

Inspect

CCR Performance Tasks

Math Grade 5: Extended Performance Task

Painting a Wall

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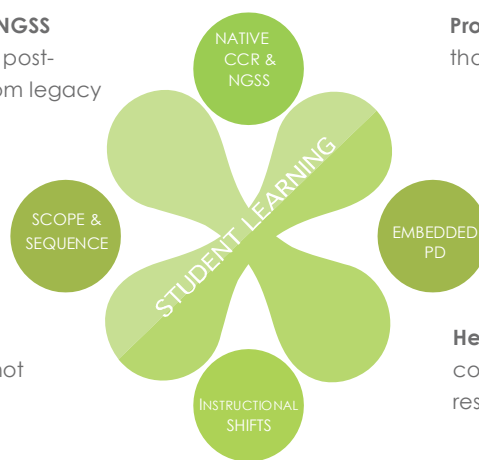
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CCR Performance Tasks

Math Grade 5: Extended Performance Task Painting a Wall Mural

Student Test Booklet

Name:

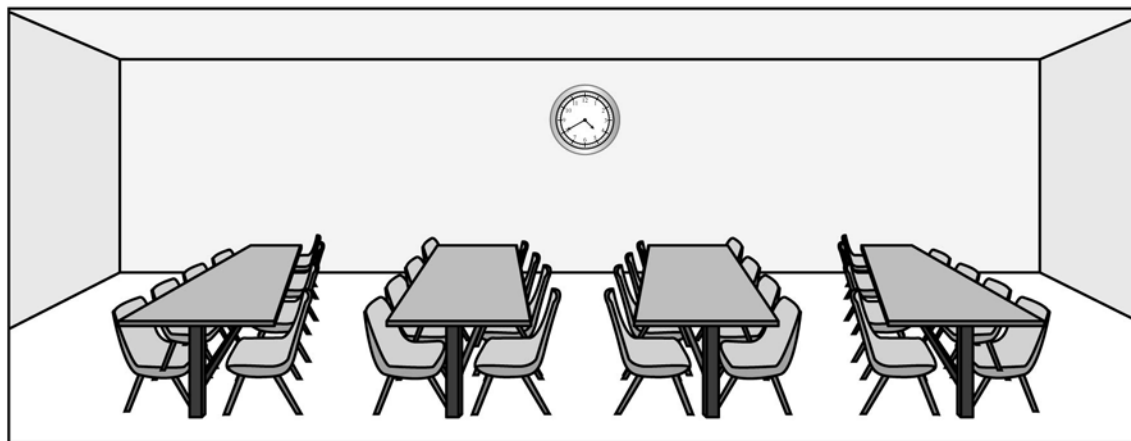
Math Grade 5: Extended Performance Task: Painting a Wall Mural

Complete all the tasks in the test booklet.

You and your fifth-grade classmates want to paint a mural on the main wall of the school cafeteria to encourage healthy eating. It is decided that the mural should have three equal-sized sections, each used to show healthy eating habits. One section will display healthy food groups, the next will feature the plate picture from the "Choose My Plate" website (a government-based nutrition program), and the third will show less-healthy foods that should be eaten in limited amounts. In order to complete the mural, you need to make a plan that describes the measurements of the mural sections, how much paint will be needed, and how long it will take to draw and paint the mural. Once you have decided on a plan, you will need to present your plan to the administration in order to get approval.

Part A: Mural Sections

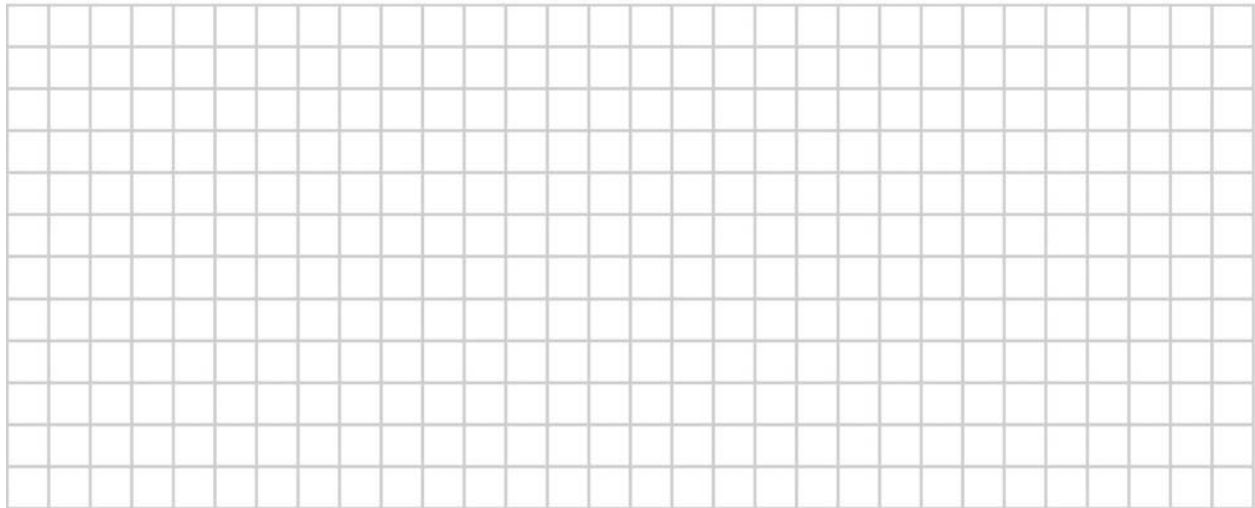
The main wall in the cafeteria has an area of 250 square feet. The actual height of the wall is 10 feet, but because of a clock you will only paint up to 7 feet. The length of the mural should take up as much of the wall as possible, but some wall space can be left on the sides of the mural.



1. Find the side lengths for your mural and for each of the three sections. Explain how you found your measurements.

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2. Use the graph below to sketch the mural with its three sections. Make sure you label the length and width of the mural and the measurements of each section. Each square is 1 square foot.



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Support Worksheet for Part A: Questions 1 and 2

What are the side lengths of your mural?

What is the area of your mural? Show your work.

How did you decide on the side lengths of the mural? Does your mural take up the entire length of the wall?

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Separate the mural into three equal-sized sections. Use the graph paper below to sketch your mural.

A full-page sheet of white graph paper featuring a uniform grid of thin, light gray horizontal and vertical lines. The grid consists of small squares covering the entire area of the page.

What are the side lengths for each section? What is the shape that you are using for each section? Are they the same?

What is the area for each section? Are the areas the same? Show your work.

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One of the three sections of the mural is used to identify and show examples of each of the five food groups. There should be five equal-sized regions in this section to show the name and some examples of the following groups:

- Fruits
- Vegetables
- Dairy
- Grains
- Protein

3. Find the side lengths and area of each of the five regions. Explain how you decided on the measurements for each of the five regions.

[illegible]

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4. Use the graph paper below to sketch the first mural section and show how it can be divided to show each of the five food groups. Label the side lengths and area of each of the five regions.



5. Find the fraction of the total mural for each of the five food group regions. Show your work.

A large, empty rectangular box with a black border, intended for showing the work for finding the fraction of the total mural for each of the five food group regions.

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Support Worksheet for Part A: Questions 3, 4, and 5

Divide one mural section into five equal-sized regions to show the five food groups.



Did you divide the mural section horizontally, vertically, or in another way? Why?

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Find the side lengths and area of each of the five food group regions.



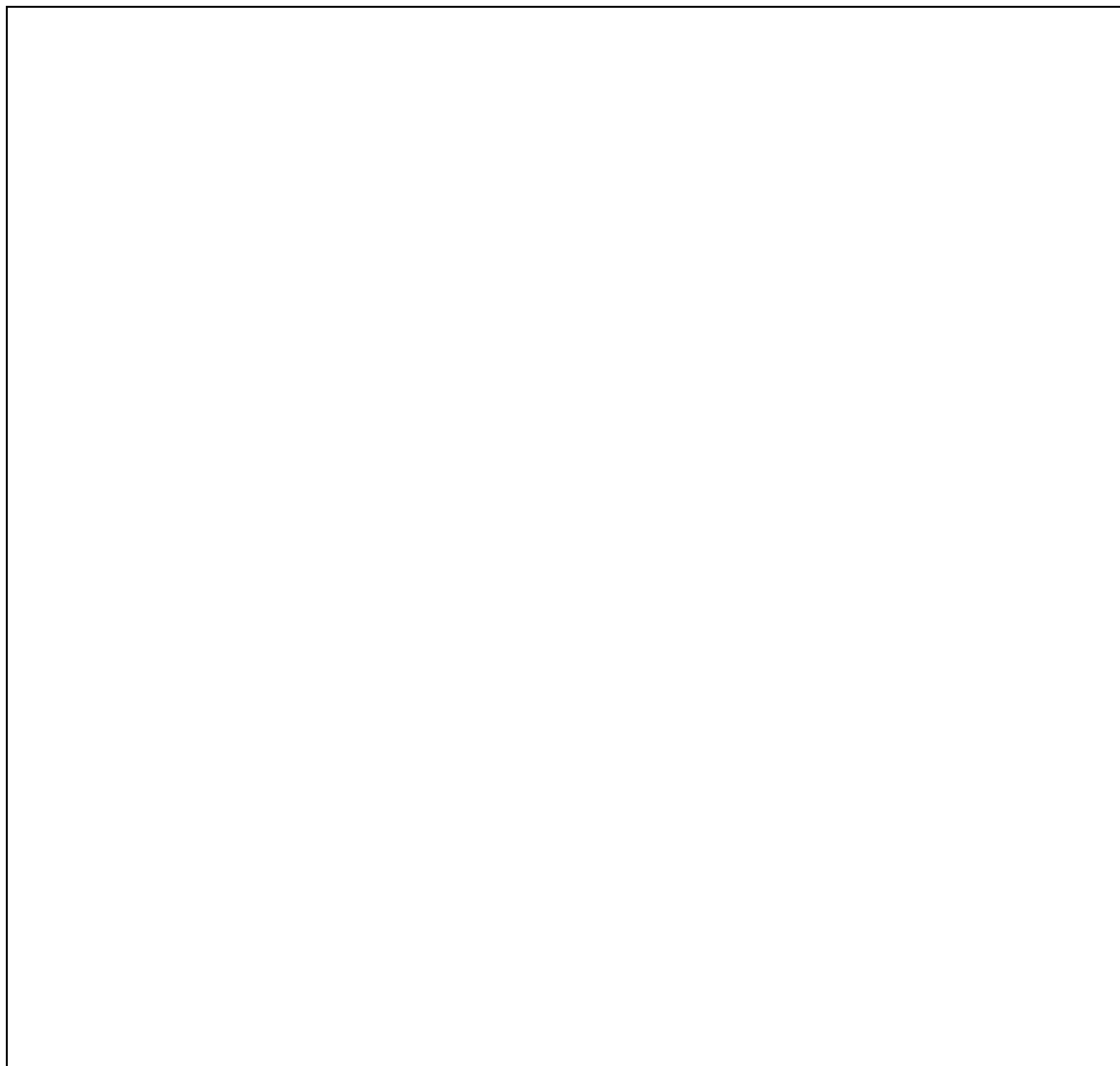
What fraction of the whole mural does each of the five regions take up? Show two ways that you can find this fraction.



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Another section of the mural features an image of the government-issued food plate that can be found at [ChooseMyPlate.gov](https://www.choosemyplate.gov).

