \times 10^{19})}{\ln(10)}$

$= 19.31$ days

(+1)