

Bell Work

Get your calc.

2/10/2015

Please get out the worksheet titled

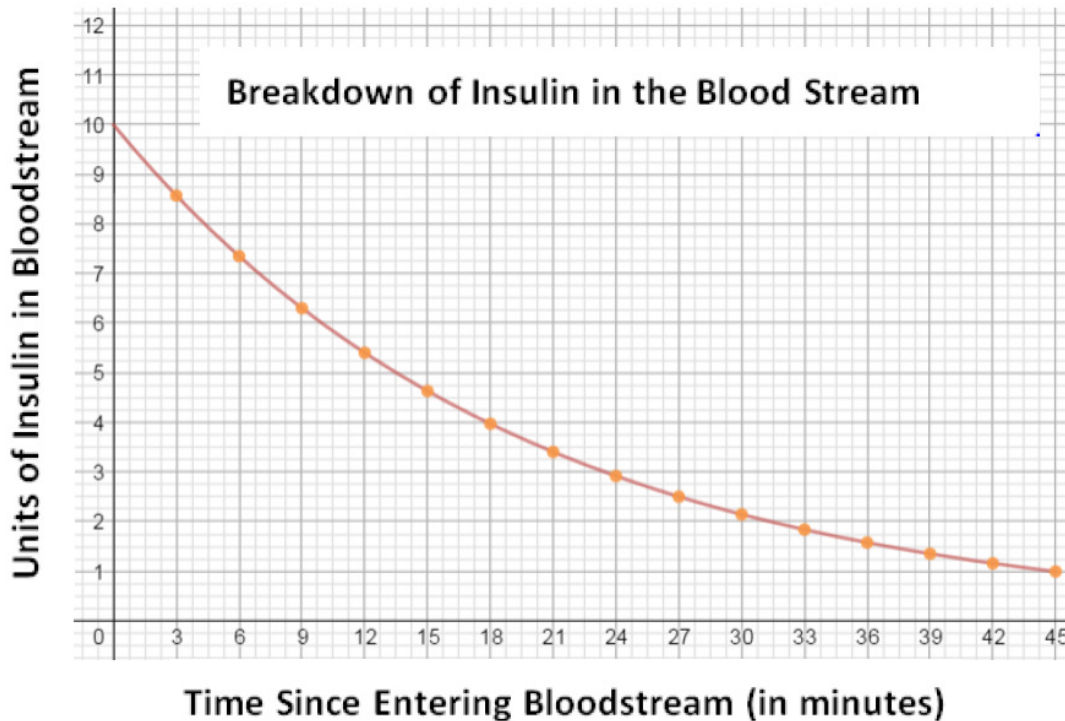
"Medicine & Mathematics" from last week

*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.

