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ABSTRACT

Math Works is the fifth grade component of the "Mathematics for the '80s" project, a series of 28 video programs and related material developed by a consortium of state and provincial education and television agencies. A formative evaluation of Math Works programs (9 and 25) was conducted to assess the instructional effectiveness and general appeal of these and other programs in the Math Works series. For Math Works Program 9 ("The Difference between Perimeter and Area"), the sample consisted of more than 400 children, principally fifth graders, in ten schools. For Program 25 ("Dividing Regions into Subregions for Finding Area"), the sample consisted of 107 boys and 83 girls, principally fifth graders from eight schools. Both samples included rural, suburban, and innercity schools. Qualitative data were used primarily to assess the appeal of the programs and to determine needed instructional enhancement; pre- and posttests were used to measure the instructional effectiveness of the programs. T-tests were performed to determine whether student performance significantly increased from the pretest to the posttest. Results indicate: (1) after each program, students' feelings toward mathematics were virtually unchanged; (2) students liked both programs slightly more than they liked mathematics; (3) students fared well on items related only to story line (91.8% correct), although their performance declined on items which asked them to recall the application of a concept within a story (41% correct); (4) results of analysis of variance for sex were inconclusive; and (5) students could identify with the characters in the story, but felt that some dramatic segments were confusing or unrealistic. Appendices contain a list of cooperating agencies, program summaries, and the pre- and posttests. (JB)

Research Report

NUMBER 94

FORMATIVE EVALUATION OF "MEASUREMENT: THE DIFFERENCE BETWEEN PERIMETER AND AREA" AND "MEASUREMENT: DIVIDING REGIONS INTO SUBREGIONS FOR FINDING AREA" FROM MATH WORKS

agency for instructional technology
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FORMATIVE EVALUATION OF

"MEASUREMENT: THE DIFFERENCE BETWEEN PERIMETER AND AREA"

AND

"MEASUREMENT: DIVIDING REGIONS INTO SUBREGIONS FOR FINDING AREA"

FROM MATH WORKS

Research Report 94

May 1985

Agency for Instructional Technology
Box A
Bloomington, Indiana 47402

The Agency for Instructional Technology is a nonprofit American-Canadian organization established in 1973 to strengthen education through technology. In cooperation with state and provincial agencies, AIT develops instructional materials using television and computers. AIT also acquires and distributes a wide variety of television and related print materials for use as major learning resources. It makes many of these materials available in audiovisual formats. From April 1973 to July 1984, AIT was known as the Agency for Instructional Television. Its predecessor organization, National Instructional Television, was founded in 1962. AIT's main offices are in Bloomington, Indiana.

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INTRODUCTION

Math Works is the fifth-grade component of the *Mathematics for the '80s* project. It is a series of twenty-eight 15-minute video programs and related printed materials that have been developed by a consortium of state and provincial education and television agencies under the supervision of the Agency for Instructional Technology. The series is planned for release in the fall of 1985.

Formative evaluation of *Math Works* includes:

1. Script review, by teachers and members of the consortium, of all programs.
2. Field testing of initial rough-cut programs.

This report summarizes the findings from field evaluation of two programs in the *Math Works* series: "The Difference Between Perimeter and Area" (Program 9) and "Dividing Regions into Subregions for Finding Area" (Program 25). (See Appendix B for descriptions of these programs.)

The purpose of the evaluation was threefold:

a. To gather information that could be used to enhance the instructional effectiveness of these and other programs in the *Math Works* series.

2. To gather information that could be used to enhance the general appeal of these and other programs in the *Math Works* series.

3. To determine the degree to which these programs are instructionally effective in their present state.

SAMPLE

For Program 9, the sample consisted of 433 students in ten schools in the cities of Louisville, Kentucky; Cincinnati, Ohio; and Mitchell, South Dakota. There were 216 boys and 217 girls. Except for 11 fourth graders, all students were in the fifth grade.

