Math 120 B | Quiz 4 (20 minutes) | May 9, 2018

Name: Key

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, engineers have built a small self replicating robot. One of these robots can create ten copies of itself in a day! A robot will not self destruct after a days work, and will instead stay on to keep building 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.

$R(t) = R_0 \cdot b^t$

$R(0) = 1 = R_0$

$R(1) = 11 = R_0 \cdot b$

$\Rightarrow b = 11$

So $R(t) = 11^t$

If 10^t [-2]

(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.

$R(t) = 25 \cdot 11^t$

(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!)

5 points

$510.1 \times 10^6 \, km^2$

$= 5.101 \times 10^8 \, km^2 = 5.101 \times 10^{20} km^2$

$1 \, km^2 = 10^{12} \, km \, m^2$

$1 \, km^2 \left(\frac{10^6 mm}{1 km}\right)\left(\frac{10^6 mm}{1 km}\right)$ 3 points

million $= 10^6 \leftarrow$ 1 pt

$10^{12} mm^2 = 1 km^2 \leftarrow$ 2 pts

Instead $10^6 \leftarrow$ -1

else -2

$25 \cdot 11^t = 5.101 \cdot 10^{20}$

$11^t = \frac{5.101 \cdot 10^{20}}{25}$

$t \cdot \ln(11) = \ln\left(\frac{5.101 \cdot 10^{20}}{25}\right)$

$t = \frac{\ln\left(\frac{5.101 \cdot 10^{20}}{25}\right)}{\ln(11)}$

≈ 18.54 days