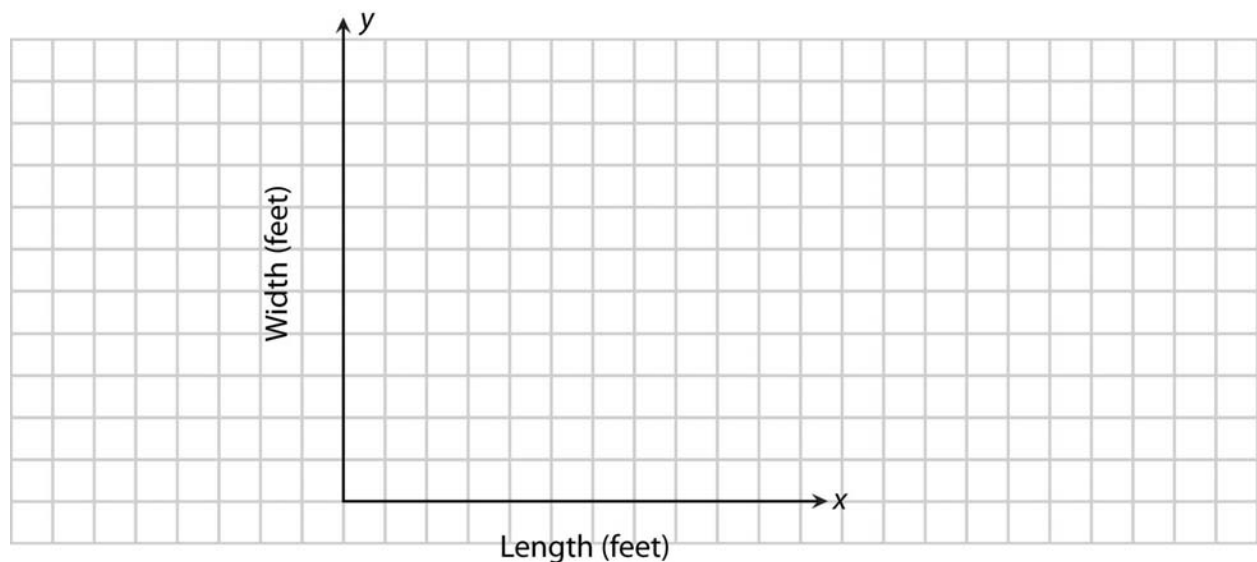
Go to the website [ChooseMyPlate.gov](https://www.choosemyplate.gov) to research healthy eating tips. Find the diagram that is used to show the guidelines for healthy eating. Sketch and label the diagram below.



This diagram is painted on the second section of the mural. The diagram shows two circles, one for the plate and another for the cup. The circles should take up as much of the space in that section as possible.

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6. Outline a rectangle to show the size of the mural section for the plate and cup.



7. The guidelines state that the fruits and vegetables should total $\frac{1}{2}$ of the plate, while grains and proteins should total $\frac{1}{2}$ of the plate. Find some combinations of these four food groups that can make up the plate. Use different fractions for each of the four groups.

A large empty rectangular box for student work, intended for drawing or writing solutions to problem 7.

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For an average fifth grader, the daily recommendations for each food group are shown below. The recommended daily servings are the total based on a fifth grader eating three meals in a day.

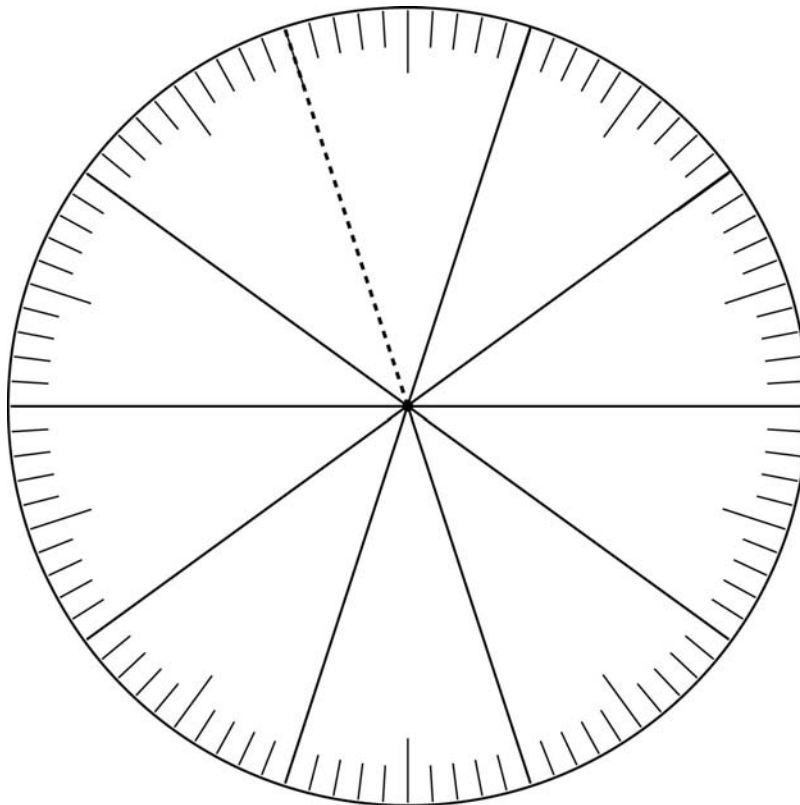
Food Group	Recommended Daily Servings
Fruits	2 cups
Vegetables	3 cups
Grains	8 ounces
Proteins	6 ounces
Dairy	3 cups

8. What are the recommended amounts for each food group, in ounces, that a fifth grader should eat in ONE meal?

9. Are these amounts the same as the guideline amounts shown on the plate? Explain your answer.

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10. Use the fraction circle to show the fractional amounts for one meal for a fifth grader. Make sure to represent each of the five food groups shown on the plate and cup. Show your work in the response area below the circle.



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What is the fractional amount of fruit that a fifth grader should eat in one meal compared to the total amount of food that should be eaten in one meal?

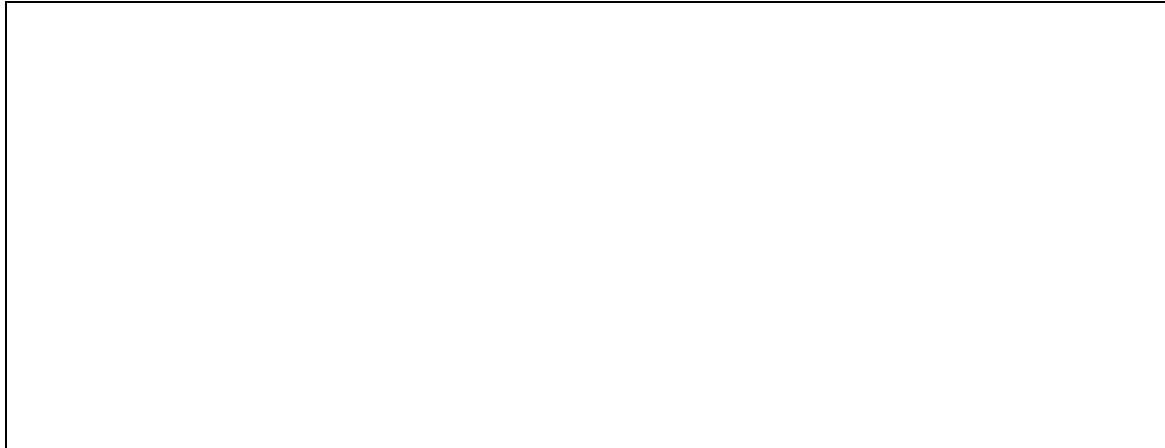
What is the fractional amount of vegetables that a fifth grader should eat in one meal compared to the total amount of food that should be eaten in one meal?

What is the fractional amount of grains that a fifth grader should eat in one meal compared to the total amount of food that should be eaten in one meal?

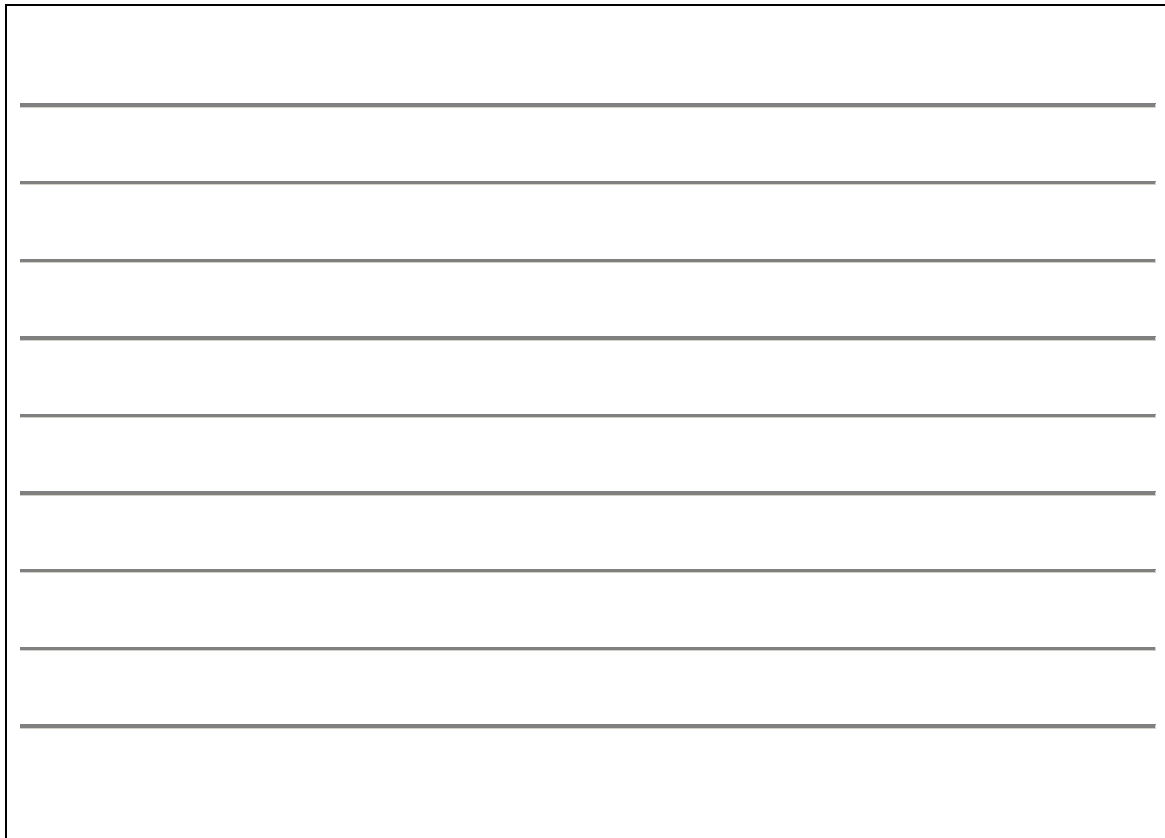
What is the fractional amount of protein that a fifth grader should eat in one meal compared to the total amount of food that should be eaten in one meal?

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What is the fractional amount of dairy that a fifth grader should eat in one meal compared to the total amount of food that should be eaten in one meal?



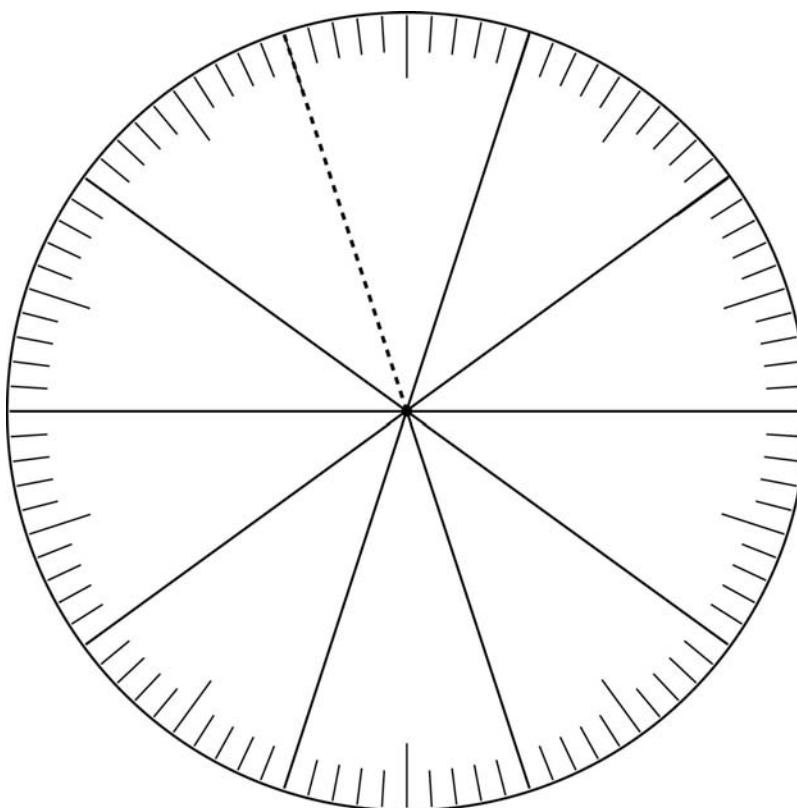
Does the recommended serving for one meal, in ounces, for fruits and vegetables match the guideline amount shown by the plate diagram? Explain any similarities or differences.