For Program 25, the sample consisted of 190 students in eight schools in the cities of Louisville, Kentucky; Cincinnati, Ohio; and Albuquerque, New Mexico. There were 107 boys and 83 girls. Except for 21 fourth graders, all students were in the fifth grade.

Both samples included a mixture of rural, suburban, and inner city schools.

METHODOLOGY

Evaluation design provided for the collection of both qualitative and quantitative data. Qualitative data was used primarily to assess the general appeal of the programs and to determine needed instructional enhancement. Quantitative data was used primarily to measure the instructional effectiveness of the programs.

A pretest and a posttest were used to collect quantitative data. (Copies of the pretest and posttest appear in Appendix C.) The pretest asked students how much they liked mathematics and also established a comparative base against which to gauge the instructional effects of the programs. The effect of pretest memory on the posttest score was controlled in two ways:

1. All teachers were asked to give the pretests to their classes so that a weekend would intervene between the pretest and the posttest. This was done so that the students would have not only time, but also intervening experiences, to occlude their memory of the pretest.

2. All teachers were instructed to give the pretest without explanation. Thus, no student taking the pretest would know of any benefit that might accrue for remembering specific pretest items.

AIT evaluators spent about an hour in each classroom. During that time they engaged the class in a discussion before the program, showed the program, administered the posttest, and held another discussion.

The purposes of the discussion before the program were to explain to students the nature of a rough-cut television program, to help the students feel at ease with the evaluators and to explain to the students the importance of being honest with the evaluators. To achieve this goal, evaluators talked with the class about their favorite commercial television shows (which the students were eager to identify and discuss) and explained a little of the television development process. The evaluators encouraged students to respond honestly to the program by asking them to

consider themselves television critics and to help AIT in the development process. It was made clear to the students that the evaluators did not actually produce the program.

Showing the program itself took about 15 minutes with the use of equipment supplied by the local school system.

The posttest was used to gather information about the program's appeal, students' retention of the story line, and the instructional effect of the program in its present state. The posttest was administered by AIT field evaluators immediately after showing the program. No discussion of the program was facilitated before the posttest.

The purpose of the discussion that followed the posttest was to ascertain the program's general appeal to the students and also to get as many specific suggestions as possible for program improvement. This discussion lasted about twenty minutes.

ANALYSIS OF THE PRETEST AND POSTTEST RESULTS

T-tests were performed to determine whether student performance significantly increased from pretest to posttest. Overall, the gain in scores was statistically significant. (See Table 1.)

Table 1

Comparison of Pretest/Posttest Scores

Program 9

School	N	Pretest Mean	Posttest Mean	Significance
Louisville 1	28	3.4	4.0	.19
Louisville 2	28	3.2	3.5	.40
Louisville 3	25	3.6	4.1	.28
Cincinnati 1	21	3.5	3.9	.41
Cincinnati 2	15	2.6	4.0	.03
Cincinnati 3	31	4.4	4.9	.18
Mitchell 1	80	4.1	5.0	.00
Mitchell 2	51	3.8	4.9	.00
Mitchell 3	61	3.8	5.0	.00
Total	340	3.8	4.5	.00

Program 25

School†	N	Pretest Mean	Posttest Mean	Significance
Louisville 1	25	1.6	3.0	.00
Louisville 3	24	1.8	2.6	.07
Cincinnati 1	21	1.7	2.3	.12
Cincinnati 2	24	1.3	3.4	.00
Cincinnati 3	28	1.7	4.7	.00
Albuquerque 1	27	1.8	3.4	.00
Albuquerque 2	18	2.0	2.9	.11
Total	193	1.7	3.0	.00

† Data from the Louisville 2 school were not used because the teacher did not give the pretest.

On a five point Likert scale, from "Math is lots of fun" (1) to "Math is no fun at all" (5), students were asked to identify their feelings toward mathematics. After either program, scores on this item were virtually unchanged. Before viewing Program 9, 42.3% of the students indicated that mathematics is "lots of fun"; afterward, 47.2% of the students indicated this response. Before viewing Program 25, 44.2% indicated that mathematics is "lots of fun"; after the program, 36.7% of the students indicated this response.

