

SITES-M Mathematics Challenge

The School Garden



Level: Kindergarten

Standard: Number and Operations

Learning Target: Focus on Comparing and Ordering

Grade Level Expectations

GLE 0006.2.3 Recognize, compare and order sets of numerals by using both cardinal and ordinal meanings.

Checks for Understanding

0006.2.8 Compare sets of ten or fewer objects and identify which are equal to, more than, or less than others.
0006.2.9 Order the numbers through 25 using numerals and words.
0006.4.7 Make direct comparisons between objects (and recognize which is shorter, taller).

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The purpose of the Mathematics Challenges is to provide opportunities for students to develop and demonstrate understanding of important mathematical concepts and standards. Each Challenge includes a set of tasks that require higher-order thinking skills. Because these types of tasks may be new for students and they will have varying levels of understanding, the student responses will vary. The Challenges and guiding questions were designed to help teachers plan their implementation and elicit, analyze, and act on evidence of student understanding.

You will be able to choose which Mathematics Challenge Packet to implement each month, according to the learning needs of your students and your teaching context. Each packet contains all the materials necessary to implement the Mathematics Challenge including a grade-appropriate Challenge, the Mathematics Challenge Meeting Protocol, and the Guiding Questions for Analyzing Student Responses to Mathematics Challenges.

For each Challenge, you will complete a six step process of planning, implementation, and analysis and reflection.

The Mathematics Challenge Process

Stage	Step	Task
Planning	Step 1.	Review the Mathematics Challenge Meeting Protocol
	Step 2.	Review and solve the Mathematics Challenge prior to your Professional Learning Community (PLC) meeting. Think about your responses to the guiding questions on the Meeting Protocol
	Step 3.	Hold your PLC meeting and discuss your responses to the Guiding Questions on the Meeting Protocol
Implementation	Step 4.	Implement the Mathematics Challenge with your class
Analysis and Reflection	Step 5.	For your own planning and documentation, respond to the Guiding Questions on the Analyzing Student Responses Protocol
	Step 6.	To help us improve the Challenges and to provide recommendations for teachers implementing them in future years, complete the Mathematics Challenge Feedback Log and provide copies of all student work to the Assessment Coordinator

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Mathematics Challenge Meeting Protocol

Each month, your Professional Learning Community will meet to discuss the implementation of one Mathematics Challenge. In preparation for your monthly meeting, please print and review this month's Mathematics Challenge, solve all tasks within the Challenge, and think about the guiding questions below. These questions will be used to facilitate a group discussion regarding the implementation of the upcoming Mathematics Challenge.

Guiding Questions for Implementing the Mathematics Challenges

1. What is the title of the Challenge that you will use this month?
2. What skills or standards is this Challenge measuring?
3. Where does this Challenge fit within your curriculum? Within which unit?
4. At what point during the unit will you administer this Challenge (e.g., At the beginning of a unit to determine what students do or do not know, at the end of a unit to assess what students have or have not learned, in the middle of a unit to determine where to go next instructionally)?
5. How will your students complete this Challenge (e.g., individually, one-on-one, in small groups, as a class)? Why?
6. Are there any prerequisite skills, common misunderstandings, or vocabulary needs that you will have to address? What are they?
7. What difficulties do you anticipate your students will have with the Challenge? How will you address them?
8. Are these skills and difficulties different for special needs students, ELL students, etc.? How? Will you do anything different for these students? What?
9. How will you evaluate student responses (e.g., grade responses with the provided rubric, scan responses to identify common mistakes/misconceptions, have students evaluate one another's responses, have students evaluate their own response)?
10. What will student responses to this Challenge tell you about student understanding?
11. How might you use this evidence of student understanding to adapt your teaching and learning?
12. What other materials, resources, or support might you need? Where can you get them?
13. How can your colleagues assist you in the analysis of student understanding?
14. What other questions or concerns do you have about this Mathematics Challenge?

After you have implemented the challenge with your class, be sure to respond to the Guiding Questions on the Analyzing Student Responses Protocol.

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Grade K–Focus on Comparing and Ordering



Standard: Number and Operations

Learning Target: Focus on Comparing and Ordering

Claims:

Students should understand and be able to explain or demonstrate how to:

- ✓ Recognize, compare and order sets of numerals by using both cardinal and ordinal meanings;
- ✓ Make direct comparisons between objects (and recognize which is shorter, taller);
- ✓ Compare sets of ten or fewer objects and identify which are equal to, more than, or less than others;
- ✓ Order the numbers through 25 using numerals and words.

