

Math Word Problem Intervention Strategy – Identification of Common Word Problem Structures and Using Schema-Based Strategies

For: Students in Grades 2 and above who are experiencing difficulty with mathematics word problems, or have not reached the benchmark on the MAP Math or MAP Math Skills, math standard/benchmark, or curriculum assessment.

Materials:

- Curricular or teacher-made materials containing word/story problems, preferably with one type of word problem structure initially, and then mixing the structures as the student learns them (See examples attached.). Oral problems may also be used, but key phrases and numbers should be written for the student.
- Recording sheet

Recommended Duration and Frequency: This intervention should be conducted at least 3 times per week for 20 – 30 minutes per session. Monitor the student’s progress once a week or twice monthly using MAP Math, standard/benchmark, or curriculum assessments. When the student’s score is at the benchmark/target for 3 consecutive monitors and teacher observation confirms that the skill has been transferred to classroom work (and the student is performing successfully on curriculum assessments), the intervention may be discontinued.

Steps for Intervention:

Note: This intervention relies on the teaching of certain common structures of math word/story problems, the identification of the structure by the student, and the visual representation of the story problem before solving. An explanation of the common word problem structures can be found on the attached sheets. One type of structure should be taught and practiced at a time, adding structures as the student is ready, and mixing “known” structures on practice sheets.

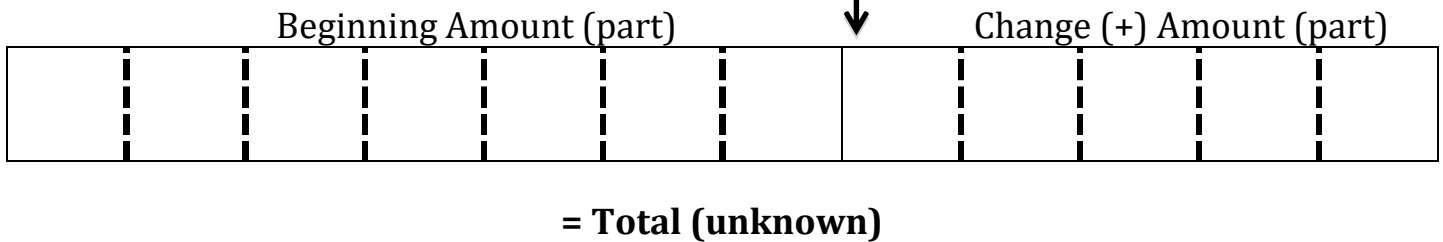
1. Tell the student that you will be talking about and examining story problem structures or “set-ups” so that s/he will eventually be able to tell what kind of story problem is being presented and will be able to “draw out” the problem. Let the student know that this will help him or her be able to solve math problems better.
2. **Model:** Present a word problem of one type of structure (see attached) to the student. Have the student read the problem.
 - a. Tell the student that this is a problem with the _____ (Compare, Equalize, etc.) structure. Describe key words and any other information about this type of structure to the student.
 - b. In your own words, retell the problem.
 - c. Draw a visual representation of the problem for the using, using the “bar-type” examples in the attached sheet, or any drawing you think would be helpful for the student. Fill in the numerical values from the problem on your drawing.
 - d. Solve the problem for the student, using “think-aloud” strategies.
 - e. Model for the student for at least 2 intervention sessions. Document the dates in which modeling was done on the Recording Sheet (attached).
3. **Guided Practice:** (This step can be completed using student partners, if desired.) Present another problem of the same structure to the student. Guide and assist the student through the following steps;

