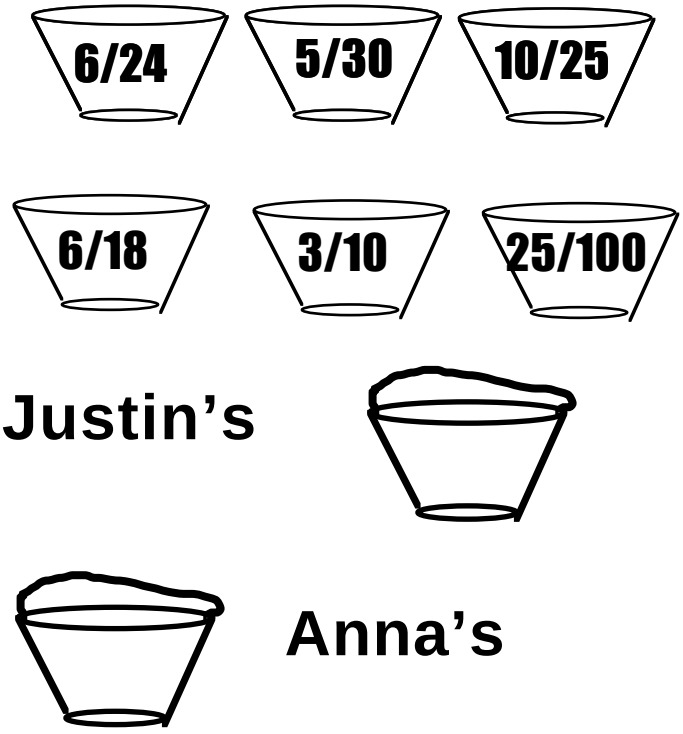
Lugging Water II

Justin and Anna were camping with their family. They joined their dad at the camp water pump where he had partially filled 6 containers. The containers had no handles. As he filled each one, he labeled the fractional amount at which he filled each container. The amounts are shown below.



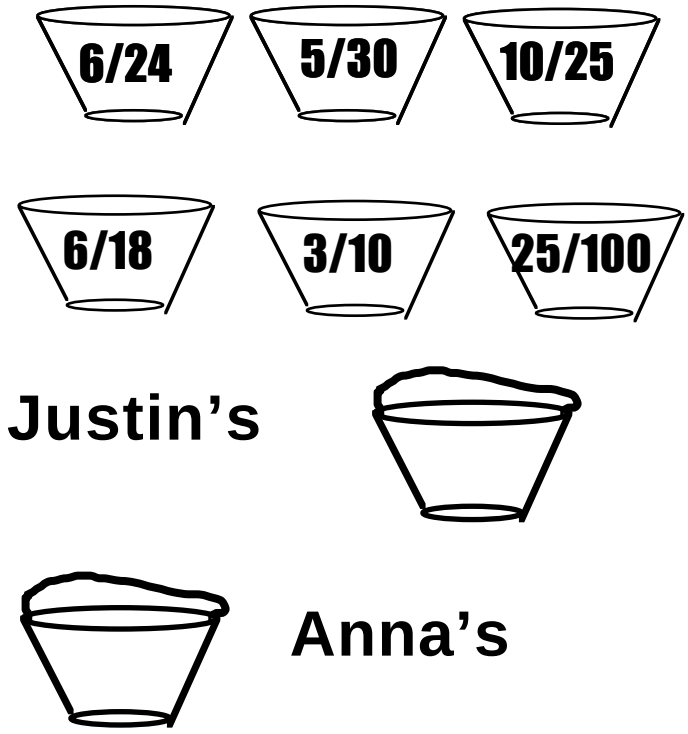
Justin and Anna each had a container that was the same size as the ones their dad filled, but theirs had handles. Their task was to pour the water from the 6 containers into their 2 containers so they could easily carry the water back to camp. Which containers should Justin and Anna pour into each of their containers so together they can transport the water back to camp in one trip? Show your math thinking.

Lugging Water II

Suggested Grade Span
Grades 6–8

Grade in Which Task Was Piloted
Grade 6

Task
Justin and Anna were camping with their family. They joined their dad at the camp water pump where he had partially filled 6 containers. The containers had no handles. As he filled each one, he labeled the fractional amount at which he filled each container. The amounts are shown below.