Task Preparation:

Each student will need copies of the student response sheet and the picture sheet, a pencil, a pair of scissors, glue, and crayons (optional).

If a student is unable to respond in writing, a scribe may be appointed or verbal answers may be accepted, but the responses will need to be documented for scoring.

Stimulus Cards (Drawing or Word Description):

Each student needs a copy of the picture sheet.

Manipulatives/Supplies:

Copies of the Student Response Sheet and the Picture Sheet for each student

Pencils

Scissors

Glue

Crayons (optional)

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Cues/Directions:

Distribute student response sheets and picture sheets. If a student is unable to respond in writing, a scribe may be appointed or verbal answers may be accepted, but these responses will need to be documented for scoring. Students should be directed to look carefully at each figure. Allow students time to answer.

1. Instruct students to follow along as you read aloud and say: **Five students in Ms. Belen’s class went to the school garden. The students are Marci, Sergio, Alex, Kelli, and Bryan. Cut out their pictures on the picture sheet. Then glue them into the boxes below so that they are in order from the shortest student to the tallest student. (TEACHER NOTE: Distribute scissors and glue. Allow about 10 minutes for this activity. Be sure that students understand that they are ordering the shortest student to the tallest student from left to right.)**
2. **Ms. Belen’s class went to the school garden and picked tomatoes. Marci, Sergio, Alex, Kelli, and Bryan picked tomatoes from the school garden. Marci picked 6 tomatoes. (TEACHER NOTE: Have students look at the picture of Marci’s tomatoes.) On the pictures below, circle who picked more tomatoes than Marci. (TEACHER NOTE: There can be more than one answer. Students should count each person’s tomatoes to find the answer.) How do you know who picked more tomatoes than Marci? (TEACHER NOTE: Students should write their answers in the box.)**
3. **Ms. Belen’s class also picked strawberries from the school garden. Kelli picked 9 strawberries. (TEACHER NOTE: Have students look at the picture of Kelli’s strawberries.) On the pictures below, circle who picked the same number of strawberries as Kelli. (TEACHER NOTE: There can be more than one answer. Students should count each person’s strawberries to find the answer.)**
4. **All the students picked apples and put them into 3 barrels. Look at the 3 barrels. The barrel on the left has 2 apples. The barrel on the right has 6 apples. Draw apples in the middle barrel so that there are more than 2 but fewer than 6. (TEACHER NOTE: Students may want to use crayons to draw their apples. Students should draw 3, 4, or 5 apples.) What is another number of apples you could draw that is also more than 2 but fewer than 6? (TEACHER NOTE: Students should write their answers in the box. Students may draw another set of apples or give one of the correct answers.)**

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5. **Put the list of numbers below in the correct blanks so that they are in order from least to greatest. (TEACHER NOTE:** Students should write one number on each blank. If needed, define that least to greatest means smallest to largest, and be sure they understand that they are ordering from left to right.)

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Student Response Sheet

The School Garden

Name: _____

Date: _____

- 1. Five students in Ms. Belen’s class went to the school garden. The students are Marci, Sergio, Alex, Kelli, and Bryan. Cut out their pictures on the picture sheet. Then glue them into the boxes below so that they are in order from the shortest student to the tallest student.**

Shortest				Tallest

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2. Ms. Belen's class went to the school garden and picked tomatoes. Marci, Sergio, Alex, Kelli, and Bryan picked tomatoes from the school garden. Marci picked 6 tomatoes.

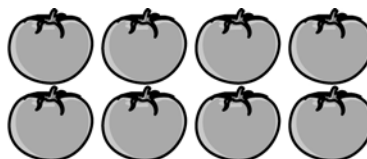


Marci

On the pictures below, circle who picked more tomatoes than Marci.



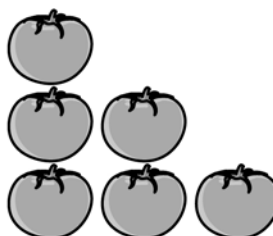
Sergio



Alex



Kelli

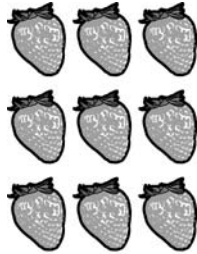


Bryan

How do you know who picked more tomatoes than Marci?

