Number Theory Unit

Grades 3 and 4

Red Lake County Central Elementary

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Day 1- Pre-Assessment Review the fact family triangles. Play, I have, who has game? Discuss how to find missing factors in a story problem

Day 2- Solving number stories. Introduce the Button Doll story. Students will continue to solve problems involving multiples and equal groups.

Day 3 - Review Multiplication Facts with Arrays. Introduce the multiplication draw game. Children will complete page 190

Day 4 - Introduce near squares, children will practice solving multiplication problems using near squares. Students will complete the rolling and recording squares activity in groups of two.

Day 5 - Review the Button Doll Story. Students will practice solving 5 different story problems in their groups.

Day 6 - Review of equations and introduction of unknowns, students will work in pairs to analyze equations

Days 7 and 8 - The students will use multiplication and division diagrams and equations with letters representing the unknowns to make sense of number stories

Day 9 - In groups of three, the students will practice multiplication and division facts using the game, "Salute!"

Day 10 - The students will write and illustrate equations that can be solved using multiplication and division. Groups will present to class.

Day 11 - Multiplicative Comparisons, real life context, equations based on animal mother/baby weights, write comparison number story

Day 12 - Multiplicative Comparison Number stories "How much more?" Activity

Day 13 - Number Sentences, Match real world problem with number sentence

Day 14 - Multiplication Number Stories, Students write their own Real World Problem

Day 15 - More Multistep Number Stories, using a table students will solve multistep number stories to calculate the cost of a trip to an amusement park, Post Assessment

Executive Summary

The unit is comprised of fifteen, 20-45 minute lessons targeting students in grades 3-4. The students are thoroughly familiar will multiplication and division facts/strategies. As this unit requires students to work in groups, procedures have been implemented to ensure students are successful when working with others. Initially, to assess student's prior knowledge, the students will be given a pre-test. The teacher will assess the pre-test and, if needed, modify the unit accordingly. On Days 1-5, the students will multiply using arrays, near squares, and solve number stories. The students will begin days 6-10 by reviewing the term "equation" and being introduced to the term "unknown". During this week, students will play "Salute!" and represent equations with unknowns. In groups, the students will also use number stories to represent equations, create number stories and illustrations with those equations from "Salute!" Days 11-15, will focus on 4th grade skills. During this week the students will focus on multi-step number stories and the teacher will introduce the order of operations. This unit will conclude with the administration of a post-test which will assess what the students have learned.

Standards:

Algebra/ Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences. 3.2.2.1 Understand how to interpret number sentences involving multiplication and division basic facts and unknowns. Create real-world situations to represent number sentences.

Algebra/ Use number sentences involving multiplication, division, and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences. 4.2.2.1 Understand how to interpret number sentences involving multiplication, division, and unknowns. Use real-world situations involving multiplication or division to represent number sentences.

Sample MCA Questions

1. Malik has 64 marbles. He puts an equal number of marbles into each of 4 jars. How many marbles are in each jar?

A 14

B 15

C 16

D 18

2. Jeff had 1,350 glass beads and 695 clay beads. He sold 138 glass beads and 47 clay beads. How many beads did Jeff have left?
   A. 470
   B. 746
   C. 1,860
   D. 2,230

3. Which story problem can be solved using the number sentence 2 n=18?

   A Tom had 18 pencils. He gave n pencils away and had 2 left over. How many pencils did Tom give away?
   B Alice bought n books and spent $18. Each book cost $2. How many books did Alice buy?
   C Maya had n rocks and 2 baskets. She put 18 rocks in each basket. How many rocks did Maya have?
   D Pedro saw 2 kinds of birds. He saw 18 robins and n crows. How many crows did Pedro see?

4. There are 35 students going on a class trip. The students ride in vans. There are 7 students riding in each van. How many vans are needed to take all the students?

A. 4

B. 5

C. 6

D. 7

8. Robert has 54 pencils. He has 1 box of pencils and 3 packages of pencils. The box has 24 pencils. Which equation can be used to find p, the number of pencils in each package?

A. p=54=3*24

B. 24=54+3*p

C. 54=3+24*p

D. 54=24+3*p

Name_____

Pretest

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A. p=54=3*24

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D. 54=24+3*p

Day 1

Standard: Algebra Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems: create real-world situations corresponding to number sentences.

3.2.2.1 Understand how to interpret number sentences involving multiplication and division facts and unknowns. Create real-world situations to represent number sentences.

Objective: to assess the students' prior knowledge and review their multiplication facts

Launch: The students will complete a pre- assessment. The teacher will write the following problem on the board. There are 6 teams and 54 players in all. Each team has the same number of players. How many players are on each team?
6x___= 54.

Explore:
The teacher will remind the students of the terms factor x factor = product. The teacher will tell the students that there is a missing factor in this number sentence and then ask the students how they could find out what that factor is. Several strategies may be suggested. The teacher will continue asking students until the correct solution. 6 x9 = 54 is suggested. The teacher will remind the students that one way to learn their multiplication and division facts is to practice with fact family triangles.
Explore: The students will play the game "Pick a Family"

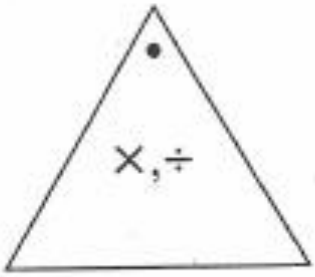
The teacher will put the students in groups of two. Each student will get a copy of the Fact Families sheet (TA 62) and a set of number cards (1-9). One student picks a number card and writes that number down on the bottom of one of the triangles on the Fact Family Page. The other student picks a card and writes that number on the same triangle. The students work together to solve that fact family problem. Several methods may be used to solve the problems. While the students are working, the teacher will walk around the room and informally assess the students on their comprehension of fact families and number rules.

Share: Each group of students will share one of their fact family triangles that they created together and talk about the strategies that they used to solve that problem.

Summarize: The teacher will ask the students to identify what makes fact families important when solving a missing factor problem.

Fact Triangles

NAME DATE TIME

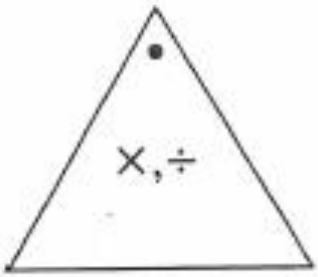


_____ × _____ = _____

_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____



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_____ × _____ = _____

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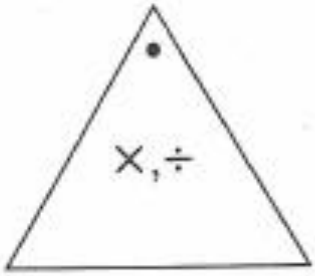
_____ ÷ _____ = _____

