

Title:	Space Travel
Grade:	5
Claim(s):	<p>Claim 4: Modeling and Data Analysis Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.</p> <p>Claim 3: Communicating Reasoning Students clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.</p> <p>Claim 2: Problem Solving Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.</p>
Assessment Target(s):	<p>Claim 4 A. Apply mathematics to solve problems arising in everyday life, society, and the workplace. D. Interpret results in the context of a situation.</p> <p>Claim 3 C. State logical assumptions being used. E. Distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in the argument—explain what it is.</p> <p>Claim 2 A. Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace. D. Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas).</p>
Standard(s):	5.NBT.6, 5.NBT.7, 5.NF.3, 5.NF.6, 5.MD.5b, 5.G.2
Mathematical Practice(s):	1, 2, 3, 4, 6
Bloom's Taxonomy Level:	Analyzing - 4
DOK Level:	Strategic Thinking/Reasoning - 3
Score Points:	13 points possible
Difficulty:	Medium
Resources:	N/A
Notes:	N/A
Task Overview:	The student will demonstrate their knowledge of the four operations in regard to fractions, decimals, and whole numbers; calculating volume; and graphing in Quadrant I of the coordinate plane.
Teacher Preparation/Resource Requirements:	None required
Time Requirements:	Approximately 60-80 minutes

Prework:	None
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Congratulations! You have been selected as one of the residents of Earth who will be responsible for settling colonies on Mars. You will need to use your expertise in fractions, decimals, calculating volume, and graphing in a coordinate plane in order to make sure that your journey is safe and your spaceship will get you to the correct landing space on Mars.

Part A

1. There were 3238 people chosen to settle colonies on Mars this year. They will join the 2348 people who were chosen last year. There are a total of 98 colonies planned, and each colony will hold an equal number of people. How many people will be in each colony?

57 people

2. Before your team can leave on its mission, you must buy your supplies. You have been given a budget of \$15,000, and the prices for supplies are found in the table below:

Supplies	Price
1 food crate	\$624.26
1 uniform crate	\$397.55
1 water tank	\$187.64

Your team decides you need:

- 15 food crates
- 8 uniform crates
- 10 water tanks

Half of your remaining money in your budget will be used for buying entertainment devices for watching movies or playing games. After buying your necessary supplies, how much money will you have left for entertainment devices?

\$289.65

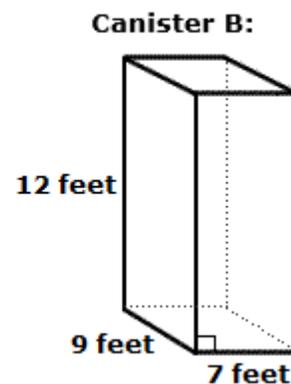
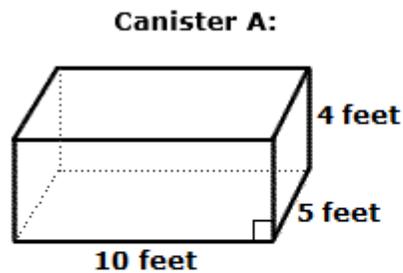
Sample Top-Score Response (Session 1)

Part B

3. Roger, one of your teammates, is in charge of preparing breakfast every morning on the spaceship. On the first morning of your trip into space, Roger served exactly three gallons of orange juice, shared equally among one table of people. Roger served every person at the table $\frac{3}{10}$ of a gallon of juice. Use your interpretation of the numerator and the denominator of this fraction to explain the assumption Roger made in order to know how much orange juice each person should receive.

Roger made the assumption that 10 people would drink orange juice. The numerator represents the total amount of orange juice, 3 gallons. The denominator represents how many people should be divided into the numerator. Since the denominator is 10, that means Roger assumed 10 people would drink juice.