- a. Have the student read the problem and then retell it in his own words.
 - b. Tell the student to look for key words and tell which structure the word problem represents.
 - c. Have the student draw a diagram or picture to represent the problem, adding numerical values into the drawing.
 - d. Ask the student to solve the problem using any strategies he knows. Take notes on the Recording Sheet (attached) to indicate any successes or problems the student is having.
 - e. Have the student complete at least 2 intervention sessions with guidance, gradually releasing the responsibility of completing the problem to the student. Take notes on the Recording Sheet. When the student appears confident with this structure type, move to the next step.
4. **Guided Practice with Previously-Taught Structures/Mixed Practice:** (Complete only if the student has been taught more than one structure type.) If the student has learned other structures through this intervention, provide a mixed selection of word problems. If using a mixed selection, remind the student that there will be different types of problems on the sheet. Have the student follow the steps in #3 above to complete the problems, providing assistance as necessary, and gradually releasing the responsibility of completing the problems to the student. Keep notes on the Recording Sheet. Complete at least 2 Guided Practice with Mixed Problems intervention sessions with the student. When the student seems confident with completing the mixed problems, move on to the next step.
5. **Independent Practice:** Provide the student with a sheet of several problems to complete. If the student has been taught only one structure type, include only problems of that type. If the student has learned other structures through this intervention, provide a mixed selection of word problems. If using a mixed selection, remind the student that there will be different types of problems on the sheet.
- a. Tell the student to follow the steps in the “Word Problem Strategy Guide” to help him complete the sheet of problems. Review the steps, if desired.
 - b. Allow the student to independently complete the problems.
 - c. When completed, check the problems with the student. Determine a percentage of accuracy. Review any problems with which the student had difficulty. Make notes on the Recording Sheet.
 - d. If the student scores below 85% accuracy during an intervention session, return to the Guided Practice with Previously-Taught Structures stage for at least 2 intervention sessions.
 - e. When the student has obtained at least 85% accuracy 3 days in a row on problem sheets, repeat steps #2 through #4 with a different structure type. Continue through the structure types until all types are learned and can be successfully identified and solved by the student.
6. **Progress Monitoring:** Use the MAP Math or MAP Math Skills, standard/benchmark, or curriculum assessment to monitor the student’s progress at least twice monthly. When student’s score is at or above benchmark for at least 3 consecutive probes and the skill has been transferred to classroom work, the intervention may be discontinued.

- John has 7 comic books. Then Sarah gave him 5 more. How many comic books does John have now?

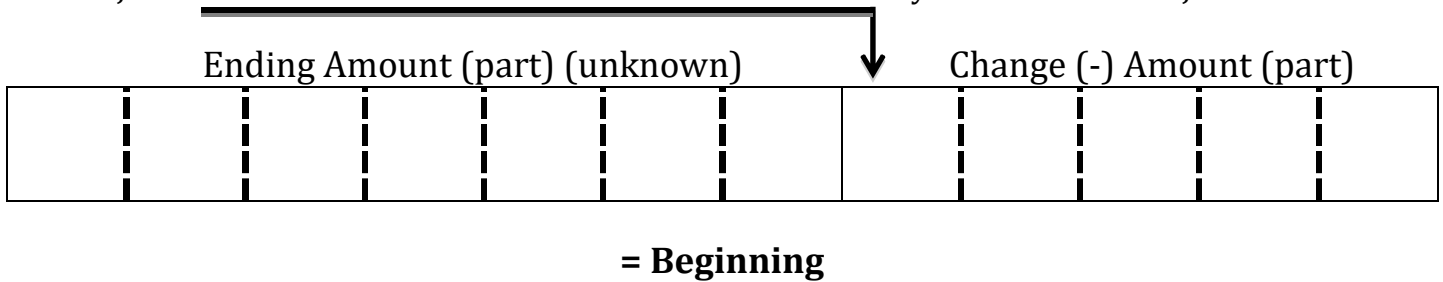
Visual Representation:

Getting more –



Getting less –

- John had 12 comic books. Sarah took 5 of them. How many comic books does John have now?



Structure #3: “Compare” (Two items of the same kind or unit are being compared.)