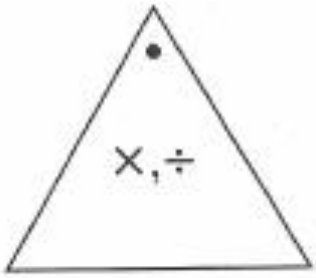


_____ × _____ = _____

_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____



_____ × _____ = _____

_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____

NT Day 1

 Picka Family

×, ÷ Fact Triangles 1: 2s, 5s, and 10s

Home Link 1-10

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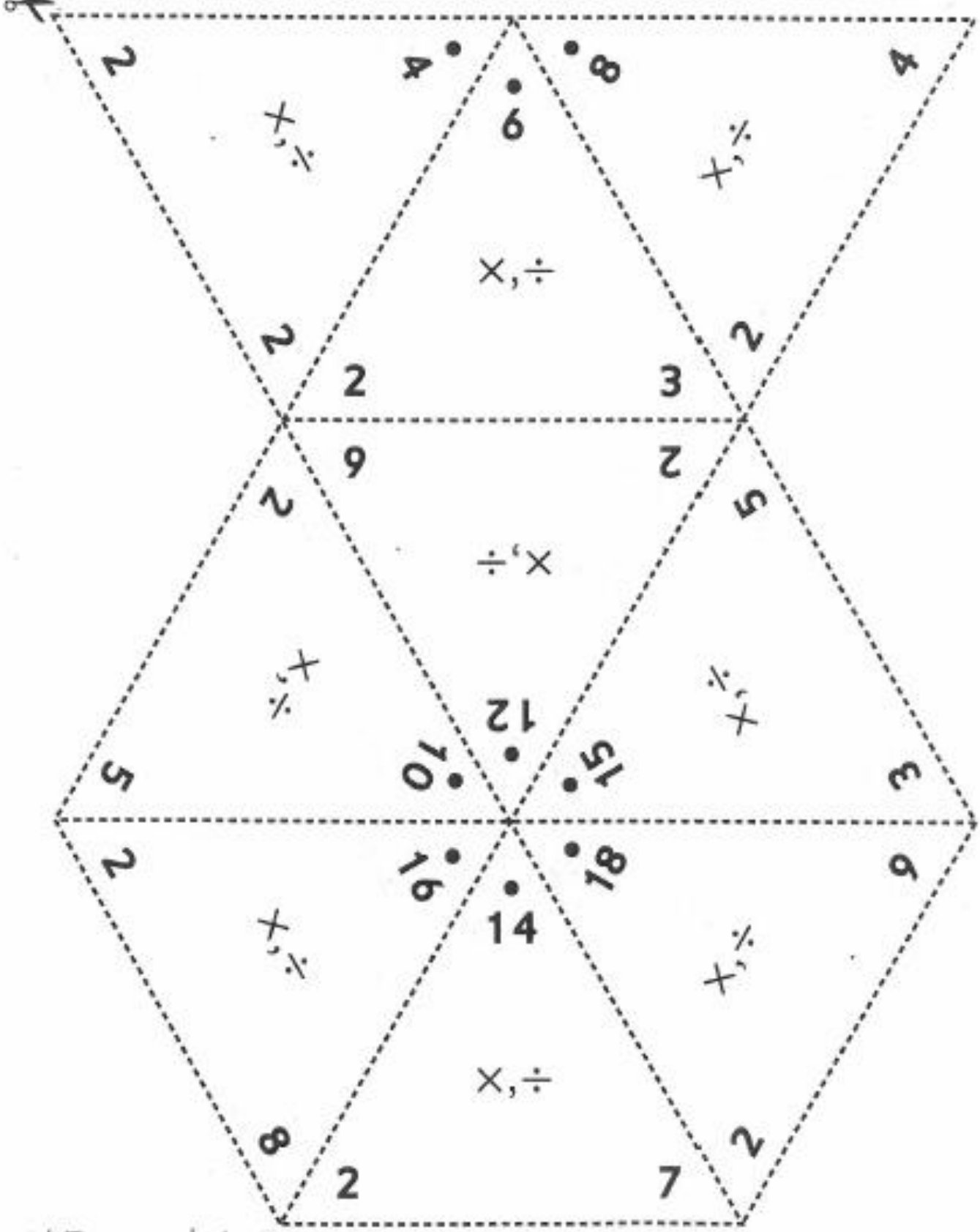
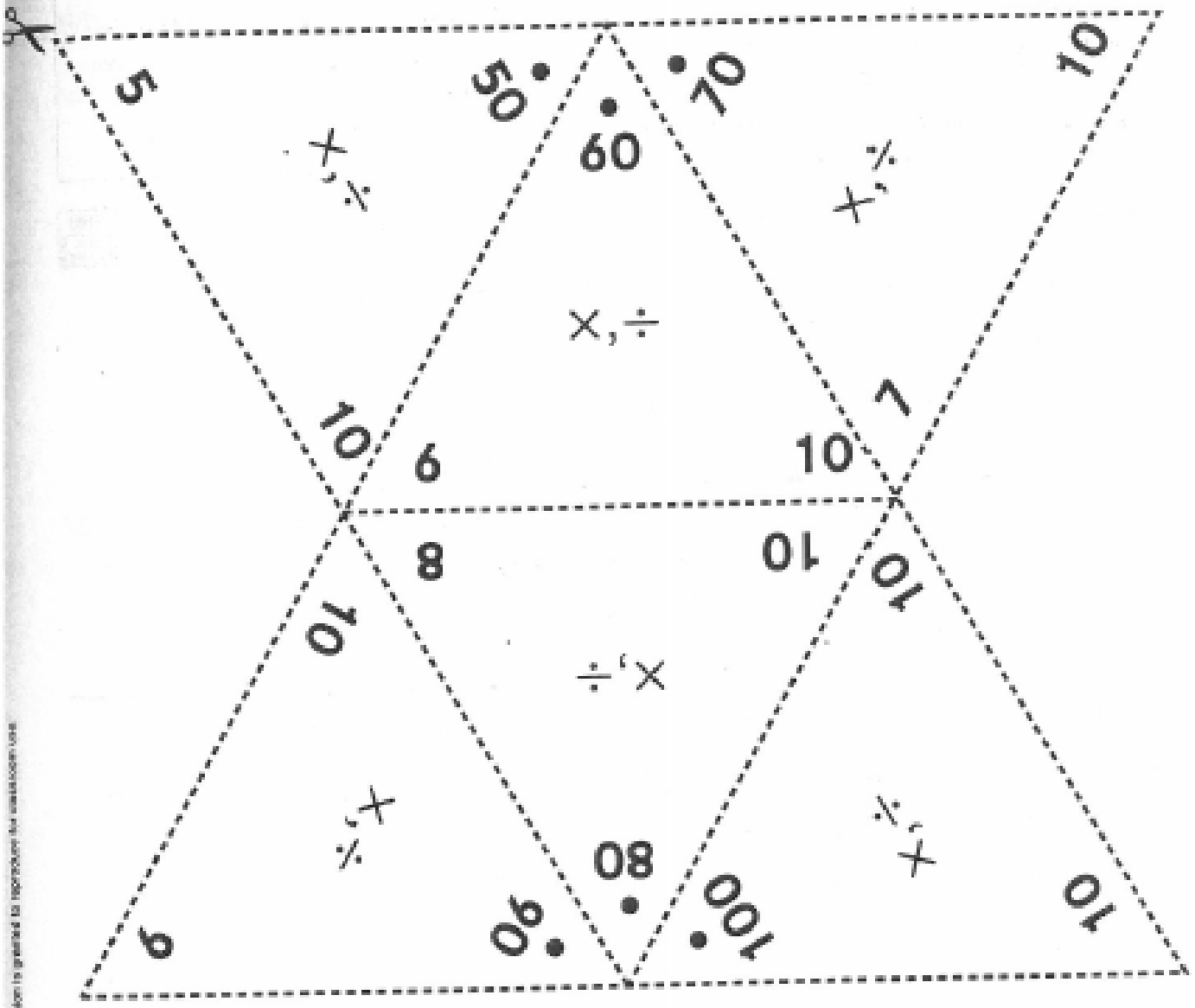


NT Day 1 : 4

×, ÷ Fact Triangles 3: 2s, 5s, and 10s

Home Link 1-10

NAME DATE TIME



NT Day1 #4

×, ÷ Fact Triangles 2: 2s, 5s, and 10s

Home Link 1-10

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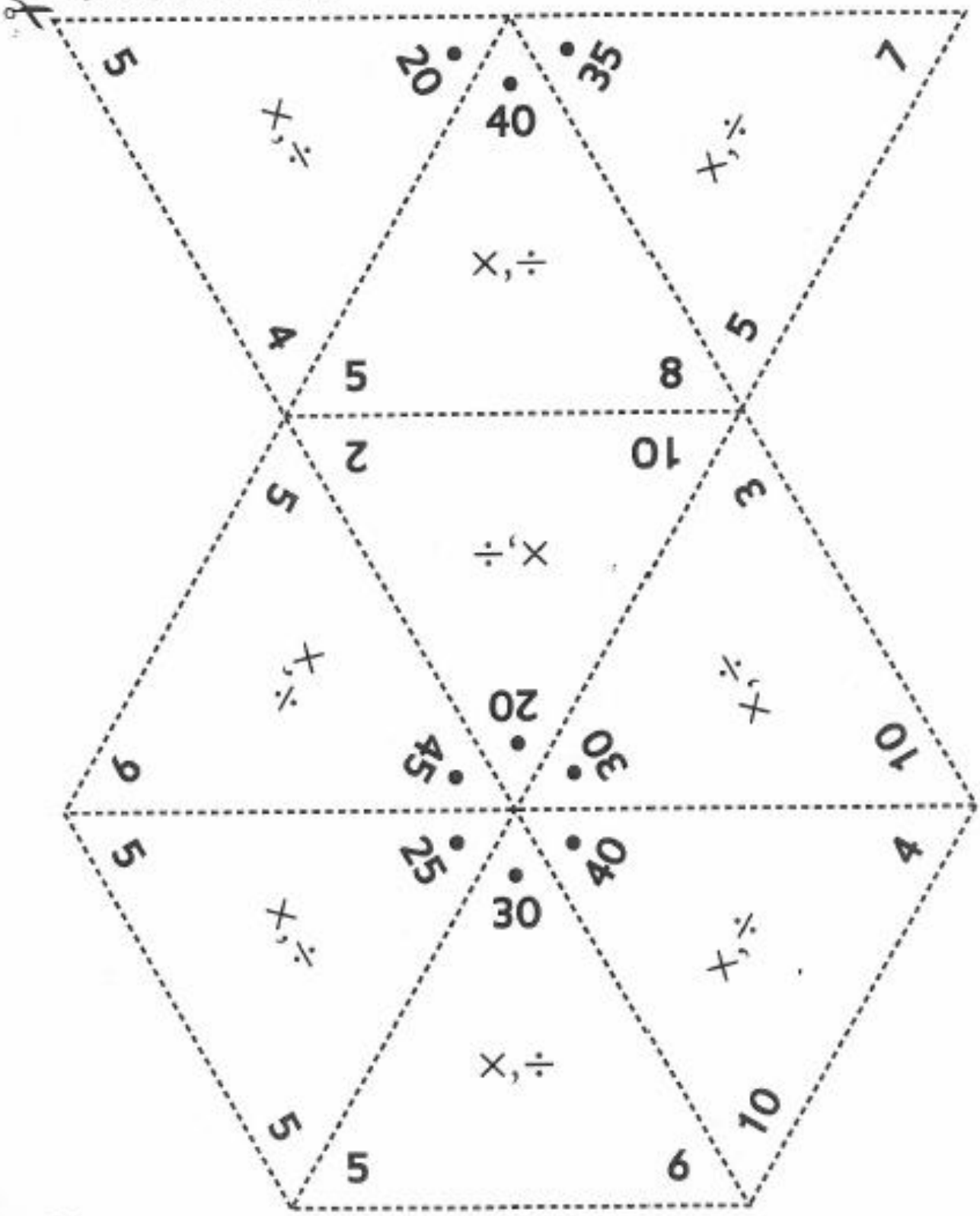
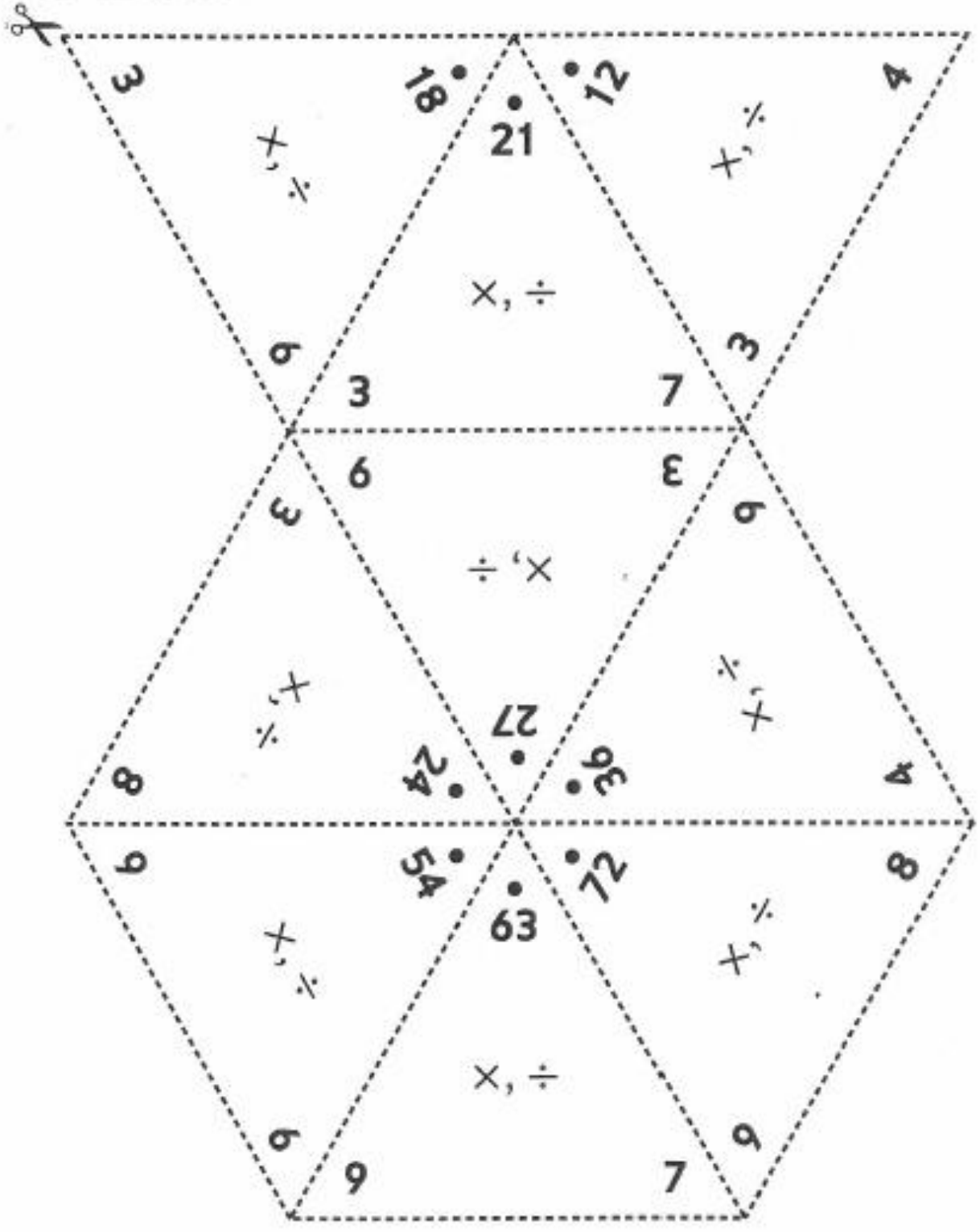


