

Third Grade Math Lesson: Division Word Problems

Division Helps Us Understand Caring & Sharing Within Our Community

Lesson Plan Created by Carin Jordan

Summary: Students will use models and manipulatives to explore strategies that may be used to solve division word problems based on a Caring & Sharing canned food drive.

A. IDENTIFY/REFERENCE NATIONAL, STATE PERFORMANCE, LOCAL CURRICULUM STANDARDS:

National (NCTM) Standards:

NUMBER AND OPERATIONS: Identify and use relationships between operations, such as division as the inverse of multiplication, to solve problems.

Math Common Core Georgia Performance Standards:

MCC.3.OA.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

Local Performance Standards:

MCC.3.OA.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

B. SPECIFY ESSENTIAL CONTENT/OBJECTIVES:

Enduring Understandings:

- A quantity can be represented numerically in various ways. Problem solving depends upon choosing wise ways.
- One representation may sometimes be more helpful than another; and, used together, multiple representations give a fuller understanding of a problem.
- Numeric fluency includes both the understanding of and the ability to appropriately use numbers.

Knowledge:

Students will:

- Demonstrate an understanding of how to solve division word problems using models and manipulatives.
- Demonstrate an understanding of how to transfer a model into pictures, numbers, and words in order to convey their understanding of a division word problem.
- Demonstrate an understanding of the various problem solving strategies that may be used when solving word problems.

Skills:

After completing this lesson students will be able to:

- Use models and manipulatives to represent the key content of a division word problem.

- Represent their understanding of the division word problem in pictures.
- Label the pictures and otherwise convey understanding of the word problem using numbers or number sentences.
- Answer the word problem and explain the response using words.

Essential Questions:

- How can division be used to solve real world problems?
- What strategy did you find most efficient when solving division word problems?

C. COLLECT A VARIETY OF MATERIALS/RESOURCES FOR STUDENT USE:

- Book: One Hundred Hungry Ants by Elinor J. Pinczes
- Classroom ActivBoard
- PowerPoint Slides created based on One Hundred Hungry Ants book
- Manipulatives:
 - Class set of Base-ten blocks
 - Class set of Counters
 - Class set of Cups
- (Qty 5) Foam Dice & Anchor Activity Sign in Plastic Frames
- Lesson Attachments:
 - Pre/Post-Assessment Handout: Caring & Sharing Food Drive Real-World Problem
 - PowerPoint Slides Comparing Rows of “Ants” (Screen shots included in Lesson Attachments.)
 - Press Release Photo of Caring & Sharing Food Drive
 - Food Drive related tiered handouts for Student New Knowledge Acquisition Activity
 - “Finished?” Anchor Activity
 - Student Observational Checklist
 - Tiered Handouts for Student Applied Practice
 - Student Self-Assessment rubric for Student Applied Practice Activity

D. CONDUCT PRE-ASSESSMENT FOR STUDENTS TO DEMONSTRATE PRIOR KNOWLEDGE

On the Friday before the lesson, students will be given a pre-assessment to determine student prior knowledge about the application of division in real-world word problems. Additionally, the teacher will use the pre-assessment data to determine how well students are able to convey understanding using numbers, pictures, and words. Based on the pre-assessment data students may be tiered into two or more groups and the lesson may be otherwise adjusted as needed.

D. (continued) ACTIVATE STUDENT PRIOR KNOWLEDGE:

On the day of the lesson, teacher will assemble the students in the front of the room to activate student prior knowledge by reading the book One Hundred Hungry Ants by Elinor J. Pinczes.

After the reading, teacher will display PowerPoint slides on ActivBoard showing several configurations of ants and ask students whether the image shows information in numbers, pictures or words? After students state that it shows the data in pictures, students will be invited to make statements about the slides in numbers and words.

