Bell Work 2/4/2015

Simplify the following:

$$(3x^6y^4)^2(10x^2w^8z^9y^11)^0(4xy)^3$$

$$3^2 x^{6\cdot 2} y^{4\cdot 2} (1) \; 4^3 x^3 y^3$$

$$3^2 x^{12} y^8 \; 4^3 x^3 y^3$$

$$3^2 4^3 x^{15} y^{11}$$

$$9 \cdot 64 x^{15} y^{11}$$

$$576 x^{15} y^{11}$$

①

Stage of Calling Tree	0	1	2	3	4	5	6	7	8	9	10
Families Informed	1	2	4	8	16	32	64	128	256	512	1024

②

Stage of Calling Tree	0	1	2	3	4	5	6	7	8	9	10
Families Informed	1	3	9	27	81	243	729	2187	6561	19683	59044

4. In each of the two calling trees, you can use the number of phone calls at any stage to calculate the number of calls at the next stage.

   a. Use the words *NOW* and *NEXT* to write equations showing the patterns.

   ② Next = Now x 3 Starting @ 1.

   ① Next = Now x 2, Starting @ 1.

   b. Explain how the equations match the patterns of change in the tables (*stage, number of families informed)* data.

   c. Describe how the equations can be used with your calculator or computer to produce the tables you made in Activities 2 and 3.

   d. Write an equation relating *NOW* and *NEXT* that could be used to model a telephone calling tree in which each family calls four other families.

Next = Now x 4, starting at 1.

Checkpoint – Calling Trees

The tables that follow show variables changing in a pattern of exponential growth.

i.

x	0	1	2	3	4	5	6
y	1	2	4	8	16	32	64

ii.

x	0	1	2	3	4	5	6
y	3	6	12	24	48	96	192

a. What equation relating *NOW* and *NEXT* shows the common pattern of growth in the tables?

i Next = now ×2 starting @1

ii Next = now · 2 starting at 3

i.

x	0	1	2	3	4	5	6
y	1	2	4	8	16	32	64

ii.

x	0	1	2	3	4	5	6
y	3	6	12	24	48	96	192

b. How are the patterns of change in the tables different? How will that difference show up in the plots of the tables?

Starting values (3 and 1) aka y-intercepts

ii increases faster b/c it starts larger

ii will increase much faster graphically

c. What equations (y = ...) will give rules for the patterns in the tables?

i $y = (1)(2)^x$

ii $y = (3)(2)^x$

d. How do the numbers used in writing those rules relate to the pattern of entries in the table? How could someone who knows about exponential growth examine the equation and predict the pattern in a table of *(x, y)* data?

Starting Point

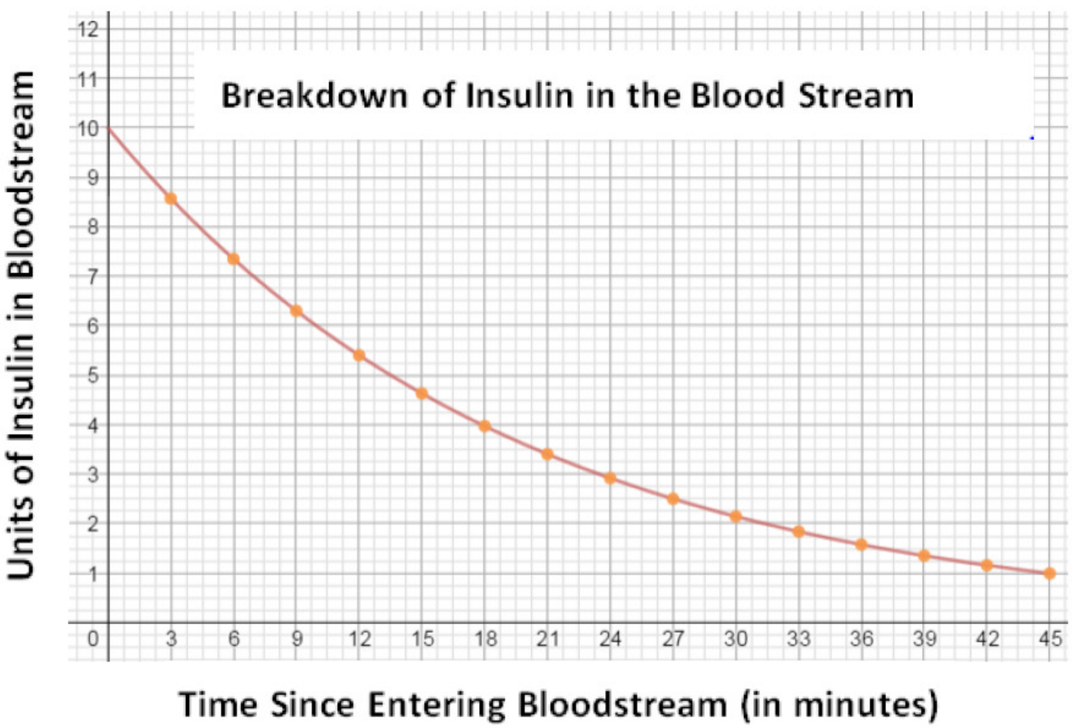
Rate of Growth

Medicine and Mathematics

Drugs are a very important part of the human health equation. Many drugs are essential in preventing and curing serious physical and mental illnesses.

Diabetes, a disorder in which the body cannot metabolize glucose properly, affects people of all ages. IN 1998, there were about 10 million diagnosed cases of diabetes in the United States. It was estimated that another 5 million cases remained undiagnosed.

In 5-10% of the diagnosed cases, the diabetic's body is unable to produce insulin, which is needed to process glucose. To provide the essential hormone, these diabetics must take injections of a medicine containing insulin. The medications used (called insulin delivery systems) are designed to release insulin slowly. The insulin itself breaks down rather quickly. The rate varies greatly between individuals, but the following graph shows a typical pattern of insulin decrease.



1. Medical scientists usually are interested in the time it takes for a drug to be reduced to one half of the original dose. They call this time the **half-life** of the drug. What appears to be the half-life of insulin in this case?

2. The pattern of decay shown on this graph for insulin can be modeled well by how well a table of values and graph from this rule fit the pattern in the graph. Then explain what the values 10 and 0.95 tell about the amount of insulin in the bloodstream.

3. What equation relating *NOW* and *NEXT* shows how the amount of insulin in the blood changes from one minute to the next, once 10 units have entered the bloodstream?

4. The insulin graph shows data points for each minute following the original insulin level. But the curve connecting those points reminds us that the insulin breakdown does not occur in sudden bursts at the end of each minute! It occurs *continuously* as time passes.
What would each of the following calculations tell you about the insulin decay situation? Based on the graph on the previous page, what would you expect as reasonable values for those calculations?

   a. $10(0.95)^{1.5}$
   b. $10(0.95)^{4.5}$
   c. $10(0.95)^{18.75}$

5. Mathematicians have figured out ways to do calculations with fractional or decimal exponents so that the results fit in the pattern for whole number exponents. One of those methods is built into your graphing calculator or computer software.

   a. Enter the rule $y = 10(0.95)^x$ into the "Y=" list of yoru calculator or computer software. Then complete the following table of values showing the insulin decay pattern at times other than whole minute intervals.

Time in Minutes	0	1.5	4.5	7.5	10.5	13.5	16.5	19.5
Units of Insulin in Blood	10							

   b. Compare the entries in this table with the data shown by points on the "Breakdown of Insulin in the Bloodstream" graph.

   c. Use your rule to estimate the half-life of insulin.