On another part of the test, students were asked to tell whether they enjoyed the program. The Likert scale for this item ranged from "I liked the program a lot" (1) to "I didn't like the program at all" (5). After viewing Program 9, 62.1% of the students indicated they liked the program "a lot." Of the students viewing Program 25, 44.8% indicated they liked the program "a lot." Students liked both programs slightly more than they liked mathematics. Results appear in Table 2.

Table 2

Student Attitude Means

Like Mathematics

	Program 9	Program 25
Mean Pretest	2.07	2.05
Mean Posttest	1.95	2.16

Like Program

	Program 9	Program 25
Mean Posttest	1.55	1.84

It might be expected that students would respond with great similarity

to these two items. However, an analysis of common variance showed 12% common variance between liking mathematics and liking Program 9 (r=.35) and 18% common variance between liking mathematics and liking Program 25 (r=.42). Therefore, the appeal of both programs goes beyond its mathematics content.

Based on this analysis, we might hypothesize that there is no statistically significant interaction between liking mathematics and liking the programs, and this does prove to be the case.

Program 9	$(F_{13,334} = 1.336)$	$({}_{.05}F_{13,334} = 2.21)$
Program 25	$(F_{14,220} = 0.589)$	$({}_{.05}F_{13,320} = 2.13)$

There were two types of items related to story line. One type dealt only with the story line itself and the other type dealt with applying the mathematical concept within the story line. An example of the first type of item would be:

The man in the program wanted to cover his lawn with

a. grass.
b. artificial turf.
c. deep purple carpet.
d. a cement patio.

An example of the second type of item would be:

In order to figure out the area of the man's lawn, Jenny and Denny had to use

a. multiplication only.
b. multiplication and addition only.
c. multiplication and subtraction only.
d. multiplication, addition, and subtraction.

Students fared well on items related only to story line (91.8% correct). However, performance declined on items in which students were asked to recall the application of a concept within the story (41% correct).

ANOVAS were performed to determine the effects of sex and of grade level. Results show that learning gain was significantly greater for fifth graders than for fourth graders. Results of the ANOVAS for sex were inconclusive. Boys and girls performed equally well on Program 25 but girls performed significantly better than boys on Program 9.

Program 9				Program 25			
N	Boys	Girls	F	N	Boys	Girls	F
333	4.33	4.47	9.085	218	3.23	3.15	.036

$_{.05}F_{\infty} = 3.92$ $_{.05}F_{\infty} = 3.92$

In one class in Bloomington, Indiana, the classroom teacher presented a follow-up lesson after the program and before the posttest. An ANOVA comparing the posttest scores in this one class to the posttest scores in other classes produced an F-ratio of 7.187, significant at the .01 level ($_{.01}F_{1, \infty} = 3.84$). Also, in this particular class, 70.4% of the students answered correctly when asked questions about application of mathematical concepts in the story line of the program.

There was generally positive classroom reaction to Program 9's appeal, content and instructional effectiveness.

Students indicated that they could identify with the children portrayed in the dramatic segments. The characters were believable. Children said they liked Duane and Lisa and that they would enjoy having them as friends or relatives. Students also felt that Duane and Lisa were about their own age.

However, rough-cut testing did reveal certain concerns about the dramatic segments. The garden and gift wrapping scenes were particularly confusing.

In the garden scene, students didn't understand how Duane's calculation of the area that could be surrounded by a 12 m fence differed from Lisa's calculation using the same length of fencing material. Duane assumed a rectangle; Lisa a square. Students suggested two ways to improve this segment. They thought they would have understood the segment better if Duane had discussed the problem with Lisa rather than figuring it out on his own, and if more visual support had been provided: an aerial view of the garden showing the completed fence, and more graphic overlays.