For example, while looking at the slide that shows a row of 100 ants and a row of 50 ants, students might make the following statements:

- *There are twice as many ants in the row of 100 than there are in the row of 50*
- *There are half the number of ants in the row of 50 than there are in the row of 100*
- *50 is half as much as 100*
- *100 is twice as much as 50*
- $50 \times 2 = 100$
- $100 \div 50 = 2$
- $50 + 50 = 100$
- $100 - 50 = 50$

The activity will be repeated with a second slide showing a row of 50 ants and a row of 10 ants and students may make statements such as the following:

- *There are five times as many ants in the row of 50 than there are in the row of 10*
- $5 \times 10 = 50$
- $50 \div 10 = 5$
- $10 + 10 + 10 + 10 + 10 = 50$
- $50 - 10 - 10 - 10 - 10 = 10$

Once these number statements have been identified, teacher will note that many of these statements would be helpful if story questions were asked about ants. Teacher will also note that different students might use different statements to aid their thinking. For example, teacher might ask:

- *If 50 ants wanted to rearrange themselves into five rows, how many ants would be in each row?*
- *What if the 50 ants wanted to rearrange themselves into 10 rows, how many ants would be in each row?*

E. PROVIDE FOR NEW KNOWLEDGE ACQUISITION:

For the Activation of New Knowledge, students will be seated in tiered groups. These tiered groups will be based upon the results of the pre-assessment as well as teacher prior knowledge of students.

The division word problem that will be explored during the New Knowledge Acquisition portion of the lesson is based on the Caring & Sharing food drive that students participated in the previous week. Teacher will highlight the following statement made in a press release by a PTA representative:

“We set a goal of at least one item of canned or dry goods per student, and it looks like we will greatly surpass this goal.”

I will then include a follow-up question for students to explore:

Mrs. Williams counted all of the cans brought in by the 21 students in her math class and exclaimed, “We collected 63 cans in all! Now we need to pack them into boxes. Let’s pack 7 boxes with an equal amount of cans in each box.” How many boxes are needed? Did they surpass the goal amount set by the PTA? If so, by how many cans?

Note that this question intentionally used a multi-part question, which is an element that many 3rd grade students find challenging. This question was intentionally delivered in this way in order to promote strategy discussion

during the New Knowledge Acquisition period. However, in order to provide the support necessary for students each differentiated group will receive a tiered handout providing scaffolding based on ability level.

Students will explore this question using models and manipulatives. Teacher will allow students to work individually or collaboratively and should use the manipulatives provided to construct answers. If the students are able to successfully construct and explain the response using manipulatives, teacher will encourage students to draw their responses and use pictures, numbers, and words to explain their response.

While students are working, teacher walk around the room and note the various strategies students use to solve the problem, noting any pertinent observations on the Observational Checklist. Teacher will scaffold or extend the question based on demonstrated student need by asking questions based on Blooms Taxonomy.

Questions may include the following:

- *What are the key words in this question?*
- *How would you state in your own words what this problem is asking you to do?*
- *How would you use the information in the question to build a model?*
- *Can you make use of your addition/subtraction/multiplication/division facts to solve this problem?*
- *Can you identify the different parts of the question?*
- *Can you propose an alternative method of solving the problem?*
- *What is your opinion of this question? Did you find it challenging but achievable?*
- *What changes would I need to make in order to help you understand this problem?*
- *What would you write if you were to create your own problem?*

Additionally, the following questions based on the “verbs of learning” will be posted at each table for use as an anchor activity for any student who finishes early. A foam die will be included, and students may roll to determine which activity to choose.

1. *Turn to another student at your table and explore whether you used the same strategy.*
2. *Explain your strategy to another student at your table.*
3. *Turn your paper over and create a story problem for another student at your table.*
4. *Investigate what would happen if you changed one or all of the numbers in the story problem.*
5. *Think of another number sentence that would represent the information included in the story problem.*
6. *How might the answer to this problem apply to real life? How might the information be used?*

After most of the students have had a chance to complete or make progress on the problem, teacher will redirect attention to the front of the room and invite students to share their strategies. Teacher will attempt to identify and highlight multiple strategies that students used to solve the problem. Strategies may include: Think Multiplication, Repeated Addition, Repeated Subtraction, picture drawing and so on.

