

Explaining Your Thinking

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Objectives

1. Understand how graphic organizers can help guide problem solving and written responses
2. Learn about scoring written responses with a rubric

But why should we write in math class?

SBAC Claim #3 Communicating Reasoning –
Students can clearly and precisely construct viable arguments to support their own reasoning and critique the reasoning of others.

Smarter Balanced Mathematics General Rubric for 4-Point Items

Score	Description
4	The student has demonstrated a full and complete understanding of the mathematical content and practices essential to this task. The student has addressed the task in a mathematically sound manner. The response contains evidence of the student's competence in problem solving, reasoning, and/or modeling to the full extent that these processes apply to the specified task. The response may, however, contain minor flaws that do not detract from a demonstration of full understanding.
3	The student has demonstrated a reasonable understanding of the mathematical content and practices essential to this task. The student has addressed most of the task in a mathematically sound manner. The response contains sufficient evidence of the student's competence in problem solving, reasoning, and/or modeling, but not enough evidence to demonstrate a full understanding of the processes he or she applies to the specified task. The response may contain errors that can be attributed to misinterpretation of the prompt; errors attributed to insufficient, non-mathematical knowledge; and errors attributed to careless execution of mathematical processes or algorithms.
2	The student has demonstrated a partial understanding of the mathematical content and practices essential to this task. The student's response contains some of the attributes of an appropriate response but lacks convincing evidence that the student fully comprehends the essential mathematical ideas addressed by this task. Such deficits include evidence of insufficient mathematical knowledge; errors in fundamental mathematical procedures; and other omissions or irregularities that bring into question the student's competence in problem solving, reasoning, and/or modeling as applied to the specified task.
1	The student has demonstrated a limited understanding of the mathematical content and practices essential to this task. The student's response is incomplete and exhibits many errors. Although the student's response has addressed at least one of the conditions of the task, the student reached an inadequate conclusion and/or demonstrated problem solving, reasoning, and/or modeling that was faulty or incomplete as related to the specified task.
0	The student has demonstrated merely an acquaintance with the topic, or provided a completely incorrect or uninterpretable response. The student's response may be associated with the task, but contains few attributes of an appropriate response. There are significant omissions or irregularities that indicate a lack of comprehension in regard to the mathematical content and practices essential to this task. No evidence is present that demonstrates the student's competence in problem solving, reasoning, and/or modeling related to the specified task.

Graphic Organizers

“Students can see relationships between and among information and concepts. They can brainstorm ideas without being concerned about correct order or solutions and can immediately record thoughts, information, ideas, relationships, or strategies to later organize, analyze, and synthesize their knowledge.”

-Zollman, A. Teaching Children Mathematics, “Mathematical Graphic Organizers” Nov. 2009

Diamondizer

<p>2. Write what you already know here:</p>	<p>3. Brainstorm ways to solve this problem (What are you going to do? Why?) here:</p>
<p>4. Try it here:</p>	<p>5. Check your work:</p>

1. What do you need to find out?

Example of the Diamondizer

2. Write what you already know here:

221 Students signed up
3 Students hurt + can't attend
Teams of 9

3. Brainstorm ways to solve this problem (W you going to do? Why?) here:

Subtract the injured players
Divide the remaining students by 9 because each team is a group of 9 students

1. What do you need to find out?

How many teams?

4. Try it here:

$$\begin{array}{r} 221 \\ - 18 \\ \hline 203 \end{array}$$

203 Students

$$\begin{array}{r} 224 \\ 9 \overline{) 203} \\ \underline{180} \\ 23 \\ \underline{18} \\ 5 \end{array}$$

24 teams

5. Check your work:

$$\begin{array}{r} 24 \\ \times 9 \\ \hline 216 \end{array}$$
$$\begin{array}{r} 216 \\ + 5 \\ \hline 221 \end{array}$$

221 Students

Differentiate with the Diamondizer

- Put fill in the blanks in each box to guide students to necessary information
- Under plan list different possibilities
- When introducing two-step problems

Solve:

Step 1:

Step 2:

Brainstorm ways to solve this problem:
(Equations, Draw a picture, Guess and Check,
Work Backwards, Make a Table)

Our Problem

The Middletown Soccer Jamboree is coming up this weekend. Organizers had 221 students signed up, but were notified today that five students are injured and cannot play. The organizers want to put the players on teams with nine players on each team. How many teams will the Jamboree have in all?