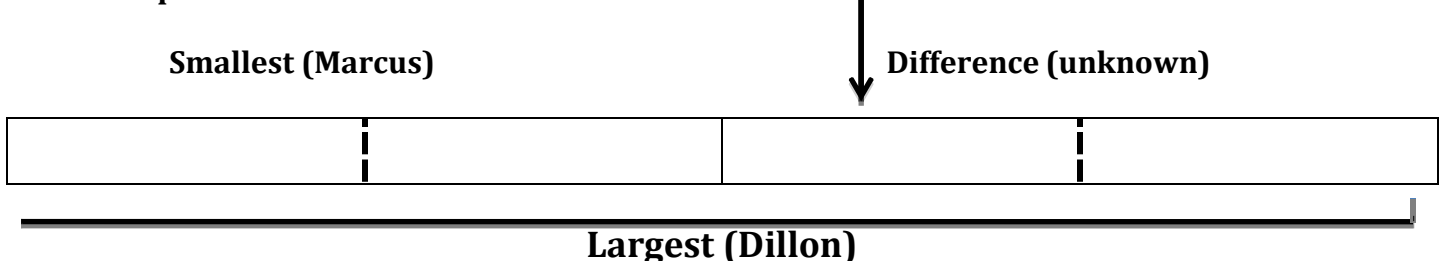
Key Identifying Words: “more”, “less”, “fewer”

This structure is common in Grades 1 – 5. The difficulty of this problem is varied across the grade levels by using bigger numbers, decimals, fractions, etc.

Examples:

- (Quantity unknown) Ray has 9 comic books. John has 7 more comic books than Ray. How many comic books does John have?
- (Difference unknown) Dillon had 4 pets. Marcus had 2 pets. How many more pets did Dillon have than Marcus?

Visual Representation:



Structure #4: “Equalize” or “Equal Groups” (The same number of items in each group... how many in each group, make the groups even, or find the total)

Key Identifying Words: “each”, “every”, “a”, “per”

This structure is common in Grades 3 - 5.

Examples:

- Debbie has 7 comic books. John has 9 comic books. How many more must Debbie get in order to have the same number as John?
- The Sports Boosters raised \$908 at their annual chili supper. The money will be shared equally by 4 athletic teams. How much money will each team receive?

Visual Representation:

A = Number of Groups (4)

b = Number in a group (unknown)	b = Number in a group (unknown)	b = Number in a group (unknown)	b = Number in a group (unknown)
--	--	--	--

c = Total (\$908)

$$(c/a = b)$$

Structure #5: “Array” or “Area” (Problems with rows, columns, sides...)

Key Identifying Words: “rows”, “lines”, “sides”, “length (long)”, “width (wide)”, “area”, “perimeter”, “cover”, “fill”

This structure is common in Grades 3 - 5.

Examples:

- There are 240 chairs to set up for the concert. Each row has 40 chairs in it. How many rows are there?
- The patio in Erika’s backyard is 5 yards long by 4 yards wide. How much carpet would Erika’s father need to buy to cover the whole patio?

Visual Representation:

Rows X	Items in a Row =	Total
???	40 chairs	240 total chairs

Length X	Width =	Area (needed to cover)
5 yards	4 yards	???

Structure #6: “Multiplicative Compare” [Compares one thing as a multiplication of another (3 times as many) or part of another (1/3 as much)]

Key Identifying Words: “times as many”, “times as much”, “of”

This structure is common in Grades 3 - 5.

Examples:

- Francine has 5 CDs. Millie has 3 times as many. How many CDs does Millie have?

Visual Representation:

Referent X	Comparison =	Total
5	3	???

Word Problem Strategy Guide

1. Problem Identification

- Retell the problem in your own words
- Identify the structure or type of problem based on its features

2. Problem Representation

- Draw a picture or diagram to represent the problem
- Fill in the numbers or values given in the problem

3. Problem Solution

- Solve the problem using strategies you know

Word Problem Structures

Structure #1: "Group" or "Combine" (Two smaller parts make a whole.)

Key Identifying Words: "altogether", "together", "how many"

Examples:

- John has 7 comic books and Sarah has 5. How many comic books do they have altogether?
- Uranus has 11 rings. Neptune has 4 rings. How many rings do they have altogether?
- Kelly bought 4 apples and 3 oranges. How many pieces of fruit did Kelly buy?

Structure #2: "Change" [Begin with an amount or quantity, and then perform an action that increases (adds to) or decreases (takes away from) that amount.]

Key Identifying Words: "then", "now"

Examples:

- Sarah bought 12 pencils. Two of them broke so she threw them away. How many pencils does she have now?
- There are 18 ducks. Then 5 more swim over. How many ducks are there now?
- John has 7 comic books. Then Sarah gave him 5 more. How many comic books does John have now?