F. ADJUST ASSIGNMENTS FOR STUDENT APPLIED PRACTICE:

Students will remain in their tiered group seating and receive a new division related real-world word problem based on the recent Barnwood Elementary Caring & Sharing food drive. The story problems will be tiered based on the ability level of each group based upon results of the pre-assessment and teacher prior knowledge of students.

Students will be instructed to use the skills and knowledge gained during the New Knowledge Acquisition portion of the lesson to work independently to solve a new word problem. Teacher will remind students to use models/manipulatives to represent the problem, then draw the problem and include numbers, number sentences, and words to explain the answer.

Instruct students that when they complete the problem, they should complete the self-assessment rubric attached to their handout and note that this is the same rubric that the teacher will use in order to determine their level of understanding based on the lesson.

Questions in Student Applied Practice are differentiated based on student readiness as follows:

Red Rockets Group: This group is still learning division concepts and as well as skills and strategies that enable them to understand and solve word problems. Many students in this group were unable to even determine how to begin the question posed in the pre-assessment. This group will receive a single step story problem using numbers under 25. Additionally, scaffolding will be provided in the form of a sequential checklist that will provide students with support as they solve the problem.

Yellow Stars Group: This group demonstrated a higher level of ability on the pre-assessment. They may not have solved the question completely or correctly, but attempted to use pictures, numbers, and words to solve the problem. This group will receive a two- step story problem using numbers under 50. Students will receive additional scaffolding in the form of a self-assessment sequential checklist as well as a mini-graphic organizer to aid them in solving the problem.

Green Gators Group: This group is comprised of only three students working at the highest level in the class. These students will receive a two-step story problem using numbers under 100. Students will not have scaffolding or prompts on the paper. If necessary, students may collaborate or teacher will provide scaffolding in order to ensure students are able to work with the more challenging problem.

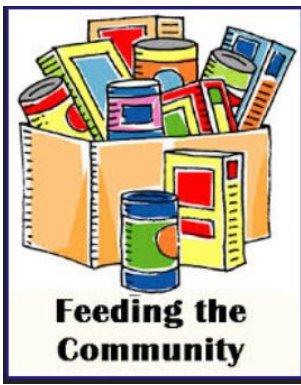
G. CONDUCT POST-ASSESSMENT FOR STUDENTS TO INDEPENDENTLY DEMONSTRATE KNOWLEDGE AND COMPETENCIES:

The word problem completed during the Student Applied Practice activity will be collected and assessed using a teacher version of the same rubric that students will use for self-assessment during the lesson.

Additionally, students will retake the pre-assessment in order to determine whether demonstrable progress was been made based on the lesson.

Teacher will use the results of the post-assessments as well as data collected on the Student Observational Checklist during the lesson to plan for and adjust instruction during future lessons.

Lesson Attachments



Pre/Post-Assessment


Name: _____

Students at Barnwood Elementary School participated in the annual Caring and Sharing food drive. On Tuesday, 3rd grade class representatives volunteered to pack cans into boxes. The representative from Mrs. Williams' class packed 56 cans of food into 8 different boxes. The representative from Mrs. Thompson's class packed 63 cans of food into 9 different boxes.

The representative from Mrs. Thompson's class commented to the representative from Mrs. Williams' class, "My box needs to be bigger than your box to fit my cans."

