How to Survive a Global Virus

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period:\_\_\_\_\_\_\_\_\_

 On June 30, 2035, a new virus is unleashed on mankind.  It is wreaking havoc on the human race! The virus spreads to \_\_\_\_\_\_\_ humans per week (R=(\_\_)), but scientists are not sure how long it will take to infect (and eventually kill) every human on the planet.  Complete the table below to show how many total humans are infected every week for the first 10 weeks of the infection.  The original number of infected humans was I=(\_\_) members, but keep in mind that newly infected humans also have the power to infect other humans.

|  |  |  |  |
| --- | --- | --- | --- |
| Week | Number of Humansinfected each week | Week | Number of Humansinfected each week |
| 0 | I = | 6 |   |
| 1 |   | 7 |   |
| 2 |   | 8 |   |
| 3 |   | 9 |   |
| 4 |   | 10 |   |
| 5 |   |  x |  |

1.  What patterns of growth do you notice in the number of humans infected each week as the weeks go by?

2. What would this data look like on a graph?  Sketch a graph of the data for weeks 1-10.

3.  From the table or graph:

1. How many humans are infected on week 10?
2. What would you have to multiply this number by to get the number of infected humans created on week 11?
3. How would the entire table change if instead of starting with I=(\_\_) infected humans we only started with one infected human? Explain
4. How long would it take now for the virus to reach every human in the world? Assume the population of the world is 6,975,000,000 and we started with I=(\_\_) infected humans. **SHOW WORK**

4. Which one of the equations below would correctly model the number of humans infected each week if you start with I=(\_\_) humans infected and R=(\_\_\_) infected humans added each week? **Explain.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| $$y=I(R)\_{}^{x}$$ | $$y=Ix\_{}^{R}$$ | $$y=Rx+I$$ | $$y=R\_{}^{x}+I$$ | $$y=R(I)\_{}^{2}$$ |

5.  What does the unknown variable, x, represent in the equation you chose from #4?

6.  Write an equation to model the pattern if instead virus infected 12 humans and the virus is powerful, so it infects 6 people per week.  How long would it take the virus to infect every human in the world now? SHOW WORK

7.  If you were given the choice of between more initial humans infected, but a slower growth rate or fewer initial infected humans, but a greater growth rate, which would you pick and why?

Within three weeks of the initial virus being reported, a group of scientists quickly began working to find an antidote for the "virus".  After three short weeks of work, they were successful, but unfortunately their antidote was found to only be successful 25% of the time.  Make a table showing how many infected humans were cured after 10 rounds of administering the antidote (assume every remaining human is given the antidote in every round and **no new humans are infected**).

|  |  |
| --- | --- |
| **Rounds of Antidote** | **Infected Humans Remaining** |
| 0 |  |
| 1 |   |
| 2 |   |
| 3 |   |
| 4 |   |
| 5 |   |
| 6 |   |
| 7 |   |
| 8 |   |
| 9 |   |
| 10 |   |
| x |  |

 8.  What patterns of "decay" do you notice in the cumulative number of infected humans remaining after each round of the antidote's administration? (hint:  If 25% of the infected humans are cured, then how many remain?)

9.  What would this data look like on a graph?

 Sketch a graph of the first 10 rounds of administration.

10.  Write an equation to model the pattern in the data.

11.  At this rate, how long will it take the scientists to completely cure all infected humans and set them free?  Can this ever really happen?  Why or why not? **SHOW WORK**

12.  What similarities and differences do you notice in the equations developed for both the initial attack and the antidote phases?

13.  What number in the equation impacts whether or not the initial value will increase or decrease over time?  Which number in the equation tells us what the initial value is?

14. Canadian mathematicians and authors of “[When Zombies Attack!: Mathematical Modeling of an Outbreak of Zombie Infections](http://loe.org/images/content/091023/Zombie%20Publication.pdf)” published the in journal of “[Infectious Disease Modelling Research](https://www.novapublishers.com/catalog/product_info.php?products_id=9750)**”** concluded that the secret to our survival is to hit zombies with everything we have... hard, fast and early. Using what you have learned about exponential growth in this worksheet, why do you think these scientists came to that conclusion?