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3. Ms. Belen's class also picked strawberries from the school garden. Kelli picked 9 strawberries.



Kelli

On the pictures below, circle who picked the same number of strawberries as Kelli.



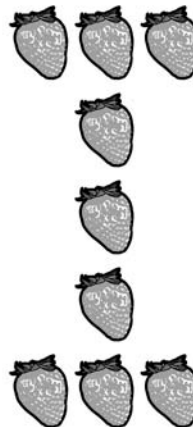
Marci



Sergio



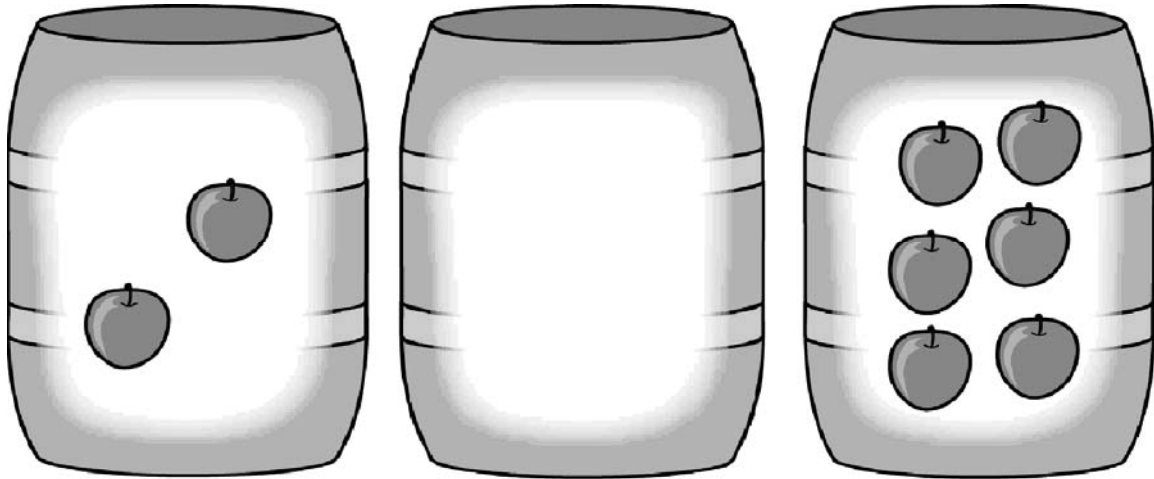
Alex



Bryan

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4. All the students picked apples and put them into 3 barrels. Look at the 3 barrels. The barrel on the left has 2 apples. The barrel on the right has 6 apples. Draw apples in the middle barrel so that there are more than 2 but fewer than 6.



What is another number of apples you could draw that is also more than 2 but fewer than 6 ?



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5. Put the list of numbers below in the correct blanks so that they are in order from least to greatest.