Do you agree with this comment? ☆☆Justify your response using numbers, pictures, and words. ☆☆

Lesson PowerPoint Slides



Math Connections to One Hundred Hungry Ants by Elinor J. Pinczes

Carin Jordan
EDU 575



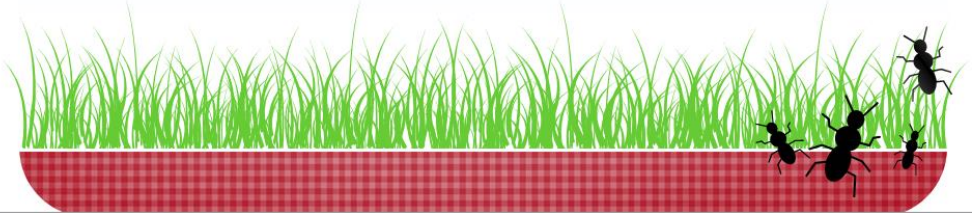
Compare the two sets of ants.

What statements can you make about the relationship between the two sets?

50 Ants



10 Ants



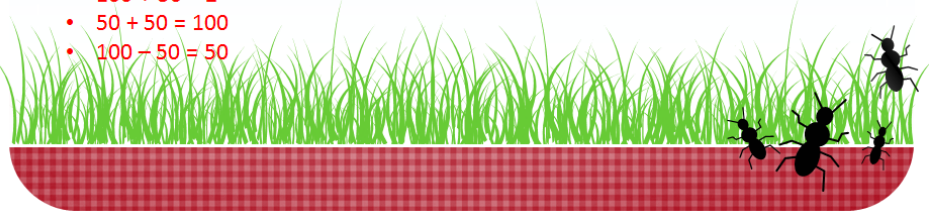
Compare the two sets of ants.

What statements can you make about the relationship between the two sets?

100 Ants

50 Ants

Example Statements in Numbers and Words:

- There are twice as many ants in the row of 100 than there are in the row of 50
 - There are half the number of ants in the row of 50 than there are in the row of 100
 - 50 is half as much as 100
 - 100 is twice as much as 50
 - $50 \times 2 = 100$
 - $100 \div 50 = 2$
 - $50 + 50 = 100$
 - $100 - 50 = 50$
- 



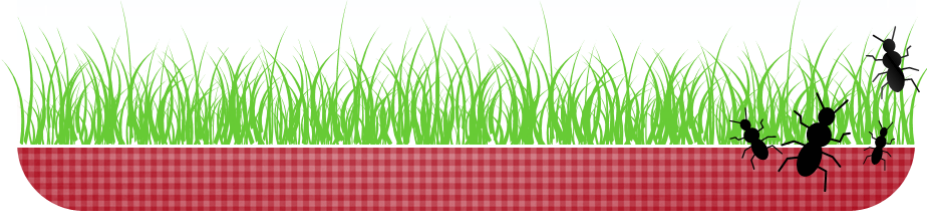
Compare the two sets of ants.

What statements can you make about the relationship between the two sets?

50 Ants



10 Ants



Barnwood Elementary School in the News!!

YUM!

Posted by: communications@fultonschools.org
Posted on: 11/22/2010



Thanksgiving celebrated through feasts and food drives

Barnwood Elementary School students are working together to take the problem of hunger off the table.

The annual food drive supports the [redacted] community and North Fulton Community Charities. From peanut butter to pancake mix, the students bagged it up and brought it into [redacted] PTA members worked with the school's Student Council to collect and sort various canned and boxed food items.

A PTA representative Kim [redacted] noted, "We set a goal of at least one item of canned or dry goods per student, and it looks like we will greatly surpass this goal." Jessica Smith, the chairperson of [redacted] Caring and Sharing Committee, stated, "The food drive helps students to realize that one person can make a big difference."

Barnwood Elementary School in the News!!

A PTA representative noted, "We set a goal of at least one item of canned or dry goods per student, and it looks like we will greatly surpass this goal."

Mrs. Williams counted all of the cans brought in by the 21 students in her math class and exclaimed, "We collected 63 cans in all! Now we need to pack them into boxes. Let's pack 7 boxes with an equal amount of cans in each box."