Structure #3: "Compare" (Two items of the same kind or unit are being compared.)

Key Identifying Words: "more", "less", "fewer"

Examples:

- (Quantity unknown) Ray has 9 comic books. John has 7 more comic books than Ray. How many comic books does John have?
- (Difference unknown) Dillon had 4 pets. Marcus had 2 pets. How many more pets did Dillon have than Marcus?

Word Problem Strategy Guide, continued

Structure #4: “Equalize” or “Equal Groups” (The same number of items in each group... how many in each group, make the groups even, or find the total)

Key Identifying Words: “each”, “every”, “a”, “per”

Examples:

- Debbie has 7 comic books. John has 9 comic books. How many more must Debbie get in order to have the same number as John?
- The Sports Boosters raised \$908 at their annual chili supper. The money will be shared equally by 4 athletic teams. How much money will each team receive?

Structure #5: “Array” or “Area” (Problems with rows, columns, sides...)

Key Identifying Words: “rows”, “lines”, “sides”, “length (long)”, “width (wide)”, “area”, “perimeter”, “cover”, “fill”

Examples:

- There are 240 chairs to set up for the concert. Each row has 40 chairs in it. How many rows are there?
- The patio in Erika’s backyard is 5 yards long by 4 yards wide. How much carpet would Erika’s father need to buy to cover the whole patio?

Structure #6: “Multiplicative Compare” [Compares one thing as a multiplication of another (3 times as many) or part of another ($\frac{1}{3}$ as much)]

Key Identifying Words: “times as many”, “times as much”, “of”

Examples:

- Francine has 5 CDs. Millie has 3 times as many. How many CDs does Millie have?
- This year in basketball, John scored 72 total points. His friend Bill scored $\frac{1}{8}$ that number of points. How many points did Bill score?

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Recording Sheet

Student: _____ Interventionist: _____

New Problem Structure: _____

Stage of Intervention	Dates when Stage was worked on	Accuracy Percentage	Notes
Stage 1: Teacher Modeling (at least 2 sessions recommended)	Date:		
	Date:		
	Date:		
	Date:		
	Date:		
Stage 2: Guided Practice (at least 2 sessions recommended)	Date:		
	Date:		
	Date:		
	Date:		
	Date:		
Stage 3: Guided Practice Mixed with Previously-Taught Structures (at least 2 sessions recommended)	Date:		
	Date:		
	Date:		
	Date:		
	Date:		
	Date:		
	Date:		
	Date:		
	Date:		
	Date:		

Results/Notes:

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Integrity Check

Interventionist:_____ **Date:**_____ **Grade Level:**_____ **Tier**_____

Integrity Monitor:_____

Descriptor - Student	Yes	No	N/A
Student has scored below benchmark on the specifically determined math assessment or has difficulty with math word problems as demonstrated on classroom tests or activities.			
Student is in Grade 1 or higher.			

Descriptor - Materials	Yes	No	N/A
Interventionist has gathered appropriate materials consisting of some worksheets with only one type of word problem structure, and some with mixed problems.			
Interventionist has a recording sheet.			
Student has a Word Problem Strategy Guide, if at the step in the intervention when it is			

Descriptor - Interventionist	Yes	No	N/A
The Interventionist maintains an environment conducive to task completion (quiet, manages behavior issues, engages student, etc.)			
The Interventionist explains the task to the student.			
Using the steps indicated in the instructions, Interventionist explicitly Models the word problem structure and solution for the student using think-alouds, and introduces only one type of problem on a given day. (If student is beyond this stage, check the recording sheet to be sure it is documented for at least 2 sessions.)			
Using the steps indicated in the instructions, the Interventionist applies Guided Practice for the student, assisting when necessary and asking relevant questions to lead the student to successful completion of the word problems, still working with only one type of problem. (If student is beyond this stage, check the recording sheet to be sure it is documented for at least 2 sessions.)			
Interventionist applies Guided Practice Mixed with Previously-Taught Structures for the student, adding problems with previously-taught structures to the work and assisting when necessary, asking relevant questions to lead the student to successful completion of the task. (If student is beyond this stage, check the recording sheet to be sure it is documented for at least 2 sessions.)			
Using the steps indicated in the instructions, the Interventionist applies Independent Practice for the student, not assisting the student at all and calculating an accuracy percentage. The student has a Word Problem Strategy Guide. Interventionist applies this stage using mixed problem practice as indicated in the intervention instructions. (If student has completed this stage, check the recording sheet to be sure the practice sessions are documented.)			
If accuracy percentage at the Independent Practice stage is less than 85%, Interventionist returns to the Guided Practice with Previously-Taught Structures stage of intervention for at least 2 sessions. Interventionist moves back into the Independent Practice stage when the student is at least 85% accurate for at least 2 sessions.			
The interventionist dates and makes notes on the Recording Sheet regarding student accuracy, performance, and any difficulty the student had.			
Student’s progress is monitored using the same appropriate math assessment (MAP, standard/benchmark, or curriculum) at least twice monthly.			