		Score
Labels	1 point: Limited labels are used in the explanation 2 points: Correct labels are used throughout the explanation	
Math Vocabulary	1 point: Limited math vocabulary is used in the explanation 2 points: Some math vocabulary is used, but may be incorrect 3 points: Math vocabulary is used and correctly written in math sentences	
Problem-Solving Process Explanation	1 point: The steps in the problem-solving process are incomplete or not explained; limited or no transition/sequence words are used 2 points: The steps ("what") in the problem-solving process are presented but the mathematical reasoning ("why") behind each step is not; transition/sequence words are used but "why" words are not 3 points: The steps ("what") in the problem-solving process are presented but not all the mathematical reasoning ("why") behind each step is presented; transition/sequence and "why" words are used but not in a logical way 4 points: The steps ("what") in the problem-solving process are presented. each with mathematical reasoning ("why") behind the steps; transition/sequence and "why" words are used correctly, but the overall explanation does not read smoothly; the answer is may be incorrect due to minor calculation error 5 points: The steps ("what") in the problem-solving process are presented, each with the mathematical reasoning ("why") behind the steps; transition/sequence and "why" words are used correctly and logically; the overall explanation is clear and reads smoothly; the answer is correct	
		Total Score:

	Student 1	Student 2	Student 3	Student 4	Student 5
1 or 2 Points Used correct labels throughout their answer					
1, 2, or 3 Points Used math vocabulary in correct math sentences.					
1, 2, 3, 4, or 5 Points Explained the steps of the process in a way that is both logical and readable.					
Total					

Put it all together

2. Write what you already know here:

221 Students signed up
5 Students hurt can't attend
Teams of 9

3. Brainstorm ways to solve this problem (What you going to do? Why?) here:

Subtract the injured players
Divide the remaining students by 9 because each team a group of 9 students

1. What do you need to find out?

How many teams?

4. Try it here:

$$\begin{array}{r} 221 \\ - 5 \\ \hline 216 \end{array}$$
$$\begin{array}{r} 24 \\ \times 9 \\ \hline 180 \\ + 36 \\ \hline 216 \end{array}$$

216 Students 24 teams

5. Check your work:

$$\begin{array}{r} 24 \\ \times 9 \\ \hline 216 \end{array} + \begin{array}{r} 5 \\ \hline 5 \end{array}$$

221 Students



Class Brainstorm



The Jamboree will have 24 total teams. I know this because, if 221 students signed up, but 5 cannot play, you have to subtract the 5 that are not playing from the 221 students that signed up to find how many students are actually playing. So when I subtracted I found that 216 students are playing. Then in the problem it stated that the organizers for the Middle Town Soccer Jamboree want to have three 9 kids on each team. I know that since there are 9 kids on each team, I know that if I divide 216 by 9 I will find my answer of how many teams there will be when divided. I found that there will be 24 teams. Therefore, at the Middle Town Soccer Jamboree there will be 24 teams in all.

Middletown Soccer Jamboree. I know this because in the problem it said that 221 students signed up but 5 were injured and could not play. I knew that the number of injured players from the number of total players in the Jamboree. After subtracting 5 from 221, I found that there are 216 players left. The problem says that there are 9 players per team, so I realized that I needed to divide 216 by 9 to find out how many teams can be made from 216 players. In other words, I would have to divide 216 into many times 9 to find the answer. After dividing I found that

$$\begin{array}{r} 221 \text{ students} \\ - 5 \\ \hline 216 \end{array}$$

24 Teams with 9 players on each

I know that the Jamboree will have 24 teams in all because the problem stated that there was going to be 9 players on each team. First, I started with subtracting the 221 students who could be there by the 5 students who could not. After subtracting, I took my answer and divided it by 9 because there was 9 players on each team. When I divided that I found that the should be 24 teams with 9 players on each team.

The Jamboree will have 24 teams in all. I know this because 221 students signed up but 5 are injured. I know that 221 students minus 5 students equals 216 students. I divided 216 students by 9 players on each team and found that there will be 24 teams playing at the Jamboree.

Differentiate Responses

Use sentence frames, transition word lists, vocabulary lists, word walls to help scaffold the written responses for students.