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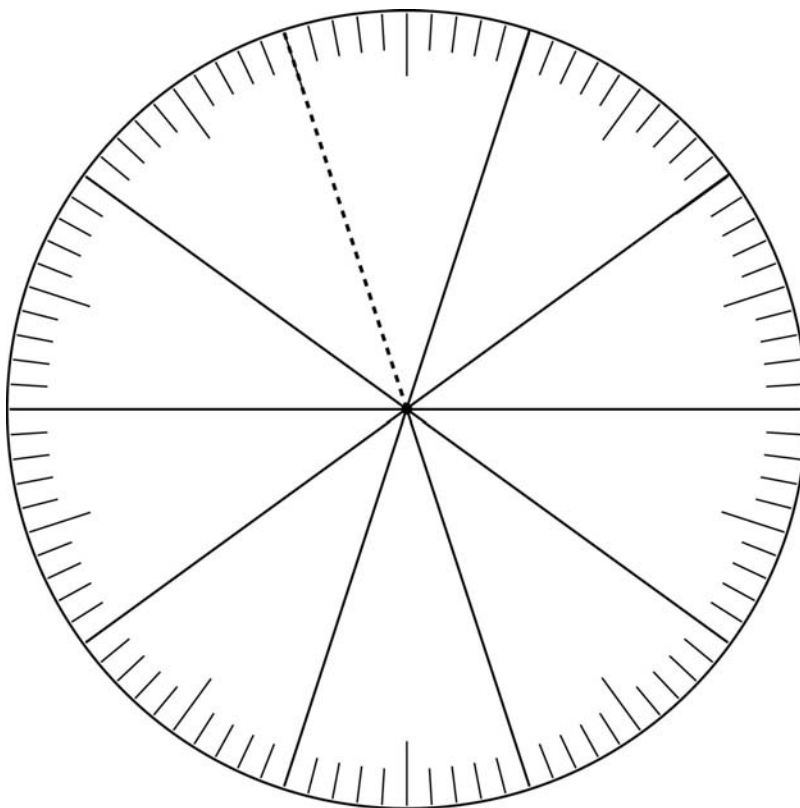
Does the recommended serving for one meal, in ounces, for grains and proteins match the guideline amount shown by the plate diagram? Explain any similarities or differences.

Use the fraction circle to show the approximate guidelines represented on the plate picture. Graph the fractional amounts that the plate shows. Label your sections.



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Use the fraction graph to show the fractional amounts for one meal for a fifth grader. Make sure to represent each of the four food groups shown on the plate.



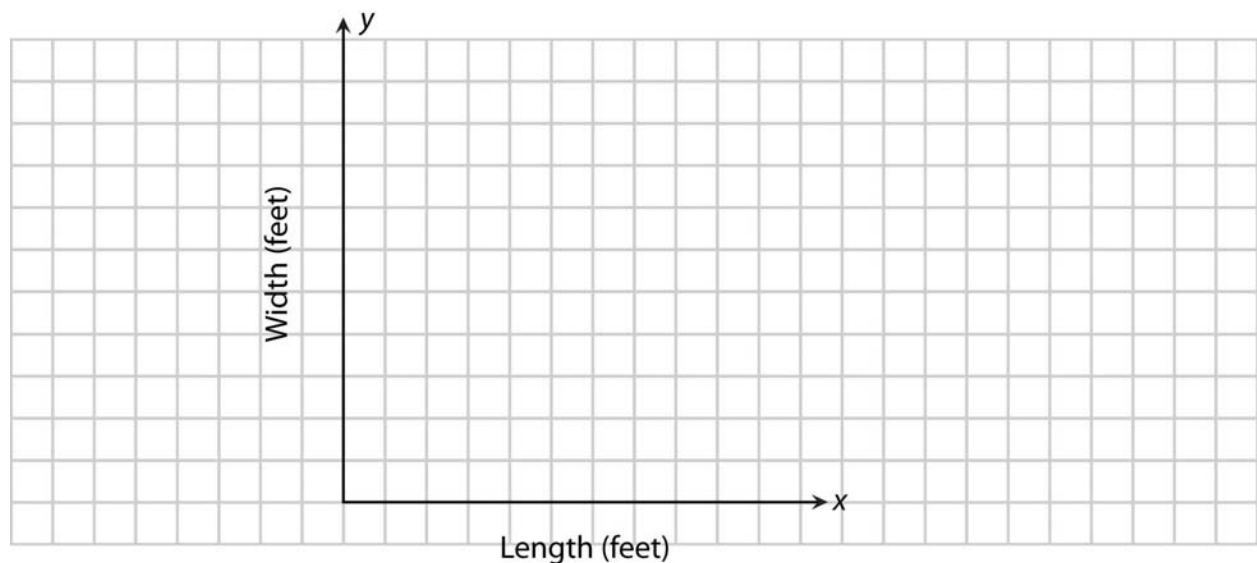
Do the two fraction circles match? Why or why not?

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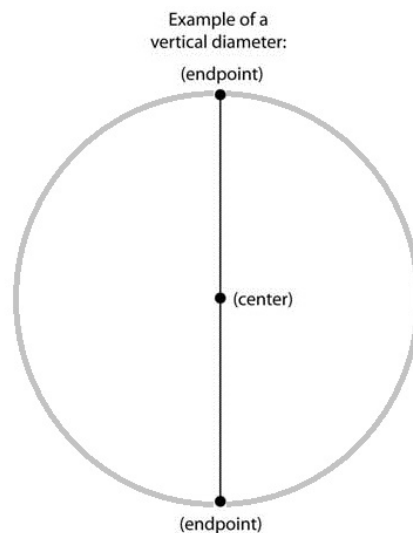
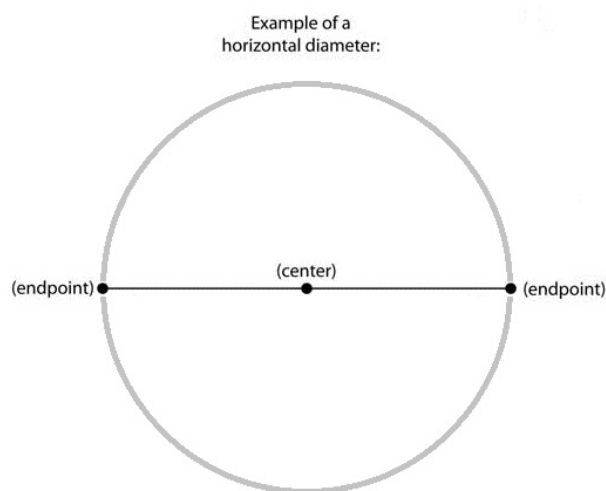
Part A (optional): Group Activity

Work with a partner for this part of the task. Work on questions a, b, c, and d on your own. Once you have completed these questions, exchange papers with your partner and answer questions about their work.

a. Draw the outline of the mural section for the plate on the graph below.



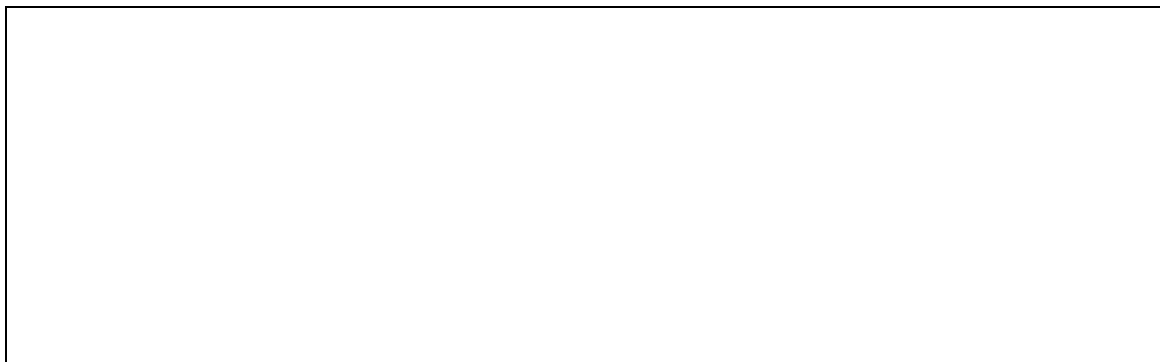
You need to draw the two circles that represent the plate and the cup in the section, making sure both circles stay within the section. Before you draw the circles, you need to measure a line segment, called the diameter, which helps you draw a circle. You need to draw a horizontal diameter and a vertical diameter that intersect in the center of the circle. A diameter goes from one point on the circle through the center to another point on the circle. These points are called endpoints. The measures from each endpoint to the center are equal. Examples of two diameters are shown below.



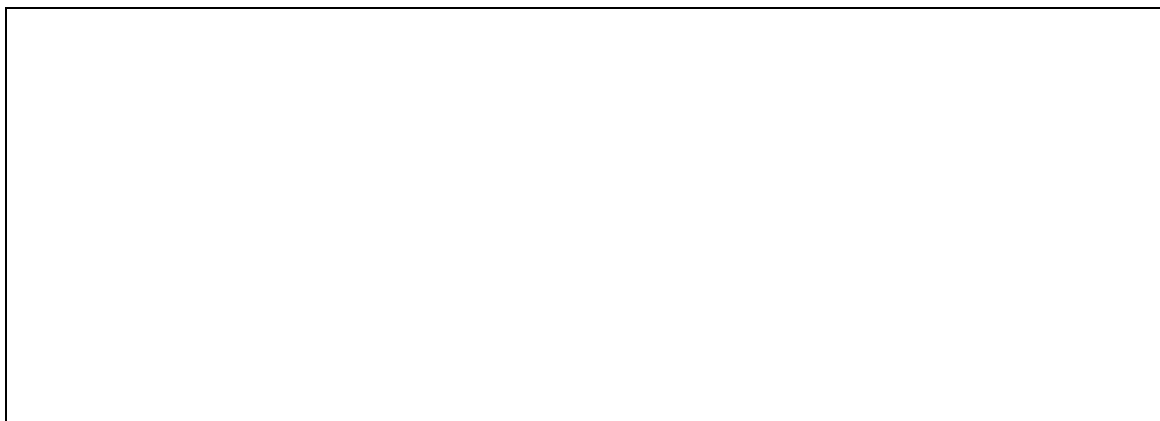
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b. Determine the lengths of the diameters for both of the circles. Use the graph paper in question 3a to help determine the lengths. Answer the questions below about your circles.

What is the length of the horizontal diameter for the circle that represents the plate? What is the length of the vertical diameter for this circle?



What is the length of the horizontal diameter for the circle that represents the cup? What is the length of the vertical diameter for this circle?

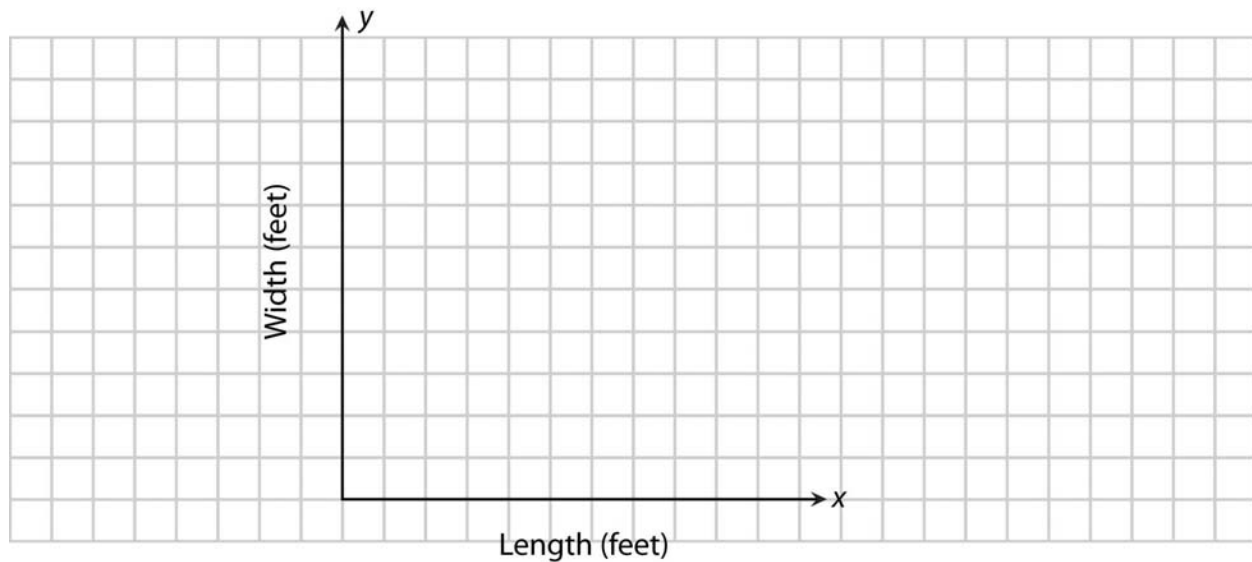


c. Fill in the table with the points (x, y) that you used to draw each circle.

