## Unit 4 Lesson 17: Logarithmic Functions

### 1 Which One Doesn’t Belong: Functions (Warm up)

#### Student Task Statement

Which one doesn’t belong? Be prepared to explain your reasoning.

$f\left(x\right)=4⋅\left(0.75\right)^{x}$

$g\left(x\right)=4⋅e^{\left(0.75x\right)}$

$h\left(x\right)=\left(0.75\right)⋅4^{x}$

$j\left(x\right)=4⋅logx$

### 2 How Long Will It Take?

#### Student Task Statement

A colony of 1,000 bacteria doubles in population every hour.

1. Explain why we can write $h=log\_{2}x$ to represent the number of hours, $h$, it takes for the one thousand bacteria to reach a population of $x$ thousand.
2. Complete the table with the corresponding values of $h$.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| * $x$ (thousands)
 | * 1
 | * 2
 | * 4
 | * 8
 | * 16
 | * 50
 | * 80
 |
| * $h$ (hours)
 | *
 | *
 | *
 | *
 | *
 | *
 | *
 |

1. Plot the pairs of values on the coordinate plane. Make two observations about the graph.
* 
1. Use the graph to estimate the missing values in the table.

|  |  |  |  |
| --- | --- | --- | --- |
| * $x$ (thousands)
 | * 10
 | * 24
 | * 72
 |
| * $h$ (hours)
 | *
 | *
 | *
 |

### 3 Another Logarithmic Function

#### Student Task Statement

Earlier we saw that $h=log\_{2}x$ represents the number of hours for 1 thousand bacteria, doubling every hour, to reach a population of $x$, in thousands.

1. Suppose the function $d$, defined by $d\left(x\right)=log\_{10}x$, represents the number of days it takes 1 thousand of another species of bacteria to reach a population of $x$, in thousands. How is this population of bacteria growing?
2. Graph $d$ using graphing technology. Make two observations about the graph.
3. Use your graph to estimate the values of $d\left(50\right)$ and $d\left(20,​000\right)$. (Adjust your graphing window as needed.) Explain what each value means in this situation.
4. Estimate or find the population after 5 days.



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