Cluster A.9: Exponential Functions and Equations

A.9C: Writing Exponential Functions: Ibuprofen in the Body

Focusing TEKS	Focusing Mathematical Process
A.9C Exponential Functions and Equations. The student applies the mathematical process standards when using properties of exponential functions and their related transformations to write, graph, and represent in multiple ways exponential equations and evaluate, with and without technology, the reasonableness of their solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to write exponential functions in the form $f(x) = ab^x$ (where b is a rational number) to describe problems arising from mathematical and real-world situations, including growth and decay. **Readiness Standard** Additional TEKS: A.9B Interpret the meaning of the values of a and b in exponential functions of the form $f(x) = ab^x$ in real-world problems. **Supporting Standard**	A.1A Apply mathematics to problems arising in everyday life, society, and the workplace. A.1B Use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. A.1E Create and use representations to organize, record, and communicate mathematical ideas. A.1F Analyze mathematical relationships to connect and communicate mathematical ideas.

Performance Task

Douglass is a nursing school student and is exploring how medication is processed by the human body as part of an assignment. Douglass is studying how much headache medication, in the form of ibuprofen, remains in the body over time. Based on his weight and age, Douglass can take 400 mg of ibuprofen when he has a headache. Each hour, the amount of ibuprofen in a person's system decreases by about 29%. What function rule can Douglass use to determine the amount of ibuprofen that would remain in his body given the number of hours since he took the medication? The ibuprofen bottle Douglass indicates that a person can take a second amount of 400 mg after 6 hours if pain persists. How much ibuprofen would be left in the body at the time the second dose can be taken? Justify your reasoning.

Answer: *$f(x) = 400(0.71)^x$ where x is the number of hours and f(x) is the amount of ibuprofen remaining. After 6 hours, there would be approximately 51 mg remaining of the original dose.*

Name _____ Date _____

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The ibuprofen bottle Douglass indicates that a person can take a second amount of 400 mg after 6 hours if pain persists. How much ibuprofen would be left in the body at the time the second dose can be taken? Justify your reasoning

Procedural	0	1	2
Conceptual	0	1	2
Communication	0	1	2

Total points:_____

Name _____ Date _____

Performance Task: A.9C
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Procedural	0	1	2
Conceptual	0	1	2
Communication	0	1	2

Total points:_____

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The ibuprofen bottle Douglass indicates that a person can take a second amount of 400 mg after 6 hours if pain persists. How much ibuprofen would be left in the body at the time the second dose can be taken?

In how many hours after taking 400 mg of ibuprofen will Douglass have less than 1 mg of ibuprofen remaining in his system? Justify your reasoning.

Procedural	0	1	2
Conceptual	0	1	2
Communication	0	1	2

Total points:_____

Name _____ Date _____

Performance Task: A.9C
Writing Exponential Functions: Ibuprofen in the Body

Douglass is a nursing school student and is exploring how medication is processed by the human body as part of an assignment. Douglass is studying how much headache medication, in the form of ibuprofen, remains in the body over time. Based on his weight and age, Douglass can take 400 mg of ibuprofen when he has a headache. Each hour, the amount of ibuprofen in a person's system decreases by about 29%.

1. If the amount of ibuprofen in the body decreases by 29% each hour, what percent of the ibuprofen remains in the system after one hour?

2. How much ibuprofen is in the body at time 0, when it is initially taken?

3. How much ibuprofen would remain after 1 hour?

4. How much ibuprofen would remain after 2 hours?

5. Use the chart below to complete the amounts of ibuprofen remaining after different numbers of hours. Include your mathematical work in the process column.

Hour	Process	Ibuprofen Remaining
0 (when taken)		
1		
2		
3		
4		

Name _____ Date _____

6. To find the amount of ibuprofen in the body after each next hour, by what number do you multiply the amount of ibuprofen in the body before?

7. By hour 2, how many times has the original 400 mg been multiplied by the number found in question #6?

8. By hour 4, how many times has the original 400 mg been multiplied by the number found in question #6?

9. How can you represent the number of times the original 400 mg is multiplied by the number found in question #6 for any number of hours, x?

10. What equation represents the original 400 mg multiplied by the number found in question #6 for any number of hours, x?

11. Using the equation rule, about how many milligrams of ibuprofen remain in the body at hour 6?