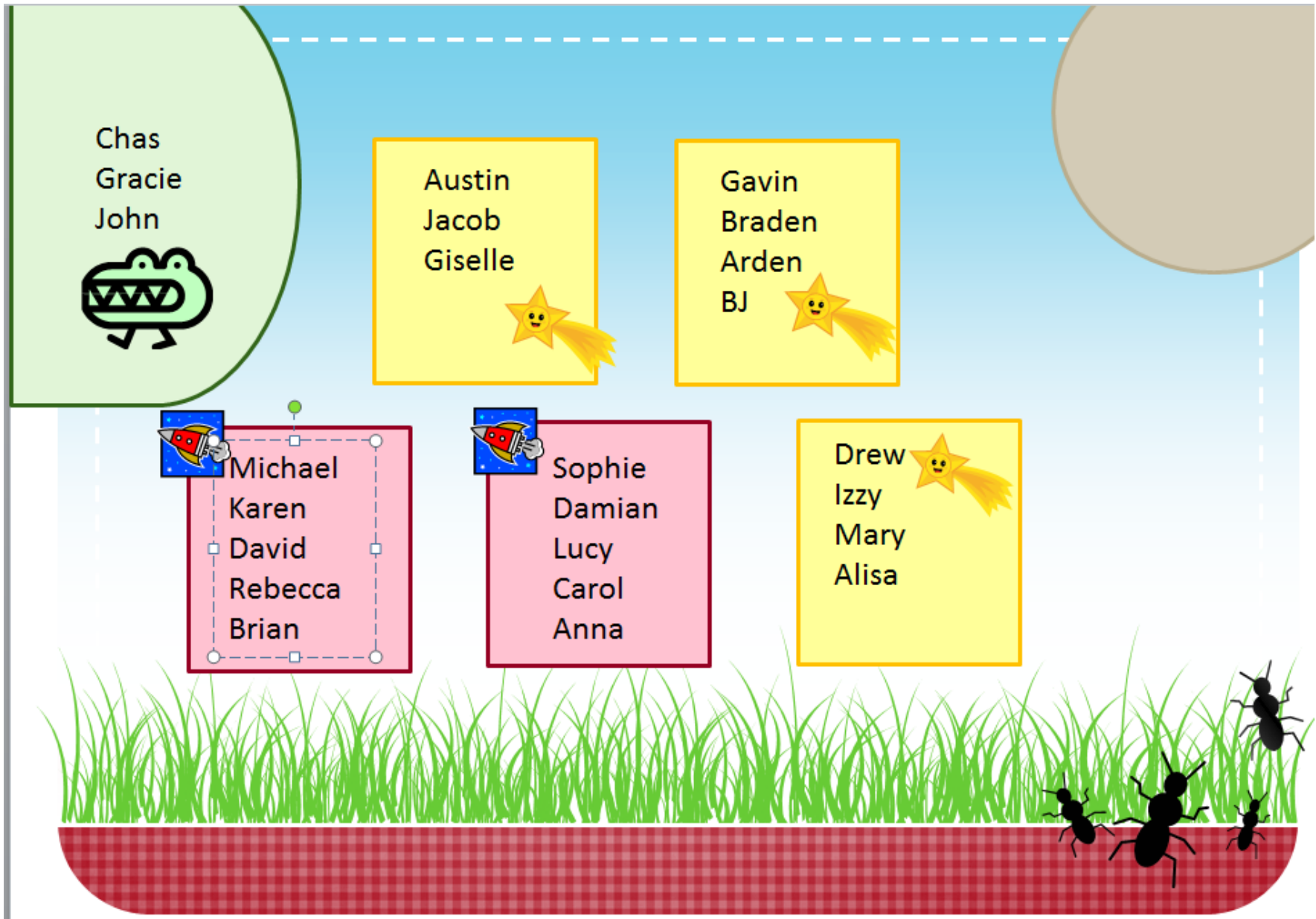
How many boxes are needed?
Did they surpass the goal amount set by the PTA? If so, by how much?

