Lesson 1.1: Reading and Identifying Key Features of Real-World Situation Graphs

North Carolina Math 4 Standard

NC.M3.F–IF.4 Interpret key features of graphs, tables, and verbal descriptions in context to describe functions that arise in applications relating two quantities to include periodicity and discontinuities.★

Warm-Up 1.1 Debrief

1. What is the domain of t?

   The mathematical domain of t is $(-\infty,\infty)$. However, t represents time, which has values greater than or equal to 0, so the modified mathematical domain is [0, ∞). The problem also assumes that no breeding pairs can be in the preserve until the time is greater than 0; at $t = 0$, $N(t) = 0$. This value of $N(0)$ conforms to the requirement that $N(t)$ should yield a whole number. The real world domain is therefore [0, ∞).

2. Based on the graph and the domain, describe what happens to the function values as time increases.

   The function values increase continuously as time increases. However, the rate at which the function values increase is decreasing as time goes on. The function also appears to approach a maximum value as time increases.

3. Rewrite the function with a positive exponent.

   In order to change a negative exponent to a positive exponent, the base and the exponent must be moved to the denominator (that is, rewrite the exponential term as its reciprocal).

   $N(t) = 5(1 - 2^{-t})$ Given function

   $N(t)=5\left(1-\frac{1}{2^t}\right)$ Rewrite the exponential term as its reciprocal.

   The original function can be rewritten with a positive exponent as $N(t)=5\left(1-\frac{1}{2^t}\right)$.

4. Use the result of problem 3 to describe what happens to the function values as t increases.

   As t increases, the value of the fraction $\frac{1}{2^t}$ becomes smaller and approaches 0. This causes the function value to approach 5 • 1 – 0, or a value of 5.

5. What are the maximum and minimum function values? Explain what these values mean within the context of the problem.

   For the real-world domain found in problem 1, $[0, \infty)$, the minimum function value would be 0, which corresponds to no breeding pairs of cougars at a time of 0 years. The maximum function value is close to 5, but since the function is limited to whole numbers, it will have to be rounded down to 4.

Connection to the Lesson

- Students will identify the differences in domains of mathematical problems and real-world problems.
- Students will recognize that mathematically unbounded (infinite or zero) domains or function values are sometimes bounded (finite) in real-world problems.
- Students will compare and contrast increasing or decreasing function values with the rate of change of function values.