Algebra 2

ELG HS.N.3: **Reason quantitatively and use units to solve problems.**

Vertical Progression:

8th Grade	**8.F.B Know that there are numbers that are not rational, and approximate them by rational numbers.** o **8.F.B.4** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
Algebra 1	**ELG.MA.HS. N.3 Reason quantitatively and use units to solve problems.** o **N-Q.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. o **N-Q.2** Define appropriate quantities for the purpose of descriptive modeling. o **N-Q.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Note: Functions may include linear, quadratic, exponential, polynomial (quadratic or cubic), square root, cube root, and piecewise-defined functions (including step and absolute value).
Algebra 2	**ELG.MA.HS.N.3 Reason quantitatively and use units to solve problems.** o **N-Q.2** Define appropriate quantities for the purpose of descriptive modeling. Note: Functions may include linear, quadratic, exponential, polynomial, square root, cube root, piecewise defined (including step and absolute value), **rational, trigonometric, and logarithmic.**

Students will demonstrate command of the ELG by:

- Selecting and defining appropriate quantities in solving real-world and mathematical problems.
- Using quantities to choose an appropriate graph scale and setting the correct scale on a graph (Set the correct window on a graphing calculator).
- Examining the results and determining if it makes sense in the context of the problem.

Vocabulary:

- descriptive model
- precision

Sample Instructional/Assessment Tasks:

1) **Standard(s): N-Q.2**
Source: https://www.illustrativemathematics.org/content-standards/HSN/Q/A/2/tasks/1850

Item Prompt:

A small company wants to give raises to their 5 employees. They have $10,000 available to distribute. Imagine you are in charge of deciding how the raises should be determined.

a. What are some variables you should consider?
b. Describe mathematically different methods to distribute the raises.
c. What information do you need to compute the raises for each employee?

d. Make up the information you need to compute specific raises for 2 different methods and apply them to the situation. Compute the specific dollar mount each employee receives as a raise.

e. Choose one of you methods that you think is most fair and construct an argument that supports your decision.

Correct Answer:
Answers may vary.

2) **Standard(s): N-Q.1-3**
Source: http://rda.aps.edu/RDA/Performance_Task_Bank/Documents/High_School/Spread%20of%20Disease.pdf

Item Prompt:
Disease can spread quickly without use of universal precautions. Suppose the spread of a direct contact disease in a stadium is modeled by the exponential equation P(t) = 10,000/$(1 + e^{3-t})$ where P(t) is the total number of people infected after t hours. (Use 2.718 as an estimate for *e* or the graphing calculator for *e* in your calculations.)

1. Estimate the initial number of people infected with the disease. Show how you found your answer.
2. Assuming the disease does not present symptoms for 24 hours, how many people will have been infected after 3 hours? Show how you found your answer.
3. What is the maximum number of people who can become infected?
4. Explain why your answer for Question #3 is the maximum.
5. The stadium needs to warn its guests about a rapid disease spread if it affects over 800 people. After how many minutes should the stadium inform its guests of the disease? Show how you found your answer.

Correct Answers:

1. About 474 people would be initially infected.
2. We would expect about 5,000 people to be infected after 3 hours.
3. The maximum number of people who can become infected is 10,000.
4. Answers will vary. Students might include logic that involves the end behavior of the function as described in the solution for Question 3 or some discussion about the function itself and how the quotient could never be more than 10,000 since that number is divided by a value that must be positive and has an upper limit of 1. Students should recognize as part of this discussion that it appears that the number of the people in the stadium is 10,000, which would explain it as the maximum number of people who can become infected.
5. The stadium needs to warn of the spreading disease in 0.56 hours or about 33 minutes.