The problem with the gift wrapping sequence was that the boxes were rotated 90 degrees and then stacked in two rows. Students understood how this changed the conglomerate shape of the boxes, but not how it changed the perimeter, even though they were able to watch the boxes being moved. Students suggested that numbering the boxes so that their movement could be traced more easily would enhance this segment.

"The Magic Carpet" animation was a useful tool in explaining the concepts of perimeter and area. Students who could not grasp the idea through

the opening dramatic segment generally understood the lesson after the explanation in the animation. Some students did comment that all the characters' voices sounded the same, and that the term "cubit" was unfamiliar and therefore confusing. Teachers thought that "Perimeter," Sulayman's snake, was essential in explaining the difference between perimeter and area.

Teachers indicated that perimeter and area were included in their fifth grade curriculum, and that they would use this program in teaching the topic. Follow-up activities suggested by teachers included measuring the perimeter and area of classroom objects such as desks and books, and reviewing lessons from mathematics texts.

Teachers and students also reacted positively to Program 25, "Dividing Regions into Subregions for Finding Area."

Students enjoyed the portrayal of Jenny and Denny. The characters were realistic and behaved like children familiar to the students.

Two of the dramatic segments were perceived as unrealistic by students. Several students raised the point that artificial turf is not measured and installed in the manner depicted in the program and said that if the artificial turf scene is portrayed correctly, it will still teach the intended lesson.

The humor of the garage covering scene was not apparent to the students. Instead, they identified it as "silly" and "dumb." Students thought that marble was an impractical building material and did not understand why the client wanted to cover his garage with it. Many students suggested either buying a new garage or using a more practical material, such as aluminum siding.

The animation "Trouble in Shape City" was appealing to the students. Students particularly enjoyed the shapes' getting together to use their "imaginations" to figure their areas. None of the students was bothered by the discriminatory membership practices of the Top Shape Club. In fact, some even indicated that the membership requirement was useful in teaching how to calculate areas of odd shapes. As with Program 9, students were better able to understand the lesson after the animation.

Calculating the area of odd shapes is a part of the curriculum in the classrooms visited. Teachers indicated that this program would be useful to them. However, several teachers indicated that more graphics were needed in the host segments. Follow-up activities suggested by teachers included reviewing lessons from mathematics texts, searching for odd shapes in everyday objects and having students design their own odd shapes.

CONCLUSIONS

Overall, teachers and students enjoyed the programs for several reasons. The combination of real-life drama and animation is preferable over just animation or just drama.

The dramatic segments are especially appealing to students. The main reason for this is that children are the main characters, not adults. The characters are realistic enough that students can easily identify with them. The dramatic segments also challenge students to think about the solution before the host or the animation clarifies it.

The animation and the graphics were useful instructional tools. Many teachers thought that more graphics during the host segments would be helpful. Animation segments served to clarify the lesson for students. However, some students were disoriented by switching from dramatic segments to animation and back to dramatic segments. Some students didn't understand why the characters were still having trouble with concepts after the explanation of the animation. Some students suggested moving the animation to the end of the program, where it would serve as the conclusion.

Television is a visual medium, and instructional television is as effective as the pictures or graphics it uses. Also, because a program can be enjoyed without enjoying the topical area, instructional television can be used to introduce reticent students to new fields of learning. If a program has characters with whom students can identify, and if it fits into the students' concept of reality, then students will enjoy the program and will perhaps open themselves to new learning experiences.

Television is an effective teaching mechanism and its effectiveness is increased by using it in conjunction with the teacher and a proven

curriculum. Teachers seem to understand this and welcome brief, high quality instructional television into their classrooms.

