

THE SCIENCE FAIR

Performance Standard 6D.G

Determine how to share space and costs for the science fair among three schools accordingly:

- *Mathematical knowledge:* Use methods for solving problems involving proportions.
- *Strategic knowledge:* Determine how to distribute the amount of space and costs for the science fair so that it is proportional to the three schools' populations.
- *Explanation:* Explain completely and clearly what was done and why it was done.

Procedures

1. ***In order to solve problems using comparison of quantities, ratios, proportions and percents (6D)***, students should experience sufficient learning opportunities to develop the following:
 - Work flexibly with fractions, decimals and percents to solve number sentences and word problems.
 - Develop, use, analyze, and explain methods for solving numeric or word problems involving proportions.
2. Provide each student a copy of the "Science Fair" task sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Have the students work individually to solve the problem. (Do not help the students or guide their thinking as they solve the problem.) Students should use proportional reasoning to change between numbers of students, fractions, and percents.
4. Evaluate each student's work using the rubric and its guide to determine the performance level. Give each student a score in each of the three categories, scoring each part of the problem separately. Minor errors in computation include making errors in the actual addition or multiplication, rounding incorrectly. Major errors include using the wrong operation or formulas, or not using the correct value for total student enrollment at all three schools (e.g., using the enrollment of the largest school as a total enrollment of all three for calculating fractions of the total). Evaluate each part of the work as follows:
 - Part A: The students should show the rectangle divided into three sections with an approximate ratio of the areas of 2:3:5. Each school's area should be clearly identified. The students' written explanation should include details on how they used the ratio of the student enrollments to determine the ratio of the areas they should receive.
 - Part B: The students should find the fractions to be equivalent to Hart having $\frac{1}{2}$ of the space; Malcolm getting $\frac{3}{10}$ ths of the space, and Kennedy getting $\frac{1}{5}$ of the total space. Somewhere the students will need to talk about the total enrollment of all three schools being viewed as the whole, and the enrollment of each school being their part of the total. If the students do not simplify their fractions, that should not effect their mathematical knowledge score on this item.
 - Part C: The students should find the percents that are equivalent to the fractions found in part B. If their fractions are off in part B, but their conversions for those fractions are correct, this would be considered a correct response. If their fractions in part B are correct, they should have solutions of 50% for Hart MS, 30% for Malcolm, and 20% for Kennedy. Their explanations should include how they found these percents, as well as why these percents are correct. If students assign percents on a basis of something other than proportional reasoning with enrollments, they should receive a score of 1 or less in mathematical knowledge and strategy.
 - Part D: the students should find that Hart should pay \$150.00; Malcolm should pay \$90.00, and Kennedy should have to pay the remaining \$60.00 of the cost. Minor errors include errors in actual computation; while major errors include taking a percent of the wrong amount, or using the wrong mathematical operation, such as dividing instead of multiplying. Their explanations should include how they found these costs and why they are correct.

Examples of Student Work follow

Time Requirements

- 15 - 20 minutes

Resources

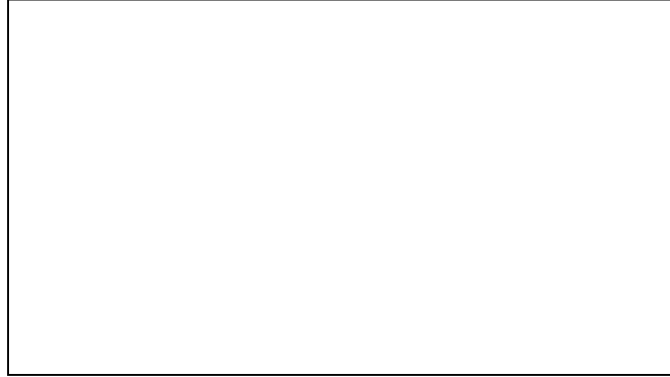
- Copies of the "The Science Fair" task sheet
- Rulers to help make equal division may be helpful but are not required
- Mathematics Rubric

NAME _____ DATE _____

SCIENCE FAIR

Three middle schools are going to have a science fair. The science fair will be in an auditorium. The amount of space given to each school is proportional to the approximate number of students enrolled in each school. Hart Middle School has about 1,000 students; Malcolm Middle School has about 600 students, and Kennedy Middle School has about 400 students.

- A. The rectangle below represents the auditorium. Divide the rectangle to show the amount of space each school should get based on the number of students they have enrolled. **Clearly label each section. Show all your computation and explain your reasoning.**



- B. What fraction of the total space available should each school get based upon their enrollments? **Show all work and explain your reasoning.**

C. If the schools share the costs of the science fair, based on the number of students enrolled, what percent of the cost should each school pay? **Show all of your work and explain your reasoning.**

D. If the cost of the science fair is \$300.00, how much should each school pay? **Show all of your work; explain and justify your answer.**

Adapted from the *New Standards* tasks and reference exams available from Harcourt Brace Educational Measurement, as included in NCSM's *Great Tasks and More* (1996).

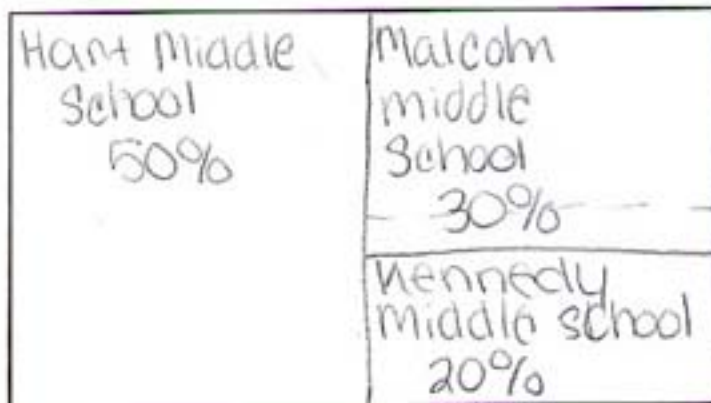
NAME _____

DATE 3/26/01

The Science Fair 4

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- A. The rectangle below represents the auditorium. Divide the rectangle to show the amount of space each school should get based on the number of students they have enrolled. Clearly label each section, and explain your reasoning.



First, I divided it into halves because $\frac{1}{2} = 50\%$ and Hart was 50%. Second, I divided the second half in half but one side (malcolm) bigger than Kennedy.

1,000
600
400

2,000

1,000 = 50%
600 = 30%
400 = 20%

- B. What fraction of the total space available should each school get, based on their enrollments? Explain your reasoning.

Hart Middle School = $\frac{1}{2}$ because they have 50% of total students.

Malcom Middle School = $\frac{3}{10}$ because they have 30% of the students.

Kennedy Middle School = $\frac{2}{10}$ because they have 20% of the students.

- C. If the schools share the costs of the science fair, based on the number of students enrolled, what percent of the cost should each school pay? Explain your reasoning.

Hart Middle School = 50% should pay 50% of costs

Malcom Middle School - pay 30%

Kennedy Middle School - pay 20%

- D. If the cost of the science fair is \$300.00, how much should each school pay? Explain and justify your answer.

$50\% \times 300 = 150$, $30\% \times 300 = 90$, $20\% \times 300 = 60$

Hart should pay the most because they have $\frac{1}{2}$ the students (\$150.00), Malcom pays 30% (\$90.00) and Kennedy pays 20% (\$60.00).

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