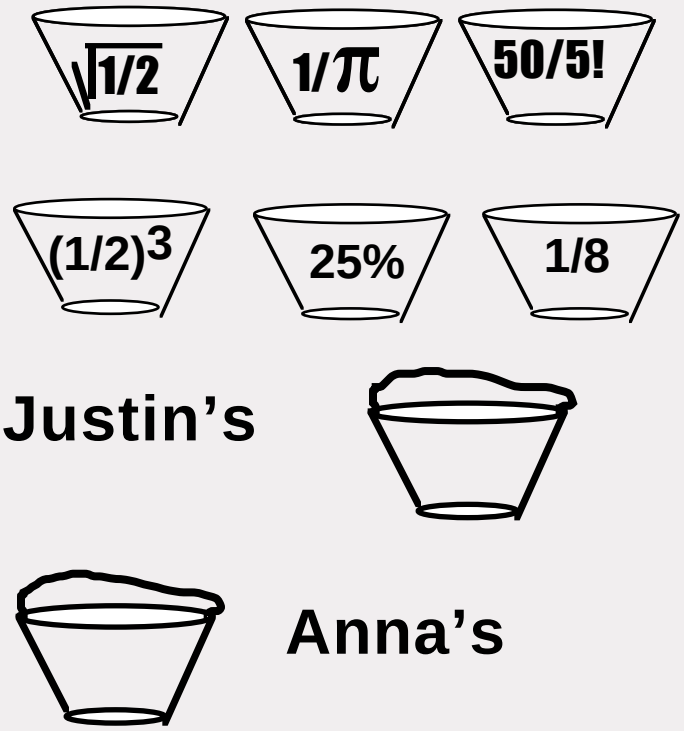


Justin and Anna each had a container that was the same size as the ones their dad filled, but theirs had handles. Their task was to pour the water from the 6 containers into their 2 containers so they could easily carry the water back to camp. Which containers should Justin and Anna pour into each of their containers so together they can transport the water back to camp in one trip? Show your math thinking.

Alternative Versions of Task

More Accessible Version:
See Lugging Water I in the grade 3–5 tasks.

More Challenging Version:
Justin and Anna were camping with their family. They joined their dad at the camp water pump where he had partially filled 6 containers. The containers had no handles. As he filled each one, he labeled the fractional amount at which he filled each container. The amounts are shown below.



Justin and Anna each had a container that was the same size as the ones their dad filled, but theirs had handles. Their task was to pour the water from the 6 containers into their 2 containers so they could easily carry the water back to camp. Which containers should Justin and Anna pour into each of their containers so together they can transport the water back to camp in one trip? Show your math thinking.

NCTM Content Standards and Evidence

Number and Operation Standard for Grades 6–8

Instructional programs from Pre–Kindergarten through grade 12 should enable students to...

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems.
  - ***NCTM Evidence:*** Work flexibly with fractions, decimals, and percents to solve problems; Compare and order fractions, decimals, and percents efficiently and find their approximate locations on a number line.
  - ***Exemplars Task Specific Evidence:*** This task requires students to find a combination of fractions to equal one whole.

Time/Context/Qualifiers/Tip(s) From Piloting Teacher

This is a medium length task for most students. Students who have a command of addition of fractions with unlike denominators may not find this as a situation where problem solving strategies need to be employed, and should be given a different task to solve.

Links

This task could link to a unit on water, or to camping.

Common Strategies Used to Solve This Task

Most students will try to rename fractions so that they all have like denominators. Others will rename the fractions as decimals or percents. Then students guess and check to find combinations that are less than or equal to 1.

Possible Solutions

Original Version:

I have labeled the buckets in the following manner:

A) 6/24 = .25	B) 5/30 = .167	C) 10/25 = .4
D) 6/18 = .33	E) 3/10 = .3	F) 25/100 = .25

There are several different correct solutions to this task. I think I have exhausted all possible combinations, but there could be more. When assessing each student's work be sure that the total of the 6 buckets used equals .1699, and that each bucket holds no more than 1.

Bucket 1	Bucket 2
A B C (.816)	D E F (.883)
B C D (.899)	A E F (.8)
A C F (.9)	B D E (.799)
A D F (.833)	B C E (.866)
B C F (.816)	A B E (.883)
B E F (.716)	A C D (.983)
C E F (.95)	A B D (.747)
A E B (.716)	C D F (.983)

More Accessible Version:
See the Lugging Water I in the grades 3–5 tasks.

More Challenging Version:
Using the following equivalents, the only combination that works is combining buckets A and D into one bucket, and then pouring all of the other buckets in the second container.

A) square root of .5 = .707 B) $1/\pi = .318$ C) $50/5! = .417$

D) $1/2^3 = .125$ E) 25% = .25 F) $1/8 = .125$

Task Specific Assessment Notes

General Notes: This task should elicit the use of math language to solve and communicate a solution. It will also be important for students to communicate clearly with the audience. Students' command of fractions in a problem solving setting can also be evaluated.