4. Your spaceship runs on fuel that is stored in rectangular prism-shaped canisters. You started your trip with 20 canisters full of fuel, but now that your journey is coming to an end, you have only two canisters left. The dimensions of each canister left are shown in the pictures below.



Your teammate, Ella, incorrectly calculates that Canister A can hold 19 cubic feet of fuel because $4 + 5 + 10 = 19$, and Canister B can hold 28 cubic feet of fuel because $12 + 9 + 7 = 28$.

What mistake did Ella make in her calculations? Correct Ella's mistake and solve to find the volumes of each canister.

Ella's mistake is that she added the dimensions instead of multiplying them. The volume of Canister A is 200 cubic feet because $4 \times 5 \times 10 = 200$. The volume of Canister B is 756 cubic feet because $12 \times 9 \times 7 = 756$.

Sample Top-Score Response (Session 1)

5. You realize that the two fuel canisters you have left from Question 4 are not completely full. Canister A has $\frac{1}{4}$ of its total volume left, and Canister B has $\frac{3}{4}$ of its total volume left.

Your spaceship uses a total of 72 cubic feet of fuel per day. How many complete days of fuel do you have left in both canisters combined? Explain how you know. Use the volumes you found in Question 4 in your calculations.

We have 8 complete days of fuel left. I multiplied $\frac{1}{4}$ by 200 to find that Canister A has 50 cubic feet of fuel left. I multiplied $\frac{3}{4}$ by 756 to find that Canister B has 567 cubic feet of fuel left. Together, that is a total of 617 cubic feet of fuel. When I divided that by 72, I found that we have 8.57 days of fuel left, which means there are 8 complete days of fuel left.

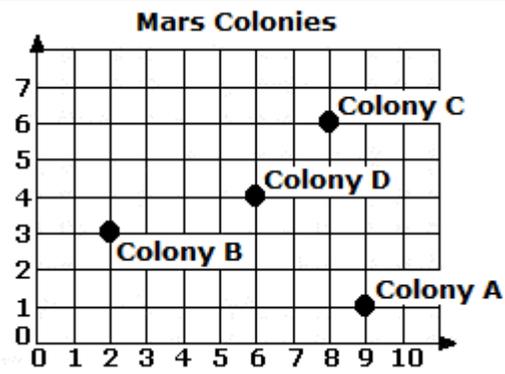
6. You and your team are now preparing to land your spaceship on Mars and begin your colony. You have been given a coordinate plane to use as a map, as well as the locations of three other colonies:

- Colony A is located at (9, 1).
- Colony B is located at (2, 3).
- Colony C is located at (8, 6).

Your team has been instructed to begin your colony—Colony D—at (6, 4) on the map.

Each line segment on the map is equal to one mile, and you are only allowed to travel on the line segments when going from colony to colony. The colony closest to yours will have extra water for you, and the colony farthest from you will have extra food.

Fill in the map below and label the locations of all four colonies. Explain how you know which colonies have your extra water and food.



Colony C will have our extra water. It is 4 miles away, which is closest to us. Colony A will have our extra food. It is 6 miles away, which is farthest from us.

End of Performance Task

Scoring Rubrics:

Scoring Rubric Question 1:	
1 Point:	The student demonstrates good understanding of finding whole number quotients. The student correctly calculates the number of people in each colony.
0 Points:	The student demonstrates no understanding of finding whole number quotients. The student does not correctly calculate the number of people in each colony.

Scoring Rubric Question 2:	
1 Point:	The student demonstrates good understanding of using the four operations with decimals. The student correctly calculates the amount available to spend on entertainment.
0 Points:	The student demonstrates no understanding of using the four operations with decimals. The student does not correctly calculate the amount available to spend on entertainment.