Appendix A

List of Cooperating Agencies

Alaska Department of Education

Alberta Education/ACCESS NETWORK

Arkansas Educational Television Network/Arkansas Department of Education

California Department of Education

Colorado
KRMA, Denver

Connecticut Department of Education

Delaware Department of Public Instruction

Department of Defense Dependents Schools

Florida State Department of Education

Hawaii Department of Education

Illinois State Board of Education

Iowa Public Television

Kentucky Authority for Educational Television

Louisiana Department of Education

Maryland Instructional Television

Massachusetts Educational Television, Massachusetts Department of Education

Missouri Department of Elementary and Secondary Education

Nebraska Department of Education

New Jersey Department of Education/New Jersey Network

New Mexico Media Network

New York State Education Department, The Center for Learning Technologies

Ohio Department of Education

Quebec Ministry of Education

South Carolina Department of Education, Office of Instructional Technology

South Dakota Department of Education, Cultural Affairs,
Division of Elementary and Secondary Education

Tennessee
- Tennessee Educational Television
  - WSJK, Knoxville
  - WTCI, Chattanooga
  - WLJT, Martin
  - WCTE, Cookeville
- Station WDCN, Nashville

Texas
- Ector County Independent School District

Utah State Office of Education

Virginia
- Fairfax County Public Schools
- Prince William County Public Schools
- Virginia Beach City Public Schools
- Virginia Department of Education

Wisconsin Educational Communications Board

Appendix B

Program Summaries

Program 9

THE DIFFERENCE BETWEEN PERIMETER AND AREA

Purpose

This program demonstrates that the perimeter of a figure and the area of that figure are different and are measured differently, and that the shape of the perimeter affects the size of the area inside it.

Essential Outcomes

1. How can you describe the difference between the (meaning of) perimeter and area?
2. How can you describe the differences between the units of measurement for perimeter and area?
3. Why can't you always find the area of a figure if you know its perimeter?

Program Summary

Story. Duane is decorating the top of his mother's birthday cake with candies in the shape of a star, but he runs out of candies before the star is done. His sister Lisa suggests that he put the candies around the border of the cake instead, and Duane has plenty of candies to do the job. The host demonstrates that the perimeter of the cake is shorter than the perimeter of the star.

A family friend brings Lisa and Duane a 12 m long roll of garden fencing. Duane calculates that there is enough fencing for a rectangle 2 m long and 4 m wide, but Lisa thinks a different shaped perimeter will give them more area. By changing the shape to a square 3 m on a side, Lisa gains gardening space. The host demonstrates that a perimeter can be the boundary of many shapes and that a perimeter's shape affects the area inside.

Real-Life Application. A carpenter shows how he uses the concepts of perimeter and area when he builds. This portion was not included in the rough-cut.

Animation. Ali Baba needs a new magic carpet to transport his large family. "Honest" Abdu sells him a carpet that has the same perimeter as the old one, but Ali Baba soon discovers that its different shape means a big change in area. Sulayman the Snake-Charmer helps Ali Baba understand his mistake and shows him how to turn the tables on Abdu.

Story. Lisa is gift wrapping boxes of candy, and wants to tie all six boxes together with one ribbon. This time Duane is able to show his sister how to arrange the boxes so the ribbon will go all the way around them.

Program 25

DIVIDING REGIONS INTO SUBREGIONS FOR FINDING AREA

Purpose

This program shows that it is useful to divide regions into familiar parts to find area, and to show several ways that regions may be divided.

Essential Outcomes

1. How do you decide when to divide a region into subregions to find its area?
2. What determines the way a region is divided into subregions?
3. How can you find the area of a given shape if it can't be covered evenly with squares?

Program Summary

Story. Jenny and Denny are partners in the Kid Covering Company, dedicated to covering rectangles. When a customer wants the floor of an L-shaped room covered with carpeting, the two youngsters have a problem. But Jenny realizes that they can apply "A = l x w" if they divide the L-shaped floor into rectangles and add the resulting areas. Denny points out that there's more than one way to divide the floor area.

Real-Life Application. The supervisor of a toy manufacturer's warehouse shows how floor area is divided and redivided to handle incoming and outgoing merchandise.