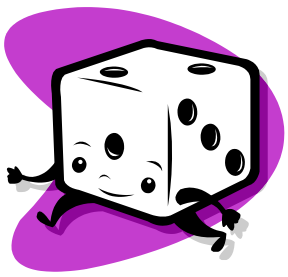
Tiered Groups & Seating Arrangement

Green Gators = High

Yellow Stars = Medium

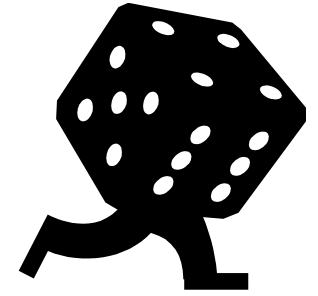
Red Rockets = Low





Finished?

Wondering what to do?
Take a roll and try something new!



If you roll this...	... then do this!
1	Turn to another student at your table and <u>explore</u> whether you used the same strategy to solve the word problem.
2	<u>Explain</u> your strategy to another student at your table.
3	Turn your paper over and <u>create</u> a story problem for another student at your table.
4	<u>Investigate</u> what would happen if you changed one or all of the numbers in the story problem.
5	<u>Think</u> of another number sentence that would represent the information included in the story problem.
6	How might the answer to this problem <u>apply</u> to real life? How might the information be used?

Student Observational Checklist

Green Gators:

John	
Gracie	
Chas	

Yellow Stars:

Drew	
Izzy	
Mary	
Alisa	
Gavin	
Braden	
Arden	
Giselle	
Austin	

BJ	
Jacob	

Red Rockets:

Sophie	
Damian	
Lucy	
Carol	
Anna	
Michael	
Karen	
David	
Rebecca	
Brian	

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Mrs. Williams counted all of the cans brought in by the 21 students in her math class and exclaimed, "We collected 63 cans in all! Now we need to pack them into boxes. Let's pack 7 boxes with an equal amount of cans in each box."

How many boxes are needed?

Did they surpass the goal amount set by the PTA? If so, by how much?



Investigate this story problem using models/manipulatives, and then respond below using pictures, numbers, and words.

Hint: There are 3 "questions" in this story problem. Go back and circle them.

- 1) *For the first question, use your manipulatives to figure out how many boxes are needed. Look at the question, and underline the key words! Then draw what you built and explain using numbers and words.*
- 2) *Now go back and look at the story again. What was the goal set by the PTA? How many cans would that be for Mrs. Williams' math class based on the number of students stated in the question?*
- 3) *Now write a number sentence comparing the number of cans collected by Mrs. Williams' math class with the goal amount set by the PTA to show by how many cans Mrs. Williams' students beat the PTA goal.*

A PTA representative noted, "We set a goal of at least one item of canned or dry goods per student, and it looks like we will greatly surpass this goal."

Mrs. Williams counted all of the cans brought in by the 21 students in her math class and exclaimed, "We collected 63 cans in all! Now we need to pack them into boxes. Let's pack 7 boxes with an equal amount of cans in each box."

How many boxes are needed?

Did they surpass the goal amount set by the PTA? If so, by how much?



Investigate this problem using models or manipulatives. Draw what you build.

Hint: There are 3 "questions" in this story problem. Go back and circle them.

1) *For the first question, use your manipulatives to figure out how many boxes are needed. Look at the question, and underline the key words! Then draw what you built and explain using numbers and words.*

2) *Now go back and look at the story again. What was the goal set by the PTA? How many cans would that be for Mrs. Williams' math class?*

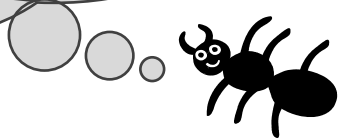
3) *Now write a number sentence comparing the number of cans collected by Mrs. Williams' math class with the goal amount set by the PTA to show by how many cans Mrs. Williams' students beat the PTA goal.*

Name: _____

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How many boxes are needed?
Did they surpass the goal amount set by the PTA? If so, by how much?



Investigate this problem using models/manipulatives.