Scoring Rubric for Part B:

Scoring Rubric Question 3:	
2 Points:	The student demonstrates good understanding of interpreting a fraction as division of the numerator and denominator. The student correctly identifies the assumption made and correctly explains the relationship between the numerator and the denominator.
1 Point:	The student demonstrates limited understanding of interpreting a fraction as division of the numerator and denominator. The student correctly identifies the assumption made but does not correctly explain the relationship between the numerator and the denominator. OR The student correctly explains the relationship between the numerator and the denominator but does not correctly identify the assumption made.
0 Points:	The student demonstrates no understanding of interpreting a fraction as division of the numerator and denominator. The student does not correctly identify the assumption made and does not correctly explain the relationship between the numerator and the denominator.

Scoring Rubric Question 4:	
3 Points:	The student demonstrates thorough understanding of calculating the volume of right rectangular prisms. The student correctly describes Ella's mistake and correctly calculates both volumes.
2 Points:	The student demonstrates good understanding of calculating the volume of right rectangular prisms. The student correctly describes Ella's mistake and correctly calculates the volume of one canister but does not correctly calculate the volume of the second canister. OR The student correctly calculates both volumes but does not correctly describe Ella's mistake.
1 Point:	The student demonstrates limited understanding of calculating the volume of right rectangular prisms. The student correctly describes Ella's mistake but does not correctly calculate the volumes of either canister. OR The student does not correctly describe Ella's mistake and does not correctly calculate the volume of one canister but does correctly calculate the volume of the second canister.
0 Points:	The student demonstrates no understanding of calculating the volume of right rectangular prisms. The student does not correctly describe Ella's mistake and does not correctly calculate the volume of either canister.

Scoring Rubric Question 5*:	
3 Points:	The student demonstrates thorough understanding of multiplying with fractions and interpreting a remainder. The student correctly calculates the amount of fuel in both canisters and correctly identifies the number of complete days of fuel left.
2 Points:	The student demonstrates good understanding of multiplying with fractions and interpreting a remainder. The student correctly calculates the amount of fuel in both canisters but does not correctly identify the number of complete days of fuel left. OR The student correctly calculates the amount of fuel in only one canister and uses the information found to correctly calculate the number of complete days of fuel left.
1 Point:	The student demonstrates limited understanding of multiplying with fractions and interpreting a remainder. The student correctly calculates the amount of fuel in only one canister and does not use the information found to correctly calculate the number of complete days of fuel left. OR The student does not correctly calculate the amount of fuel in either canister but does use the information found to correctly calculate the number of complete days of fuel left.
0 Points:	The student demonstrates no understanding of multiplying with fractions and interpreting a remainder. The student does not correctly calculate the amount of fuel in either canister and does not use that information to correctly calculate the number of complete days of fuel left.

**A student should receive full credit for this question if they correctly calculate with the incorrect numbers from the previous question(s).*

Scoring Rubric Question 6:	
3 Points:	The student demonstrates thorough understanding of graphing in Quadrant I of the coordinate plane. The student correctly graphs all four colonies and correctly identifies the colonies with extra water and food.
2 Points:	The student demonstrates good understanding of graphing in Quadrant I of the coordinate plane. The student correctly graphs all four colonies, correctly identifies the colony with extra water but does not correctly identify the colony with extra food. OR The student correctly graphs all four colonies, correctly identifies the colony with extra food but does not correctly identify the colony with extra water. OR The student correctly graphs two or three of the four colonies but uses that information to correctly identify the two colonies with extra water and food.
1 Point:	The student demonstrates limited understanding of graphing in Quadrant I of the coordinate plane. The student correctly graphs all four colonies but does not correctly identify the colonies with extra water and food. OR The student correctly graphs two or three of the colonies but uses that information correctly to identify only the colony with extra water. OR The student correctly graphs two or three of the colonies but uses that information correctly to identify only the colony with extra food. OR The student correctly graphs zero or one of the four colonies but uses that information correctly to identify the colonies with extra water and food.
0 Points:	The student demonstrates no understanding of graphing in Quadrant I of the coordinate plane. The student does not correctly graph the colonies and does not correctly identify the colonies with extra water and food.