Story. The Kid Company's next customer thinks it would be more convenient to have artificial turf in his yard instead of grass. Jenny and Denny are willing to do the job if they can figure out how to find the area of the yard minus the base of the yard lamp, the fountain, and the walkway.

Animation. Shape City's citizens are divided into two groups: the Rectangles and the Oddshapes. Only those who know their own areas are allowed to join the social club, and that prohibits the Oddshapes. But Penelope Pentagon finds the solution and helps the Oddshapes meet the membership requirement.

Story. Denny sees that the yard objects are rectangles whose area can be subtracted from the area of the larger rectangular yard. The host demonstrates that rectangles are made up of many parts and can be divided in many ways.

The last customer wants to cover his garage with marble -- a fitting monument to his vintage car. Jenny and Denny agree that the garage is made of rectangular shapes, except for the triangular peaks. As the program ends, Jenny seems to have solved the problem of the triangles.

School _____

Appendix C

Boy or Girl _____ Grade ___

Program 9 Pretest

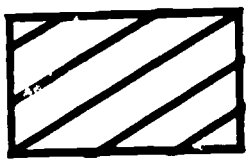
Directions: Select the answer that is the best way to answer the question and place the corresponding letter in the blank on the left side of the page.

_____ 1. Math is _____.

a. lots of fun
b. some fun
c. a little fun
d. not much fun
e. no fun at all

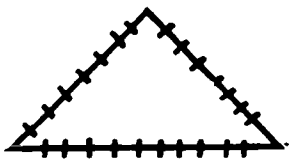
_____ 2. The slanted lines represent the _____ of the rectangle.

a. perimeter
b. area
c. neither perimeter nor area
d. both perimeter and area



_____ 3. The lines represent the _____ of the triangle.

a. perimeter
b. area
c. neither perimeter nor area
d. both perimeter and area



_____ 4. To calculate the area of a rectangle, you need to know its

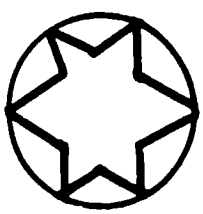
a. perimeter.
b. surface.
c. length and width.
d. circumference.

_____ 5. The perimeter is always a

a. line.
b. surface.
c. volume.

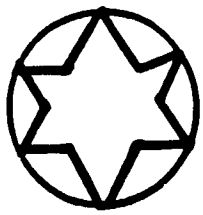
_____ 6. Is the perimeter of the circle or of the star longer?

a. circle
b. star
c. both the same
d. can't tell



_____ 7. Which covers more area--the circle or the star?

a. circle
b. star
c. both the same
d. can't tell



8. Opposite sides of a rectangle are

   a. equal
   b. unequal
   c. can be either equal or unequal

School _____

Girl or Boy _____ Grade ___

Program 9 Posttest

Directions: Select the answer that is the best way to answer the question and place the corresponding letter in the blank on the left side of the page.

_____ 1. Math is _____.

a. lots of fun
b. some fun
c. a little fun
d. not much fun
e. no fun at all

_____ 2. How much did you like the program you just saw?

a. a lot
b. some
c. a little
d. not much
e. not at all

_____ 3. The star on Mom's birthday cake could not be finished because

a. Duane ran out of candies
b. Lisa ran out of candies
c. the star was finished with candies.

_____ 4. Duane and Lisa put a fence around their

a. rabbits.
b. garden.
c. yard.
d. dog house.

_____ 5. Duane made the ribbon fit around the boxes by changing their

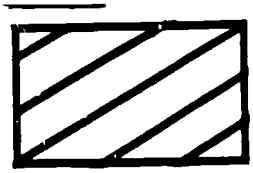
a. shape.
b. perimeter.
c. area.
d. both a and b.

_____ 6. Lisa and Duane were

a. husband and wife.
b. mom and son.
c. brother and sister.
d. none of the above.

