



Mrs. cole
Subject: Mathematics
State: Michigan

Student Name: _____

Teacher Name: _____

School Name: _____

1 Marco and Seth are lab partners studying bacterial growth. They were surprised to find that the population of bacteria doubled every hour.

(a) The table shows that there were 2,000 bacteria at the beginning of the experiment. What was the size of the population of bacteria after 1 hour? After 2, 3, and 4 hours? Enter this information into the table:

Hours into study			0	1	2	3	4
Population (thousands)			2				

(b) If you know the size of the population at a certain time, how do you find the population one hour later?

(c) Marco said he thought they could use the equation $P = 2t + 2$ to find the population at time t . Seth said he thought they could use the equation $P = 2 \cdot 2^t$. Decide whether each of these equations produces the correct populations for $t = 1, 2, 3, 4$.

(d) Assuming the population doubled every hour before the study began, what was the population of the bacteria 1 hour *before* the students started their study? What about 3 hours before?

(e) If you know the population at a certain time, how do you find the population one hour *earlier*?

(f) What number would you use to represent the time 1 hour before the study started? 2 hours before? 3 hours before? Finish filling in the table if you haven't already.

(g) Now use Seth's equation to find the population of bacteria 1 hour before the study started. Use the equation to find the population 3 hours before. Do these values produce results consistent with the arithmetic you did earlier?

(h) Use the context to explain why it makes sense that $2^{-n} = \left(\frac{1}{2}\right)^n = \frac{1}{2^n}$. That is, describe why, based on the population growth, it makes sense to define 2 raised to a negative integer exponent as repeated multiplication by $\frac{1}{2}$.

2 James was trying to decide whether or not the following expressions are between 0 and 1.

For each expression, circle YES or NO to indicate whether or not the expression has a value between 0 and 1.

YES or NO 1) $8^7 \cdot 8^{-12}$

YES or NO 2) $\frac{7^4}{7^{-3}}$

YES or NO 3) $\left(\frac{1}{3}\right)^2 \cdot \left(\frac{1}{3}\right)^9$

YES or NO 4) $\frac{(-5)^6}{(-5)^{10}}$

3 Which is equivalent to the expression below?

$$7^4 \div 7^9$$

(A) -35

(B) $\frac{1}{7^5}$

(C) 7^5

(D) 7^{13}

4 Which expressions are equivalent to $\frac{3^{-8}}{3^{-4}}$? Select **all** that apply.

(A) 3^{-12}

(B) 3^{-4}

(C) 3^2

(D) $\frac{1}{3^2}$

(E) $\frac{1}{3^4}$

(F) $\frac{1}{3^{12}}$

5 Which expressions are equivalent to $\frac{1}{2^6}$?

Select **all** that apply.

(A) $2^{-5} \cdot 2^{-1}$

(B) $2^{-3} \cdot 2^2$

(C) $2^{-2} \cdot 2^{-4}$

(D) $2^1 \cdot 2^5$

(E) $2^1 \cdot 2^6$

(F) $2^2 \cdot 2^{-8}$

(G) $2^3 \cdot 2^3$

6 Which exponential expression is equal to $2^{-5} \cdot 2^8$?

(A) $\frac{2^2}{2^{-1}}$

(B) $(2^3)^{-1}$

(C) $\frac{2^{-2}}{2^{-1}}$

(D) $(2^{-1})^3$