NT Day 1 ÷ 4

×, ÷ Fact Triangles: 3s and 9s

Home Link 3-12

NAME DATE TIME



 NT Day 1 : 4

Day 2

Standard: Algebra Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems: create real world situations corresponding to number sentences.

3.2.2.1 Understanding how to interpret number sentences involving multiplication and division facts and unknowns. Create real-world situations to represent number sentences

Objective: to solve real-world problems using multiplication

Launch: The teacher will read the problem as follows: Tonya is making button dolls for the school fair. On each doll, she uses 2 buttons for the eyes, 1 button for the nose, and 3 buttons for the clothes. There are 8 buttons in a package. Tonya needs to buy packages of buttons so that all of the buttons will be used without any left over. How many packages could she buy? How many dolls will that make?

The teacher will pass out pencils and crayons and copies of The Button Doll Story (p.178- 179) to each group of 2 students.

Explore:
The teacher will tell the students to work with their partner to solve the problem. The students should use words or pictures to show how you solved it. For children who are having trouble getting started provide counters to help them understand. Encourage them to see how many dolls they can make using one package of buttons, then two packages, and so on, using any leftovers as they go until there are none left.

If children can easily solve the problem, ask them to find another solution that allows Tonya to make more dolls. Students may realize that they can make 8 dolls using 48 buttons, 12 dolls using 72 buttons, and so on.

Share: The teacher will have the students talk about their solutions to the problem and what strategies they used to solve the problem. The teacher will also

ask the students who created additional problems to talk about how many dolls that were created from a different number of buttons.

Summarize: The teacher will talk to the students about their stories and the number of buttons that they used and the number of dolls that were created to see if they could understand what strategies they used to solve each problem.

Button Dolls

(continued)

Lesson 5-10

NAME DATE TIME

Work with a partner to solve the problem. Use words or pictures to show how you solved it.

How many packages could Tonya buy? _____

How many dolls will that make? _____

NT Day 2

Button Dolls

Lesson 5-10

NAME DATE TIME

Read the problem below. Think about what you understand from the story.

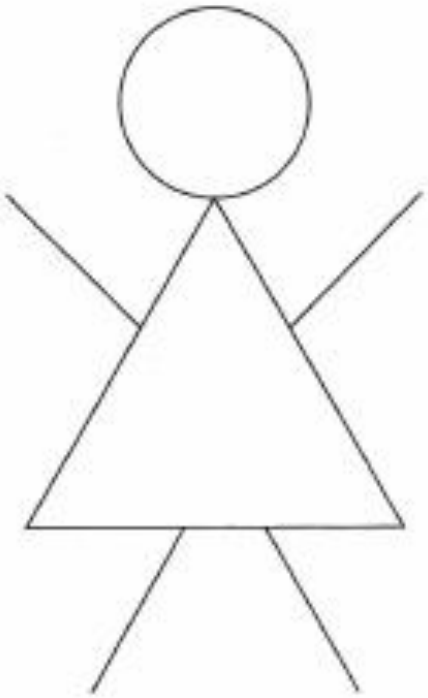
Tonya is making button dolls for the school fair. On each doll, she uses 2 buttons for the eyes, 1 button for the nose, and 3 buttons for the clothes.

There are 8 buttons in each package.

Tonya needs to buy packages of buttons so that all of the buttons will be used without any left over.

How many packages could she buy? How many dolls will that make?

With your partner, show what you know about the problem using the pictures.



Take turns with your partner. Tell each other what you know about the problem and what you have to find out.

NT OZ

Day 3

Standard: Algebra Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems: create real-world situations corresponding to number sentences.

3.2.2.1 Understand how to interpret number sentences involving multiplication and division basic facts and unknowns. Create real-world situations to represent number sentences.

Objective: to review their multiplication facts by playing Array Bingo

Launch: The teacher will tell the student the following problem: Sam has 3 five dollar bills. He wants to buy a hat that cost $22 dollars. The teacher will ask the students to find out how much money Sam has to spend and if he have enough to buy the hat. The teacher will remind the students how to solve the problem using an array. Three five dollar bills would be the same as 3 x5, or 3 rows with 5 dots in each row. The teacher will have one of the students demonstrate what the array would look like on the board. After the students have looked at the array, they will determine that Sam has only $15 dollars and he does not have enough money to buy the hat. The teacher tells the students that they are going to practice their multiplication facts by playing the game Array Bingo. The teacher will divide the students into groups into pairs. Each pair will get a set of Array Bingo cards and the number cards (0-20).

Explore: Each player arranges his or her Array Bingo Cards face-up in a 4x4 array. The number cards are placed face down. Players take turns and draw a number card. The player will look for any one of their array cards with that number of dots and turn it facedown. If there is no matching array, then their turn is done. Player two does the same thing and the game is played until someone gets a row, column or diagonal bingo. After the students have played one game, the teacher will have the complete

Share: The students will talk about the facts that they reviewed and how arrays help them to solve missing factor multiplication problems like the one presented in today's lesson.

Summarize: The teacher will remind the students that arrays can be a great way to solve missing factor problems.

Practicing Multiplication Facts with Arrays

Lesson 6-2

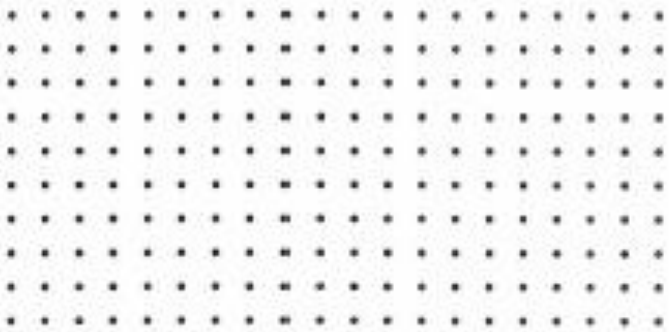
NAME DATE TIME

List the times _____ facts. If you are not sure of a fact, draw an array.

① 2 × _____ = _____

② 3 × _____ = _____

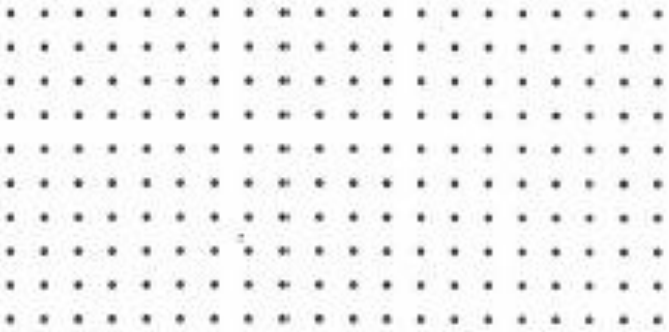
③ 4 × _____ = _____



④ 5 × _____ = _____

⑤ 6 × _____ = _____

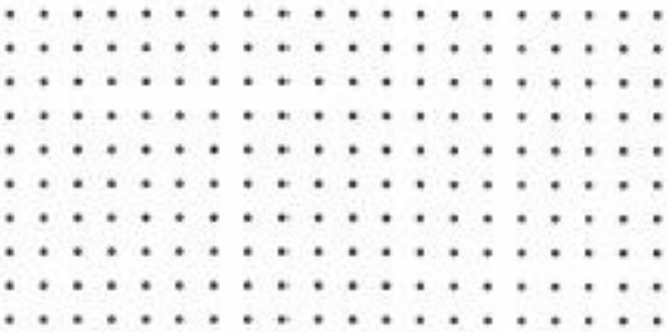
⑥ 7 × _____ = _____



⑦ 8 × _____ = _____

⑧ 9 × _____ = _____

⑨ 10 × _____ = _____



Talk to a partner about the patterns you find in your list.