	Food Plate Circle	Dairy Cup Circle
Horizontal Diameter Endpoints		
Vertical Diameter Endpoints		
Center		

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d. Draw the two circles in the graph paper in question a. Make sure your endpoints and diameters are clearly drawn for both circles. Use the graph below to sketch the two circles for practice, if needed.



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e. Exchange papers with your partner. Check your partner's work and graph. Answer the questions below.

- Are both of the circles within the outline of the section of the mural? Explain.
- Are the diameters and the endpoints clearly marked on the circles? Explain.
- Are the horizontal and vertical diameters equal in the plate circle? Are they equal in the cup circle? Explain.
- Do the circles cover as much of the section as they can? Explain.
- Is there anything you would change to make the circles look more like the food plate and dairy cup shown in the diagram? Explain.

f. Give your partner his or her paper back. Read over the answers made by your partner in part e. You may need to go back to your circles in part a and make some changes. Discuss any questions that you have with your partner. Write down any changes you made and why in the response box below.

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The third section shows foods, such as sugars, salt, and fat, that need to be limited in the daily food intake. The three foods and suggested daily amounts are to be displayed in triangle shapes. The triangles should cover the entire section. The three triangle shapes can be any combination of types of triangles based on the side lengths.

11. Use the grid to sketch a design showing the three triangles.



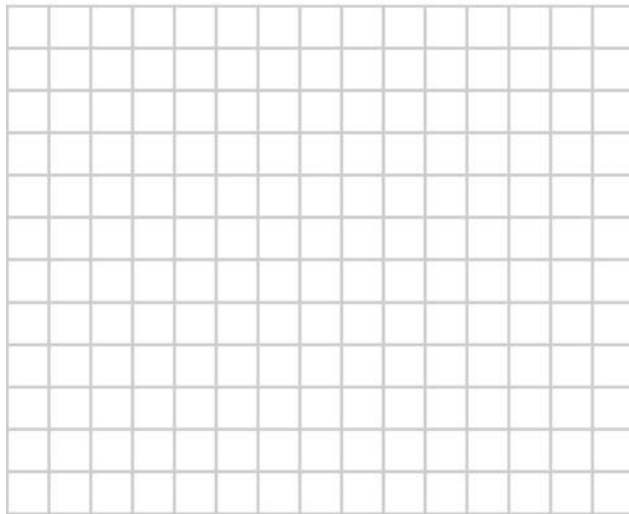
12. Find the base, height, and area for each of the three triangles. Show your work.

13. What fraction of the whole mural does each of the triangles in this third section take up? Show your work.

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Support Worksheet for Part A: Questions 11, 12, and 13

Sketch the three triangles within the outline for the third section on the graph below. The triangles should cover the entire section.



Find the base, height, and area for each of the three triangles. Do they have the same areas? Show your work.

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What fraction of the third section does the first triangle take up? The second triangle? The third triangle? Show your work.

Do the triangles take up the same amount of space? Explain.

What fraction of the whole mural does each of the three triangles take up? Show your work.

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Part B: Art Supplies

You and your classmates will use seven different colors to paint the mural: blue, red, yellow, black, orange, green, and white. You will need at least 1 quart of paint of each color. A local hardware store has donated a \$60 gift card for you to use to buy the paint. The store sells paint by the pint for \$6 and by the quart for \$10. The donated gift card of \$60 is the budget. In addition, the art teacher has donated paint that you can use.

The existing paint colors and their amounts are shown below:

$\frac{3}{8}$ quart of blue

$\frac{1}{4}$ quart of yellow

$\frac{5}{8}$ quart of white

$\frac{3}{4}$ quart of red

$\frac{1}{2}$ quart of black

14. How much additional paint is needed in order to have at least 1 quart of paint of each color? Show your work.

15. What is the total cost of the paint? Is this amount within the amount of the gift card? Show your work.

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Support Worksheet for Part B: Question 14

Find the existing amount and amount needed for each color to equal 1 quart. Fill in the table.

Color	Existing Amount	Amount Needed

How do you know if you need to buy a pint or a quart?

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Find the amount of paint needed so that there is 1 quart of each color. Fill in the table.

Paint Color	Amount of Paint to Buy	Buy a Pint or Quart?	How Much Paint? (total, in quarts)

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Support Worksheet for Part B: Question 15

Complete the table to find the total cost.

Paint Color	Amount (pt or qt)	Cost

Does the cost to have at least 1 quart of each color stay within the gift card amount? If the cost is within the budget, is there money left over? Show your work.

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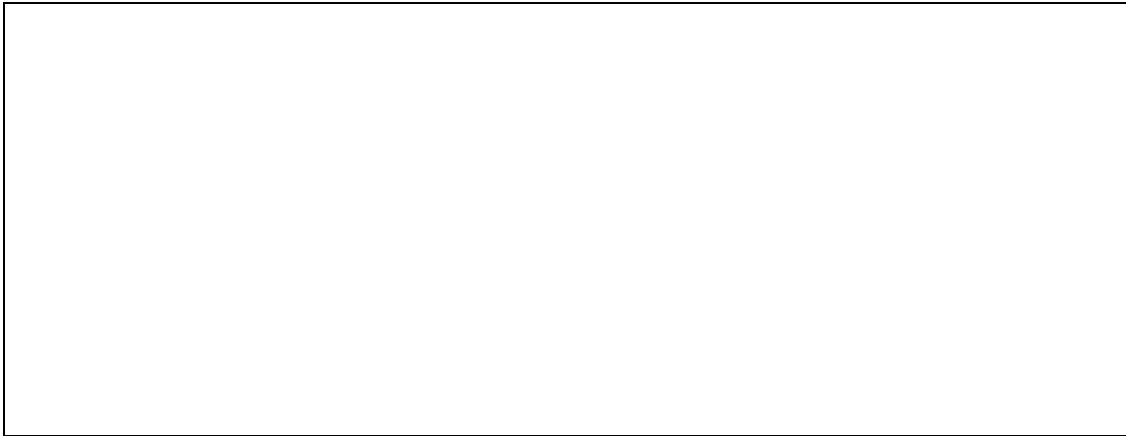
Part C: Painting the Mural

The art teacher who is overseeing the project estimates that it will take about 150 hours to complete the mural. This is based on the number of students working multiplied by the number of hours that each student works. Some of the students can come in after school and some can work during activity time during the school day. There are two 30-minute activity times in the afternoon, A and B.

The student schedule is as follows:

- 5 students work after school (90 minutes, twice a week)
- 3 students work during activity time A (30 minutes, 5 times a week)
- 4 students work during activity time B (30 minutes, 5 times a week)

16. How many weeks are needed for the students to complete the mural? Show your work.



17. Find two ways the schedule can be changed if the mural needs to be finished one week earlier than it would be with the current schedule. Show your work.



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Support Worksheet for Part C: Questions 16 and 17

What is the total number of minutes that are equal to 150 hours? Show your work.

What is the total number of weekly minutes for the students working after school and during activity times? Show your work.

What is the total number of weeks needed to complete the mural? Show your work.

Part D: Writing Component

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There is no handwriting or other markings on the paper.

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Support Worksheet for Part D: Writing Component

Write a detailed plan to present to the administration for approval to construct the mural. Make sure to explain 1) the purpose of and a description of the mural, 2) how the paint will be bought, 3) how many students are involved in painting the mural and when they will be working on it, 4) the estimated time that is needed to create and paint the mural, and 5) two other important pieces of information that should be included to get approval from the administration.

Plan Title: _____

By: _____

The purpose of this mural is...

The mural will have...

The total cost of the paint will be...

There will be 5th grade students working on the mural...

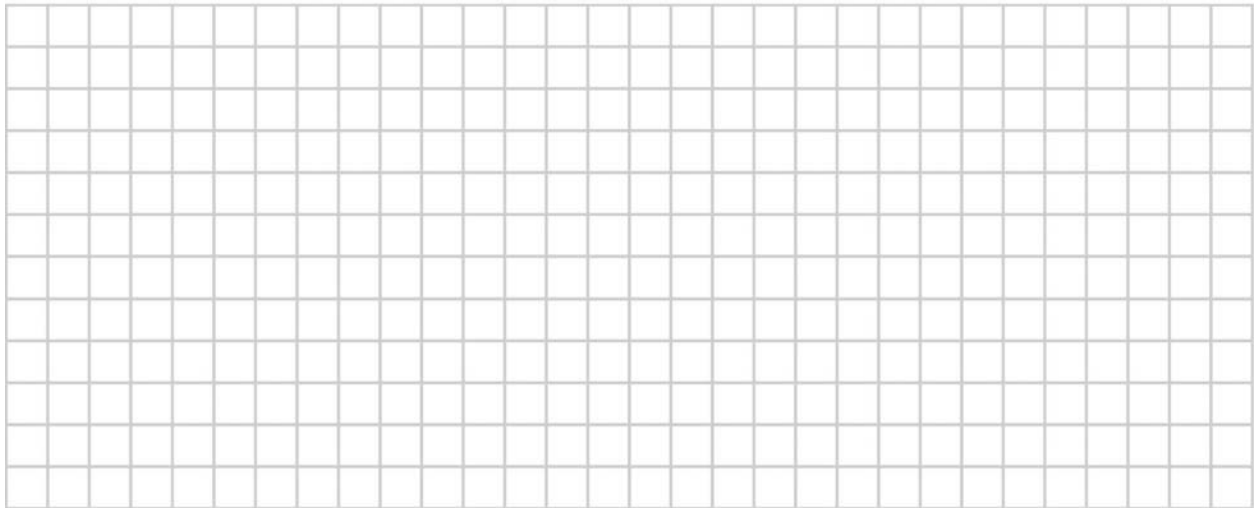
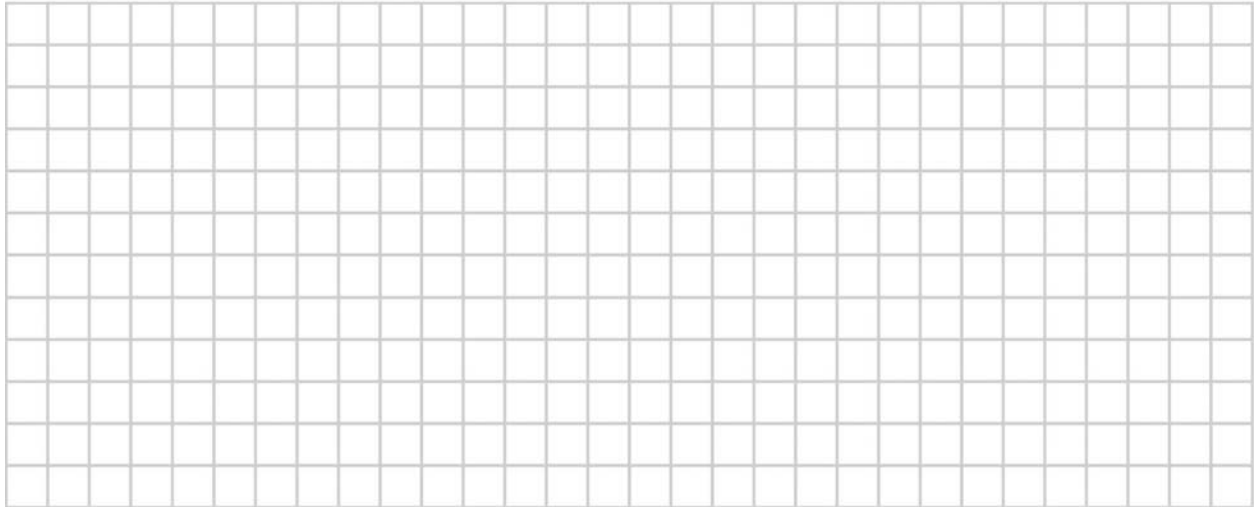
It will take...

What are two important things that you can write to persuade the administration to approve your plan?

