

## Task Background

**Domain & Area:** Mathematics - Number Sense

**Target CCR Standard(s)** (including level of standard, if needed) and/or adult diploma competency for Science or Social Studies:

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**Number Sense (MN k-12 Academic Standards:** ABE instruction in Levels D and E covering Number Sense (Demonstrated competency mastery in all Level D standards and at least one Level E standard in the CCRS for Number Sense).

### CCRS Number Sense Level D standards

1. Apply and extend previous understandings of numbers to the system of rational numbers.

- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (6.NS.5)
- Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. (6.NS.6)
  - Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g.,  $-(-3) = 3$ , and that 0 is its own opposite. (6.NS.6a)
  - Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. (6.NS.6b)
  - Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane. (6.NS.6c)
- Understand ordering and absolute value of rational numbers. (6.NS.7)
  - Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.

*For example, interpret  $-3 > -7$  as a statement that  $-3$  is located to the right of  $-7$  on a number line oriented from left to right. (6.NS.7a)*

- Write, interpret, and explain statements of order for rational numbers in real-world contexts.

*For example, write  $-3^{\circ} C > -7^{\circ} C$  to express the fact that  $-3^{\circ} C$  is warmer than  $-7^{\circ} C$ . (6.NS.7b)*

- Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.

*For example, for an account balance of  $-30$  dollars, write  $|-30| = 30$  to describe the size of the debt in dollars. (6.NS.7c)*

- Distinguish comparisons of absolute value from statements about order.

*For example, recognize that an account balance less than  $-30$  dollars represents a debt greater than 30 dollars. (6.NS.7d)*

- Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. (6.NS.8)

2. Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

- Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. (7.NS.1)
  - Describe situations in which opposite quantities combine to make 0. For example, if a check is written for the same amount as a deposit, made to the same checking account, the result is a zero increase or decrease in the account balance. (7.NS.1a)
  - Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. (7.NS.1b)
  - Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. (7.NS.1c)
  - Apply properties of operations as strategies to add and subtract rational numbers. (7.NS.1d)
- Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. (7.NS.2)
  - Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. (7.NS.2a)
  - Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts. (7.NS.2b)
  - Apply properties of operations as strategies to multiply and divide rational numbers. (7.NS.2c)
  - Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. (7.NS.2d)
- Solve real-world and mathematical problems involving the four operations with rational numbers. (7.NS.3)

3. Know that there are numbers that are not rational, and approximate them by rational numbers.

- Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g.,  $\pi^2$ ).

*For example, by truncating the decimal expansion of  $\sqrt{2}$ , show that  $\sqrt{2}$  is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations. (8.NS.2)*

4. Understand ratio concepts and use ratio reasoning to solve problems.

- Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. (6.RP.3)
  - Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. (6.RP.3a)
  - Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed? (6.RP.3b)
  - Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. (6.RP.3c)
  - Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. (6.RP.3d)

5. Analyze proportional relationships and use them to solve real-world and mathematical problems.

- Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

*For example, if a person walks  $\frac{1}{2}$  mile in each  $\frac{1}{4}$  hour, compute the unit rate as the complex fraction  $\frac{1/2}{1/4}$  miles per hour, equivalently 2 miles per hour. (7.RP.1)*

- Recognize and represent proportional relationships between quantities. (7.RP.2)
  - Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. (7.RP.2a)
  - Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. (7.RP.2b) [Also see 8.EE.5]
  - Represent proportional relationships by equations.

*For example, if total cost  $t$  is proportional to the number  $n$  of items purchased at a constant price  $p$ , the relationship between the total cost and the number of items can be expressed as  $t = pn$ . (7.RP.2c)*

- Explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate. (7.RP.2d) Use proportional relationships to solve multistep ratio and percent problems.

*Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. (7.RP.3) [Also see 7.G.1 and G.MG.2]*

**CCRS Number Sense Level E standard**

6. Extend the properties of exponents to rational exponents.
- Rewrite expressions involving radicals and rational exponents using the properties of exponents. (N.RN.2)

**Task Description:** The purpose of this task is for a student to demonstrate knowledge in number sense, exhibiting knowledge meeting level D and E standards.

**Information for the Teacher**

- All materials described below are found in a Google Doc here:  
<https://drive.google.com/drive/folders/1FO1TanxnYZpSiaDjQSA7uywwtxZWq6nq?usp=sharing>
- Student should complete capstone after completing ABE curriculum or achieving knowledge through other accepted means. The student should have already been introduced to the concepts of number sense and be able to complete problems at level D and level E.
- This task was designed to be completed independently by a learner in an appropriate, quiet testing environment. For learners needing more support, teachers can break up the task into sections, and have the student complete each section individually after providing review, practice and corrections.
- There is an answer key provided for the task. Criteria: Student will achieve a score of 80% or higher overall, and 80% or higher for Level E problems. If a student does not meet mastery scores, additional instruction and replacement problems in the specific standard will be provided.
- Include the following items when submitting this task as evidence for the diploma portfolio:
  - Completed Standard Adult High School Diploma Cover Sheet
  - Graded Student Capstone Assignment

**Activities**

**Title:** Number Sense Capstone

**Materials:** This activity includes the capstone document and the capstone answer key.