NT Day 3

Day 4

Standard: Algebra Use number sentences involving multiplication and division facts and unknowns to represent and solve real-world and mathematical problems: create real-world situations corresponding to number sentences.

3.2.2.1 Understand how to interpret number sentences involving multiplication and division facts and unknowns. Create real world situations to represent number sentences.

Objective: The students will practice their understanding of solving Fact Family multiplication problems.

Launch: The teacher will tell the students the following problem: Sally, Heather and Jody each have nine markers. How many markers do they have in all? The teacher will ask the students how they can solve this problem using multiplication. After the correct response is given (27), the teacher will discuss how the problem was solved. After some discussion about the strategies used, the teacher will introduce a game called "Beat the Calculator."

Explore:

The teacher will put the students in groups of two or three and ask them to take out a set of their fact family triangles. The teacher will give each group a calculator. The teacher will give the students the following directions.
1) Each player chooses a role: Caller, Calculator, or Brain
2) The fact family triangles are placed in a pile on the table. The caller draws one Fact Triangle from anywhere the pile, covering up the product. The Caller asks for the product of the numbers.
3) The Calculator solves the problem with a calculator. The Brain solves the problem without a calculator. The Caller says who answered faster.
4) The Caller continues to draw Fact triangles from the deck and ask for the product of the numbers. Players trade roles every 10 turns.

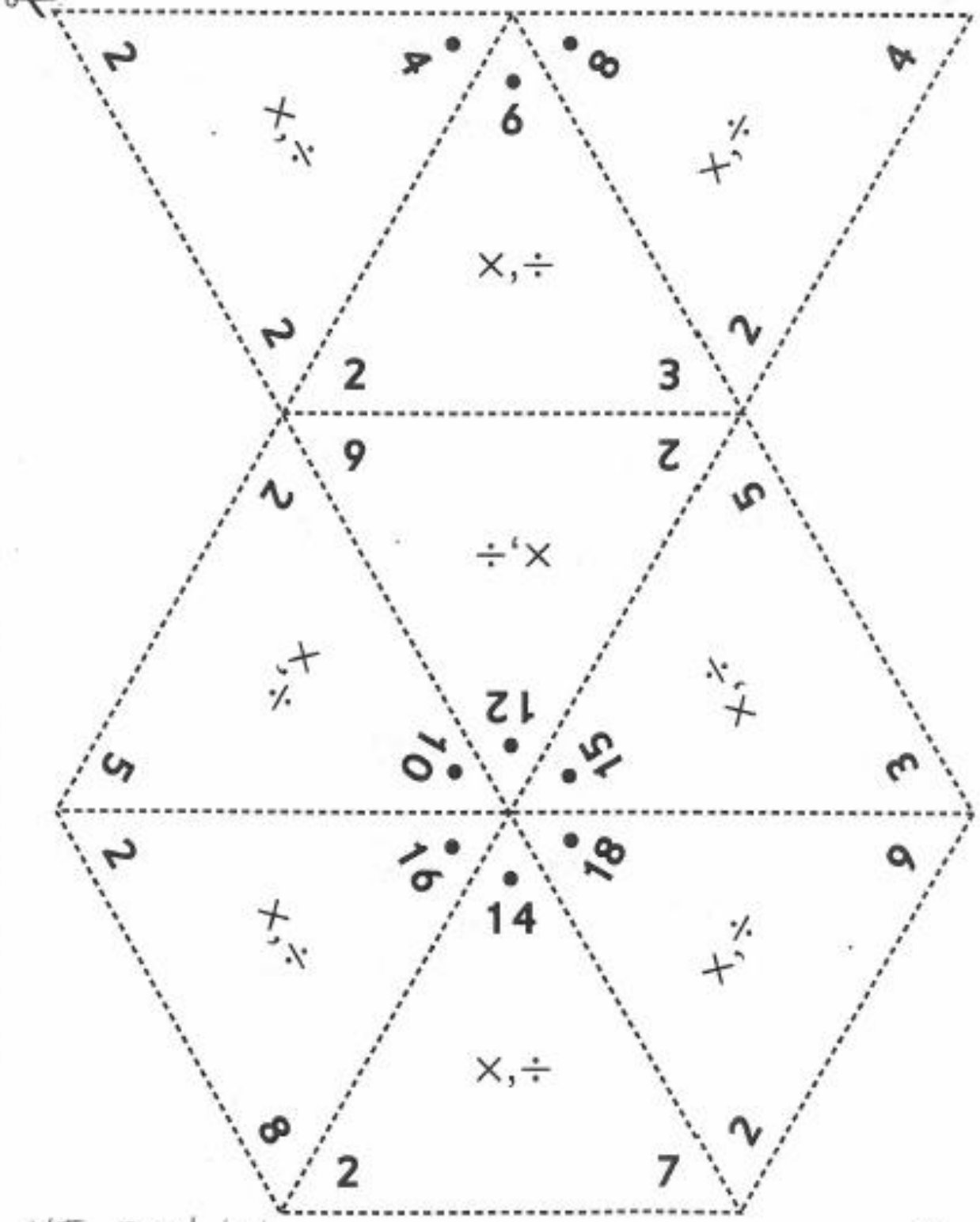
Share: The students will discuss which role was easier for them to and what facts were easier for them to solve.

Summarize: The teacher will emphasis how important it is to have a good understanding of how Fact Families work and that games like these will help them enjoy learning those facts.