23

12

17

5

8

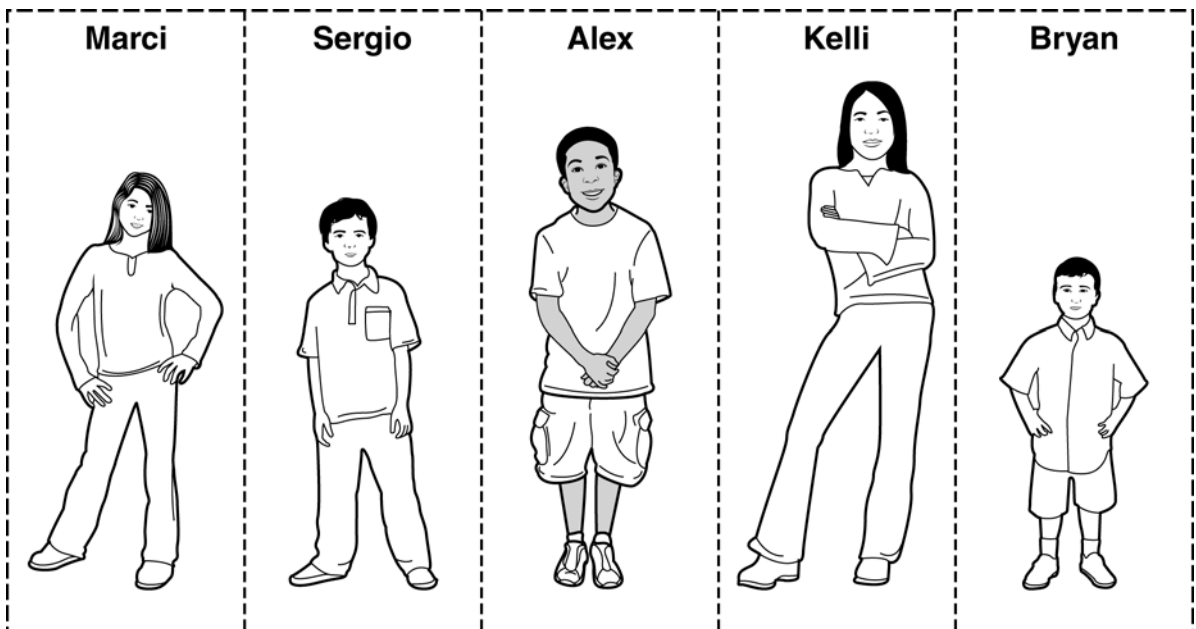
Least

Greatest

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Picture Sheet



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Learning and Teaching Considerations

Task 1:

- A) Be sure that students understand that the words “in order” signify that, in the case of a list, each number or object has a certain relationship to the ones on either side of it. For task 1 each student must be taller than the one to the left and shorter than the one to the right.
- B) Be sure that students understand that the word “shortest” signifies shorter than all the others, when comparing heights of objects. The word “shorter” signifies a lesser height than one other or some others.
- C) Some students may have the misconception that the word “shorter” signifies the same meaning as “shortest” and will glue pictures of the shorter students together, though not necessarily in order. Working with manipulatives or physically lining up students of different heights may help.
- D) Be sure that students understand that the word “tallest” signifies taller than all the others, when comparing heights of objects. The word “taller” signifies a greater height than one other or some others.
- E) Some students may have the misconception that the word “taller” signifies the same meaning as “tallest” and will glue pictures of the taller students together, though not necessarily in order. Working with manipulatives or physically lining up students of different heights may help.
- F) Be sure that students understand that the words “shortest to tallest” signify that the students should increase in height going from left to right, as they read.

Task 2:

- A) Be sure that students understand that the word “more” generally signifies comparing numbers or counts to find out which is greater. For task 2 students have to compare each set of tomatoes with Marci’s by actually counting them to determine who picked a greater number.
- B) Some students may have the misconception that there is never more than one correct answer to a question or prompt. For example, they may circle Alex, but not Kelli.

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- C)** Some students may have the misconception that objects placed in longer rows, taller columns, and higher or wider stacks of objects automatically means there are a greater number of objects. For example, some students may think that Alex must have picked more tomatoes than Marci because his rows are longer, or that Kelli and Bryan must have picked more tomatoes because their stacks are higher. That is why students at this grade level should actually count the objects to compare.
- D)** Students may answer in words, symbols (digits, dots, dashes, base-10 block representations, etc.), pictures (tomatoes), or by using manipulatives (blocks, cubes). They may also count on their fingers, use number lines, or recall number sense and subtraction facts. Be sure that they understand that they can get the correct answer using any of the strategies, though some are more efficient.
- E)** Be sure that students understand that as you move right (\rightarrow) on a number line, the numbers increase in value. As you move left (\leftarrow), the numbers decrease in value.
- F)** If a student says or writes, “I just know,” prompt him or her by saying something like “I’m glad you know, but it’s important in math to be able to explain your answers so other people can understand what you’re thinking.” (That applies to the other tasks, as well.)
- G)** If a student says or writes, “I don’t know,” say something positive like “Let’s start with what you do know about this problem.” Students often know more than they think or say, and getting them to vocalize or write about that knowledge is all they need. (That applies to the other tasks, as well.)

Task 3:

- A)** Be sure that students understand that the words “same number” signify an equal count of objects. For task 3 students have to compare each set of strawberries with Kelli’s by actually counting them to determine who picked the same number.
- B)** Some students may have the misconception that there is never more than one correct answer to a question or prompt. For example, they may circle Marci, but not Sergio or Bryan.
- C)** Some students may have the misconception that objects placed in longer rows, taller columns, and higher or wider stacks automatically means there are a greater number of objects. For example, they may think that Alex and Bryan picked more strawberries than Kelli because the stacks are higher, or that Marci and Sergio picked more strawberries because the stacks are wider. That is why students at this grade level should actually count the objects to compare.