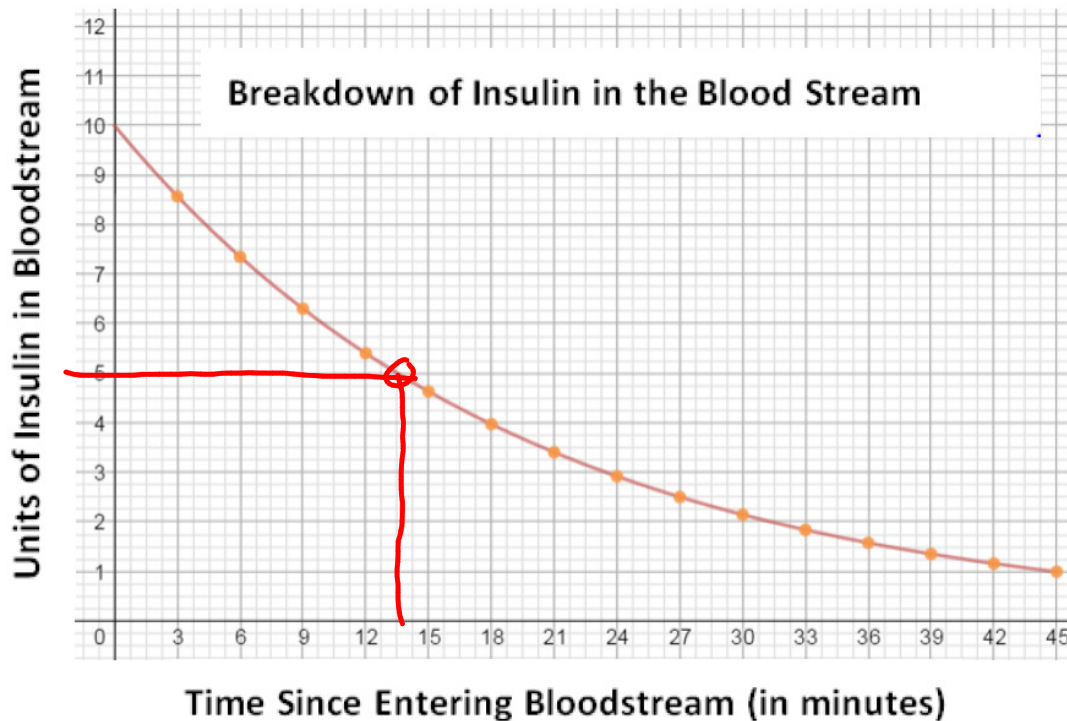


### Medicine and Mathematics

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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?  
**13.5 minutes**
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?

$$\text{Next} = \text{Now} \times (0.95)$$

Starting @ 10

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.  $10(0.95)^{1.5}$  → 9.25 units

b.  $10(0.95)^{4.5}$  → 7.94 units

c.  $10(0.95)^{8.75}$  → 3.82

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 your calculator or computer software. Then complete the following table of values showing the insulin decay pattern at times other than whole minute intervals.

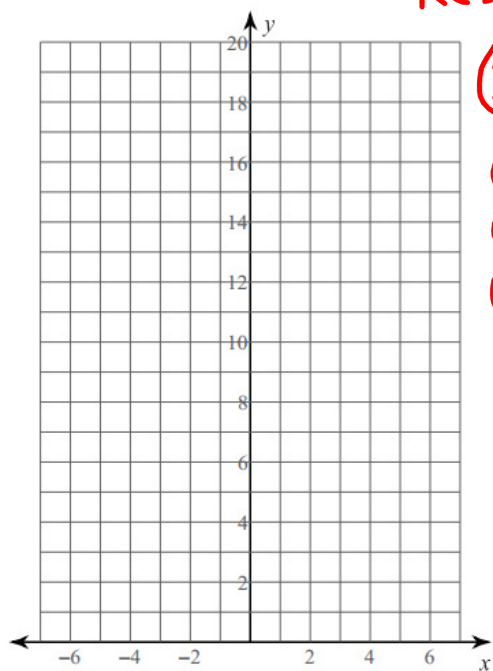
Time in Minutes	0	1.5	4.5	7.5	10.5	13.5	16.5	19.5
Units of Insulin in Blood	10	9.26	7.94	6.81	5.84	5.00	4.29	3.68

- 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.

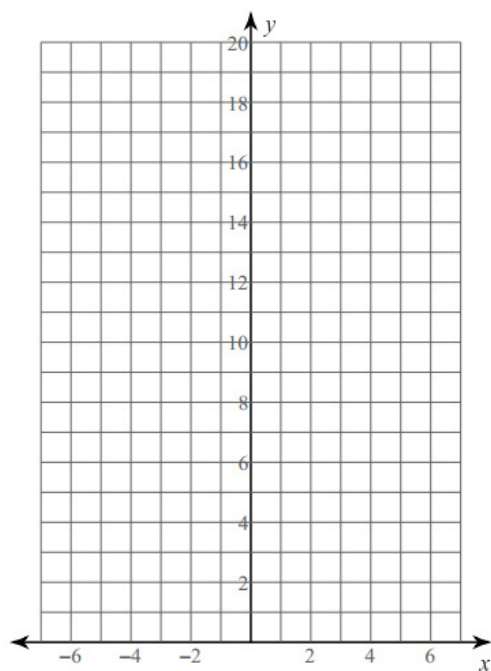
Sketch the graph of each function.

