Unit 4 Lesson 12: The Number e

1 Matching Situations and Equations (Warm up)

Student Task Statement

Match each equation to a situation it represents. Be prepared to explain how you know. Not all equations have a match.

$f(t) = 400 \cdot (0.5)^{0.1t}$

$g(t) = 400 \cdot (1.25)^{0.1t}$

$h(t) = 400 \cdot (0.75)^{0.1t}$

$j(t) = 400 \cdot (2)^{10t}$

$k(t) = 400 \cdot (2)^{0.1t}$

1. A scientist begins an experiment with 400 bacteria in a petri dish. The population doubles every 10 hours. The function gives the number of bacteria t hours since the experiment began.
2. A patient takes 400 mg of a medicine. The amount of medicine in her bloodstream decreases by 25% every 10 hours. The function gives the amount of medicine left in her bloodstream after t hours of taking the medicine.
3. The half-life of a radioactive element is 10 years. There are 400 g of the element in a sample when it is first studied. The function gives the amount of the element remaining t years later.
4. In a lake, the population of a species of fish is 400. The population is expected to grow by 25% in the next decade. The function gives the number of fish in the lake t years after it was 400.

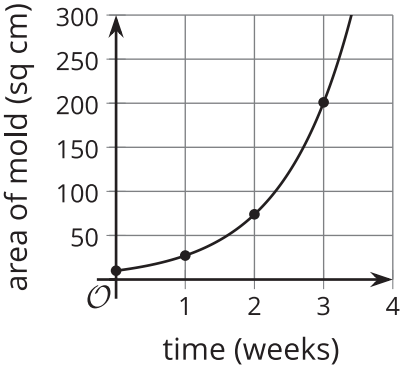
2 Notice and Wonder: Moldy Growth

Student Task Statement

A spot of mold is found on a basement wall. Its area is about 10 square centimeters. Here are three representations of a function that models how the mold is growing.

time (weeks)	area of mold (sq cm)
0	10
1	27
2	74
3	201
4	546

$a(t) = 10 \cdot e^t$



What do you notice? What do you wonder?

3 $(1 + \text{tiny})^{\text{huge}}$

Student Task Statement

1. Here are some functions. For each function, describe, in words, the outputs for very tiny, positive values of x and for very large values of x.
   $a(x) = 1^x$

   $b(x) = -x$

   $d(x) = \frac{1}{x}$

   $f(x) = \left(\frac{1}{x}\right)^x$

   $g(x) = \left(1 + \frac{1}{x}\right)^x$

   $h(x) = e^x$

   $k(x) = 1 + x$

2. Remember that $e \approx 2.718$. What does the function g have to do with the number e?

3. What do you notice about the relationship between h and k for very small, positive values of x?

Activity Synthesis