Spreading Doom

Student Activity

Name ___________________

Class ___________________

Modeling the Spread of a Virus

At 8 AM on January 26, 2004, the Mydoom virus was released. Six days later, over 1,000,000 people reported that their computers were infected and Mydoom was named the fastest spreading computer virus ever. In this activity, you will explore how the virus spread so quickly and derive an equation to model its spread.

Before we begin, discuss as a class how the virus spread.

1. Users received an email with an attachment, often from a familiar email address.
2. If they opened the attachment, the virus infected their computer.
3. Then the virus sent copies of itself to all the email addresses in their contact list. The virus would even guess additional email addresses to send itself to. For example, if it found *bob@xyz.com* in a contact list, it would also send emails to *jim@xyz.com*, *alex@xyz.com* and so forth.
4. Those users would receive the emails and the cycle would repeat.

An example that you be more familiar with is a chain email: when you get the email, you forward it to your 5 closest friends. Then 1 + 5 = 6 people have seen the email. Then each of your 5 closest friends forwards it to their 5 closest friends. Now 31 (1 + 5 + 25) people have seen the email, and the chain continues.

The Mydoom virus was like a chain email that forwarded itself to your closest friends and thousands of other people you didn't even know!

No one knows exactly how fast Mydoom spread. The table shows one approximation of what we do know. The first column gives the number of hours since the virus was released. The second column gives the number of emails sent by the virus in that hour.

hours	email
0	6000
1	10800
2	19440
3	34992

1. In your own words, describe how the virus spread.

2. What is the common ratio for the sequence 6000, 10800, 19440, 34992, …? How do you know?

3. What is the rule to find the next term of this sequence?

4. How many emails were sent by Mydoom in the 10th hour after it was released?

5. Describe the shape of the scatter plot.

6. Complete the table to find a function to model the spread of the Mydoom virus.

x	***f*(*x*)**	**Exponential Expression**
x = 0	*f*(0) = 6000	*f*(0) = 6000 * 1.8^____
x = 1	*f*(1) = *f*(0) * 1.8 = 6000 * 1.8	*f*(1) = 6000 * 1.8^____
x = 2	*f*(2) = *f*(1) _______ = 6000 * 1.8 * 1.8	*f*(2) = 6000 * 1.8^____
x = 3	*f*(3) = *f*(2) _______ = 6000 * ________________	*f*(3) = 6000 * 1.8^____
x = 4	*f*(4) = *f*(3) _______ = 6000 * _____________________	*f*(4) = 6000 * 1.8^____

7. Write a function that gives the number of emails $f(x)$ sent by the virus in the xth hour after its release.

8. This function is an exponential function of the form $f(x) = a \cdot b^x$. In your own words, explain what the values of a and b represent.

9. Use the function to find the number of emails sent by the virus in the 144th hour after its release.

10. Models often work well only for a limited range of inputs. What are the real-world limitations of the exponential model in this case? Qualitatively, how would the real-world shape of the scatter plot look if the horizontal scale were extended to 144 hours? How about in the chain mail example? Can you think of other examples of exponential models, and how they might have limited applicability? Justify your answers.