Division of Labor

This problem has been adapted from the "Games" segment of *Weekend Edition* on Vermont Public Radio, August 28, 1994. The host said he found it in an unpublished manuscript of brainteasers and other puzzles.

There were 4 hobos that arrived in town looking for work. They met with a business owner who said he could pay them for 200 hours of work. However, there was a catch. They could divide up the work anyway they wanted, but each hobo had to work the same number of days as s/he worked hours in 1 day. For example, if a hobo worked 8 hours a day, s/he had to work for 8 days. The other catch is that the laziest hobo of all did the negotiations with the business owner and then went back to present the plan to his/her pals.

The question is how many hours a day did each hobo work?

Grade Levels 6 - 8

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Context

We had been exploring square numbers through block patterning and this offered an opportunity to recognize a source of square numbers and provide the opportunity to manipulate this set of numbers.

What This Task Accomplishes

This task gave students the opportunity to generate square numbers, estimate, explore problems with more than one possible solution, and express their results with graphic representations.

What the Student Will Do

Students had to read carefully to see that each person had to work the same number of days as s/he worked hours in one day. It was not possible to simply divide the total hours between the four people. They then had to generate all the possible numbers of hours one could work (square numbers from 1 - 144). They could decide how many hours to have the "lazy" person work, giving way to a variety of possible solutions. Through trial and error they were able to find combinations of hours that equaled 200.

Time Required for Task

Two or three class periods for complete solutions, including graphic representations. This could also be assigned to be completed outside class time.

Interdisciplinary Links

The problem could easily be rewritten to be about any four individuals, not just "hobos", to fit another unit of study.

Teaching Tips

You might want to add another stipulation stating that no two people worked the same number of hours - as two easy solutions are having two people work 10 hours a day and two not work, or have two work eight hour days and two work six hour days. You might want to talk about the entire job (200 hours) being 100% and suggest a pie graph as mathematical representation.

Suggested Materials

Calculators

Possible Solutions

Two people work 10 hour days and two do not work.

Two work eight hour days and two work six hour days.

One works a two hour day, one works a four hour day, one works a six hour day and one works a 12 hour day.

One works 10 hours, one works eight hours, one works six hours and the lazy one does not work.

Benchmark Descriptors

Novice
This student did not use the information that each person had to work the same number of days as hours worked in one day. The solution equals 200 hours, but each person works 10 hours per day for five days. This is not an acceptable solution.

Apprentice
This student understands that there needs to be an equal number of days and hours for each person working, but falls short of being able to find the right combinations.

Practitioner
This student satisfies the requirements of the task as stated and recognizes that s/he is working with square numbers. S/he finds a relatively easy solution and attempts an extension that goes nowhere. While s/he gets the idea that using a graph to represent his/her solution would be a good idea, s/he uses three attempts, which prove to be redundant.

Expert
While this student only finds one solution, it is a more difficult solution and takes into account

that the lazy hobo would want to work less than the others. His/her strategy is methodical and his/her results are well organized.