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- D)** Other students may have the misconception that groups contain the same number of objects only if they are configured identically. For example, they may think that none of the four students picked the same number of strawberries as Kelli because the stacks are configured differently.

Task 4:

- A)** Remind students that the word “more” signifies comparing numbers or counts to find out which is greater. They should also understand that the word “fewer” signifies a smaller number or count than one other or some others. For task 4 students need to determine a number or count of apples that is greater than 2 but fewer than 6.
- B)** For the first part be sure that students understand that there is more than one correct answer. They may draw 3, 4, or 5 apples.
- C)** For the second part students may answer in words, symbols, pictures, or by using manipulatives. They may also count on their fingers, use number lines, add on, or recall number sense and subtraction/addition facts. Be sure that they understand that they can get the correct answer using any of the strategies, though some are more efficient.

Task 5:


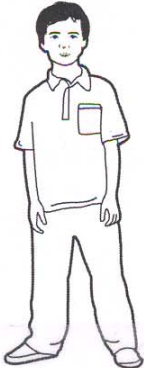
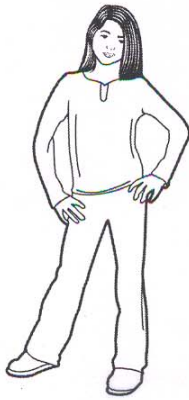


- A)** Be sure that students understand that the word “least” signifies a number smaller in value than all the others, and the word “greatest” signifies a number larger in value than all the others. For task 5 students need to compare each number in the list with the one to the right and to the left of it.
- B)** Be sure that students understand that the words “in order” signify that each number in the list has a certain relationship to the ones on either side of it. For task 5 each number must be greater in value than the one to its left and lesser in value than the one to its right.
- C)** Be sure that students understand that the words “least to greatest” signify that the numbers should increase in value going from left to right, as they read.

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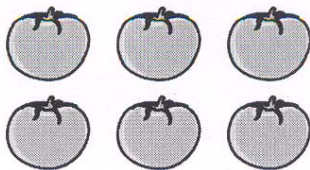
Name: ANSWER KEY Date: _____

1. Five students in Ms. Belen's class went to the school garden. The students are Marci, Sergio, Alex, Kelli, and Bryan. Cut out their pictures on the picture sheet. Then glue them into the boxes below so that they are in order from the shortest student to the tallest student.

Shortest				Tallest
Bryan	Sergio	Marci	Alex	Kelli
				

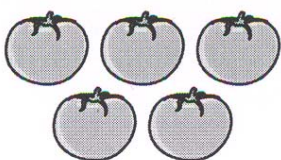
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2. Ms. Belen's class went to the school garden and picked tomatoes. Marci, Sergio, Alex, Kelli, and Bryan picked tomatoes from the school garden. Marci picked 6 tomatoes.

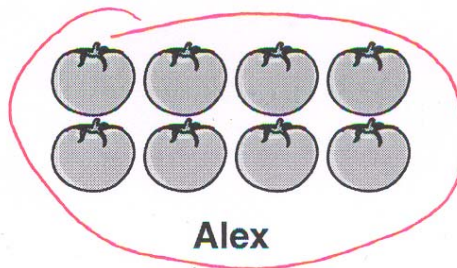


Marci

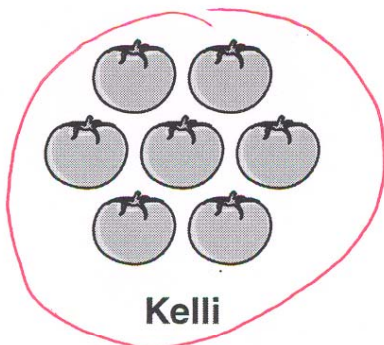
On the pictures below, circle who picked more tomatoes than Marci.



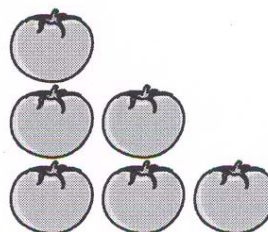
Sergio



Alex



Kelli



Bryan

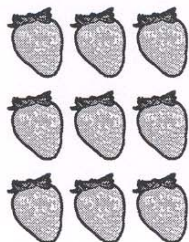
How do you know who picked more tomatoes than Marci?