Name _____

Date _____

I wanted to figure out _____

I knew that _____

I decided to _____ because _____

When I _____

Therefore _____

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More Graphic Organizers

K What do I KNOW from the information stated in this problem?	N What information do I NOT need in order to solve this problem?	W WHAT exactly does this problem ask me to find?	S What STRATEGY or operation will I use to solve this problem?

Adapted from *Teaching Reading in Mathematics* by Mary Lee Barton and Clare Heidema

<p>Understand</p> <ul style="list-style-type: none"> Read the problem carefully. What is the problem asking you to find? What information is needed and what is not needed? 	<p>Plan</p> <ul style="list-style-type: none"> How will you solve the problem? What strategy will you use? <p><i>Draw a picture</i> <i>Guess & Check</i> <i>Make a table</i> <i>Estimate</i> <i>Work backwards</i> <i>Write an equation</i> <i>Choose an operation</i></p>
<p>Solve</p> <ul style="list-style-type: none"> Show all your work. Show all your steps. Record your answer. 	<p>Check</p> <ul style="list-style-type: none"> Re-read the question? Did you answer the question? Does your answer make sense?



When does this get implemented?

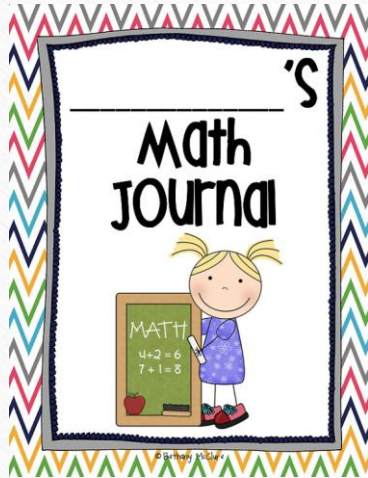
- Math workshop problem solving station
- Weekly problem solving and response
- Pre and post unit assessment
- Daily warm-up

Top Four Tips

1.



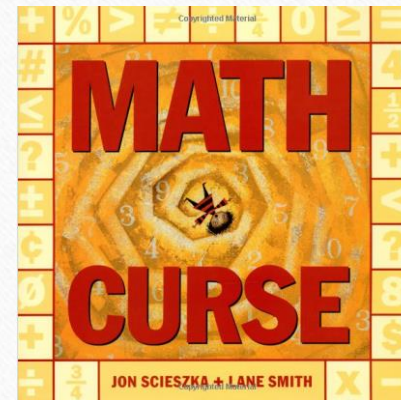
2.



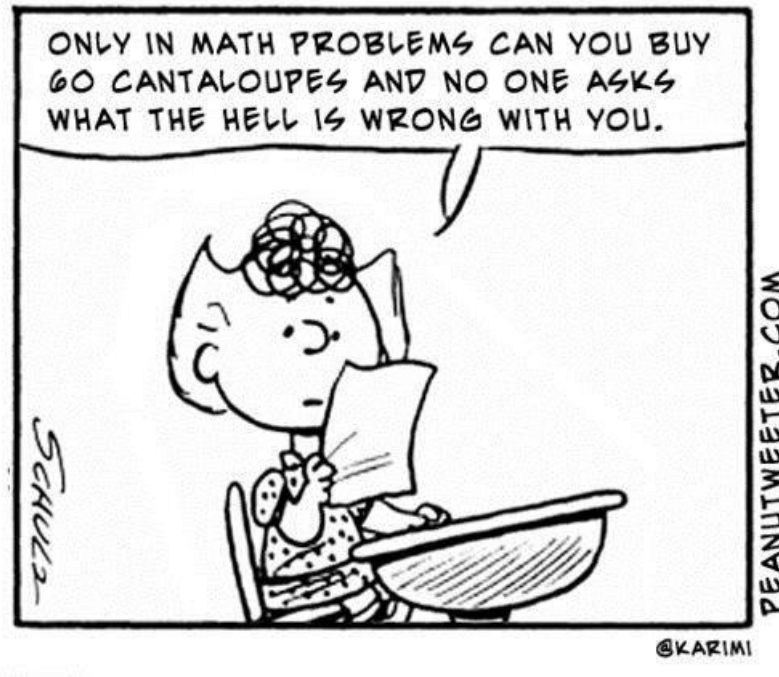
3.



4.



Questions?



Resources

- Denman, G. Think it, Show it Mathematics
- Zollman, A. “Mathematical Graphic Organizers”. Teaching Children Mathematics. November 2009
- Work of various students from Granby, CT