×, ÷ Fact Triangles 1: 2s, 5s, and 10s

Home Link 1-10

NAME DATE TIME

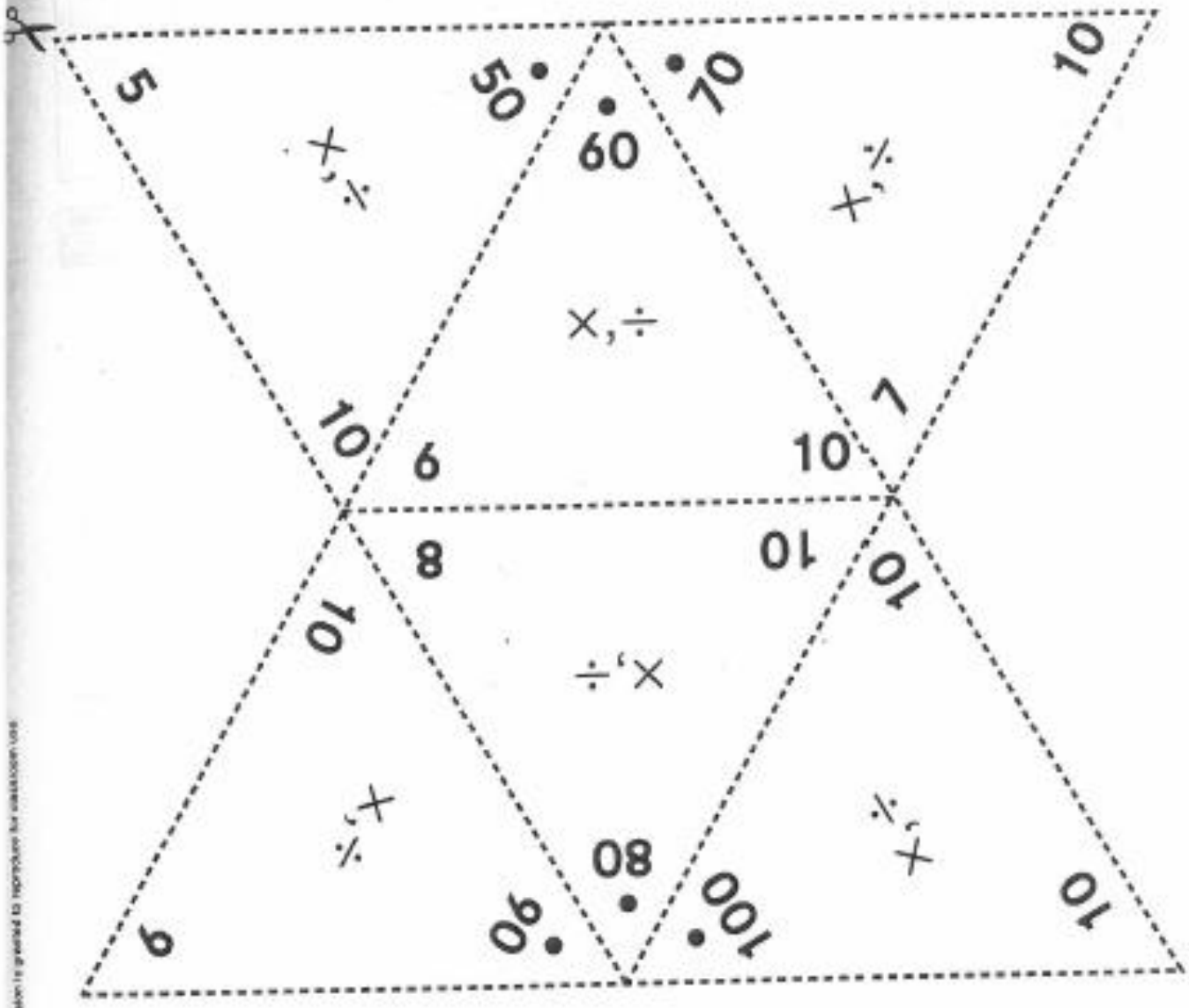


NT Day1 : 4

×, ÷ Fact Triangles 3: 2s, 5s, and 10s

Home Link 1-10

NAME DATE TIME



NT Day1 3:4

×, ÷ Fact Triangles 2: 2s, 5s, and 10s

Home Link 1-10

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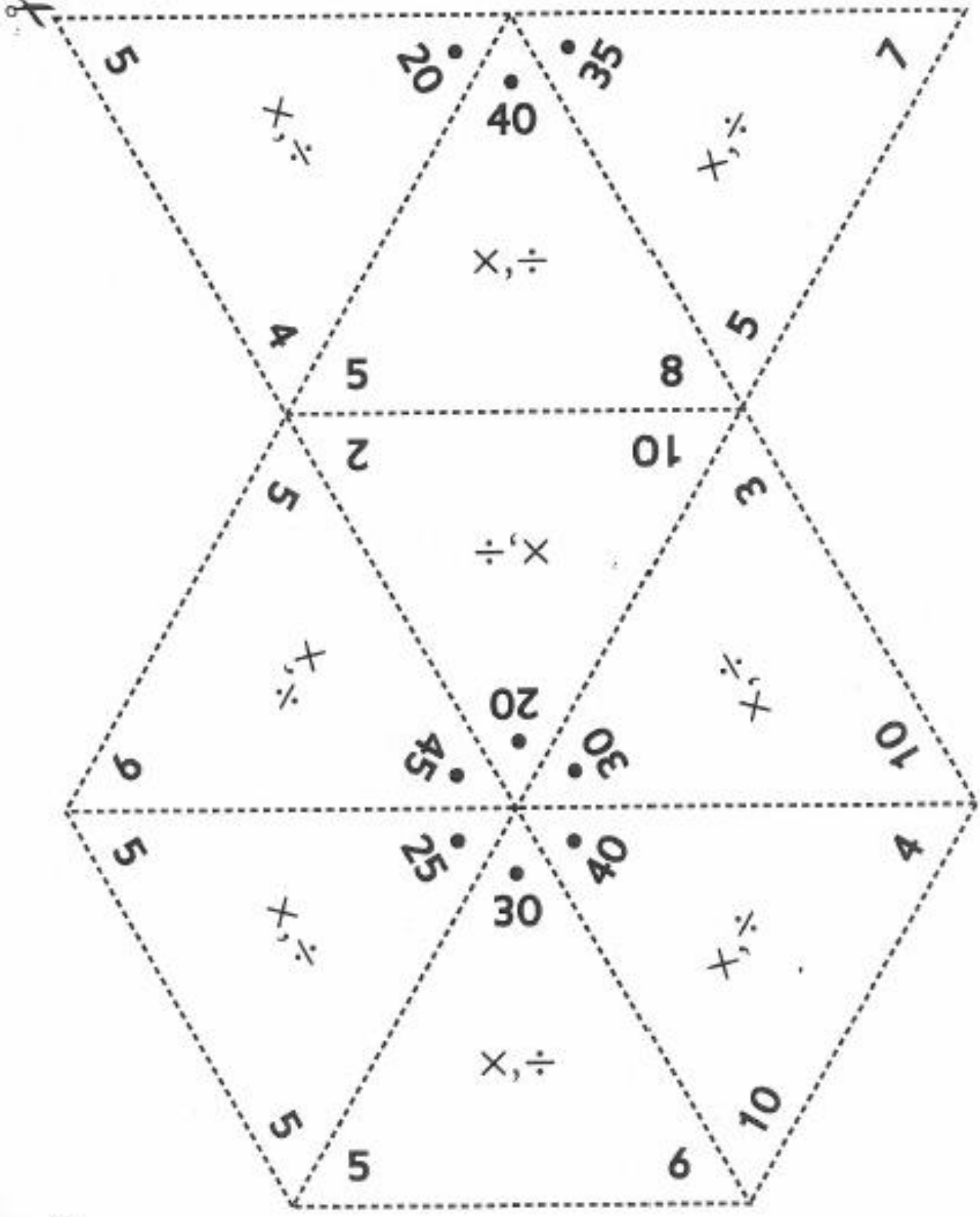

NT Day 1 ÷ 4

×, ÷ Fact Triangles: 3s and 9s

Home Link 3-12

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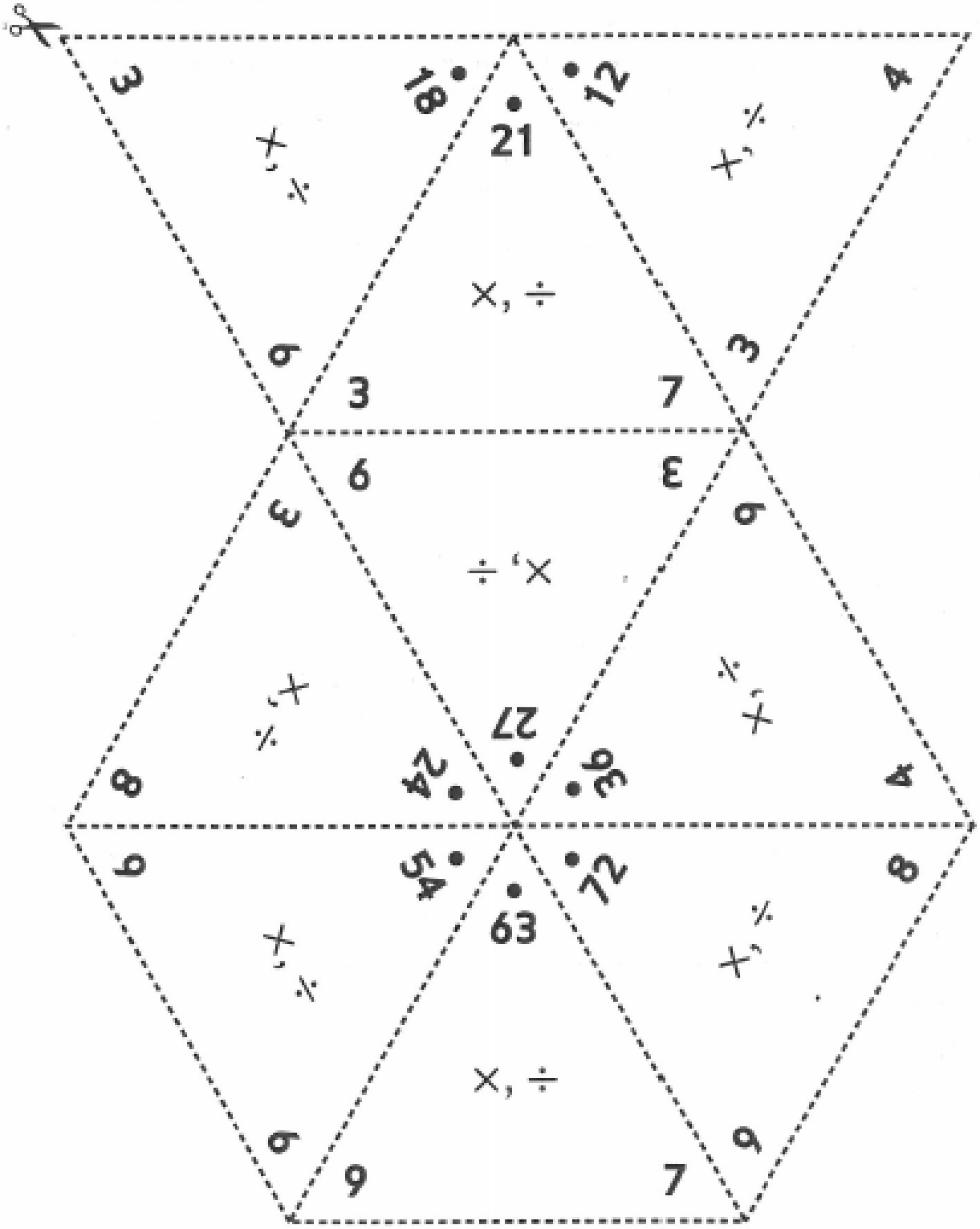
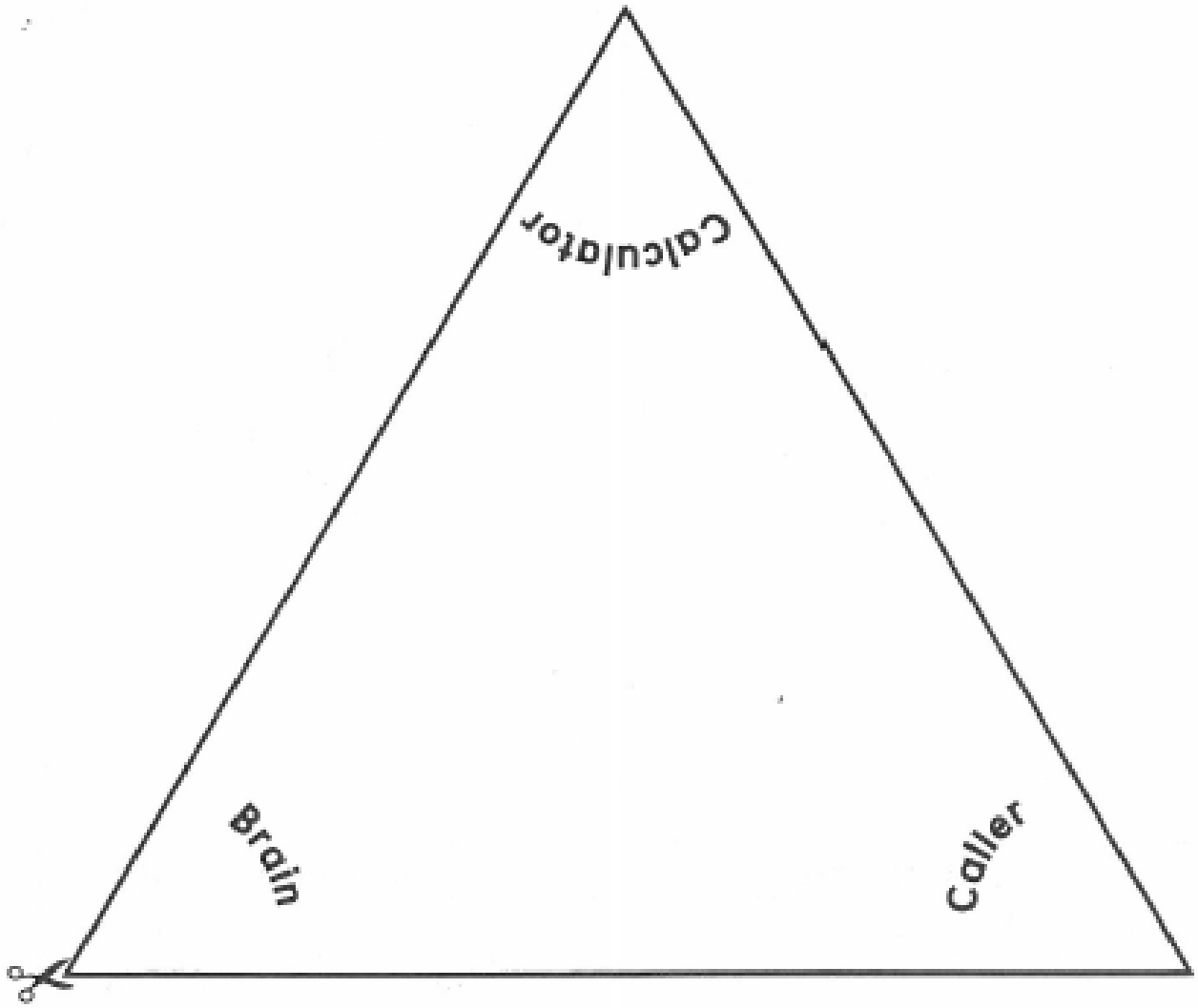