I COUNTED: SERGIO 5
ALEX 8
KELLI 7
BRYAN 6

MARCI PICKED 6. 7 AND 8 ARE MORE
THAN 6. 5 AND 6 ARE NOT MORE
THAN 6.

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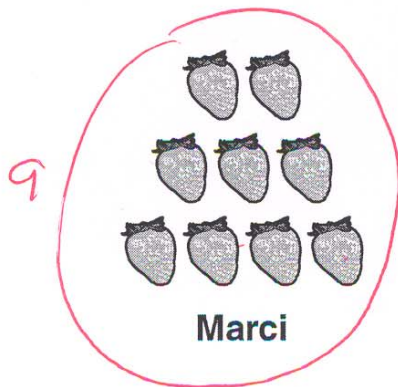
3. Ms. Belen's class also picked strawberries from the school garden. Kelli picked 9 strawberries.



9

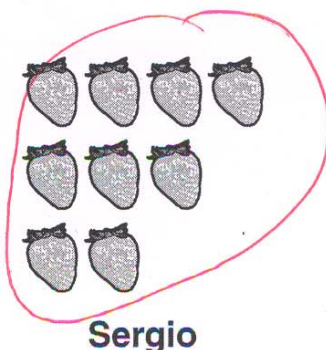
Kelli

On the pictures below, circle who picked the same number of strawberries as Kelli.



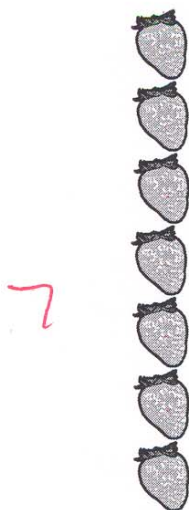
9

Marci



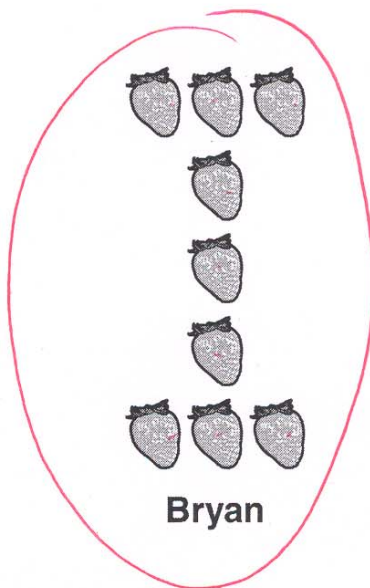
9

Sergio



7

Alex

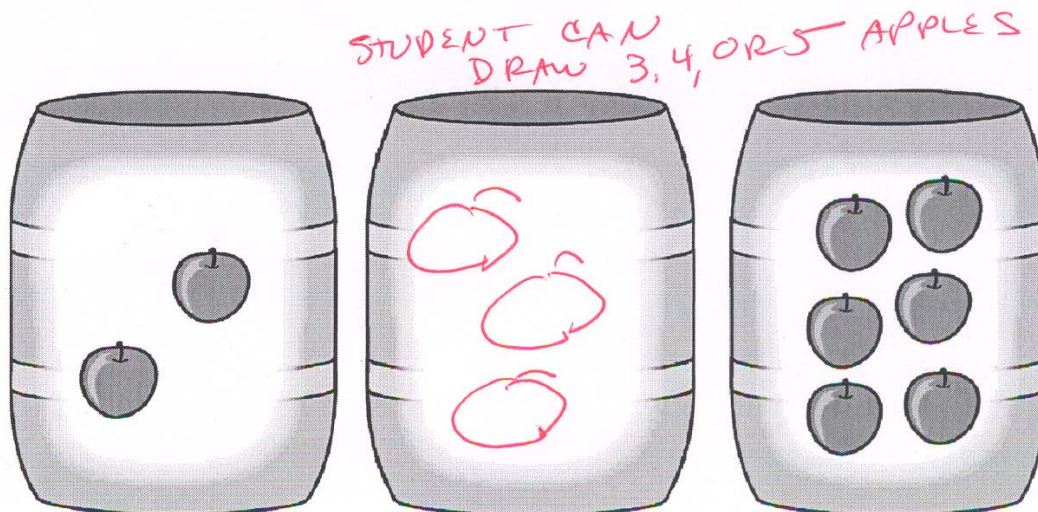


9

Bryan

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4. All the students picked apples and put them into 3 barrels. Look at the 3 barrels. The barrel on the left has 2 apples. The barrel on the right has 6 apples. Draw apples in the middle barrel so that there are more than 2 but fewer than 6.