_____ 7. The slanted lines represent the _____ of the rectangle.

a. perimeter
b. area
c. neither perimeter nor area
d. both perimeter and area



(OVER)

_____ 8. The lines represent the _____ of the triangle.

a. perimeter
b. area
c. neither perimeter nor area
d. both perimeter and area

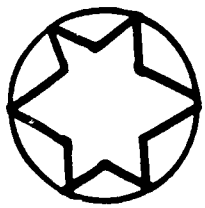
____ ____ 9. To calculate the area of a rectangle, you need to know its

a. perimeter.
b. surface.
c. length and width.
d. circumference.

_____10. The perimeter is always a

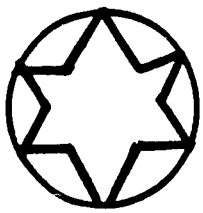
a. line.
b. surface.
c. volume.

_____11. Is the perimeter of the circle or of the star longer?



a. circle
b. star
c. both the same
d. can't tell

_____ 12. Which covers more area--the circle or the star?



a. circle
b. star
c. both the same
d. can't tell

_____13. Opposite sides of a rectangle are

a. equal
b. unequal
c. can be either equal or unequal

School _____

Girl or Boy _____ Grade ___

Program 25 Pretest

Directions: Select the answer that is the best way to answer the question and place the corresponding letter in the blank on the left side of the page.

_____ 1. Math is _____.

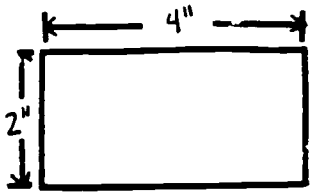
a. lots of fun
b. some fun
c. a little fun
d. not much fun
e. no fun at all

_____ 2. Parts missing from rectangles should be _____ in order to find the area.

a. subtracted
b. multiplied
c. added
d. ignored

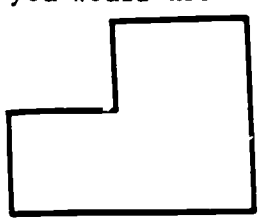
_____ 3. What is the area of this rectangle?

a. 2 square inches
b. 4 square inches
c. 6 square inches
d. 8 square inches



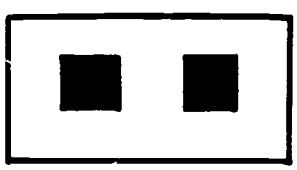
_____ 4. To calculate the area of this shape, you would use

a. multiplication only.
b. addition only.
c. multiplication and addition
d. multiplication and subtraction



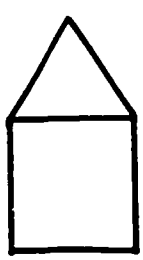
_____ 5. To calculate the white area of this wall, you would use

a. multiplication only
b. addition only
c. multiplication and addition
d. multiplication and subtraction



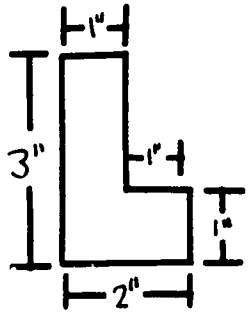
_____ 6. To calculate the area of this wall, you would use

a. multiplication and addition
b. imagining a new shape and multiplication and addition
c. imagining a new shape and multiplication and subtraction
d. multiplication and addition and subtraction



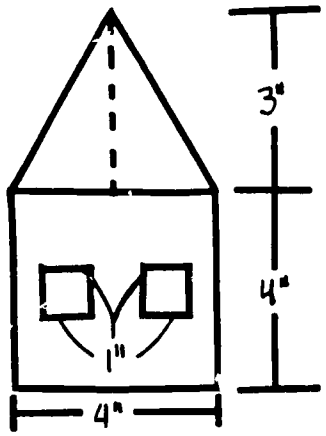
(OVER)

7. What is the area of this I-shape?



a. 4 square inches
b. 6 square inches
c. 7 square inches
d. 10 square inches

8. What is the area of the white portion of this shape?



a. 7 square inches
b. 15 square inches
c. 20 square inches
d. 25 square inches

School _____

Girl or Boy _____ Grade ___

Program 25 Posttest

Directions: Select the answer that is the best way to answer the question and place the corresponding letter in the blank on the left side of the page.