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Extra graph paper

Question 2



Math Grade 5: Extended Performance Task: Painting a Wall Mural

Extra graph paper

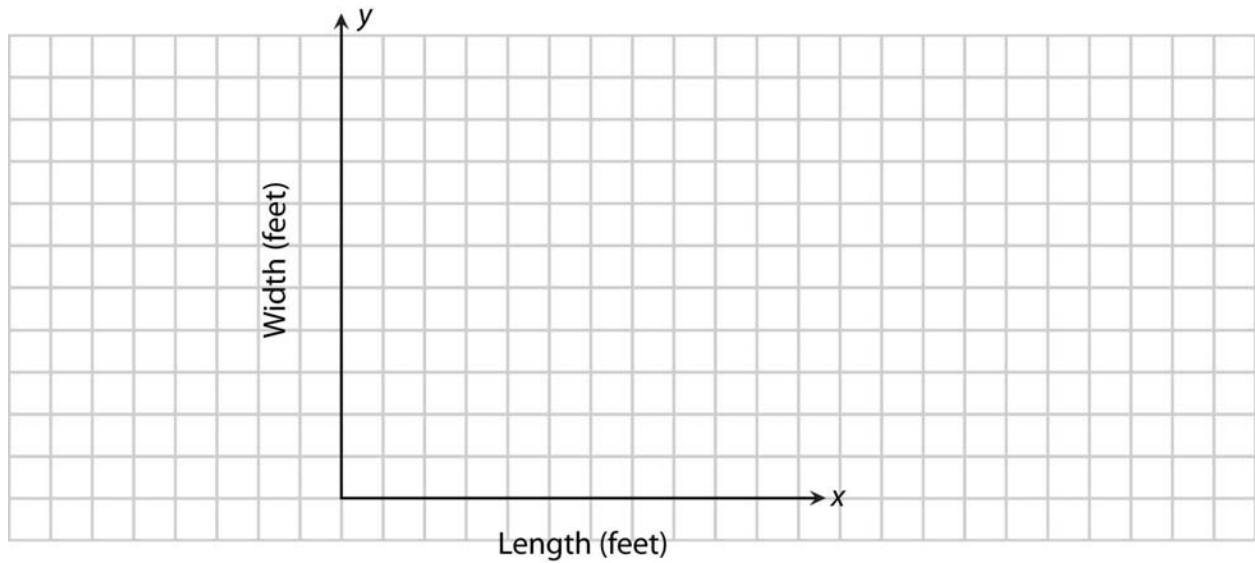
Questions 4 and 11



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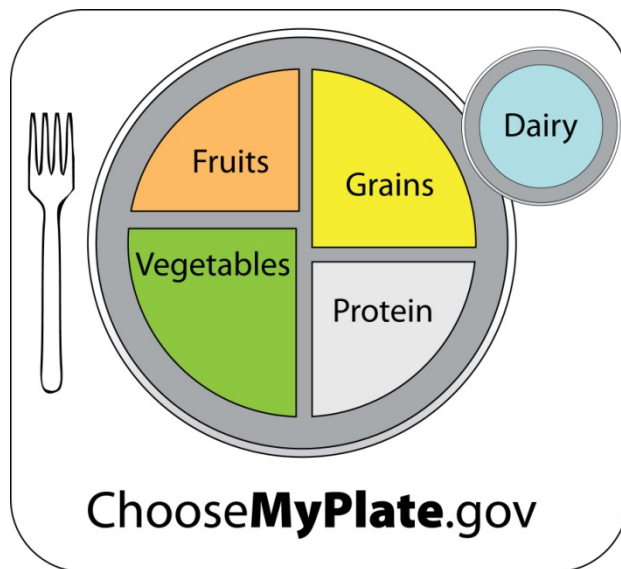
Extra graph paper

Question 6



Math Grade 5: Extended Performance Task: Painting a Wall Mural

Food Plate from ChooseMyPlate.gov



CCR Performance Tasks

Math Grade 5: Extended Performance Task Painting a Wall Mural

Teacher Guide

Name: _____

Task Specifications

Content Area	Mathematics
Title	Painting a Wall Mural
Grade Level	Grade 5
Problem Type	Extended Performance Task
Standards for Mathematical Practices	<p>Mathematical Practice 1 (MP.1): Make sense of problems and persevere in solving them.</p> <p>Mathematically proficient students:</p> <ul style="list-style-type: none"> • Explain to themselves the meaning of a problem and look for entry points to the solution. • Analyze givens, constraints, relationships, and goals. • Make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. • Consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. • Monitor and evaluate their progress and change course if necessary. • Explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. • Check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” • Understand the approaches of others to solving complex problems and identify correspondences between different approaches. <p>Mathematical Practice 4 (MP.4): Model with mathematics.</p> <p>Mathematically proficient students:</p> <ul style="list-style-type: none"> • Apply the mathematics they know to solve problems arising in everyday life, society and the workplace. • Apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. • Identify important quantities in a practical situation and map their relationships using tools as diagrams, two-way tables, graphs, flowcharts and formulas. • Analyze those relationships mathematically to draw conclusions. • Interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. <p>Mathematical Practice 6 (MP.6) Attend to precision.</p> <p>Mathematically proficient students:</p> <ul style="list-style-type: none"> • Communicate precisely to others. • Use clear definitions in discussion with others and in their own reasoning. • State the meaning of symbols they choose, including using the equal sign consistently and appropriately. • Are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. • Calculate accurately and efficiently, and express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other.

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Common Core State Standards	<p>5.NF.1 Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.</p> <p>5.NF.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.</p> <p>5.NF.3 Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem.</p> <p>5.NF.4a Interpret the product $(a/b) \times q$ as a parts of a partition of q into b parts; equivalently, as the result of a sequence of operations $a \times q \div b$.</p> <p>5.NF.4b Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.</p> <p>5.NF.6 Solve real world problems involving multiplication of fractions and mixed numbers, e.g. by using visual fraction models or equations to represent the problem.</p> <p>5.NF.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.</p> <p>5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.</p>
CCSS ELA Literacy Standards	<p>W.5.1 Write opinion pieces on topics or texts supporting a point of view with reasons and information.</p>
SBAC Assessment Claims	<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>
PARCC Assessment Claims	<p>Sub-Claim D: Highlighted Practice M.P.4 with Connections to Content (modeling/application)-The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice.</p>
Depth of Knowledge	<p>Level 4: Extended Strategic Thinking- Curricular elements assigned to the level demand extended use of higher order thinking processes such as synthesis, reflection, assessment and adjustment of plans over time. Students are engaged in conducting investigations to solve real-world problems with unpredictable outcomes. Employing and sustaining strategic thinking processes over a longer period of time to solve the problem is a key feature of curricular objectives that are assigned to this level. Key strategic thinking processes that denote this particular level include: synthesize, reflect, conduct, and manage.</p>

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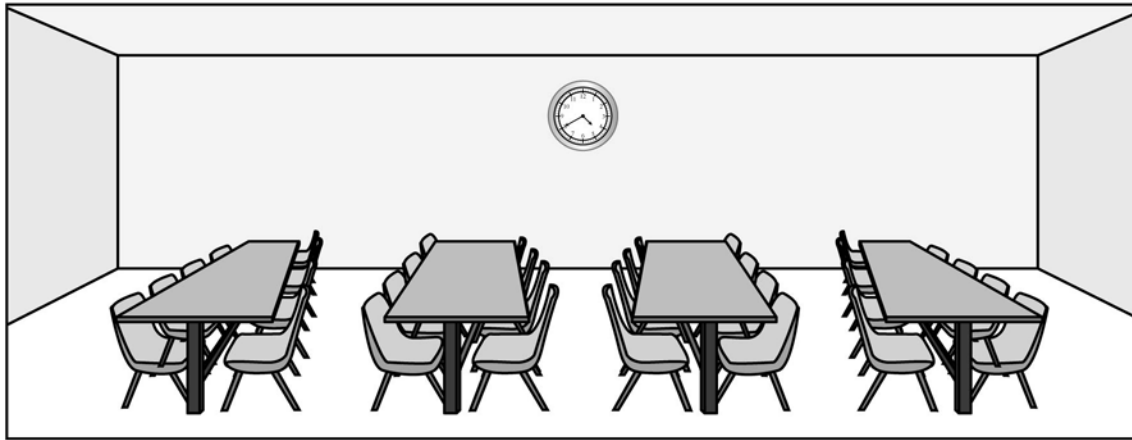
Task Overview	<p>In this task you will be asked to construct a plan to paint a mural on the wall of the cafeteria showing healthy eating; determine the length, width and area of the sections of the mural as well as the entire mural; and find the fractional amounts of each section that will be attributed to specific topics of healthy eating. With a given budget, you will create a purchase plan for the colors and amounts of paint needed for the mural. You will also create a time schedule for the mural artists based on the number of hours needed to complete the mural, construct a quadrant grid to determine ordered pairs to show specific locations on the mural, and finally, write a detailed plan to present to the administration for approval.</p>
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Student Task

You and your fifth-grade classmates want to paint a mural on the main wall of the school cafeteria to encourage healthy eating. It is decided that the mural should have three equal-sized sections, each used to show healthy eating habits. One section will display healthy food groups, the next will feature the plate picture from the "Choose My Plate" website (a government-based nutrition program), and the third will show less-healthy foods that should be eaten in limited amounts. In order to complete the mural, you need to make a plan that describes the measurements of the mural sections, how much paint will be needed, and how long it will take to draw and paint the mural. Once you have decided on a plan, you will need to present your plan to the administration in order to get approval.

Part A: Mural Sections

The main wall in the cafeteria has an area of 250 square feet. The actual height of the wall is 10 feet, but because of a clock you will only paint up to 7 feet. The length of the mural should take up as much of the wall as possible, but some wall space can be left on the sides of the mural.



1. Find the side lengths for your mural and for each of the three sections. Explain how you found your measurements.
2. Use the graph below to sketch the mural with its three sections. Make sure you label the length and width of the mural and the measurements of each section. Each square is 1 square foot.

One of the three sections of the mural is used to identify and show examples of each of the five food groups. There should be five equal-sized regions in this section to show the name and some examples of the following groups:

- Fruits
- Vegetables
- Dairy
- Grains
- Protein

3. Find the side lengths and area of each of the five regions. Explain how you decided on the measurements for each of the five regions.
4. Use the graph paper below to sketch the first mural section and show how it can be divided to show each of the five food groups. Label the side lengths and area of each of the five regions.
5. Find the fraction of the total mural for each of the five food group regions. Show your work.

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Another section of the mural features an image of the government-issued food plate that can be found at ChooseMyPlate.gov.

Go to the website ChooseMyPlate.gov to research healthy eating tips. Find the diagram that is used to show the guidelines for healthy eating. Sketch and label the diagram below.

This diagram is painted on the second section of the mural. The diagram shows two circles, one for the plate and another for the cup. The circles should take up as much of the space in that section as possible.

6. Outline a rectangle to show the size of the mural section for the plate and cup.

7. The guidelines state that the fruits and vegetables should total $\frac{1}{2}$ of the plate, while grains and

proteins should total $\frac{1}{2}$ of the plate. Find some combinations of these four food groups that can make up the plate. Use different fractions for each of the four groups.

For an average fifth grader, the daily recommendations for each food group are shown below. The recommended daily servings are the total based on a fifth grader eating three meals in a day.

Food Group	Recommended Daily Servings
Fruits	2 cups
Vegetables	3 cups
Grains	8 ounces
Proteins	6 ounces
Dairy	3 cups

8. What are the recommended amounts for each food group, in ounces, that a fifth grader should eat in ONE meal?

9. Are these amounts the same as the guideline amounts shown on the plate? Explain your answer.

10. Use the fraction circle to show the fractional amounts for one meal for a fifth grader. Make sure to represent each of the five food groups shown on the plate and cup. Show your work in the response area below the circle.

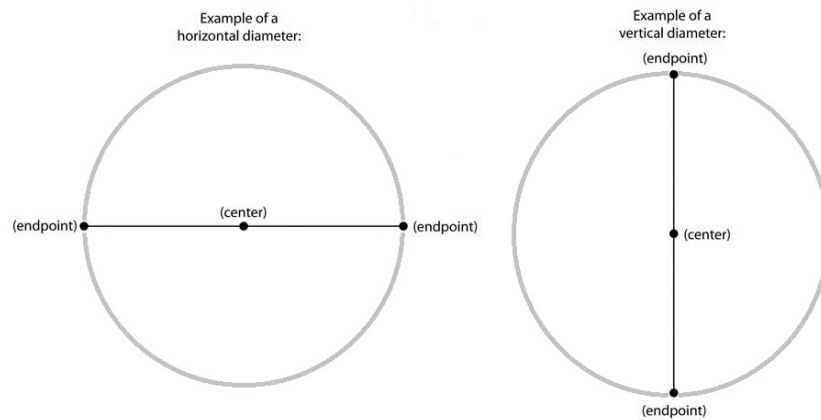
Part A (optional): Group Activity

Work with a partner for this part of the task. Work on questions a, b, c, and d on your own. Once you have completed these questions, exchange papers with your partner and answer questions about their work.

a. Draw the outline of the mural section for the plate on the graph below.