5)  $f(x) = 4 \cdot 2^x$

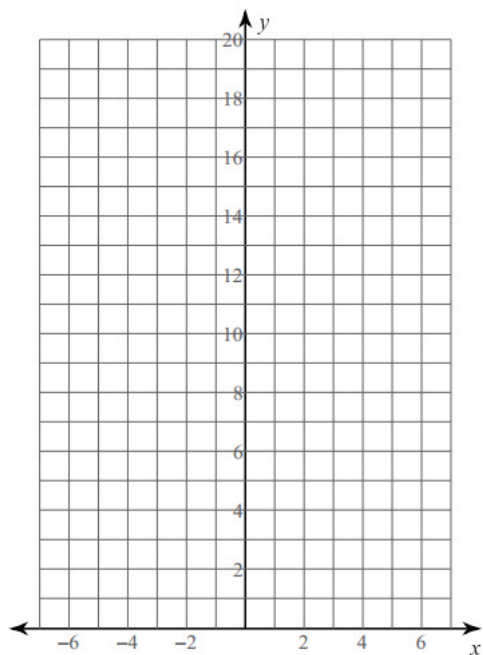
Reset  
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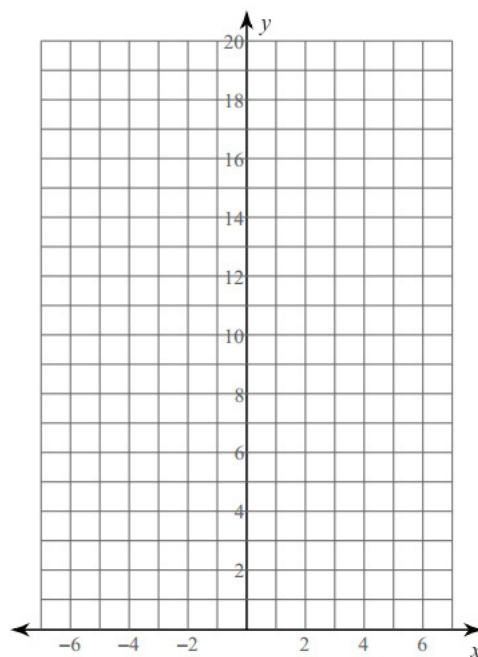
6)  $f(x) = 4 \cdot \left(\frac{1}{2}\right)^x$



7)  $f(x) = \frac{1}{2} \cdot 3^x$

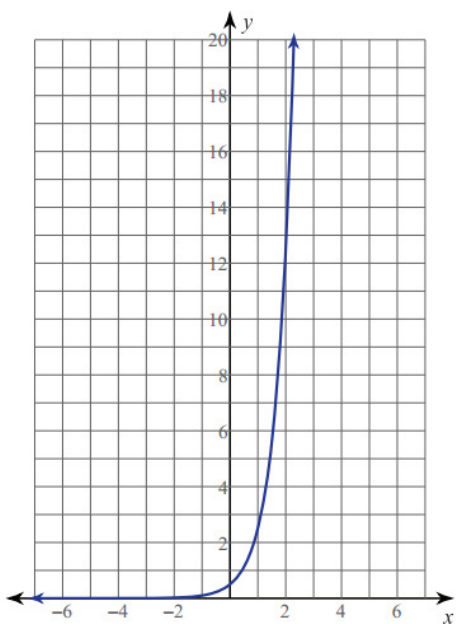


8)  $f(x) = 5 \cdot \left(\frac{1}{2}\right)^x$



Write an equation for each graph.

9)



10)

