Objective

To guide children as they solve Frames-and-Arrows problems having two rules.

Key Concepts and Skills

- Use dollars-and-cents notation.  
  [Number and Numeration Goal 2]
- Calculate values of coin and bill combinations.  
  [Operations and Computation Goal 2]
- Identify and use rules for a function involving addition and subtraction of coins.  
  [Patterns, Functions, and Algebra Goal 1]

Key Activities

Children make up and solve Frames-and-Arrows problems about coins and use coins to solve Frames-and-Arrows problems having two rules.

Ongoing Assessment: Informing Instruction

See page 216.

Ongoing Assessment: Recognizing Student Achievement

Use Math Masters, page 431.  
[Patterns, Functions, and Algebra Goal 1]

Materials

Math Journal 1, pp. 69 and 70  
Home Link 3-6  
Math Masters, pp. 75–77 and 431  
transparencies of Math Masters, pp. 75–77 and 431 (optional)  
per child: 5 quarters, 5 dimes, 5 nickels, and 5 pennies

Advance Preparation

For the Math Message, make one copy of Math Masters, page 75 for every two children. Cut the copies apart and place them near the Math Message.

For Part 1, make overhead transparencies of Math Masters, pages 75–77 and 431, or draw a two-rule Frames-and-Arrows diagram on the board.

Teacher’s Reference Manual, Grades 1–3 pp. 205, 206

Practicing Complements of 100 by Playing Dollar Rummy

Math Journal 1, p. 71  
Math Masters, pp. 454 and 455

Children find as many different combinations of $1.00 as possible.

Math Boxes 3-6

Math Journal 1, p. 72

Children practice and maintain skills through Math Box problems.

Home Link 3-6

Math Masters, p. 78

Children practice and maintain skills through Home Link activities.

Counting Up and Back on a Number Line

Math Masters, p. 79

Children find the rules for skip counts on a number line.

Solving Frames-and-Arrows Puzzles

Math Masters, p. 80

Children explore two-rule Frames-and-Arrows diagrams.
Getting Started

Mental Math and Reflexes

Pose comparison number stories, which practice –9 and –8 subtraction facts or +9 and +8 addition facts, depending on which number model a child uses; for example, 4 + 8 = 12 or 12 – 4 = 8. Have children share strategies. Suggestions:

○ ○ Damian is 6 years old. Maya is 9 years older. How old is Maya? 15 years old
○ ○ Jenna has $4. Martina has $12. How many more dollars does Jenna need in order to have the same amount of money as Martina? $8
○ ○ Jackson has 14 sports magazines in his collection. Luis has 9. How many more magazines does Luis need in order to have the same number of magazines as Jackson? 5 magazines

Math Message

Here is a Frames-and-Arrows problem that uses nickels:

Add 5¢

10¢ 15¢ 20¢ 35¢

Take a blank Frames-and-Arrows diagram from Math Masters, page 75. Make up a problem that uses nickels, dimes, or quarters. Hand in your problem.

Getting Started

Home Link 3-5 Follow-Up

Have small groups of children compare their bar graphs by asking questions like the following:

• What is the greatest number of pockets shown by any graph? The least number?
• Use all of your group’s graphs. What is the total number of people who had zero pockets? 1 pocket? (Continue with other numbers.)

Math Masters, p. 75

1 Teaching the Lesson

Math Message Follow-Up

(Math Masters, p. 75)

Algebraic Thinking Choose two of the children’s Frames-and-Arrows problems. Review filling in frames and finding a missing rule. Share solution strategies with the class on an overhead transparency of Math Masters, page 75 or on the board. Make sure everyone understands these one-rule Frames-and-Arrows diagrams.

Solving Frames-and-Arrows Diagrams Having Two Rules

(Math Masters, pp. 76, 77, and 431)

Algebraic Thinking Display the example on Math Masters, page 76. Ask what is different about this Frames-and-Arrows diagram from Frames-and-Arrows diagrams that children have seen before. Sample answer: There are two kinds of arrows, one dashed and one solid. Explain that the two kinds of arrows stand for two different rules.

Have children act out the example with you. Start with a dime as indicated in the first frame, add a nickel (solid-arrow rule) to get the result shown in the second frame, add a dime (dashed-arrow rule) to get the result shown in the third frame, and so on.
Adjusting the Activity

Have children write the appropriate rule above each arrow to help them navigate filling in the frames. For example, write +10¢ and –5¢ above the arrows in Problem 1 on Math Masters, page 76.

Repeat the procedure with the other problems on Math Masters, pages 76 and 77. Use the Frames-and-Arrows blank diagrams on Math Masters, page 431 to make up more problems as necessary.