You need to draw both circles that represent the plate and the cup in the section, making sure both circles stay within the section. Before you draw the circles, you need to measure a line segment, called the diameter, which helps you draw a circle. You need to draw a horizontal diameter and a vertical diameter that intersect in the center of the circle. A diameter goes from one point on the circle through the center to another point on the circle. These points are called endpoints. The measures from each endpoint to the center are equal. Examples of two diameters are shown on the next page.

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b. Determine the lengths of the diameters for both of the circles. Use the graph paper in question 3a to help determine the lengths. Answer the questions below about your circles.

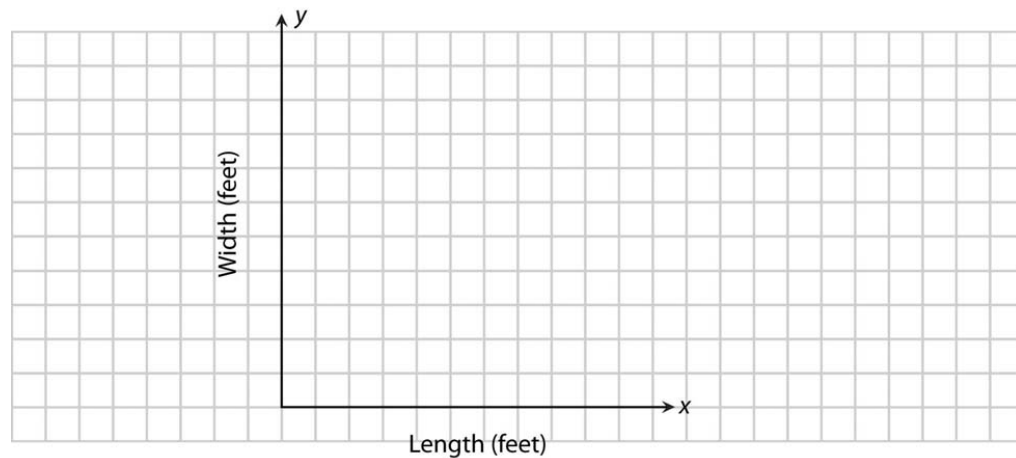
What is the length of the horizontal diameter for the circle that represents the plate? What is the length of the vertical diameter for this circle?

What is the length of the horizontal diameter for the circle that represents the cup? What is the length of the vertical diameter for this circle?

c. Fill in the table with the points (x, y) that you used to draw each circle.

	Food Plate Circle	Dairy Cup Circle
Horizontal Diameter Endpoints		
Vertical Diameter Endpoints		
Center		

d. Draw the two circles in the graph paper in question a. Make sure your endpoints and diameters are clearly drawn for both circles. Use the graph below to sketch the two circles for practice, if needed.



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e. Exchange papers with your partner. Check your partner's work and graph. Answer the questions below.

- Are both of the circles within the outline of the section of the mural? Explain.
- Are the diameters and the endpoints clearly marked on the circles? Explain.
- Are the horizontal and vertical diameters equal in the plate circle? Are they equal in the cup circle? Explain.
- Do the circles cover as much of the section as they can? Explain.
- Is there anything you would change to make the circles look more like the food plate and dairy cup shown in the diagram? Explain.

f. Give your partner his or her paper back. Read over the answers made by your partner in part e. You may need to go back to your circles in part a and make some changes. Discuss any questions that you have with your partner. Write down any changes you made and why in the response box below.

The third section shows foods, such as sugars, salt, and fat, that need to be limited in the daily food intake. The three foods and suggested daily amounts are to be displayed in triangle shapes. The triangles should cover the entire section. The three triangle shapes can be any combination of types of triangles based on the side lengths.

11. Use the grid to sketch a design showing the three triangles.

12. Find the base, height, and area for each of the three triangles. Show your work.

13. What fraction of the whole mural does each of the triangles in this third section take up? Show your work.

Part B: Art Supplies

You and your classmates will use seven different colors to paint the mural: blue, red, yellow, black, orange, green, and white. You will need at least 1 quart of paint of each color. A local hardware store has donated a \$60 gift card for you to use to buy the paint. The store sells paint by the pint for \$6 and by the quart for \$10. The donated gift card of \$60 is the budget. In addition, the art teacher has donated paint that you can use.

The existing paint colors and their amounts are shown below:

$\frac{3}{8}$ quart of blue	$\frac{1}{4}$ quart of yellow	$\frac{5}{8}$ quart of white
$\frac{3}{4}$ quart of red	$\frac{1}{2}$ quart of black	

14. How much additional paint is needed in order to have at least 1 quart of paint of each color? Show your work.

15. What is the total cost of the paint? Is this amount within the amount of the gift card? Show your work.

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Part C: Painting the Mural

The art teacher who is overseeing the project estimates that it will take about 150 hours to complete the mural. This is based on the number of students working multiplied by the number of hours that each student works. Some of the students can come in after school and some can work during activity time during the school day. There are two 30-minute activity times in the afternoon, A and B.

The student schedule is as follows:

- 5 students work after school (90 minutes, twice a week)
- 3 students work during activity time A (30 minutes, 5 times a week)
- 4 students work during activity time B (30 minutes, 5 times a week)

16. How many weeks are needed for the students to complete the mural? Show your work.

17. Find two ways the schedule can be changed if the mural needs to be finished one week earlier than it would be with the current schedule. Show your work.

Part D: Writing Component

18. Write a detailed plan to present to the administration for approval to construct the mural. Make sure to explain 1) the purpose of and a description of the mural, 2) how the paint will be bought, 3) how many students are involved in painting the mural and when they will be working on it, 4) the estimated time that is needed to create and paint the mural, and 5) two other important pieces of information that should be included to get approval from the administration.

Teacher Instructions

This performance task is designed to assess student understanding of a variety of standards and claims. Students are challenged to use and apply knowledge of area, fractional parts, and measurement units for the real-world task of designing, costing, and scheduling the painting of a wall mural in the school cafeteria. In addition, students are challenged to write a persuasive essay to receive administrative approval to create the mural. This task was designed with the understanding that all classrooms and students are different. Some students may need an extension activity, some may need to reduce the number of days planned for this task, and some may need to omit or simplify certain parts depending on what time during the school year this task is given.

Test Definition File

Item	Correct Answer	Practice Standard	Common Core Standards
1	See Scoring Rubric	Mathematical Practice 1, 4, and 6	5 NF.1, 5 NF.2, 5 NF.3, 5 NF.4a, 5 NF.4b, 4 NF.7, 5 G.2
			CCSS ELA-Literacy Standards
			ELA. W. 5.1

SBAC Claims	PARCC Sub-Claims
4	D

Before the task,

- Use a set of area manipulatives to explore how unit squares relate to the application of area formulas (e.g., counting squares inside a rectangular shape, transitioning to finding the area by multiplying length and width).
- Students should review finding unknown side lengths when the area is given.
- Students should review computation skills involving adding and subtracting unlike fractions, as well as multiplying fractions.
- Students should review computation and conversion skills involving time and measurements (pints in a quart, ounces in a cup).
- Students should review showing fractions with different denominators on a fractional circle.
- Students should review construction of triangles based on the side lengths, and how to find the area of a triangle.
- Students should review plotting and labeling coordinate pairs.

Vocabulary:

Mural

Area

Dimensions (base, height, length, width)

Budget

Measurement units (pint, quart, cup, ounce)

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Setting the Context:

Teacher: “Have you ever seen a wall mural? Murals are often used to convey information or a theme. Some wall murals are created in an outside area, and some on a wall inside a large room.” [Let students respond and share information such as the type and location of murals that the students have seen.]

Give an introduction to the task. A suggested introduction is below. Some of the information may need to be repeated each day.

Teacher: “Schools sometimes allow students to create murals that express a theme that is of particular interest to the students or the community. You will be working to help create a plan for the creation of a wall mural in a school cafeteria, showing information about healthy eating. You will decide on the dimensions of the total mural, as well as several individual sections and their contents. You will be making estimates for paint for the mural and also the time needed to complete the mural. In order to seek permission to create the mural, you will write a proposal to the school administration with information on the mural’s costs and benefits.”

Timeline:

There are two different options from which to choose.

Option 1: This option takes 3 days (or 3 hours, with the assumption that math lessons and activities take up an hour during a school day).

Day 1: The students complete part A, questions 1 through 11*.

Day 2: The students complete part A, questions 12 through 14**, and parts B and C.

Day 3: The students complete part D, the writing component.

* Some students may need additional time to complete the portion of the task in part A, which requires the use of the internet to research the ChooseMyPlate website.

** The group activity in part A should be omitted.

Option 2: This option takes 4 days (or 4 hours, with the assumption that math lessons and activities take up an hour during a school day).

Day 1: The students complete part A, questions 1 through 11*.

Day 2: The students complete part A, questions 12 through 14, including the group activity.

Day 3: The students complete parts B and C.

Day 4: The students complete part D, the writing component.

* Some students may need additional time to complete the portion of the task in part A, which requires the use of the internet to research the ChooseMyPlate website.

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Other Suggestions:

Some students may require more support in answering the questions. Support worksheets are provided within this task to assist in breaking down the question that is being asked in a more organized manner. Consider reviewing some of the worksheets with the whole class, as a model for how to organize information in a multistep problem. Then students may be able to create their own organizational systems or re-create the table model themselves.

In part A of this task, there is a research component. The students are directed to go to ChooseMyPlate.gov to research healthy eating. They should also find the food plate that is used as a guideline for healthy eating. If time or resources do not permit this, the food plate is given after the student task. You can make copies or display the plate for the class.

It may be useful for students to have extra copies of the graph paper given in question 2 so that they may continue drawing scale models of the mural as they go through the task. Extra graph paper is provided at the end of the student task.

Students are intentionally given real world numbers to use in this task. In some instances, they may need guidance in rounding or estimating to make friendlier numbers (such as in part A, question 10, where students need to use the fraction circle to show the food group amounts).

In part A of this task, there is an optional collaborative activity. The students should be divided into pairs (partners). They should be given about 30-45 minutes to answer the questions on their own first, then exchange papers so that their partner can check their work. After they have had a chance to check each other's work, they should give the papers back and discuss any issues that were found. If needed, the students should correct any mistakes.

The collaborative (group) activity may contain material that the student is not familiar with in grade 5. The activity should contain enough instruction that the students can discover parts of a circle (diameter, center, and endpoints) and understand their meaning. The students may need more help in these concepts before they are able to graph them in quadrant I. Walking around the classroom during the activity and helping with this instruction is beneficial to the learning and discovery process of these concepts.

There is a writing component at the end of the task. Included with this task are an optional graphic organizer and a sentence starter to help scaffold the writing.

Extension Activity

In this section you need to work with two other students. Each student designs and draws a scale model of one of the sections of the mural. Design the section based on the suggestions and measurements found in the task. When completed, all three sections can be combined to show what the completed mural looks like. This can be presented with the writing plan to the administration when you are seeking approval for the mural.

Scoring Rubric

Part A

4 Point Response:

The response demonstrates a high level of understanding. The response demonstrates:

- A strong ability to make sense of a design problem and develop a solution that meets given requirements;
- A strong ability to identify important quantities in everyday life and interpret their mathematical results in the context;
- A strong ability to assess the reasonableness of answers;
- A strong ability to check work and communicate reasoning in a clear, precise way;
- A strong ability to use area, measurement, and number and operations concepts to solve real-world problems.