Gradual Release of Responsibility Integrity Check Summary: _____ of _____ applicable components are observed.

Notes:

Word Problem Samples

The following word problem samples are not grade-level specific. They are indications of the different varieties of problems one might find within each word problem structure. Interventionists are free to adapt the problems to suit the levels of the child (i.e. using larger numbers, substituting decimals, etc.)

“Group” or “Combine” Structure

1. John has 7 comic books and Sarah has 5. How many comic books do they have altogether?
2. Uranus has 11 rings. Neptune has 4 rings. How many rings do they have altogether?
3. Kelly bought 4 apples and 3 oranges. How many pieces of fruit did Kelly buy?
4. Jasmine swims 12 laps every afternoon, Monday through Friday. How many laps does she swim in one week?
5. Janelle, who is 12, and her mother want to go to a movie. Children under 13 cost \$5, and adults cost \$8. How much will it cost for them to see the movie?
6. Mrs. Johnson is taking all three of her pre-school children to a movie. Children under 13 cost \$5, and adults cost \$8. How much will it cost for all 4 of them to see the movie?
7. A candy store sells giant jawbreakers for \$2 and candy bars for \$1. Shelby buys 3 jawbreakers and a candy bar. Kendra buys 2 jawbreakers and 4 candy bars. How much did the girls spend altogether?
8. Albert is setting out four boards of lumber. The lengths of the boards are 4.5 feet, 4.52 feet, 4 feet, and 4.505 feet. How many feet of lumber does he have in all?
9. In 2010, 34 million, 586 thousand, 42 people visited the state park. The next year 35 million, 87 thousand, 3 people visited. What was the total number of people who visited the state park in both years?
10. Mike, Jake, and Aaron are buying snowboards. Mike’s costs \$219.49. Jake’s costs \$279.97, and Aaron’s costs \$234.95. How much are the boys paying altogether for their snowboards?
11. Gloria drove 53.2 miles to her grandmother’s home. From her grandmother’s home, she drove 12.67 miles to her aunt’s home. How many miles is it from Gloria’s home to her aunt’s home?
12. Carmen bought 6 pounds of seafood. She bought $1\frac{3}{4}$ pounds of salmon and $2\frac{1}{5}$ pounds of catfish. How many pounds of shrimp did she buy?
13. The class collected $9\frac{5}{7}$ pounds of glass bottles and $6\frac{1}{2}$ pounds of aluminum cans. How many pounds of glass and aluminum did the class collect in all?
14. A kite has two pairs of congruent sides. If two sides are 56 centimeters and 34 centimeters, what is the perimeter of the kite?
15. Before soccer practice, Joe warms up by jogging around a soccer field that is 100 yards by 130 yards. How many yards does he run?
16. I had 5 pennies. I earned some more. Now I have 9 pennies. How many pennies did I earn?

“Change” Structure

1. Sarah bought 12 pencils. Two of them broke so she threw them away. How many pencils does she have now?
2. There are 18 ducks. Then 5 more swim over. How many ducks are there now?
3. John has 7 comic books. Then Sarah gave him 5 more. How many comic books does John have now?
4. Josie received \$50 as a gift. She plans to buy two CDs that cost \$9 each and an earphone set that costs \$25. How much money will she have left?

