Key

Math 1

**U5 L2 I1 & I2 Practice**

Name____________________

Date________

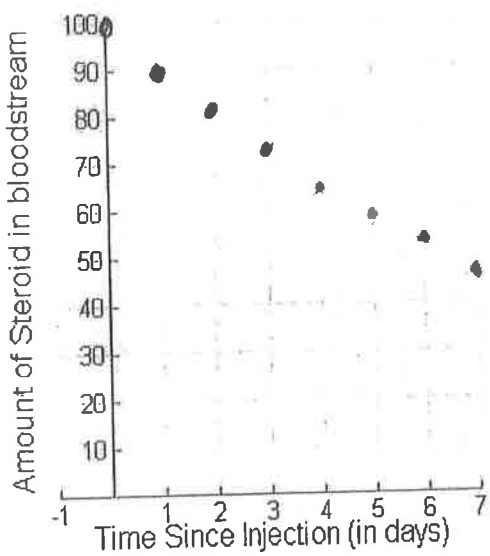
1. Recently, there has been much a lot of publicity surrounding baseball players and steroid use. Steroids, while having a positive effect for the user in the short-term, have many long-term side effects. One reason for this is that steroids leave the human body very slowly. With one injection of the steroid *ciprionate*, about 90% of the drug and its by-products will remain in the body one day later. Then 90% of that amount will remain after the second day, and so on. Suppose an athlete injects himself/herself with a dose of 100 milligrams of *ciprionate*. Analyze the pattern of that drug in the athlete's body by completing the following tasks.

a. Write an equation in the form $y = a \cdot b^x$ that models this situation.

$f(x) \cancel{y} = 100\,(0.90)^x$

b. Complete the below table and graph showing the amount of the drug remaining at various times:

| Time Since Use (in days) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Steroid Present (in mg) | 100 | 90 | 81 | 72.9 | 65.61 | 59.049 | 53.144 | 47.8297 |




c. Use your equation to find out how much of the steroid is left after 11 days.

$f(11) \cancel{y} = 100\,(0.90)^{11} \approx \boxed{31.38\text{ mg}}$

d. How long until there is less than 1mg of the steroid remaining in the bloodstream?

$100\,(0.90)^x < 1$ $\boxed{x > 43.7\text{ days}}$

e. Theoretically (according to the equation), will the steroid every completely leave the bloodstream?

No! Never reaches zero!

$y = 0$

2. Radioactive materials have many important uses in the modern world, from fuel for power plants to medical x-rays. Radioactive materials also can be very dangerous – for example it can cause cancer. Extreme care must be taken in transportation and disposal of these substances. They decay very slowly – for one certain substance, if any amount is stored at the beginning of a year, only 4% of that amount will decay by the end of the year.

a. Write an equation in the form $y = a \cdot b^x$ that can be used to calculate the amount of the substance remaining after any number of years. unknown initial amount

$f(x) = a(0.96)^x$

b. If 240 grams (a bit more than half of a pound) of the substance are released due to an accident, how much of that substance will still be around after 1 year? After 5 years?

$f(1) = 240(0.96)^1 = \boxed{230.4g \text{ after 1 year.}}$ $\boxed{195.689 \text{ after } 5_{yrs.}}$

c. Write a recursive equation that can be used to calculate the amount of the substance remaining after any number of years.

$\begin{cases} g_1 = 230.4 \\ g_n = g_{n-1} \cdot 0.96 \end{cases}$

d. How long is the **half-life** of the substance. That is, how long until half of the original amount remains? Explain how you found your answer.

$120 = 240(0.96)^x \rightarrow 0.5 = 0.96^x$ $\boxed{x \approx 17 \text{ years}}$

e. How long until less than 5 grams of the original substance? Explain how you found your answer.

$240(0.96)^x < 5$

$\boxed{x > 94.8 \text{ years}}$

3. Suppose you conduct the following experiment: You roll 100 dice. You remove all the dice that are showing either a 2 or a 4. You then gather all the remaining dice and roll them again. You again remove all the dice showing a 2 or a 4. You continue this process for several more rolls.

a. Write a "*y* =" (explicit) equation that models how many dice you would *expect* to remain after each roll based on what you know about the chance of rolling a number on a six-sided die. $\frac{4}{6}$ or $\frac{2}{3}$

$\frac{2}{6}$ chance of rolling 2 or 4. $\frac{2}{6} = \frac{1}{3}$ $f(x) = 100\left(\frac{2}{3}\right)^x$

b. Fill in the below table for the expected number of dice remaining. Round to nearest whole #.

| Roll # | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Expected Dice Remaining | 67 | 44 | 30 | 20 | 13 | 9 | 6 |

c. How many rolls do you think it would take until you have no dice remaining? Explain.

Theoretically, it will never happen

I think it would take about 10-12 rolls based on how many are left after 7 rolls

d. ~~If you actually conducted this experiment, do you think your data would turn out exactly like the table in part (a)? Explain why or why not.~~

~~No. The data is based off of theoretical probability, or what we EXPECT will happen. Real world is often different.~~