Vertical Progression:

7th Grade	**7.RP.A Analyze proportional relationships and use them to solve real-world and mathematical problems.** ○ **7.RP.A.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. ○ **7.RP.A.2** Recognize and represent proportional relationships between quantities. ○ **7.RP.A.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. ○ **7.RP.A.2c** Represent proportional relationships by equations. **7.EE.B Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** ○ **7.EE.B.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations as strategies to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. **7.G.B Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.** ○ **7.G.B.6** Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
8th Grade	**8.F.B Use functions to model relationships between quantities.** ○ **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.** ○ **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. ○ **N-Q.2** Define appropriate quantities for the purpose of descriptive modeling. ○ **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.** ○ **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:

- Choosing appropriate units of measurement when solving 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).
- Determining the appropriate numeric representation of the quantities in a word problem (appropriately rounding per context of the situation).
- Consistently labeling all quantities throughout the process of solving a problem.
- Examining the results and determining if it makes sense in the context of the problem.

Vocabulary:

- accuracy
- descriptive model
- origin
- precision
- scale
- unit conversions

Sample Instructional/Assessment Tasks:

1) **Standard(s):** N-Q.A

Traffic Jam

Source: Illustrative Mathematics
https://www.illustrativemathematics.org/content-standards/HSN/Q/A/tasks/84

Item Prompt:

Last Sunday an accident caused a traffic jam 12 miles long on a straight stretch of a two lane freeway. How many vehicles do you think were in the traffic jam? Explain your thinking and show all calculations.

Correct Answer:

The solution depends upon the estimate of the length occupied by a vehicle in the traffic jam. Students should be given wide latitude on how they determine this length as long as they explain their thinking clearly and the estimates are reasonable, from cited references. For example: According to answers.com, the average mid-size sedan is about 13.5 ft long and the average large pick-up truck is about 16.4 ft long. If all of the vehicles in the traffic jam were average mid-size sedans, and there was no gap between them, there would be approximately 5,280 ft/mile×12 miles13.5 ft≈4,700 cars in the jam.

If all the vehicles were large trucks, and there was no gap between them, there would be approximately 5,280 ft/mile×12 mi16.4 ft≈3,900trucks. As in the commentary, note that if different conventions are made about how many lanes are involved in the context, this might affect this estimate by a factor of 2 or 4.

A more reasonable assumption would be that there are both trucks and cars, but fewer trucks than cars. For example, if there are 1500 trucks, they would occupy 1500×16.4=24,600 ft, leaving 38,760 ft for the sedans. This would amount to 38,760/13.5≈2900 for a total of 4,400vehicles in the traffic jam.

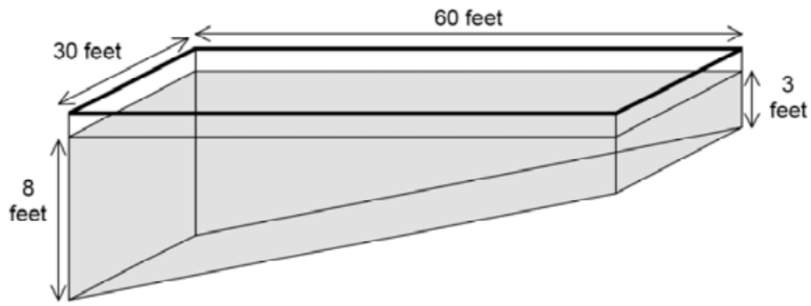
Making allowance for the gap between vehicles, and using a created unit of "length occupied by a vehicle in a traffic jam", would decrease all these estimates.

2) **Standard(s):** N-Q.A

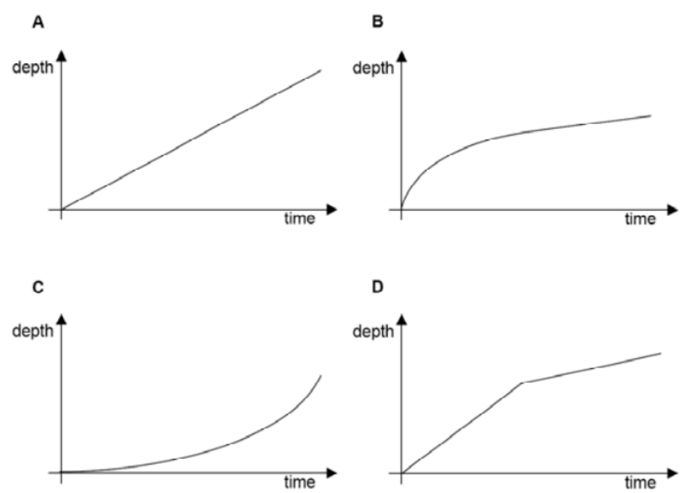
Swimming Pool

Source: http://www.insidemathematics.org/assets/common-core-math-tasks/swimming%20pool.pdf

Item Prompt:
(Swimming Pool) This diagram shows a swimming pool. The top of the swimming pool is a rectangle measuring 30 feet by 60 feet. Two of the sides of the pool are trapezoids. The water is 8 feet deep at the deep end and 3 feet deep at the shallow end.



1. Find the volume of water in the pool. Show your calculations.
2. The volume of water in the pool is 74,250 gallons. A pump fills the pool at a rate of 1 gallon per second. How long, in hours and minutes, does it take to deliver 74,250 gallons of water into the pool?
3. Which of these graphs best represents the depth of the water in the pool as it is filled at a steady rate of one gallon per second? Explain your reasons.



Correct Answer:

1. Gives correct answer: **9,900** cubic feet

   Shows correct calculation such as: $60 \times \frac{(8 + 3)}{2} \times 30$

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2. Gives correct answer: **20** hours, **37.5** minutes

   Shows correct calculation: dividing 74,250 by 60 x 60
   = 20.625 hours

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3. (a) Gives correct answer: Graph **B**

   (b) Gives correct explanation such as:
   At first the depth increases quickly, but then more slowly as the water moves up the slope. For the final 3 feet, the depth increases at a constant rate.

Note: Exemplar student work and multiple approaches can be found at link (*http://www.insidemathematics.org/assets/common-core-math-tasks/swimming%20pool.pdf*)