Novice: The novice will demonstrate little or no understanding of the task. The novice will not know that the fractions need to be changed into equivalent forms so as to make computation more manageable. Little engagement in the task will be evident, or all work present will be incorrect.

Apprentice: The apprentice will have a partially correct solution with a strategy that will work for solving part of the task. The apprentice may achieve a correct solution without mathematical justification. This will especially be the case where students choose to use diagrams to solve the task. If diagrams are used they need to be labeled and done with intent to show that the sum of the fractions does not exceed a whole. The apprentice may have an approach that would work for solving the task, but achieves an incorrect solution due to computation or reasoning errors.

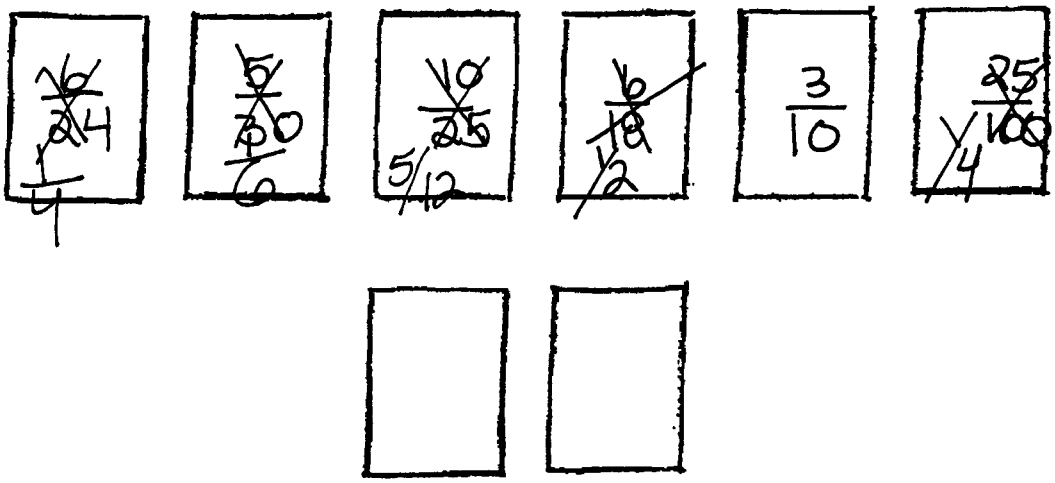
Practitioner: The practitioner will achieve a correct solution to the task with supporting work. The practitioner will clearly communicate the solution with correct reasoning and justification. Math language will be relied on to communicate to the audience.

Expert: The expert will not only achieve a correct solution, but will also utilize other good problem solving strategies such as creating a rule to solve the task, or going above and beyond the task requirements to extend the solution. Many students may rely on verifying the solution in order to prove their solution is correct.

Author

This task was written by **Deb Armitage**, Pre K–8 Mathematics Assessment Consultant at the Vermont Department of Education. The task was piloted by teachers and students in Vermont.

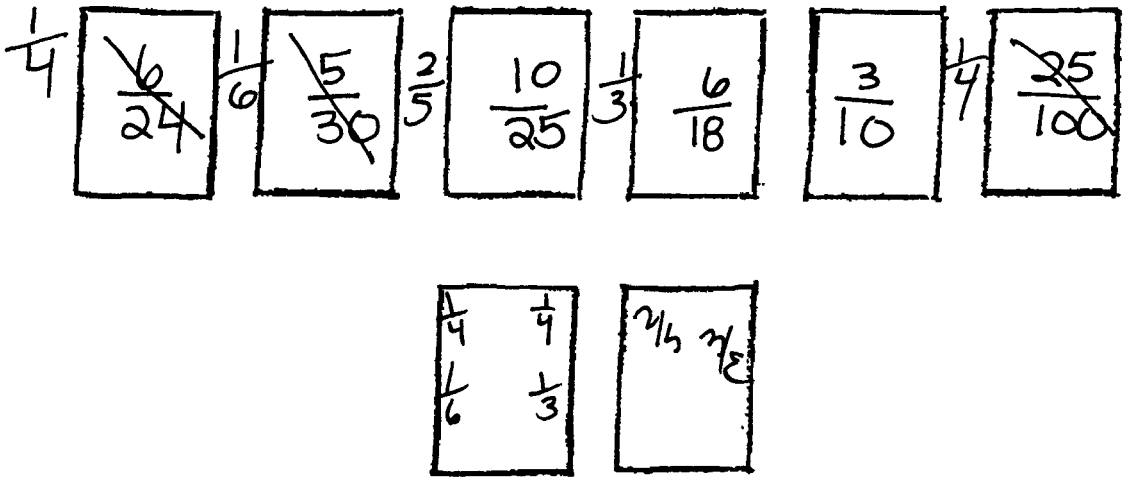
Novice



Little or no understanding of the task is demonstrated. A few of the fractions are simplified correctly, but then no attempt is made to do anything with this data.

