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# Overview of Instructional Task: Solving a Coin Problem

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In this instructional task, students find the number and value of coins in a collection based on what fraction each type of coin represents in the collection. It is important to discuss students' solutions and allow time to share how they record mathematical thinking so students become more confident with problem-solving strategies.

## Task Window

Within Unit 8, task window is flexible.

Task should be implemented after students have begun work on fractional parts of a collection but before complete mastery.

## Summary of Instructional Task

- One to two days before lesson, do the section titled Before Lesson.
- The lesson plan gives suggested time allotments, questions, and prompts to support students with the task. Collaborative groups as well as whole group work is noted.
- After the lesson, students read and revise their original responses and write what they learned.
- Analyze student responses to identify next instructional steps.

Task details are included on the following pages.

- Content/Language Objective, Standards, Background for Teachers (page 2)
- Lesson (pages 3–5)
- Student work samples (pages 6–9)
- Master for the task (page 10)

## Framework for Effective Teaching

- I.1 Clearly communicates standards-based content/language objectives for lessons, connecting to larger rationales.
- I.2 Provides rigorous tasks that require critical thinking with appropriate digital and other supports to ensure student success.
- I.6 Provides differentiation that addresses students' instructional needs and supports mastery of content/language objectives.
- I.8 Promotes student communication and collaboration using appropriate digital and other resources.

## ELG Connection

- 3.NN.2: Read, write, model, and locate on a number line fractions (with denominators of 2, 3, 4, 6, and 8) (3.NF.2). Understand a fraction  $\frac{1}{b}$  as a quantity formed when a whole is divided into  $b$  equal parts and  $\frac{a}{b}$  as the quantity formed by  $a$  parts of size  $\frac{1}{b}$  (3.NF.1). Represent these quantities on a number line by defining the interval from 0 to one as the whole and partitioning it into  $b$  equal parts (3.NF.2a–b). (Major)

# Instructional Task: Solving a Coin Problem

## Content/Language Objective

Students find fractions of 24, add money, and **explain their solutions verbally and in writing, using verbs (e.g., divided) and supports such as:**

- a. coins,
- b. sentence stems (e.g., Robert found \_\_\_\_ pennies, \_\_\_\_ nickels, \_\_\_\_ dimes, and \_\_\_\_ quarters.), and/or
- c. sentence stems (e.g., I divided the total number of coins, 24, by \_\_\_\_ because \_\_\_\_).

## Common Core State Standards

This instructional task emphasizes the following Standards for Mathematical Practice:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique others' reasoning.
4. Model with mathematics.
6. Attend to precision.

This instructional task also asks students to select and apply mathematical content from the Common Core State Standards.

3.NF.1: Understand fractions  $\frac{1}{b}$  as the quantity formed by 1 part when whole is partitioned into  $b$  equal parts; understand fraction  $\frac{a}{b}$  as the quantity formed by  $a$  parts of size  $\frac{1}{b}$ .

## Background for Teachers

This task helps students develop strategies for problem solving. In this task, students find the number and value of coins in a collection based on what fraction each type of coin represents in the collection.

- Before the lesson, students attempt the task individually. Review their work and formulate questions for students to answer to improve their solutions.
- At the start of the lesson, students work alone answering teacher questions about the same task.
- Then students are grouped and engage in collaborative discussions of the same task.
- In the same small groups, students are given student work samples to comment on and evaluate.
- In a whole class discussion, students explain and compare alternative solution strategies they have seen and used.
- Finally, students revise their original solutions and comment on what they learned.

## Required Materials

- Copies of task, Solving a Coin Problem, for students (page 10)
- 24 counters or coins—10 pennies, 10 nickels, 10 dimes, 10 quarters, if available

## Time

- Before lesson: 10–15 minutes
- Lesson: 60 minutes
- Total Time: 70–75 minutes

## Before Lesson

### Initial Exploration Before Providing Student Feedback (10–15 minutes)

Before the lesson, have students read the Solving a Coin Problem task (page 10) individually and think about and record what information they know and what questions they have to answer in order to solve the task. Provide students with 24 counters or coins—10 pennies, 10 nickels, 10 dimes, 10 quarters, if available.

