

## What is Fair?

Elizabeth, Katie, Gretchen and I had a great time at the conference we attended together in New Hampshire. We all agree that it is only fair to share our expenses. The problem is, we are having a very difficult time figuring out who owes whom money and how much? Can you help us? Show all your work in a way that will make sense to us. Be as clear as possible because as you can see, it is all very confusing.

Facts:

On Sunday, I put \$10 worth of gas in my car and headed to Massachusetts. Sunday night I met the other ladies at our hotel in New Hampshire. Gretchen drove Elizabeth and Katie to New Hampshire in her car. Before they left, she spent \$15 on gas. We all paid for our own things while in New Hampshire. Before returning to Vermont on Tuesday, Gretchen put \$9 worth of gas in her car and then she put another \$9 worth of gas in her tank once she got back to Waitsfield. Before I left to come home, I also had to put gas in my car. I spent \$12. Once I got back to Vermont, I filled up my gas tank again and spent another \$9! Katie and Elizabeth drove back to Vermont with Gretchen and me.

So, the question is, who owes whom money and why?

Good Luck!

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# Exemplars

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## What is Fair?

### Suggested Grade Span

3-5

### Task

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### Alternate Versions of Task

#### More Accessible Version:

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How much money did we spend on gas in all? If we divide the cost evenly among the 4 of us, how much should we all pay?

## More Challenging Version:

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So, the question is, who owes whom money and why?

If gas costs \$1.099 per gallon, how many gallons of gas in all were purchased?

## Context

Note: Gretchen, Katie, Elizabeth and Amy are the students' teachers.

I went to a conference with three other teachers from school for a few days. When I got back to school the children were asking all about it. They wanted to know how we got to the conference and how we decided who drove. This "everyday" type of conversation turned into a big question of what was fair. Comments were made about it being unfair for the drivers to pay for all the gas. When I asked the class how much money they thought would be fair for each person to pay, the realization that this was not easy to figure out hit. We took advantage of this application of math to everyday situations and engaged in what proved to be a difficult and controversial task!

## What This Task Accomplishes

This task engaged the children in everyday, seemingly simple mathematics. This problem had multiple steps and required a lot of patience, planning and organizing on the part of the students. They needed to "weed" through information to find out which of it was meaningful to the solution and they had to decide what fair meant.

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## What the Student Will Do

Most students had a very difficult time trying to figure out which of the gas expenses should be shared. For example, filling the gas tanks before leaving for the trip versus filling up once the trip was over. The fact is, most kids did not even realize this was an issue. A few kids used water, containers and toy cars to act out the solution. This strategy seemed to work well, but often distracted the students.

The majority of the students did not take into account that I had gone to Massachusetts first. Many children also did not go back and look at their solutions after solving them to see if the totals were fair. Most children seemed to use some form of table to organize their data.

## Time Required for Task

Two to three, 45-minute periods

## Interdisciplinary Links

Although I did not link this directly to a unit of study, it tied in beautifully with our on-going conversations and lessons about equity, equality, fairness and justice. In the future I will use this type of a task when working out transportation arrangements for field trips or even a Civil Rights unit (editing the content to be more appropriate).

## Teaching Tips

I would suggest having a discussion about fairness, expenses and general issues concerning cars and fuel. We got into some interesting discussions about miles/gallon and m.p.h..

I might encourage the children to act it out by doing a similar problem together as a class. As always have manipulatives available for the children to use.

## Suggested Materials

- Liquid containers
- Matchbox cars
- Bear/people counters to represent the people
- Money
- Rulers
- Graph paper
- Beans

## Possible Solutions

Answers will vary depending on several things: 1) Did everyone share in all or part of the cost of my trip to Massachusetts? 2) Was the amount of money owed divided evenly between all of us?

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Did the drivers pay less due to the use of their cars? (If so, make sure this is stated... do not assume!) 3) Was money paid for gas put all together and then divided or was it done by who rode in who's car?

## More Accessible Version Solution:

$$\$10 + \$15 + \$9 + \$9 + \$12 = \$55$$

$$\$55 \div 4 = \$13.75 \text{ each}$$

## More Challenging Version Solution:

$$\$10 + \$15 + \$9 + \$9 + \$12 + \$9 = \$64$$

$$\$64 \div \$1.099 = \text{approximately } 58 \text{ gallons}$$

## Task Specific Assessment Notes

### Novice

This child did not understand the task. There is very little evidence of mathematical reasoning or a representation to help unravel the problem. The answer reflects what s/he believes Amy and Gretchen owe the gas company.

### Apprentice

This student did not complete the problem although s/he showed an understanding of how to get started.

### Practitioner

This student shows a broad understanding of the problem, uses effective reasoning and provides a very clear explanation of why s/he made the decisions that s/he did.

### Expert

This child's solution shows a deep understanding of all aspects of this problem. S/he takes into account that one of the drivers only had a passenger one way as well as the fact that not all the gas paid for was gas used on the trip. S/he provides a clear explanation of how the problem was solved and why decisions were made. This child's work is neat and well organized.

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