A level 4 response should include:

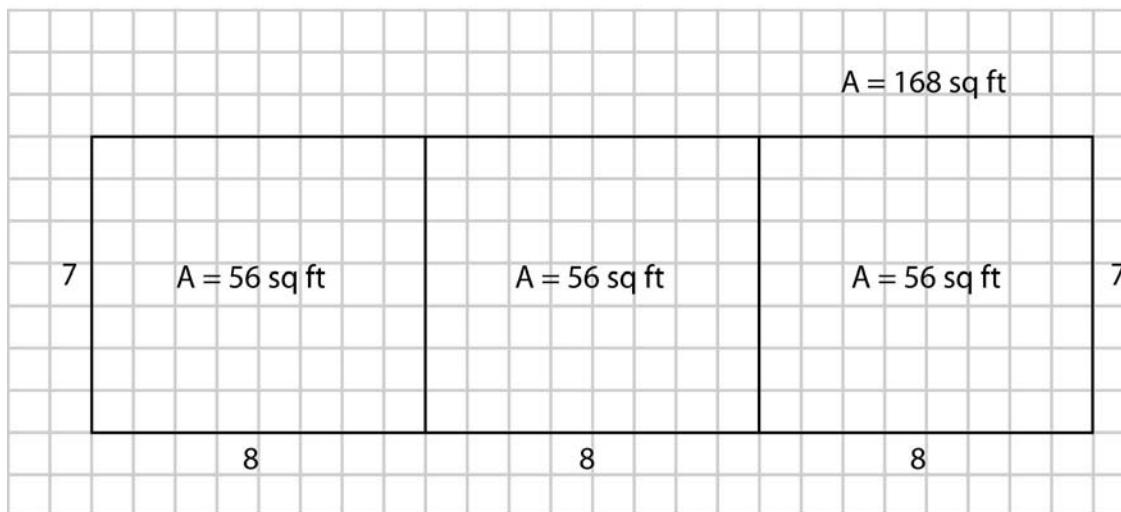
- A model of the entire mural and each of its sections correctly drawn to scale and labeled in questions 2, 4, 6, and 11;
- A clear and correct explanation or work shown to find the length, width, and area for the entire mural and each of its sections in questions 1, 3, and 12;
- A clear and correct explanation or work shown to find the correct fractional amounts in questions 5, 7, and 13;
- A correct fractional model shown in question 10;
- The correct conversion amounts given in question 11;
- A clear and correct explanation of the comparison between the amounts a fifth grader should eat in one meal and the guideline amounts shown on the food plate at ChooseMyPlate.gov in question 12.

Sample Response for Part A

Question 1:

I found the length and width of my mural by following these steps. I divided $250 \div 10 = 25$ to get the wall length of 25 feet. I decided on a total mural length of 24 feet and a width of 7 feet, so the whole area is 168 sq. ft. For each section, I divided $24 \div 3$ to get a section length of 8. Each section is 8 feet by 7 feet, so $8 \times 7 = 56$ square feet for each section.

Question 2:

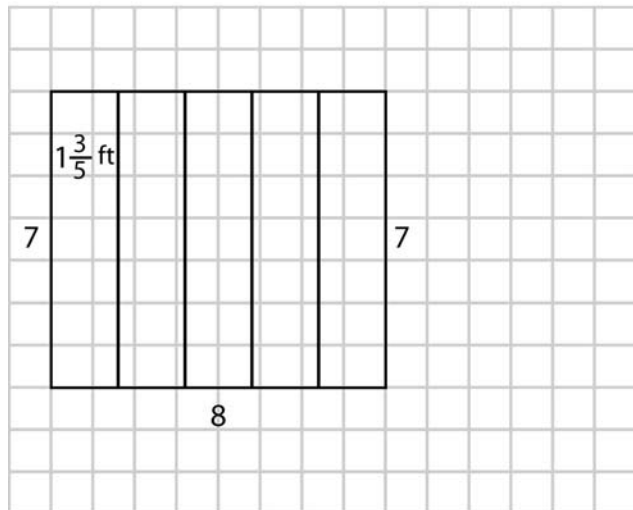


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Question 3:

The side lengths of each section are $1\frac{3}{5}$ ft and 7 ft. I divided the length of 8 feet by 5 to find that I could separate the length into 5 equal sections that each measure $1\frac{3}{5}$ feet. Each section has a height of 7 feet. The area is $1\frac{3}{5}$ times 7, which equals $11\frac{1}{5}$ square feet.

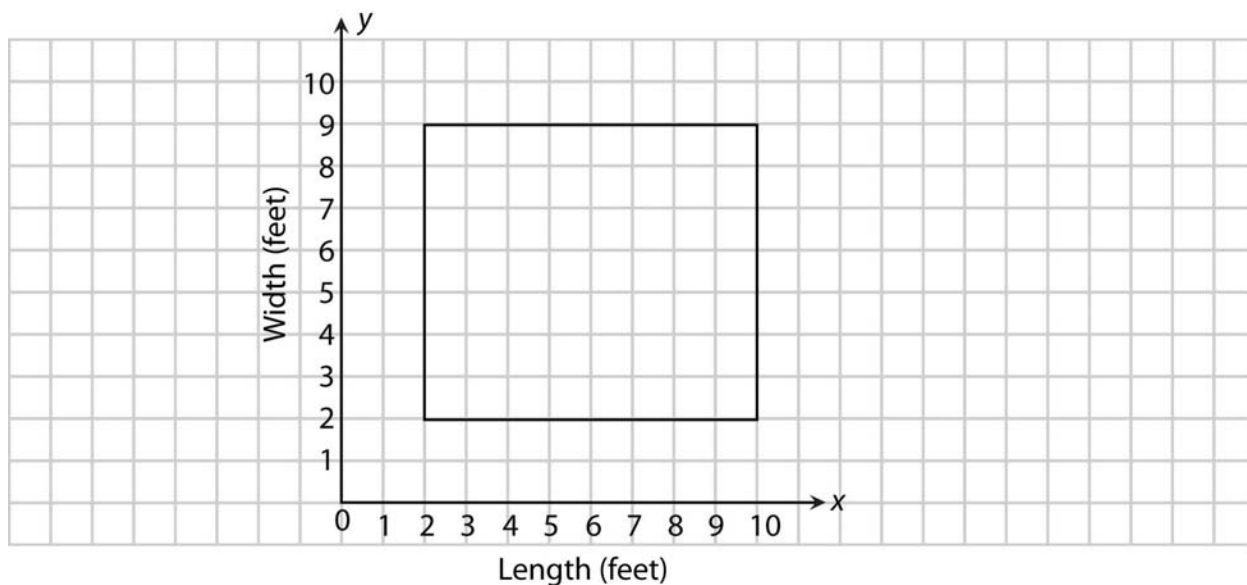
Question 4:



Question 5:

There are two ways to find the fraction of the total mural for each of the 5 food group sections. Since they are all equal to $\frac{1}{5}$ of the first section and the first section is $\frac{1}{3}$ of the entire mural, you can multiply $\frac{1}{5}$ times $\frac{1}{3}$ to get the fraction $\frac{1}{15}$. So each of the 5 food group sections is $\frac{1}{15}$ of the entire mural. You can also use the area to find the fraction. Since each food group section has an area of $11\frac{1}{5}$ or $\frac{56}{5}$, you can divide this area by the area of the entire mural, which is 168. So $\frac{56}{5}$ times $\frac{1}{168}$ (the reciprocal of the denominator) is simplified to $\frac{1}{15}$. This again proves that each food group section is $\frac{1}{15}$ of the entire mural.

Question 6:



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Question 7:

Possible fractions for fruits and vegetables are $\frac{1}{6} + \frac{2}{6}$, and for grains and proteins are $\frac{2}{10} + \frac{3}{10}$.

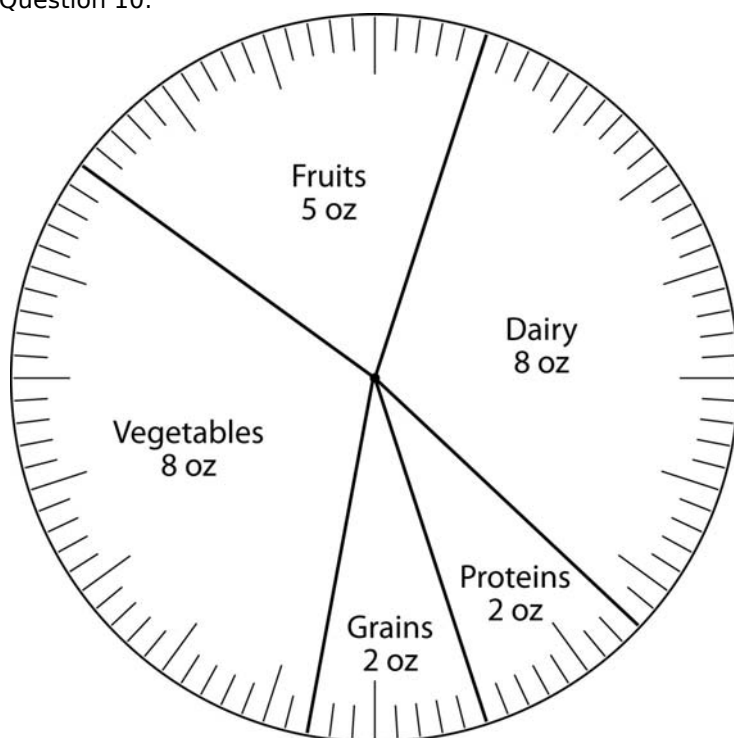
Question 8:

Possible serving amounts for one meal include fruit (5-6 oz), vegetables (8 oz), grains (2-3 oz), protein (2 oz), and dairy (8 oz).

Question 9:

No, the suggested serving for a fifth grader and the guidelines on the plate are not the same. The fruits and vegetables equal a total of about 13 oz and the grains and protein equal a total of about 4 oz. If you add the dairy amount to these, then the total measurement for all 5 food groups is about 25 oz. The total of fruits and vegetables is about half of all the groups as shown on the plate. But the total amount of grains and proteins is only about a fourth of the amount instead of half like the plate shows. If you add in the 8 oz of milk with the grains and proteins, then you have the other half of the plate. The image on the food plate can be used as the size of the food group, and since grains can be bread and protein can be steak, each of those take up about half the plate if placed next to each other.

Question 10:



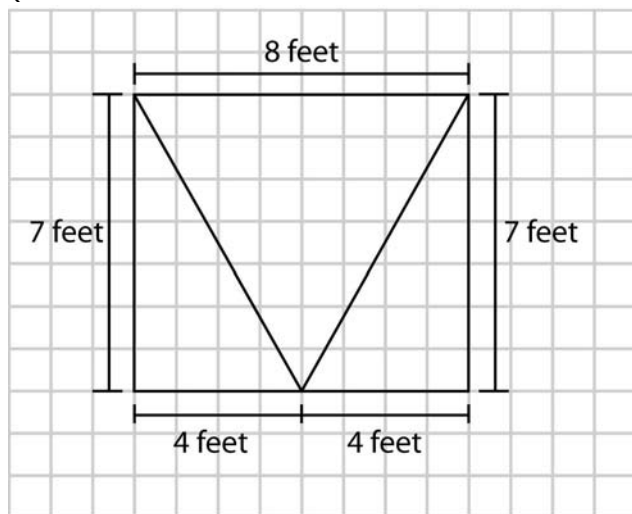
To find the amount to model on the fraction circle, I added all the suggested serving sizes for all food groups for one meal together to get 25 ounces. I then made each of the food group amounts a fraction by placing the serving size over the total. Since the fraction circle was divided by 100, I wanted my denominator to equal 100. I multiplied the denominator and number by 4. I used the numerator to count the number of marks to find the size of the section to model for each food group.

$$\text{Fruit: } \frac{5}{25} \cdot \frac{4}{4} = \frac{20}{100} \quad \text{Vegetables: } \frac{8}{25} \cdot \frac{4}{4} = \frac{32}{100} \quad \text{Grains: } \frac{2}{25} \cdot \frac{4}{4} = \frac{8}{100}$$

$$\text{Proteins: } \frac{2}{25} \cdot \frac{4}{4} = \frac{8}{100} \quad \text{Dairy: } \frac{8}{25} \cdot \frac{4}{4} = \frac{32}{100}$$

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Question 11:



Question 12:

I found that both of the right triangles have a base of 4 feet and a height of 7 feet. The triangle in the middle has a base of 8 feet and a height of 7 feet. The area of the two right triangles is 14 square feet. I found this by solving $\frac{1}{2}(4 \times 7) = 14$. The area for the triangle in the middle is 28 square feet. I found this area by solving $\frac{1}{2}(8 \times 7) = 28$.

Question 13:

Since the larger middle triangle has an area that is double that of the 2 right triangles, I know that I could divide that triangle to make 2 right triangles that would equal the other right triangles. This means that the rectangle is split into 4 equal triangles. So the 2 right triangles are $\frac{1}{4}$ of this section, and the middle triangle is $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$ of this section. Because this section is $\frac{1}{3}$ of the entire mural, I can multiply the two fractions together to get the answer. The two right triangles are $\frac{1}{12}$ of the entire mural. The middle triangle is $\frac{1}{6}$ of the entire mural.