Adjusting the Activity

In Problems 4 and 5, children find one of the rules and complete the frames. To find the rule, children should use coins to act out the pattern. Children can then fill in the empty frames.

Focus on Problems 1–3. With additional practice on journal pages and in Math Boxes throughout the year, children will be better prepared for Problems like 4 and 5.
**Solving Frames-and-Arrows Problems**  
*(Math Journal 1, pp. 69 and 70)*

**Algebraic Thinking** Children solve Frames-and-Arrows problems and use coins to help them. Encourage children to check each problem after they have completed it by applying the rules to the completed frames. For example, to check Problem 2, children begin with their answer of 10¢. The solid-arrow rule is Add 10¢. The second frame is 20¢. Does 10¢ + 10¢ = 20¢? Yes, so the answer is correct.

**Ongoing Assessment: Informing Instruction**

Watch for children who do not have a strategy for completing Frames-and-Arrows problems where the first frame is blank. Suggest that the children write the rule above the arrows. Use either a number grid or a number line to demonstrate how to count up and back.

**Creating Frames-and-Arrows Problems**  
*(Math Masters, p. 431)*

**Algebraic Thinking** Children create and solve their own two-rule Frames-and-Arrows problems. Encourage children to vary the operations and numbers they use for the rules.

You may want to have children trade papers with a partner to solve each other's problems. Children should check each other's work.

**Ongoing Assessment: Recognizing Student Achievement**

Use *Math Masters, page 431* to assess children's ability to create number patterns and rules in Frames-and-Arrows problems. Children are making adequate progress if they can make up a problem and complete it accurately. Some children may be able to include more difficult numbers for the rules.

[Patterns, Functions, and Algebra Goal 1]
Ongoing Learning & Practice

**Practicing Complements of 100 by Playing Dollar Rummy**

(Math Journal 1, p. 65; Math Masters, pp. 454 and 455)

Explain the rules of Dollar Rummy on journal page 65. Using game cards cut from Math Masters, page 454, have children find as many different combinations of $1.00 as they can. For another version, use cards cut from Math Masters, page 455.

**Math Boxes 3-6**

(Math Journal 1, p. 72)

**Mixed Practice** Math Boxes in this lesson are paired with Math Boxes in Lesson 3-8. The skills in Problems 5 and 6 preview Unit 4 content.

**Home Link 3-6**

(Math Masters, p. 78)

**Home Connection** Children use coins to solve Frames-and-Arrows problems that have two rules.

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**Student Page**

**Math Boxes**

1. Write the amount. Fill in the circles next to the best answer.

2. Solve.

3. How many children have cats? 15 children
   How many children have fish? 5 children

4. Tomorrow I will get dressed for the day. (Circle one.)

5. I had 17 tulips. I planted 20 more. How many do I have now?


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**Home Link Master**

**Frames-and-Arrows Problems**

(Math Journal 1, p. 71)

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**Lesson 3-6**

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### Differentiation Options

**READINESS**

#### Counting Up and Back on a Number Line

*(Math Masters, p. 79)*

To explore navigating on a number line, have children find the rules for skip counts on the number line. Introduce the activity by doing several counts with children on the first number line. They should follow along with their fingers and say each stopping point together. *Suggestions:*

- **Start at 5 and count up by 2s** on the number line. Say the stops together. 7, 9, 11, 13, 15, 17, 19
  
  *Add 2* Write the rule on the board.

- **Start at 20 and count back by 3s** on the number line. Say the stops together. 17, 14, 11, 8, 5, 2
  
  *Subtract 3* Write the rule on the board.

Now work on a couple of two-rule problems together, having children use their fingers to follow along on the number line. Tell children that they have been using only one rule, but that now they are going to do counts with two rules. *Suggestions:*

- **Start at 1. Combine the “Add 3” rule and the “Add 2” rule.** Say the stops together. 4, 6, 9, 11, 14, 16, 19

- **Have children repeat this two-rule count.** This time, have them draw the hops on the number line. Use the red crayon when they add 3 (3 hops) and use the blue crayon when they add 2 (2-hops).

Children work with a partner to complete the page.

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**ENRICHMENT**

#### Solving Frames-and-Arrows Puzzles

*(Math Masters, p. 80)*

**Algebraic Thinking** To further explore two-rule Frames-and-Arrows diagrams, have children solve frames-and-arrows puzzles on *Math Masters*, page 80. The arrows will not always alternate ABAB. Note that the order in which children place the rules will not matter as long as each rule is used the correct number of times. You may want to have children color-code their rules with crayons—underline the first rule in red and the second rule in blue for each problem; then draw the appropriate color arrow between the frames. Have children explain their solution strategies. *Sample answer:* I always take the biggest rule first until I am close to my number.