 NT Day 1 ; 4

Beat the Calculator Triangle

NAME DATE TIME



 NT Day 4

Day 5

Standard: Algebra Use number sentences involving multiplication and division facts and unknowns to represent and solve real-world and mathematical problems: create real-world situations corresponding to number sentences.

3.2.2.1 Understand how to interpret number sentences involving multiplication and division facts and unknowns. Create real world situations to represent number sentences.

Launch: The teacher will remind the students of all of the various multiplication strategies that they have learned this year. After reviewing all of the methods that they have learned, the teacher will pass out copies of the story problems for each student.

Objective: the students will work in groups of two to solve several story problems.

Launch: The students will work in groups of two to solve the following story problems:

1. The school bus has 14 seats. 3 students can sit on each seat. If all the seats on the bus are full, how many students are riding the bus?

2. Bobby needs rubber bands for the newspapers that he delivers. He delivers 17 newspapers a day. A box of rubber bands lasts him nine days. How many rubber bands are in the box?

3. Kate goes out to lunch with 4 of her friends. Each friend orders the $12 lunch special. Kate agrees to pay the bill. How much will she have to pay?

4. There are 12 cars in a garage and Tom will place new tires on each car. How many tires will Tom need?

Share: The students will talk about each problem they solved and the strategy that they used to solve their problem

Summarize: The teacher will check for the students' understanding of the problem and review the strategy that was used.

Multiplicative Comparison Problems

Lesson 2-9

DATE TIME

Use a diagram or drawing to show the relationship between quantities, if needed. Write an equation with an unknown to represent and solve each number story.

SRB 58-59

1. It takes 3 hours to fly from Chicago to Alberta, Canada. It takes 4 times that amount to fly from Chicago to Buenos Aires, Argentina. How many hours does it take to fly to Buenos Aires?

Equation with unknown: _____ Answer: ____ hours

2. Shar used her chalk to draw a line that was 6 feet long. Diego's line was 36 feet long. Diego's line was how many times as long as Shar's?

Equation with unknown: _____ Answer: ____ times as long

3. Complete the table.

Comparison Statement	Equation	Diagram
a. 4 times as many as 7		
b.	$6 * 5 = 30$	
c.		$R =$ 11 | | | | $K =$ 4 times as many as Randee R is the number of T-shirts Randee sold. K is the number of T-shirts Kristin sold.

Day 6

Standard:

Algebra: Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

3.2.2.1. Understand how to interpret number sentences involving multiplication and division basic facts and unknowns. Create real-world situations to represent number sentences.

Objectives:

- The students will use prior mathematical knowledge to make sense of multiplication and division real-world problems
- The students will use mathematical models to solve real-world situations encompassing multiplication and division.
- The students will understand how to represent stories using equations with letters to stand for the unknowns.

Launch:

To review the term "equation", the teacher will invite a volunteer to remind the class of the meaning of "equation". The student should define the term as "a number sentence that contains an equals sign" using prior knowledge from previous equation lessons and activities. The teacher will write "Equation" on the Class Data Pad (this encompasses an ongoing compilation of math terms and examples covered in each applicable unit) and record its meaning as given by the student (be sure to leave space for an example of an equation in the "Share" portion of this lesson).

Explore:

The teacher will pass out individual dry erase boards and markers. In pairs, the students will record at least two different equations with a "?" or another symbol representing the missing number to model the following real-world problem projected from the Smartboard: "Sarah has bags of cherries for her team. In each bag there are 5 cherries. There are 45 cherries in all. How many bags does

Sarah have?" The teacher will allow students adequate time to work together to form an equation.

Share:

The teacher will record student's suggestions on the Smartboard as the pairs share their responses. The teacher will analyze each equation with the class to check whether it fits the story presented or needs to be revised. The students, with the teacher's agreement, will chose one of the equations to write on the Class Data Pad next to or under the word "Equation". The teacher will draw attention to the symbols used to represent the unknown quantity. The teacher will explain the word "unknown" and tell the students that they are allowed to use a question mark, box, blank line, picture, letter or another symbol as a placeholder for the unknown value as long as they understand what it represents. The teacher will write the word "Unknown" on the Class Data Pad. The teacher will reference the real-world problem on the Smartboard and ask: "What is the unknown in this story?" The students should say, "The number of bags of cherries." The teacher will explain that mathematicians often use a letter to represent an unknown value. The teacher will instruct students to use B to represent the unknown quantity for this lesson because we want to find the number of bags. The students will rewrite their equations so that B represents the unknown. The teacher will write the equation and the unknown next to or under the word "Unknown".

Summarize:

The teacher will tell the students that an "unknown" is what we need to find out in a situation and explain that we can represent it symbolically.

Day 7

Standard:

Algebra: Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

3.2.2.2. Use multiplication and division basic facts to represent a given problem situation using a number sentence. Use number sense and multiplication and division basic facts to find values for the unknowns that make the number sentences true.

Number and Operation: Add and subtract multi-digit whole numbers; represent multiplication and division in various ways; solve real-world and mathematical problems using arithmetic.

3.1.2.2. Use addition and subtraction to solve real-world mathematical problems involving whole numbers. Use various strategies, including the relationship between addition and subtraction, the use of technology and the context of the problem, to assess reasonableness of results.

Objectives:

- The students will use number sense and multiplication and addition basic facts to find values for the unknowns.
- The students will represent equations with a missing factor or addend as the unknown.

Launch:

- The teacher will tell students that they will be playing a math game in which they will have to find the unknown. The teacher will separate the students into groups of three in preparation for the game "Salute!" The teacher will explain all directions, post directions on the Smartboard for student reference and model how to play the game prior to students working in their groups.

Explore:

The teacher will give each group a set of number cards 1-6 and 10(4 of each). One student will begin as the dealer. The dealer gives one card to each of the other two players. Without looking at their cards, the players hold them on their foreheads with the numbers facing out. The dealer looks at both cards and says the product of the two numbers. Each player looks at the other player's card. They use the number they see and the product said by the dealer to figure out the unknown number on their card. They say that number out loud. Once both players have said their numbers, they can look at their own cards to check their answers and all group members will write the equation in their math journals. The group members will take turns rotating roles clockwise and play again in addition to writing the equations in their journals. The dealer may choose which player's equation they would like to write in their journal. The students will use these equations on Day 10. The game continues until everyone has been the dealer five times. The teacher will divide students into new groups and the students will do this activity using addition.

Share:

The students will share their equations with the class and the teacher will clear up any misconceptions the students may have. The students should mention that the unknown was not the product or sum in these equations.

Summarize:

The teacher will tell the students that the unknown may be in any part of the equation.

Day 8-9

Standard:

Algebra: Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

3.2.2.1. Understand how to interpret number sentences involving multiplication and division basic facts and unknowns. Create real-world situations to represent number sentences.

3.2.2.2. Use multiplication and division basic facts to represent a given problem situation using a number sentence. Use number sense and multiplication and division basic facts to find values for the unknowns that make the number sentences true.

Objectives:

- The students will use prior mathematical knowledge to make sense of multiplication and division real-world problems
- The students will use mathematical models to solve real-world situations encompassing multiplication and division.
- The students will understand how to represent stories using equations with letters to stand for the unknowns.
- The teacher will tell students that we used situation diagrams to help them represent number story symbolically.