Draw what you build, then answer the question and justify your response using words and numbers.



Students in Mrs. Williams' class collected 25 cans of food for the Caring & Sharing food drive. They are packing boxes that will be given to local families for Thanksgiving. Mrs. Williams suggested that five cans of food go into each box. How many boxes will the class make in all?

OK, to solve this problem, this is what I need to do:	Completed?
Investigate this problem by building a model with manipulatives at my desk.	
On this paper, create a picture of what I have built at my desk.	
Label the pictures with numbers and words to explain what I drew.	
Write number statements about the pictures I drew.	
Reread the entire story problem and ANSWER THE QUESTION!	

How many cans will go into each box?

Answer: _____



Thanksgiving Food Drive

Name: _____

Students in Mrs. Williams' class collected 25 cans of food for the Caring & Sharing food drive, and packed 5 boxes. Students in Mrs. Green's class collected 30 cans of food and packed 5 cans into each of their boxes. Which class packed more boxes?

Using models/manipulatives create this story problem, and then respond below using pictures, numbers, and words

OK, to solve this problem, this is what I need to do:	Completed?
Investigate this problem by building a model with manipulatives at my desk.	
On this paper, create a picture of what I have built at my desk.	
Label the pictures with numbers and words to explain what I drew.	
Write number statements about the pictures I drew.	
Reread the entire story problem and ANSWER THE QUESTION! Don't forget to label.	

Hint: Build two models, one for each class!!!

Mrs. Williams' Class	Mrs. Green's Class

Answer:



Thanksgiving
Food Drive

Name: _____

Students in Mrs. Williams' class collected 72 cans of food for the Caring & Sharing food drive, and packed 9 different boxes with equal amounts of cans. Students in Mrs. Green's class collected 63 cans of food and packed 9 cans into each box. One student commented, "I wonder which class packed more boxes?" Using models/manipulatives create this story problem, and then respond below using pictures, numbers, and words.

Student Word Problem Rubric/Self-Assessment

Word Problems: Student Self-Assessment Rubric			
	Got it!	I'm Halfway There!	Help Please!
Important Words	I underlined all of the important words in the question.	I underlined some of the important words in the question. I am not sure which ones were important.	I need help figuring out which are the important words in the question.
Pictures	I understood the word problem and was able to draw it in pictures.	I tried to draw pictures to match the word problem but I am not sure if I did it correctly.	I need help drawing pictures.
Numbers	The student uses correct and complete sentences to represent the math problem including +, -, x, ÷ and = signs.	I used some numbers to help explain my work.	I need help using numbers to explain my work.
Explanation (Words)	The student explained their work. The explanation is fully correct, and matches the problem.	I tried to explain my work in words, but I am not really sure if I explained it correctly.	I need help to explain my work in words.
Answer	I included an answer. I am pretty sure it is correct and that I labeled it correctly.	I included an answer but I didn't label it. I am not sure if my answer is correct.	I need help to figure out the answer.

Word Problems: Student Self-Assessment Rubric			
	Got it!	I'm Halfway There!	Help Please!
Important Words	I underlined all of the important words in the question.	I underlined some of the important words in the question. I am not sure which ones were important.	I need help figuring out which are the important words in the question.
Pictures	I understood the word problem and was able to draw it in pictures.	I tried to draw pictures to match the word problem but I am not sure if I did it correctly.	I need help drawing pictures.
Numbers	The student uses correct and complete sentences to represent the math problem including +, -, x, ÷ and = signs.	I used some numbers to help explain my work.	I need help using numbers to explain my work.
Explanation (Words)	The student explained their work. The explanation is fully correct, and matches the problem.	I tried to explain my work in words, but I am not really sure if I explained it correctly.	I need help to explain my work in words.
Answer	I included an answer. I am pretty sure it is correct and that I labeled it correctly.	I included an answer but I didn't label it. I am not sure if my answer is correct.	I need help to figure out the answer.