5. Sue got a score of 90% on her math test, but she forgot to put her name on her paper. Her teacher deducts 5% for papers without names. What score did Sue receive?
6. Jenny has \$95 to spend on athletic shoes. If she buys a pair for \$59.99, how much money will she have left?
7. Albert's birthday is 7 days after Corey's birthday. Albert's birthday is on March 9th. What day is Corey's birthday?
8. Rebecca and Richard are testing their paper airplanes. Rebecca's plane flew 6 feet farther than Richard's. If Rebecca's plane flew 10 feet, how far did Richard's fly?
9. Oscar is saving money to buy a jacket that costs \$47. He already has \$25. How much money does he still need?
10. Sophie, the house cat, scared away 5 birds when she jumped onto the porch. If 3 birds remain, how many birds were on the porch before Sophie jumped?
11. Claudio went for a walk. While he was walking, \$1.35 fell out of his pocket. When he got home, Claudio had \$2.55 left. How much did he have when he started his walk?
12. Kevin had 37 marbles before he went out for recess. During recess he lost some marbles. He now has 22 marbles. How many did he lose during recess?

"Compare" Structure

1. (Quantity unknown) Ray has 9 comic books. John has 7 more comic books than Ray. How many comic books does John have?
2. (Difference unknown) Dillon had 4 pets. Marcus had 2 pets. How many more pets did Dillon have than Marcus?
3. The average height of a pitch pine tree is 55 feet. The average height of a lodgepole pine tree is 48 feet. What is the different in their average heights?
4. Albert is setting out four boards of lumber. The lengths of the boards are 4.5 feet, 4.52 feet, 4 feet, and 4.505 feet. How much longer is the longest board compared to the shortest board?
5. In 2010, 34 million, 586 thousand, 42 people visited the state park. The next year 35 million, 87 thousand, 3 people visited. How many more people visited the state park in 2011?
6. Mike, Jake, and Aaron are buying snowboards. Mike's costs \$219.49. Jake's costs \$279.97, and Aaron's costs \$234.95. How much more did Jake's snowboard cost than Aaron's?
7. A piano solo on a CD is 5.33 minutes long. A guitar solo is 9.67 minutes long. How much longer is the guitar solo than the piano solo?
8. People in the United States spend about \$366, 200 on grape and strawberry jelly every year. They spend only about \$291,500 on all other kinds of jelly combined. How much more do they spend on grape and strawberry jelly than on the other kinds?
9. Ben is creating a painting. He has $\frac{5}{8}$ of a tube of red paint and $\frac{3}{8}$ of a tube of green paint. How much more red paint does he have than green paint?
10. It usually takes Emilie $1\frac{3}{4}$ hours to get to her grandmother's house. Because of Thanksgiving traffic, this year it took $3\frac{1}{3}$ hours. How much longer did it take this year?
11. Larry bought a CD player for \$9 less than the regular price. If he paid \$32, what was the regular price?
12. The average January temperature in Anchorage, Alaska is 15 degrees. The average temperature in Barrow, Alaska for the same month is -13 degrees. On average, how much warmer is it in Anchorage in January than in Barrow?
13. Mary sold 78 candy bars for the school fundraiser. Chantel sold 101. How many more did Chantel sell?
14. Mary sold 78 candy bars for the school fundraiser. Chantel sold 23 more than Mary. How many did Chantel sell?

15. Chantel sold 101 candy bars for the school fund raiser. This was 23 more than Mary. How many did Mary sell?
16. Kari built a tower with 6 blocks, and Alex built a tower with 4 blocks. How much larger is Kari's tower?
17. Angela has 11 cents and Mary has 25 cents. How much more money would Angela need to have as much money as Mary?