Launch:

The teacher will remind students of the diagrams (parts-and-total, change, and comparison) and unit boxes that they used in Unit 2 to help solve addition and subtraction number stories. The teacher will explain that today they will use a multiplication/division diagram to organize the number of groups, the number in each group, and the total in each number story. As a class, revisit the word "unknown" using the Class Data Chart that was utilized yesterday. The teacher will tell the students that the unknown could be any of these quantities, so the

diagrams will be helpful for representing a story before writing a number model. The teacher will pass out the diagram handout to each student. The teacher will tell the students to fold and glue the handout into their math journal. The teacher will tell the students that the first box in the top row tells the number of groups, the second box tells the number of items per group and the third box tells the total number of items. The teacher will pose the following number story on the Smartboard: Daniel has 8 bags of cookies. Each bag has the same number of cookies. "Daniel has 48 cookies in all. How many cookies are in each bag? Write an equation to match the story and then solve." The teacher will ask guiding questions to help students work through the story. The teacher will say, "What do we know after reading this story?" The students should say, "Daniel has 8 cookies and 48 in all." The teacher will say, "What do we need to find out?" The students should say, "The amount of cookies in each bag." The teacher and students will write "bags" in the top left box and "8" below it. The teacher and students will write "cookies" in the top right box and "56" below it because this is the total number of items. The teacher will explain that "C" can represent the unknown quantity which is the number of cookies per bag. The teacher and students will write "Cookies" in the top middle box and "C" in the box below.

Explore:

In pairs, the students will use the diagram to write an equation to fit the number story in their math journals. Some examples can be: 8 X R = 56, 56 / 8= R. The students will solve the equation and check their answer. The students will do this same process using the following two number stories posted on the Smartboard: "There are 36 third graders at an amusement park on a field trip. The teachers want to group them into teams of 4. How many teams can they make?" "There are 7 baskets and a total of 42 flowers to divide equally among the baskets. How many flowers should be place in each basket?"

Share:

In pairs, the students will share their diagrams, and strategies for creating their equations, and solving the solutions.

Summarize:

The teacher will tell students that we used diagrams and equations to help represent number stories.

Day 10

Standard:

Algebra: Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

3.2.2.1. Understand how to interpret number sentences involving multiplication and division basic facts and unknowns. Create real-world situations to represent number sentences.

3.2.2.2. Use multiplication and division basic facts to represent a given problem situation using a number sentence. Use number sense and multiplication and division basic facts to find values for the unknowns that make the number sentences true.

Number and Operation: Add and subtract multi-digit whole numbers; represent multiplication and division in various ways; solve real-world and mathematical problems using arithmetic.

3.1.2.2. Use addition and subtraction to solve real-world an mathematical problems involving whole numbers. Use various strategies, including the relationship between addition and subtraction, the use of technology and the context of the problem, to assess reasonableness of results.

Objectives:

- The students will use prior mathematical knowledge to make sense of multiplication and division real-world problems
- The students will use mathematical models to solve real-world situations encompassing multiplication and division.
- The students will understand how to represent stories using equations with letters to stand for the unknowns.

Launch:

The teacher will model writing a number story and drawing an illustration to represent an equation. The teacher will ask a student for an equation from Day 7. For example, 6 X 3 = 18. The teacher, with students input, will write this number story on the Smartboard: Jimmy has 6 cups with 3 raisins in each cup. How many raisins does he have in all? The teacher will create the illustration with student input.

Explore:

The teacher will tell the students to take out the equations written in their math journals from Day 7. The teacher will organize students into pairs. The teacher will tell the students that they will chose one of their equations that they wrote on Day 7, write a number story and create and illustration that represents that equation.

Share:

The students will share their number stories and illustrations with the class. Some students will remember that we had to find the missing factor or addend not the missing product or sum and they may have created division and subtraction number stories also.

Summarize:

The teacher will tell the students that we learned how to represent equations using number stories and drawings.

Multiplication/Division Diagrams

_____	per _____	_____ in all
_____	per _____	_____in all
_____	per _____	_____in all

Day 11 Number Theory

Standard: Students will use number sentences involving multiplication, division, and unknowns to solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Benchmark: 4.2.2.1 - Students will understand how to interpret number sentences involving multiplication, division, and unknowns. Students will use real-world situations using multiplication or division to represent number sentences.

Lesson Objectives: Students will

- Make sense of problems and persevere in solving them
- Create mathematical representations using number, words, pictures, symbols, gestures, tables, graphs, and concrete objects.
- Make connections between representations

Launch: Give students two different lengths of ribbon. Write the statement "Eve's ribbon is shorter than Maxine's ribbon. Have students measure the two ribbons in centimeters and write two or more statements describing how the lengths compare. Ask students to share their statements as you record them. Be sure to make the following comparisons:

- The length of Maxine's ribbon is 2 times the length of Eve's ribbon.
- Maxine's ribbon is twice as long as Eve's ribbon.
- Two of Eve's ribbons would be equal to the length of Maxine's ribbon.
- Eve's ribbon is half the length of Maxine's because 8 is half of 16.

The teacher will explain that these statements are called comparison statements. They include information about both quantities, or amounts, being compared. The teacher will point out comparison words and ideas: shorter than, longer than, two of this will equal that, two times as long, and so on. The teacher will explain that these relationships involve multiplication, so these specific statements are called multiplicative comparison statements. The teacher will also display the following statement: A DVD costs $15 and a book costs $5. The teacher will ask students

to make multiplicative comparison statements about the two objects. The teacher will be sure to discuss how specific parts of each equation represent specific parts of the situation and model. The teacher will ask, "What does the 5 represent? " "What does the 3 represent?" "What does the 15 represent?" "What is the mathematical relationship between the two items?"

Explore: Students will work in pairs or groups to write multiplicative equations representing comparisons based on information about mother and baby animal weights.

Share: Students will share the equations and answers that their group or pair came up with. Students will share different equations and why they chose that specific way to write it.

Summarize: Remind students that each equation involves two quantities (one of the factors and the product) and another number (the other factor) that represent how many times as much or how many times as many.

Comparing Animal Weights

Lesson 2-8

NAME DATE TIME

The table below shows about how much an animal weighs at birth and about how much its mother weighs.

SRB

Animal	Weight of Baby in Kilograms	Weight of Mother in Kilograms
Beluga whale	80	1,000
Blue whale		190,000
Deer	3	
Elephant	115	4,000
Giraffe	75	1,200
Polar bear		450
White rhinoceros	50	2,200

Write an equation with an unknown. Then find the answer and write it in the table above.

(1) A mother deer weighs 30 times as much as her baby. How much does the mother weigh?

Equation with unknown: _____ Answer: _____ kilogram(s)

(2) A mother polar bear weighs 450 times as much as her baby. How much does the baby weigh?

Equation with unknown: _____ Answer: _____ kilogram(s)

(3) A mother white rhinoceros weighs about how many times as much as her baby?

Equation with unknown: _____ Answer: _____ times as much

(4) A mother blue whale weighs 95 times as much as her baby. How much does her baby weigh?

Equation with unknown: _____ Answer: _____ kilogram(s)

(5) On the back, write your own multiplicative comparison number story using the data in the chart.

Day 12

Standard: Students will use number sentences involving multiplication, division, and unknowns to solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Benchmark: 4.2.2.1 - Students will understand how to interpret number sentences involving multiplication, division, and unknowns. Students will use real-world situations using multiplication or division to represent number sentences.

Lesson Objectives:

- Students will create mathematical representations using numbers, words, pictures, symbols, gestures, tables, and objects.
- Students will model real-world situations using graphs, drawings, tables, symbols, numbers, diagrams, and other representations.
- Students will use mathematical models to solve problems and answer questions

Launch: Students will be given the problems below and asked to explain how the problems differ from each other. Problem A: Linda sold 9 bookmarks. Paul sold 8 more than Linda. How many did Paul sell? Problem B: Linda sold 9 bookmarks. Paul sold 8 times as many. How many did Paul sell? Students will discuss in pairs or groups. Students will share solution strategies. The teacher will help them see the difference between additive comparisons and multiplicative comparisons. They teacher will point out different ways to write equations to show how the quantities are related. For example, for problem A we might write 8+9=b or 9+8=b. The teacher will stress both ways are correct. The teacher will do the same for problem B, explaining we would write 8*9=b or 9*8=b. Discussion of how the two problems are similar and different will occur.

Explore: Students will work with a group or in pairs to complete this problem: ** During the summer, Daryn read 5 times as many books as Julie. Julie read 8 books. How many did Daryn read? If no one suggests it, use a diagram to illustrate the problem.

8

8	8	8	8	8

Pose another problem: The distance from Pedro's house to the library is 3 miles. The distance from Pedro's house to his aunt's house is 27 miles. The distance to his aunt's house is how many times as far as the distance to the library?

Ask students to use a diagram to help them solve the equation. 27=9*3 Record the answer 9 times as far. Have students work in pairs of groups to complete journal page 55. Students will use comparison statements, equations, and diagrams or drawings to represent situations and solve problems. The teacher will circulate and assist as needed

Share: Students will share their multiplicative sentences and diagrams. The group will discuss different sentences and diagrams and "why?" they chose that format.

Summarize: The teacher will remind students the focus of the lesson which is multiplicative comparison number stories. The teacher will restate some of the verbal statements and equations, as well as illustrate drawings and models to help keep track of which quantity are more and which are less. Remind students that statements include information about both quantities being compared. Verbal statements of multiplicative relationships include language like"_____times as long as_____", "_____times as much as _____", "_____times as tall as _____", or "_____four times as many as_____".

Multiplicative Comparison Problems

Lesson 2-9

DATE TIME

Use a diagram or drawing to show the relationship between quantities, if needed. Write an equation with an unknown to represent and solve each number story.

SRB 58-59

1. It takes 3 hours to fly from Chicago to Alberta, Canada. It takes 4 times that amount to fly from Chicago to Buenos Aires, Argentina. How many hours does it take to fly to Buenos Aires?

Equation with unknown: _____ Answer: ____ hours

2. Shar used her chalk to draw a line that was 6 feet long. Diego's line was 36 feet long. Diego's line was how many times as long as Shar's?

Equation with unknown: _____ Answer: ____ times as long

3. Complete the table.

Comparison Statement	Equation	Diagram
a. 4 times as many as 7		
b.	$6 * 5 = 30$	
c.		$R =$ 11 $K =$ 4 times as many as Randee R is the number of T-shirts Randee sold. K is the number of T-shirts Kristin sold.