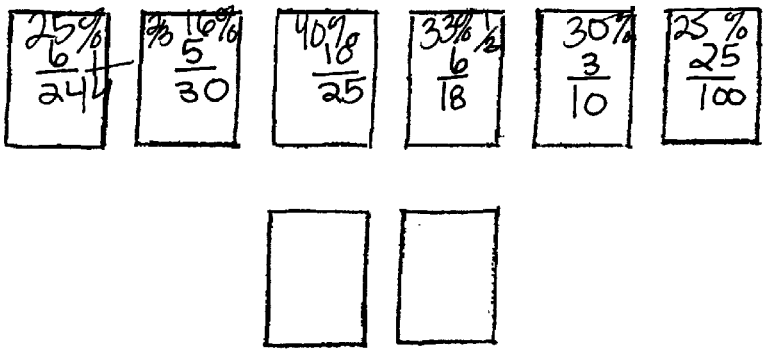
No problem solving strategies are implemented.

Apprentice



Correct answers are achieved but there is no documentation or approach to making sure the amounts will fit in the container.

Practitioner



I have to use the fractions of water that can go into the 2 empty container I will turn the fractions into percentages and try to get 100%.

Practitioner cont.

Container 1

$\frac{6}{24} = 25\%$

$\frac{25}{100} = 25\%$

$\frac{5}{30} = 16\frac{2}{3}\%$

$\frac{6}{18} = 33\frac{1}{3}\%$

100%

Container 2

$\frac{10}{25} = 40\%$

$\frac{3}{10} = 30\%$

$\frac{70}{100}$ 70%

missing 30 percent

The mislabeling of mixed numbers does not distract from the solution.

Work is correct and a possible solution is achieved. The approach is explained. Work is organized and clearly displayed.

Expert

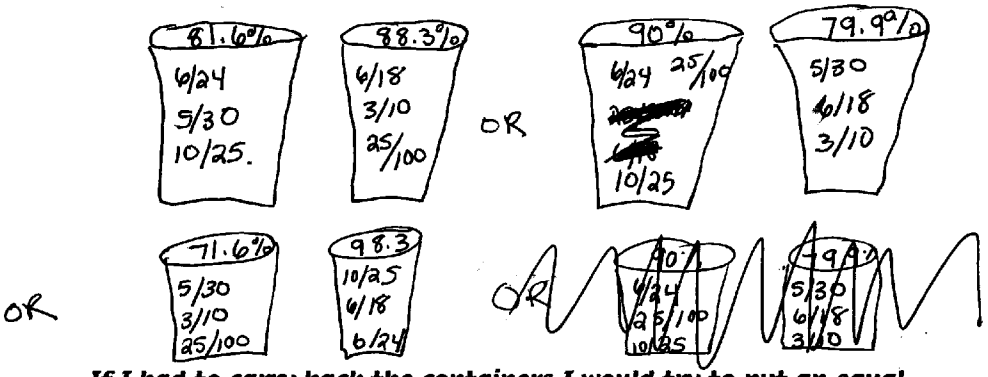
All work is shown and explained. Correct answers are achieved. Correct and sophisticated reasoning is used.

My Solution to Lugging Water

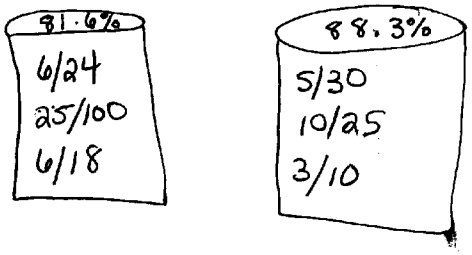
The first thing I did to solve the problem was to make each fraction equal a percent. This is what I got.

6/24 = 1/4 = 25%
5/30 = 1/6 = 16.6%
10/25 = 2/5 = 40%
6/18 = 1/3 = 33.3%
3/10 = 30%
25/100 = 1/4 = 25%

Then I realized that there are many different answers to the problem because each container can hold up to 100%. Some of the answers that work are



If I had to carry back the containers I would try to put an equal amount in each container. The best answer I came up with for this is



The student evaluates the solutions to choose one that is best. Knowledge of fractions and decimals is demonstrated.