_____ 1. Math is _____.

a. lots of fun
b. some fun
c. a little fun
d. not much fun
e. no fun at all

_____ 2. How much did you like the program you just saw?

a. a lot
b. some
c. a little
d. not much
e. none at all

_____ 3. The man in the show wanted to cover his lawn with

a. grass
b. artificial turf
c. deep purple carpet
d. a cement patio

_____ 4. The trouble in Shape City was that

a. Penelope Pentagon had no imagination
b. too many of the shapes didn't have straight sides
c. odd shapes had to learn how tofigure out their areas
d. some of the odd shapes had no money for the Top Shape Club

_____ 5. Jenny and Denny named their company

a. The Kid Covering Company
b. The Kid Moving Company
c. Jenny's and Denny's Covering Company
d. Jenny's and Denny's Moving Company

_____ 6. In order to figure out the area of the man's lawn, Jenny and Denny had to use

a. multiplication only
b. multiplication and addition only
c. multiplication and subtraction only
d. multiplication, addition and subtraction only

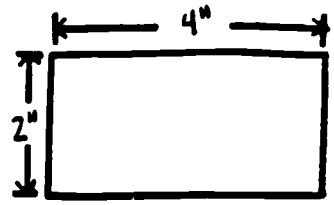
_____ 7. Parts missing from rectangles should be _____ in order to find the area.

a. subtracted
b. multiplied
c. added
d. ignored

(OVER)

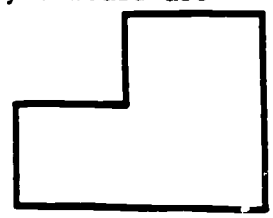
_____ 8. What is the area of this rectangle?

a. 2 square inches
b. 4 square inches
c. 6 square inches
d. 8 square inches



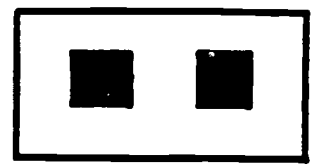
_____ 9. To calculate the area of this shape, you would use

a. multiplication only.
b. addition only.
c. multiplication and addition.
d. multiplication and subtraction.



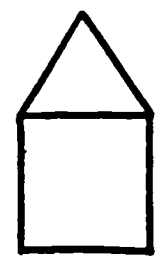
_____ 10. To calculate the white area of this wall, you would use

a. multiplication only
b. addition only
c. multiplication and addition
d. multiplication and subtraction



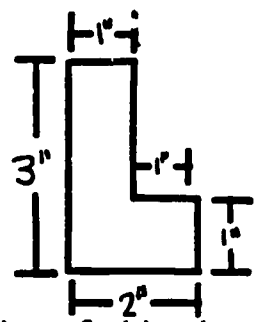
_____ 11. To calculate the area of this wall, you would use

a. multiplication and addition.
b. imagining a new shape and multiplication and addition.
c. imagining a new shape and multiplication and subtraction.
d. multiplication and addition and subtraction.



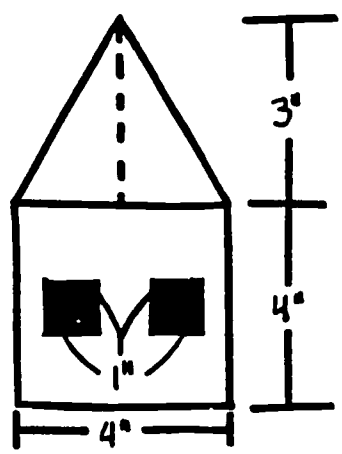
_____ 12. What is the area of this L-shape?

a. 4 square inches
b. 6 square inches
c. 7 square inches
d. 10 square inches



_____ 13. What is the area of the white portion of this shape?

a. 7 square inches
b. 15 square inches
c. 20 square inches
d. 25 square inches



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