Unit 4 Lesson 5: Changes Over Rational Intervals

1 Changes Over Intervals (Warm up)

Student Task Statement

Consider the exponential function $h(x) = 4^x$. For each question, be prepared to share your reasoning with the class.

1. By what factor does h increase when the exponent x increases by 1?

2. By what factor does h increase when the exponent x increases by 2?

3. By what factor does h increase when the exponent x increases by 0.5?

2 Machine Depreciation

Student Task Statement

After purchase, the value of a machine depreciates exponentially. The table shows its value as a function of years since purchase. If a spreadsheet tool is available, consider using it to help you reason about the following questions.

years since purchase	value in dollars
0	16,000
0.5	
1	13,600
1.5	
2	11,560
3	9,826

1. The value of the machine in dollars is a function f of time t, the number of years since the machine was purchased. Find an equation defining f and be prepared to explain your reasoning.

2. Find the value of the machine when t is 0.5 and 1.5. Record the values in the table.

3. Observe the values in the table. By what factor did the value of the machine change:
   a. every one year, say from 1 year to 2 years, or from 0.5 years to 1.5 years?

   b. every half a year, say from 0 to 0.5 year, or from 1.5 years to 2 years?

4. Suppose we know $f(q)$, the value of the machine q years since purchase. Explain how we could use $f(q)$ to find $f(q + 0.5)$, the value of the machine half a year after that point.

3 Fever Medicine

Student Task Statement

The graph shows the amount of medicine in a child's body h hours after taking the medicine. The amount of medicine decays exponentially.
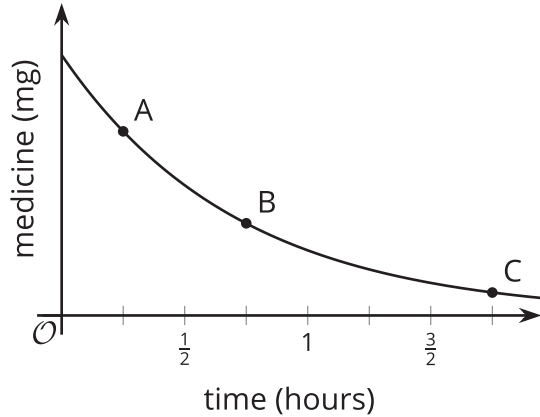
1. After $\frac{1}{4}$ hour there are about 7 mg of medicine left. After $\frac{3}{4}$ hour there are about 3.5 mg of medicine left. About how many mg of medicine are left after $1\frac{3}{4}$ hours? Explain how you know.

2. How does the decay rate from $\frac{1}{4}$ hour to $\frac{1}{2}$ hour compare to the decay rate from $\frac{1}{2}$ hour to $\frac{3}{4}$ hour? Explain how you know.