Have students work on the task individually for ten minutes. Collect students' responses to the task. Make notes on what their work reveals about their current levels of understanding and their different problem-solving approaches.

Do not score students' work. Research shows that it is counterproductive, as it encourages students to compare their scores and distracts their attention from what they can do to improve their mathematics.

Instead, help students make further progress by summarizing their difficulties as a series of questions, such as the suggestions below. Write a list of your own open-ended questions, based on your students' work. You may write questions on each student's work or select a few questions that will help the majority of students to write on the board at the beginning of the lesson. You may also note students with particular issues, so you can ask them about their difficulties in the formative lesson.

Common Issues	Suggested Questions and Prompts
Student has difficulty getting started.	<ul style="list-style-type: none"> <li>• <i>What do you know?</i></li> <li>• <i>What do you need to find out?</i></li> </ul>
Student has difficulty describing relationship between division and finding fraction of the collection.	<ul style="list-style-type: none"> <li>• <i>What could we do with the counters to visualize the task?</i></li> <li>• <i>What would number sentences look like for questions 1 and 3?</i></li> </ul>
Student works unsystematically.	<ul style="list-style-type: none"> <li>• <i>Can you organize your work in a different way?</i></li> <li>• <i>Would labeling your work help?</i></li> </ul>
Student presents work poorly.	<ul style="list-style-type: none"> <li>• <i>Would someone unfamiliar with your type of solution easily understand your work?</i></li> <li>• <i>Have you explained how you arrived at your answer?</i></li> </ul>
Student produces correct solution. Student needs extension task.	<ul style="list-style-type: none"> <li>• <i>Could you have a total of 36 coins and still have the same fractional groups? Why or why not?</i></li> </ul>

## Suggested Lesson Outline

### Improve Individual Solutions to Instructional Task (10 minutes)

*Recall what we looked at yesterday. What was the task? I have read the work you have done, and I have some questions about your work. I would like you to work on your own to answer my questions for about ten minutes.*

### Small Group Collaborative Work (10 minutes)

Organize the class into small groups of two or three students and distribute a blank Solving a Coin Problem task (page 10) to each group. Ask students to try the task again; this time combining their ideas. Encourage students to use the counters or coins.

*Put your own work aside until later in the lesson. I want you to work in groups now. Your task is to produce a solution that is complete and expands on than your individual solutions.*

While students work in small groups, note different student approaches to the task and support student problem solving.

**Note Different Student Approaches to Task**

Use this information to focus a whole class discussion towards the end of the lesson. In particular, note any common mistakes.

**Support Student Problem Solving**

Try not to make suggestions that move students towards a particular approach to this task. Instead, ask questions that help students clarify their thinking. To help students really struggling with the task, use the questions on the previous page to support your questioning.

If the whole class struggles with the same issue, write relevant questions on the board. You could also ask students who performed well on the task to help struggling students. If students are having difficulty making any progress at all, hand out the student work samples (pages 6–9) to model problem-solving methods.

**Collaborative Analysis of Student Work Samples (20 minutes)**

After students have had sufficient time to attempt the task, give each small group of students copies of the student work samples (pages 6–9) and ask for written comments. This step gives students the opportunity to evaluate a variety of possible approaches to the task, without providing a complete solution strategy.

*Imagine you are the teacher and have to assess this work. Correct the work and write comments on the accuracy and organization of each response.*

Each student work sample poses specific questions for students to answer. In addition to these questions, you could ask students to evaluate and compare responses. To help them do more than check if the answer is correct, you may ask the following questions.

- *How did this student organize his or her work?*
- *What mistakes have been made?*
- *What isn't clear?*
- *What questions would you like to ask this student?*
- *In what ways might the work be improved?*

Every group may not have enough time to work through all student work sample questions. If so, be selective about what you hand out. For example, groups that successfully completed the task using one method might benefit from looking at different approaches. Other groups that struggled with a particular approach may benefit from seeing a student version of the same strategy.

During small group work, support students as before. Note similarities and differences between students' approaches during small group work and student work sample approaches. Also check which methods students have difficulties understanding to focus the next activity, a whole class discussion.