Word Problems: Student Self-Assessment Rubric			
	Got it!	I'm Halfway There!	Help Please!
Important Words	I underlined all of the important words in the question.	I underlined some of the important words in the question. I am not sure which ones were important.	I need help figuring out which are the important words in the question.
Pictures	I understood the word problem and was able to draw it in pictures.	I tried to draw pictures to match the word problem but I am not sure if I did it correctly.	I need help drawing pictures.
Numbers	The student uses correct and complete sentences to represent the math problem including +, -, x, ÷ and = signs.	I used some numbers to help explain my work.	I need help using numbers to explain my work.
Explanation (Words)	The student explained their work. The explanation is fully correct, and matches the problem.	I tried to explain my work in words, but I am not really sure if I explained it correctly.	I need help to explain my work in words.
Answer	I included an answer. I am pretty sure it is correct and that I labeled it correctly.	I included an answer but I didn't label it. I am not sure if my answer is correct.	I need help to figure out the answer.

Teacher Word Problem Rubric

Word Problems: Teacher Rubric			Total: _____/15
	3 pts.	2pts	0-1pts
Important Words	All of the important words are underlined or written in both the word problem and the question.	Some of the important words are underlined or written in both the word problem and the question.	Important words are not underlined or only incorrect words are underlined.
Pictures	The story problem is correctly represented in pictures.	The story problem includes some pictures but they are incomplete or do not match the problem.	Pictures are not included in solution.
Numbers	The student uses correct and complete sentences to represent the word problem including +, -, x, ÷ and = signs.	The student uses numbers to identify the picture elements of the problem but is not able to create number sentences with the numbers.	Numbers are not included in solution.
Explanation (Words)	The student is able fully and correctly explain work.	The student attempted to explain work. The explanation is not fully correct or does not match the problem.	The student did not attempt to explain their work or the explanation does not correlate to with the word problem.
Answer	The answer to the word problem is correct and labeled.	The answer is correct but not labeled.	The answer is wrong or not included.

Word Problems: Teacher Rubric			Total: _____/15
	3 pts.	2pts	0-1pts
Important Words	All of the important words are underlined or written in both the word problem and the question.	Some of the important words are underlined or written in both the word problem and the question.	Important words are not underlined or only incorrect words are underlined.
Pictures	The story problem is correctly represented in pictures.	The story problem includes some pictures but they are incomplete or do not match the problem.	Pictures are not included in solution.
Numbers	The student uses correct and complete sentences to represent the word problem including +, -, x, ÷ and = signs.	The student uses numbers to identify the picture elements of the problem but is not able to create number sentences with the numbers.	Numbers are not included in solution.
Explanation (Words)	The student is able fully and correctly explain work.	The student attempted to explain work. The explanation is not fully correct or does not match the problem.	The student did not attempt to explain their work or the explanation does not correlate to with the word problem.
Answer	The answer to the word problem is correct and labeled.	The answer is correct but not labeled.	The answer is wrong or not included.

Word Problems: Teacher Rubric			Total: _____/15
	3 pts.	2pts	0-1pts
Important Words	All of the important words are underlined or written in both the word problem and the question.	Some of the important words are underlined or written in both the word problem and the question.	Important words are not underlined or only incorrect words are underlined.
Pictures	The story problem is correctly represented in pictures.	The story problem includes some pictures but they are incomplete or do not match the problem.	Pictures are not included in solution.
Numbers	The student uses correct and complete sentences to represent the word problem including +, -, x, ÷ and = signs.	The student uses numbers to identify the picture elements of the problem but is not able to create number sentences with the numbers.	Numbers are not included in solution.
Explanation (Words)	The student is able fully and correctly explain work.	The student attempted to explain work. The explanation is not fully correct or does not match the problem.	The student did not attempt to explain their work or the explanation does not correlate to with the word problem.
Answer	The answer to the word problem is correct and labeled.	The answer is correct but not labeled.	The answer is wrong or not included.