What is another number of apples you could draw that is also more than 2 but fewer than 6 ?

RESPONSE DEPENDS ON HOW MANY APPLES DRAWN.

IF 3, THEN 4 OR 5

IF 4, THEN 3 OR 5

IF 5, THEN 3 OR 4.

STUDENT MAY DRAW IN THE NUMBER OF APPLES.

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5. Put the list of numbers below in the correct blanks so that they are in order from least to greatest.

23	12	17	5	8
<u>5</u>	<u>8</u>	<u>12</u>	<u>17</u>	<u>23</u>
Least				Greatest

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Rubric

CATEGORY	4	3	2	1
Mathematical concepts	Response shows complete understanding of the mathematical concepts used to solve the problem(s).	Response shows substantial understanding of the mathematical concepts used to solve the problem(s).	Response shows some understanding of the mathematical concepts needed to solve the problem(s).	Response shows very limited understanding of the underlying concepts needed to solve the problem(s), OR the response is not written.
	<p>Response shows evidence in ALL of the following tasks.</p> <p>Task 1. Student shows ability to order the students by height from shortest to tallest.</p> <p>Task 2. Student circles both Alex and Kelli and does not circle anyone else.</p> <p>Task 3. Student circles Marci, Sergio, and Bryan and does not circle Alex.</p> <p>Task 4. Student shows evidence of understanding that 3, 4, and 5 are each between 2 and 6.</p> <p>Task 5. Student lists numbers as 5, 8, 12, 17, 23.</p>	<p>Response shows evidence in only 4 of the tasks described in category 4. Response may exhibit the following errors.</p> <p>Task 1. Student orders correctly but in the opposite direction.</p> <p>Task 2. Student circles more than Alex and Kelli.</p> <p>Task 3. Student circles everyone.</p> <p>Task 5. Student orders correctly but in the opposite direction.</p>	<p>Response shows evidence in only 2 or 3 of the tasks described in category 4.</p>	<p>Response shows evidence in 1 or none of the tasks described in category 4.</p>

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Rubric

CATEGORY	4	3	2	1
Strategy and procedures	Student typically uses an efficient and effective strategy to solve the problem(s).	Student typically uses an effective strategy to solve the problem(s).	Student sometimes uses an effective strategy to solve the problem(s), but not consistently.	Student rarely uses an effective strategy to solve the problem(s).
	<p>Response shows evidence in ALL of the following tasks.</p> <p>Task 1. Student shows evidence of aligning pictures (after cutting them out) to determine relative heights of figures.</p> <p>Task 2. Student shows evidence of counting tomatoes (numbers, tally marks, pencil marks, etc.).</p> <p>Task 3. Student shows evidence of counting strawberries (numbers, tally marks, pencil marks, etc.).</p> <p>Task 4. Student may show evidence of crossing out numbers as they are used to fill in the blanks.</p>	Response shows evidence in only 3 of the tasks described in category 4.	Response shows evidence in only 2 of the tasks described in category 4.	Response shows evidence in only 1 or none of the tasks described in category 4.

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Rubric

CATEGORY	4	3	2	1
Explanation and communication	Explanation is detailed and clear; uses appropriate terminology and/or notation.	Explanation is clear; uses some appropriate terminology and/or notation.	Explanation is a little difficult to understand, but includes critical components; shows little use of appropriate terminology and/or notation.	Explanation is difficult to understand, is missing several components, and does not use or include appropriate terminology and/or notation.
	Response shows evidence in the following explanations. Task 2. Student explains that Marci has 6 tomatoes. Student explains that, after counting tomatoes for each student, 8 and 7 are both more than 6 and 5 and 6 are not more than 6.	Response shows evidence of counting all tomatoes. However, response only talks of 7 and 8 being more than 6 and does not compare 5 and 6 to 6.	Response only says that 7 and 8 are greater than 6. Response does not say that all tomatoes were counted and does not compare 5 and 6 to 6.	No response is shown.