"Equalize" or "Equal Groups" Structure

1. Debbie has 7 comic books. John has 9 comic books. How many more must Debbie get in order to have the same number as John?
2. The Sports Boosters raised \$908 at their annual chili supper. The money will be shared equally by 4 athletic teams. How much money will each team receive?
3. On a certain day, 525 people signed up to play softball. If 15 players are assigned to each team, how many teams can be formed?
4. Willow purchased a new car. Her loan, including interest, is \$12,720. How much are her monthly payments if she has 60 monthly payments to make?
5. Sarah had her birthday party at the city pool. It cost \$2.50 for each person to attend. If the total bill was \$25.00, how many people went to Sarah's party?
6. Frank, Gina, Judy, and Connie are splitting their dinner bill. After the tip, the total is \$30.08. How much does each person owe if they split the bill four ways?
7. Katherine spends \$1,089.72 each month for rent and supplies to run her hair salon. If she charges \$18 for a haircut, how many haircuts must Katherine do to cover her monthly expenses?
8. Kurt is on a camping trip. He has $5\frac{3}{5}$ cups of tuna. He wants to eat the same amount of tuna each day of his 7-day trip. How much tuna can he eat each day?
9. Alita, Alisa, and Alano are sharing the cost of a birthday gift for their mom. The gift costs \$147. How much will they each need to pay?
10. The 5th grade class is planning a field trip. 348 students and 18 teachers are going. If each bus holds 48 people, how many buses will they need? (This is a two-part problem with the first part being a "Combine" problem.)
11. In Mrs. Jones' class there are 27 students, but only 9 computers. How many students will have to share a computer?
12. Latisha's uncle gave her 32 stamps and a new stamp book. The book has 8 pages, and she put the same number of stamps on each page. How many stamps did she put on each page?

"Array" or "Area" Structure

1. There are 240 chairs to set up for the concert. Each row has 40 chairs in it. How many rows are there?
2. The patio in Erika's backyard is 5 yards long by 4 yards wide. How much carpet would Erika's father need to buy to cover the whole patio?
3. The measure of the area of a floor is 49 square feet. What is the most likely length and width of the room?
4. A kitchen is 12 feet square. What is the kitchen's area?
5. On a sticker sheet, there are 6 rows of stickers with 8 stickers in each row. How many stickers are on the sheet?
6. Your teacher asks you to put out 3 rows of chairs with 7 chairs in each row. How many chairs

do you need?

7. Ben arranged his soccer trophies into 3 equal rows. If he has 12 trophies, how many trophies are in each row?
8. The Richardson family has a tent that covers 54 square feet of ground. The tent is 9 feet long. How wide is it?
9. My teacher made a large tray of cookies. The tray has 7 rows with 5 cookies in each row. If we have 38 students in the class, how many more cookies with my teacher need to make if every student gets 1 cookie?

“Multiplicative Compare”

1. Francine has 5 CDs. Millie has 3 times as many. How many CDs does Millie have?
2. An Eastern White Pine is about 75 feet tall. The Lodgepole Pine is about 48 feet tall. The Longleaf Pine is approximately 110 feet tall, and the Ponderosa Pine is about 140 feet tall. Which tree is about $\frac{1}{2}$ as tall as the Ponderosa?
3. Carla has 12 marbles. John has 4 times as many as Carla. How many marbles does John have?
4. On Monday, the science club sold 86 books. This is half as many as they sold on Saturday. How many did they sell on Saturday?
5. A local pizza restaurant surveyed 100 of their customers to find out which of two pizzas - sausage or pepperoni - was liked more. Two-fifths of the people liked the sausage better. How many people liked each kind of pizza?
6. Georgia is making brownies. The recipe calls for $\frac{1}{3}$ cup of butter, but she wants to double the recipe. How much butter will she need now?
7. It takes June 3 times as long as it takes Karla to get ready for school in the morning. It takes June 45 minutes to get ready. How long does it take Karla?
8. Clarice is $\frac{1}{5}$ as old as her mother, and twice as old as her brother Jason. Clarice's mother is 30 years old. How old is Jason?
9. This summer it rained only $\frac{1}{4}$ as much as it did last summer. Last summer it rained 12 inches. How many inches did it rain this summer?
10. Mrs. Johnson planted 8 rose bushes in her garden. She planted 3 times as many azalea bushes. How many azalea bushes did she plant?
11. The number of coaches in the basketball league is $\frac{1}{7}$ the number of players. If there are 56 players, how many coaches are there?
12. Anne-Marie has saved \$9 for a new coat. That is $\frac{1}{6}$ of the amount she will need. How much is the coat she wants?