**Whole Class Discussion: Compare Different Approaches (10 minutes)**

Organize a whole class discussion to consider different approaches used in the student work samples. Focus the discussion on those parts of the small group tasks that students found difficult. Ask students to compare different solution methods.

- *Which approach did you find easiest to understand? Why?*
- *Which approach did you find most difficult to understand? Why?*

**Review Original Solutions to Task (10 minutes)**

Ask students to read their original responses to the task.

*Read your original solutions and think about your work on this task. Write down what you learned. Which method would you prefer to use if you were doing the task again? Why?*

Encourage students to compare new approaches they learned during the task with their original methods.

## Solutions

The solution should have 8 pennies, 6 nickels, 4 dimes, and 6 quarters. Students should show their work with pictures, coins, counters, or whatever they need. Students explain finding the number of dimes using division by 6 because the question asked for  $\frac{1}{6}$  of the coins to be dimes. The denominator tells students to divide the whole by 6. \$2.28 is the total.

# Sample 1: Student A

Name \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

**LESSON**  
**8-9**

## Open Response

Progress  
Check 8



Robert found 24 coins.  $\frac{1}{3}$  of them were pennies,  $\frac{1}{4}$  of them were nickels,  $\frac{1}{6}$  of them were dimes, and the rest were quarters.

1. Tell how many of each coin Robert found. Show all of your work. Use coins, pictures, counters, or whatever you need.

Handwritten student work for question 1:

- Equation:  $8 \times 3 = 24$  (circled)
- Equation:  $24 \div 3 = 8$  (circled)
- Equation:  $24 \div 4 = 6$  (circled)
- Equation:  $24 \div 6 = 4$  (circled)
- Equation:  $19 + 6 = 24$  (circled)
- Labels: 8 pennies, 6 dimes, 4 nickels, 6 quarters
- Diagram: A hand-drawn oval containing 10 coins. 4 are labeled '1' (pennies), 2 are labeled '5' (nickels), and 4 are labeled '25' (quarters).

2. Explain how you found the number of dimes.

Because 6 is  $\frac{1}{2}$  of 12 and 12 is  $\frac{1}{2}$  of 24 6 would be the answer.

3. How much are his coins worth altogether? \$12.48

Handwritten student work for question 3:

- Text: Show all of your work.
- Diagram: A vertical stack of coins represented by vertical lines. The top row has 8 lines, the middle row has 6 lines, and the bottom row has 4 lines. The number 24 is written to the left of the stack.
- Equation:  $\$2 + 3 + 2 + 8 = \$12.48$

*What isn't clear?*

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*What would you do to improve this solution?*

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## Sample 2: Student B

Name \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

**LESSON**  
**8-9**

### Open Response

 Progress  
 Check 8


Robert found 24 coins.  $\frac{1}{3}$  of them were pennies,  $\frac{1}{4}$  of them were nickels,  $\frac{1}{6}$  of them were dimes, and the rest were quarters.

1. Tell how many of each coin Robert found. Show all of your work. Use coins, pictures, counters, or whatever you need.

8	pennies	6	nickels
4	dimes	6	quarters

2. Explain how you found the number of dimes.

*I stuck all of the counters and I got 4 dimes*

3. How much are his coins worth altogether?  $8 + 4 + 6 + 6 = 24$   
 Show all of your work.



*What is missing from this solution?*

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*How could you improve this solution?*

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*What questions would you ask this student?*

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Name \_\_\_\_\_

Date \_\_\_\_\_

Time \_\_\_\_\_

**LESSON**  
**8•9****Open Response**Progress  
Check 8**Solving a Coin Problem**

Robert found 24 coins.  $\frac{1}{3}$  of them were pennies,  $\frac{1}{4}$  of them were nickels,  $\frac{1}{6}$  of them were dimes, and the rest were quarters.

1. Tell how many of each coin Robert found. Show all of your work. Use coins, pictures, counters, or whatever you need.

Robert had \_\_\_\_\_ pennies \_\_\_\_\_ nickels

\_\_\_\_\_ dimes \_\_\_\_\_ quarters

2. Explain how you found the number of dimes.

3. How much are his coins worth altogether? \_\_\_\_\_  
Show all of your work.