Day 13 Number Theory

Standard: Students will use number sentences involving multiplication, division, and unknowns to solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Benchmark: 4.2.2.1 - Students will understand how to interpret number sentences involving multiplication, division, and unknowns. Students will use real-world situations using multiplication or division to represent number sentences.

Lesson Objectives:

The students will know…

- How to write a number sentence to match a given problem situation.
- How to use opposite operations to solve algebraic expressions.

The students will be able to…

- Write number sentences to match given problem situations.
- Use opposite operations to solve algebraic expressions.

Launch: 1) Ask students what they know about addition and subtraction. Elicit responses from students until a student says that they are opposite operations. Ask students what they know about multiplication and division. Again, elicit responses from students until a student says that they are opposite operations.

2) Tell students that you wanted them to start thinking about addition and subtraction and also multiplication and division as opposite operations because it's important for what they will be learning how to do in the lesson. Write the word algebra on the board, and tell students that they will be learning how to write and solve some algebra problems. Ask students what they know about algebra, and elicit responses. Students will likely mention that algebra uses letters instead of numbers. Tell students that algebra is math in which unknowns are represented with letters.

3) Give each student a copy of the Teaching Problems, and project a copy of it under a document camera. Read aloud the first problem, and ask students if they knew how many basketballs Ariel bought, what would they do to find the cost. Elicit responses, leading students to see that they would multiply the cost of a basketball by the number of basketballs to find the cost. Explain that because the number of basketballs is not given in the problem, they will use a letter to represent that number, b. Record the equation 7 x b = 42 in the second column. See the Teaching Problems' answer key, if necessary. Have students do the same.

4) Tell students that many of them may already know what number can be multiplied by 7 to get a product of 42, but you want them to understand how to use an unknown, on one side of the equation. Show students how to use the opposite operation of multiplication, division, to divide by 7 in order to isolate the b on one side of the equation. See the Teaching Problems' answer key, if necessary. Then, show students how to simply divide 42 by 7 to find the cost of the basketballs, $6. Repeat this process for the remaining two problems.

Explore: Put students in pairs, and give each pair a chart from the Guided Practice and a set of the cards from the Guided Practice. Give each pair of students some scissors, and have them cut out the cards. Explain to students that the cards are mixed up, and they should read each problem; find the equation that would solve the problem, and then the solution to the problem. They should place the cards beside each other on the chart so that the problem matches the equation and solution. When students understand what to do, allow them to work in their pairs.

Share: When pairs have finished, have them raise their hands so that you can check their progress and answers. When you have checked all pairs' work, go over any problems that students struggled with the whole group. Allow other groups to share their findings as whole group and ask for explanations about what they discovered and how the students found their answers.

Summarize: After students have presented their answers and ideas to the whole group, the teacher will go over problems and point out numbers and key words that allow the students to see once more what strategies to use while solving real world problems. After, each student will be given a copy of the Independent Practice, explain the directions, and allow students to work independently. The teacher will ask students to give examples of number sentences to match a given problem. The teacher will also refresh students on opposite operations to solve algebraic expressions.

Problem	Write a number sentence.	Solve it!
Arial bought some basketballs at a sports store. She spent a total of $42. Each basketball cost $7. How many basketballs did she buy?		
Lawrence and Robby sold candy bars and pickles at the concession stand. They sold a total of 30 items. If the boys sold 14 candy bars, how many pickles did they sell?		
A total of 32 people divided themselves into lines for the movie theater. If there were 8 people in each line, how many lines were there?		

Problem	Number Sentence	Answer

Kenneth read twice as many books over the summer as his friend Jackson. If Kenneth read 24 books, how many books did Jackson read?	t + 5 = 65	41
The temperature outside during recess was 65°. That was 5 degrees warmer than it was when Crystal arrived at school. What temperature was it when Crystal got to school?	b x 2 = 24	13
Amanda has read 24 pages in her book. There are a total of 65 pages in her book. How many more pages does Amanda need to read?	5 x p = 65	60
There were 5 teams competing in a softball tournament. There were a total of 65 players. If each team had the same number of players, how many players were on each team?	24 + p = 65	12

Day 14 Number Theory

Standard: Students will use number sentences involving multiplication, division, and unknowns to solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Benchmark: 4.2.2.1 - Students will understand how to interpret number sentences involving multiplication, division, and unknowns. Students will use real-world situations using multiplication or division to represent number sentences.

Lesson Objectives:

- **Students will make sense of their problem**
- **Compare strategies that they and other students use**
- **Use an appropriate level of precision for their problem**

Materials:

Launch: Display "Mr. Swanson has $350 to order music books for the new school year. Music books cost $10 each and come in packages of 5. Mr. Swanson orders 6 packages. How much money will he have left after he buys the books?

Invite students to share how they made sense of the problem and how they made a plan for solving it. Ask students to represent their solution strategies using number models, using m to represent the money left over. As they share, explain how parentheses can be used to show which step should be completed first. For Example ($10*5)*6=m, m=$300, so then you can write $350-$300=b…other students may have solved$10 * (5*6)=m. Then pose a new problem. "Mr. Swanson also needs new strings for his 19 violin students. Each violin has 4 strings. Strings are $2 each and come in sets of 4. Mr. Swanson decides to buy 2 sets of strings for each student. How much money should Mr. Swanson take to the store to be sure he has enough for all the strings?" The students will discuss with their groups or pair the steps for solving the problem as equations. Of the many different ways to do this, illustrate a method in which the 2 digit multiplication is the final step.

Explore: Students will write a number story requiring at least three steps, one which involves multi-digit multiplication. They solve the number story, trade with a partner, and solve each other's problem. Students discuss solutions, analyzing any mistakes or difference of opinion.

Share: Students will be invited to share their own problem or one they switched and enjoyed doing with the class. Students will share how they solved and set up their equations.

Summarize: The teacher will walk the students through solving a problem. Review guiding questions like these: "What do you want to find out?" "What steps do you need to take to find it?" How can you record those steps in an equation?" The teacher will tell students that when they should make sense of the problem and then choose an appropriate strategy based on what the problem is asking.

Day 15 Number Theory

Standard: Students will use number sentences involving multiplication, division, and unknowns to solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Benchmark: 4.2.2.1 - Students will understand how to interpret number sentences involving multiplication, division, and unknowns. Students will use real-world situations using multiplication or division to represent number sentences.

Lesson Objectives:

- Students will make sense of problems and persevere in solving them
- Students will model real-world situations using graphs, drawings, tables, symbols, numbers, diagrams, and other representations
- Students will use clear labels, units, and mathematical language

Launch: Students will look at the following table projected on a document camera.

Entertainment Option	Number of Performers	Hours of Entertainment	Cost per Performer
Jugglers	3	2	$30/hour
Singing Group	4	3	$16/hour
Tumblers	8	3	$ 22/hour
Tap Dancers	6	2	$33/hour

Food Option	Number of Pieces/Items per package	Number of Package Needed	Cost per Piece/Item
Corn-on-the-Cob	4	24	$2
Burritos	8	13	$3
Sandwiches	5	18	$6
Baked Potatoes	10	9	$2

The teacher will ask students,

"How much more would it cost to hire the tap dancers than the jugglers?" Students will then share how they made sense of the problem and how they made a plan for solving it. The teacher will record the steps for solving the problem and have students provide equations illustrating each step.

Step 1 - Find the cost of the tap dancers. 6*2*33= cost of tap dancers

Step 2- Find the cost of hiring jugglers. 3*2*30= cost of jugglers

Step 3- Subtract the cost of the jugglers from the cost of the tap dancers. Cost of tap dancers-Cost of jugglers = How much more the tap dancers cost.

The teacher will remind students that the learned how to write the steps required for solving a multistep problem in a single number model, using a letter for the unknown quantity. In the previous lesson they learned to use parentheses to show which steps they did first or which steps goo together, and that they should use a letter to show the number they are trying to find. The teacher will ask," How could you show all the steps for this problem as one single number model? Students will use the steps we recorded before as a model for how to proceed (6*2*33)-

(3*2*30) =c. Have students illustrate and explain their solution methods for each step in the single number model. After students have found the correct answer (216), ask, "What does the 216 represent?"

Explore: Students will be in pairs or groups. The teacher will pose two more problems based on the table. "How much would it have to have both corn-on-the-cob and the baked potatoes?" and "How much more would it cost to hire the tumblers than the singing group?" Students will work with their partner or group to figure out equations with unknowns to solve the problem.

Summarize: The teacher will review with students the steps to solve multistep number stories, and how to express their solution strategies using appropriate number models. To help summarize visually for the students to see, the teacher will display, "A Trip to Thrill City" and work with students to complete number one, while talking through the steps. Students will finish the last two problems on their own.

Name_____

Posttest

1. **A table is shown**

INPUT	Output
6	24
8	32
9	36

What is the output number when the input number is 11?

a. 22

b. 33

c. 44

d. 55

2. Bill buys a snack for $0.69. She pays with a $1 bill. She receives the fewest possible coins in change. What change does Bill receive?

a. 1 quarter, 1 nickel, and 1 penny

b. 1 quarter and 1 penny

c. 2 quarters, 1 nickel, and 4 pennies

d. 3 dimes and 1 nickle

3. A table is shown.

F	G
16	4
32	8
40	10

What rule was used to make the table?

A. G=4f
B. G=f/4
C. G=f+4
D. G=2f=4

Source Citations

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Days 1, 2, 3,4
DeBellis, Valerie A., Eric W. Hart, Margaret J. Kenney, and Joseph G. Rosenstein. Navigating Through Discrete Mathematics in Pre-kindergarten-Grade 5 The National Council of Teachers of Mathematics Inc. 2009 p 35-45, 205, 217

Days 11 & 15 Everyday Mathematics, McGraw Hill
Day 12 Study Island, 2015, Teacher Lesson Plan Input Output function