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Rubric

CATEGORY	4	3	2	1
Mathematical accuracy	All or almost all of the steps and solutions have no mathematical errors.	Most of the steps and solutions have no mathematical errors.	Some of the steps and solutions have no mathematical errors.	Few of the steps and solutions have no mathematical errors.
	<p>Student provides correct answers for ALL of the following tasks.</p> <p>Task 1. Students are correctly ordered by height from shortest to tallest.</p> <p>Task 2. Student circles both Alex <u>and</u> Kelli and does not circle anyone else.</p> <p>Task 3. Student circles Marci, Sergio, <u>and</u> Bryan and does not circle Alex.</p> <p>Task 4. Student draws 3, 4, or 5 apples in the middle barrel.</p> <p>Task 5. Student lists numbers as 5, 8, 12, 17, 23.</p>	<p>Student provides correct answers for only 4 of the tasks described in category 4, or student orders task 1 or task 5 in reverse.</p>	<p>Student provides correct answers for only 2 or 3 of the tasks described in category 4.</p>	<p>Student provides a correct answer for only 1 or none of the tasks described in category 4.</p>

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Scoring Notes Checklist

Task	Check Yes	Category
Task 1		
Student shows ability to order the students by height from shortest to tallest.		Concept
Student shows evidence of aligning pictures (after cutting them out) to determine relative heights of figures.		Strategy
Students are correctly ordered by height from shortest to tallest.		Accuracy
Task 2		
Student circles both Alex <u>and</u> Kelli and does not circle anyone else.		Concept
Student shows evidence of counting tomatoes (numbers, tally marks, pencil marks, etc.).		Strategy
Student explains that Marci has 6 tomatoes. Student explains that, after counting tomatoes for each student, 8 and 7 are both more than 6 and 5 and 6 are not more than 6.		Explanation
Student circles both Alex <u>and</u> Kelli and does not circle anyone else.		Accuracy
Task 3		
Student circles Marci, Sergio, <u>and</u> Bryan and does not circle Alex.		Concept
Student shows evidence of counting strawberries (numbers, tally marks, pencil marks, etc.).		Strategy
Student circles Marci, Sergio, <u>and</u> Bryan and does not circle Alex.		Accuracy
Task 4		
Student shows evidence of understanding that 3, 4, and 5 are each between 2 and 6.		Concept
Student may show evidence of crossing out numbers as they are used to fill in the blanks.		Strategy
Student draws 3, 4, or 5 apples in the middle barrel.		Accuracy
Task 5		
Student lists numbers as 5, 8, 12, 17, 23.		Concept
Student lists numbers as 5, 8, 12, 17, 23.		Accuracy

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Analyzing Student Responses Protocol

The purpose of the Mathematics Challenges is to provide opportunities for students to develop and demonstrate understanding of important mathematical concepts and standards. They include extended responses, open-ended tasks, and tasks that require higher-order thinking skills. Because these types of tasks may be novel for students and they will have varying levels of understanding, the student responses will vary.

The guiding questions below were designed to assist you in analyzing your class' response to the Challenge and determining appropriate next steps for your teaching and learning. Responses to these questions are for your reflection and documentation and will not be collected.

Guiding Questions for Analyzing Student Responses to the Mathematics Challenges

1. When completing the Challenge, what did your students do well? How do you know?

2. When completing the Challenge, what did your students struggle with? How do you know?

3. When your students completed the Challenge, did they implement multiple correct solutions strategies? What insightful approaches to problem solving did you observe?

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4. What, if any, patterns (e.g., common errors/misconceptions) did you observe across your student responses?

5. What questions or concerns did your students have when working through this Challenge or a particular task? Are these things you should address for the class as a whole?

6. What, if any, feedback did you provide to your class? How did you provide it?

7. What did you learn about your students' mathematical understanding based on their responses to this Challenge?

Reminders:

- 1) After you have completed the Challenge with your class and responded to these Guiding Questions for Analyzing Student Responses, please complete the Challenge Feedback Log. A link to this Log is e-mailed to you each month. Responses will be used to improve the Challenges and to provide recommendations for teachers implementing the Challenges in future years.

- 2) Please provide copies of all student work to the Assessment Coordinator.