3 Point Response:

The response demonstrates a strong understanding and ability to make sense of the problem, but the work or explanation is incomplete or contains minor errors.

A level 3 response is characterized by:

- A strong ability to develop a model drawn to scale, an explanation, or work shown to find the side lengths and area, but a minor calculation error is made or the work shown is incomplete;
- A strong ability to develop equations that show how to find fractional amounts, but a minor calculation error is made or the work shown is incomplete;
- A strong understanding of measurement conversions, shown by correctly finding the amounts, correctly displaying the amounts on a fractional model, and correctly comparing the amounts as stated in the questions.

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2 Point Response:

The response demonstrates a basic but incomplete understanding.

A level 2 response is characterized by:

- The ability to develop a model drawn to scale, an explanation, or work shown to find the area, but two or more minor calculation errors are made or one major error is made;
- An ability to develop equations that show how to find fractional amounts, but two or more minor calculation errors are made or one major error is made;
- A basic understanding of measurement conversions, shown by finding the amounts, displaying the amounts on a fractional model, and comparing the amounts as stated in the questions, but one or two minor errors are made so that the model and the comparisons are incorrect.

1 Point Response:

The response demonstrates minimal understanding.

A level 1 response is characterized by:

- A weak ability to develop a model drawn to scale, an explanation or work shown to find the side lengths and area, but two or more major errors are made;
- A weak ability to develop equations that show how to find fractional amounts, and two or more errors are made;
- A weak understanding of measurement conversions, shown by finding the amounts, displaying the amounts on a fractional model, and comparing the amounts as stated in the questions, but one or two major calculation errors are made so that the model and the comparisons are incorrect, incomplete, or missing.

0 Point Response:

There is no response, or the response is off topic.

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Part B

4 Point Response:

The response demonstrates a high level of understanding. The response demonstrates:

- A strong ability to use fractional amounts, measurement, and number and operations concepts to solve real-world problems.

A level 4 response should include:

- The correct fractional amount of a quart needed for each of the five colors;
- The correct total cost of the paint needed for the mural;
- A clear and concise explanation or work shown to find the amount of paint needed and the total cost of paint.

Sample Response for Part B

Question 14:

The amount of existing paint and needed paint:

Blue: I have $\frac{3}{8}$ quart so I need another $\frac{5}{8}$ quart. Since this amount is greater than $\frac{1}{2}$ I need to buy 1 quart of paint at a cost of \$10.

Red: I have $\frac{3}{4}$ quart so I need another $\frac{1}{4}$ quart. Since this amount is less than $\frac{1}{2}$ I need to buy only 1 pint of paint at a cost of \$6.

Yellow: I have $\frac{1}{4}$ quart so I need another $\frac{3}{4}$ quart. Since this amount is greater than $\frac{1}{2}$ I need to buy 1 quart of paint at a cost of \$10.

Black: I have $\frac{1}{2}$ quart so I need another $\frac{1}{2}$ quart. Since this amount is equal to $\frac{1}{2}$ I need to buy only 1 pint of paint at a cost of \$6.

White: I have $\frac{5}{8}$ quart so I need another $\frac{3}{8}$ quart. Since this amount is less than $\frac{1}{2}$ I need to buy only 1 pint of paint at a cost of \$6.

Orange: I don't have any of this paint, so I need 1 quart of paint at a cost of \$10.

Green: I don't have any of this paint, so I need 1 quart of paint at a cost of \$10.

Question 15:

Total cost: \$58, which is \$2 under the budget of \$60.

An explanation similar to "I subtracted the existing fraction from 1 to find the fraction needed. For the fraction amounts that were $\frac{1}{2}$ or less, I need 1 pint. For the fraction amounts that were greater than $\frac{1}{2}$, I need 1 quart. I calculated the total of 4 quarts \times \$10 = \$40 and 3 pints \times \$6 = \$18, and added \$40 + \$18 = \$58. Then I subtracted \$60 - \$58 = \$2 remaining."

3 Point Response:

The response demonstrates a strong understanding but the work is incomplete or contains minor errors.

A level 3 response is characterized by:

- A strong understanding of number and operations, demonstrated by developing a solution strategy in calculating the amount of paint needed for all seven colors, but a minor calculation error is made or the work shown is incomplete;
- A strong ability to use conversions to find measurement amounts, but a minor error is made;
- A strong understanding of number and operations, demonstrated by developing a solution strategy in calculating the total cost of the needed paint, but a minor calculation error is made or the work shown is incomplete.

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2 Point Response:

The response demonstrates a basic but incomplete understanding.

A level 2 response is characterized by:

- A basic understanding of number and operations, demonstrated by developing a solution strategy in calculating the amount of paint needed for all seven colors, but two minor calculation errors are made or one major error is made;
- A basic ability to use conversions to find measurement amounts, but two minor errors are made;
- A basic understanding of number and operations, demonstrated by developing a solution strategy in calculating the total cost of the needed paint, but two minor calculation errors are made or one major error is made.

1 Point Response:

The response demonstrates minimal understanding.

A level 1 response is characterized by:

- A weak understanding of number and operations, demonstrated by developing a solution strategy in calculating the amount of paint needed for all seven colors, but two or more major errors are made;
- A weak ability to use conversions to find measurement amounts, but a major error is made;
- A weak understanding of number and operations, demonstrated by developing a solution strategy in calculating the total cost of the needed paint, but two or more major errors are made.

0 Point Response:

There is no response, or the response is off topic.

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Part C

4 Point Response:

The response demonstrates a high level of understanding. The response demonstrates:

- A strong ability to use time and numbers and operations to solve real-world problems;
- A strong ability to adjust the solution to a problem when one of the constraints changes;
- A strong ability to communicate reasoning in a clear and concise way.

A level 4 response includes:

- The correct number of minutes, hours, and weeks needed to complete the mural with the given schedule;
- A correct and complete explanation or work shown to find the total number of weeks needed to complete the mural with the given schedule;
- A correct and complete explanation or work shown to adjust the schedule so that the mural is finished a week earlier.

Sample Response for Part C

16. It takes about 150 hours to complete the mural. Because the schedule is broken down by minutes, I found how many minutes are in 150 hours: $150 \times 60 = 9,000$ minutes. Then, I figured out the total number of minutes that each group works on the mural. The first group of 5 students work for 90 minutes twice a week: $5 \times 90 \times 2 = 900$ min/week. The second group of 3 students work for 30 minutes every school day during activity time A: $3 \times 30 \times 5 = 450$ min/week. The third group of 4 students work for 30 minutes every school day during activity time B: $4 \times 30 \times 5 = 600$ min/week. I added the total number of minutes for each group of students to find the total number of minutes that the students can work on the mural: $900 + 450 + 600 = 1,950$ min/week. I divided 9,000 by 1,950 to find how many weeks it takes for the 12 students to finish the mural. This gives the quotient of 4 weeks and 1,200 minutes, which is almost 5 weeks. If the students working after school paint for only 1 day instead of 2 days, that is 450 minutes. The students working during activity times could work on Monday, Tuesday, and Wednesday, which is 630 minutes. This leaves 120 minutes that still are needed to finish the mural, so the 4 students that work during activity time B could paint on Thursday and that then totals the 1,200 minutes. So, it takes 4 weeks and 4 days. You can also say that it takes 5 weeks to account for any student that is absent or misses painting during his scheduled time.

17. If I use 5 weeks as the total number of weeks that it takes to paint the mural, then I find the difference in minutes between 5 weeks and 4 weeks that the students are working. There was a remainder of 1,200 minutes when I divided 9,000 by 1,950, and that tells me how many extra minutes for which I need to find more students to work or add more days or periods to the schedule. If I add 5 more students to the 2 days for 90 minutes after school schedule, that is an extra 900 minutes. Now I have 300 minutes left and I can get 1 more student to work during activity time A and 1 more student to work during activity time B every school day. So, adding 7 more fifth grade students to the schedule covers the 1,200 minutes and allows the mural to be finished in exactly 4 weeks instead of 5 weeks.

3 Point Response:

The response demonstrates a strong understanding, but the work is incomplete or contains minor errors.

A level 3 response is characterized by:

- A strong understanding of time conversion and numbers and operations concepts, demonstrated by developing a solution strategy in calculating the total number of minutes, hours, and weeks it takes to paint the mural, but a minor calculation error is made or the work is incomplete;
- A strong understanding of how to adjust the solution to find a new schedule so that the mural is finished a week early, but a minor calculation error is made or the work is incomplete.

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2 Point Response:

The response demonstrates a basic but incomplete understanding.

A level 2 response is characterized by:

- A basic understanding of time conversion and numbers and operations concepts, demonstrated by developing a solution strategy in calculating the total number of minutes, hours, and weeks it takes to paint the mural, but two or more minor calculation errors are made or one major error is made;
- A basic understanding of how to adjust the solution to find a new schedule so that the mural is finished a week early, but two or more minor calculation errors are made or one major error is made.

1 Point Response:

The response demonstrates minimal understanding:

A level 1 response is characterized by:

- A weak understanding of time conversion and numbers and operations concepts, demonstrated by developing a solution strategy in calculating the total number of minutes, hours, and weeks it takes to paint the mural, but two or more major errors are made;
- A weak understanding of how to adjust the solution to find a new schedule so that the mural is finished a week early, but two or more major errors are made.

0 Point Response:

There is no response, or the response is off topic.

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Part D

4 Point Response:

The response demonstrates a high level of understanding. The response demonstrates:

- A strong ability to make sense of a design problem and develop a solution that meets the given requirements;
- A strong ability to use area, measurement, and number and operations concepts to solve real-world problems;
- A strong ability to convey and support ideas and information clearly in a written plan.

A level 4 response shows a complete, well-organized plan which includes:

- A clear explanation of the purpose and description of the mural. The plan includes the amount of paint that is needed and how the paint that is needed will be bought, the number of students who are involved in painting the mural and when they will be working on it, and the estimated time that is needed to create and paint the mural. The plan also includes two other important pieces of information to get approval from the administration;
- The reasoning behind the choices made by the student including correct calculations. The choices are strongly supported with at least 6 sentences that clearly demonstrate a strong understanding of the thought process involved in making these decisions.

3 Point Response:

The response demonstrates a strong understanding, but the work is incomplete or contains minor errors.

A level 3 response is characterized by:

- A plan that demonstrates a strong understanding of the purpose and description of the mural. The plan includes the amount of paint that is needed and how the paint that is needed will be bought, the number of students that are involved in painting the mural and when they will be working on it, and the estimated time needed to create and paint the mural. The plan may contain one or two minor errors or may be incomplete;
- A plan that contains the reasoning behind the choices made by the student, but one or two minor errors are made in the calculations given. The choices are strongly supported with at least five or six sentences that demonstrate a strong understanding of the thought process involved in making these decisions, but one or two ideas are incomplete or incorrect due to minor errors made in the calculations.

2 Point Response:

The response demonstrates a basic but incomplete understanding.

A level 2 response is characterized by:

- A plan that demonstrates a basic understanding of the purpose and description of the mural. The plan includes the amount of paint that is needed and how the paint will be bought, the number of students that are involved in painting the mural and when they will be working on it, and the estimated time needed to create and paint the mural. The plan may contain two or more minor errors or one major error, or may be incomplete;
- A plan that contains the reasoning behind the choices made by the student, but more than two minor errors are made or one major error is made in the calculations given. The choices are supported with at least four or five sentences that demonstrate a basic understanding of the thought process involved in making these decisions, but two or more ideas are incomplete or incorrect due to the errors made in the calculations.

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1 Point Response:

The response demonstrates minimal understanding.

A level 1 response is characterized by:

- A plan that demonstrates minimal understanding of the purpose and description of the mural. The plan includes the amount of paint that is needed and how the paint that is needed will be bought, the number of students that are involved in painting the mural and when they will be working on it, and the estimated time needed to create and paint the mural. The plan may contain two major errors or may be incomplete;
- A plan that contains the reasoning behind the choices made by the student, but two major errors are made in the calculations given. The choices are supported with at least three or four sentences that demonstrate a minimal understanding of the thought process involved in making these decisions, but two or more ideas are incomplete or incorrect due to the errors made in the calculations.

0 Point Response:

There is no response, or the response is off topic.