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ABSTRACT

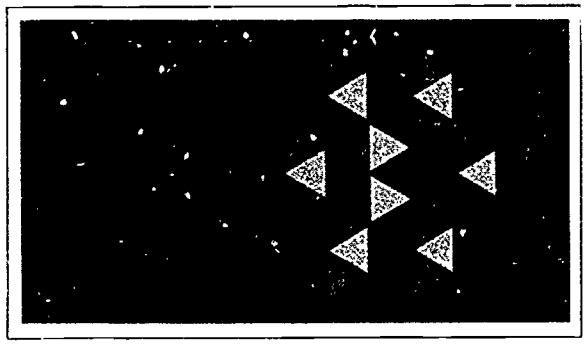
This survey reflects new developments in the mathematics curriculum as emphasized in the curriculum frameworks and state-adopted textbooks. The first section describes the procedure for the development of the survey and the rationale for the topics and types of questions included on the mathematics portion of the test. The second section describes the mathematics content to be assessed and includes illustrative questions. Areas assessed are: (1) "Numbers"; (2) "Operations"; (3) "Algebra"; (4) "Geometry"; (5) "Measurement"; (6) "Probability and Statistics"; (7) "Tables, Graphs, and Integrated Applications"; and (8) "Problem Solving." An answer key to the examples is provided. (YP)

California Assessment Program

Survey of Academic Skills: Grade 8

Rationale and Content

Mathematics



Survey of Academic Skills: Grade 8

Rationale and Content

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CONTENTS

California Assessment Program

INTRODUCTION TO SURVEY OF ACADEMIC SKILLS: GRADE 8 MATHEMATICS

This document provides information about the mathematics portion of the *Survey of Academic Skills: Grade 8*. Under the provisions of the Hughes-Hart Educational Reform Act (Senate Bill 813), an eighth grade test was added to the other tests at grades three, six, and twelve in spring, 1984. The *Survey* reflects new developments in curriculum as emphasized in the curriculum frameworks and state-adopted textbooks. The expansion of the California Assessment Program (CAP) to include grade eight underscores the commitment of the Legislature, the Governor, and the Superintendent of Public Instruction to meet the challenge of educational reform.

The description of the *Survey* has been divided into two parts. The first part describes the procedure for the development of the *Survey* and the rationale for the topics and types of questions included on the mathematics portion of the test. The second part describes the mathematics content to be assessed and includes illustrative questions.

Test Development

Development of the mathematics section of the test spanned a three-year period. During this time the Mathematics Assessment Advisory Committee developed test specifications, and ad hoc committees, consisting primarily of eighth grade teachers and specialists, wrote items. Special consultants helped the committees to strengthen the assessment of skills in geometry, measurement, and problem solving. The important steps of the test development process are highlighted below.

- The Mathematics Assessment Advisory Committee drafted preliminary test content specifications based on the new state mathematics framework and state-adopted textbooks. The advisory committee was composed of curriculum specialists from school districts, offices of county superintendents, professional associations, colleges, The California State University, the University of California, and the State Department of Education. The names of the statewide committee members, ad hoc committee members, and special consultants are listed on pages ix and x.

- During the spring of 1983, teachers from approximately 150 districts participated in a review of the proposed specifications. Teachers were asked to indicate the degree of emphasis they assign to each skill area listed and to identify other important skills they teach that were not included on the list.

- Using sample items as models, groups of item writers, consisting primarily of eighth grade teachers from a variety of districts, developed items for the list of skills. The departmental staff reviewed the items for alignment with proposed test content specifications.

- The assessment advisory committee reviewed the preliminary data from teachers regarding the degree of emphasis assigned to each skill area and then modified and refined the specifications accordingly. Members of the committee also reviewed, screened, and revised the preliminary item pool and prepared it for field testing.

- Between 1983 and 1985, more than 1,500 items were field-tested in more than 500 school districts on approximately 20,000 students. Approximately 600 teachers participated in the field test by evaluating one or two test forms on an item-by-item basis, indicating the degree of instructional emphasis and testing appropriateness placed on the content measured by each item. This tryout also allowed CAP to assess the difficulty of each test item, the clarity of directions, and such problems as bias, unclear wording, inappropriate response choices, or unfamiliar formats among the items so that only the best items would survive the analyses of the field test.

- The content area advisory committee reviewed the results of the field test and, working with the CAP staff, selected the final set of 468 items. The final pools of items were then subjected to another intensive review by CAP staff and testing professionals. In addition, a variety of item statistics were examined in search of otherwise undetected defects and sources of bias. The items were also reviewed for linguistic, ethnic, and gender bias.

Rationale for the Test Content

In the past few years, a consensus has developed among educators and the public in favor of a more rigorous instructional program incorporating a strong foundation in mathematics. It has become clear that a great many children—not just the college-bound—can succeed in a more intensive academic program based on raising academic and behavioral expectations for all students, increasing homework, and insisting that students attain higher-level thinking skills, such as those needed for solving problems and computing with understanding. Too often, only college-bound students take programs rich in mathematics instruction. However, students who do not plan to attend college also need a strong foundation in mathematical concepts and procedures in order to lead productive lives.

The theme of higher expectations and improved achievement is addressed in the *Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve* (1985), which states:

> The mathematics program recommended in this framework reflects raised expectations for student achievement. The goal is for all students to be able to use mathematics with confidence; therefore, every student must be instructed in the fundamental concepts of each strand of mathematics, and no student should be limited to the computational aspects of the number strand. . . .

> Most students will go beyond the fundamental concepts to achieve deeper and broader capability in mathematics; but even less capable students, by learning these concepts, will have appropriate experiences in all of the strands. They must not, for example, be deprived of work in geometry or probability in order to have more practice with narrow computational skills. Rather, they will continue to learn the new concepts of all of the strands and to integrate those concepts into their understanding throughout their school careers.
>
> This expectation applies to all students, including students with special needs and those who come from groups that have historically been underrepresented in upper-level mathematics courses. (p. 2)

A major emphasis of the *Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve* (1985) and the *Mathematics Model Curriculum Guide* (1987) is **teaching for understanding**. The theme of teaching for understanding as stated in the *Mathematics Framework* is:

> Teaching for understanding emphasizes the relationships among mathematical skills and concepts and leads students to approach mathematics with a commonsense attitude, understanding not only how but also why skills are applied. Mathematical rules, formulas, and procedures are not powerful tools in isolation, and students who are taught them out of any context are burdened by a growing list of separate items that have narrow application. Students who are taught to understand the structure and logic of mathematics have more flexibility and are able to recall, adapt, or even recreate rules because they see the larger pattern. Finally, these students can apply rules, formulas, and procedures to solve problems, a major goal of this framework. (p. 12)

In keeping with the spirit of the *Framework* and the *Model Curriculum Guide*, the rationale used for the development and selection of the questions used on the eighth grade mathematics *Survey of Academic Skills* was based on the concern for assessing students' ability to discern mathematical relationships, reason logically, solve problems, and use effectively the mathematics they have learned in all settings. The net result of this concern was that over half (56 percent) of the 468 items involve the students in doing some sort of problem-solving activity. Furthermore, many of the problem-solving items in the major content reporting areas (Numbers, Operations, Algebra, Geometry, Measurement, Probability and Statistics, Tables, Graphs, and Integrated Applications) are items involving problems in everyday life settings.

The problem-solving questions on the eighth grade *Survey of Academic Skills* involve one-step applications, multistep applications, and problem-solving processes. The four major problem-solving processes are:

- Formulating problems
- Analyzing problems and selecting strategies
- Finding solutions
- Verifying and interpreting solutions

Note that each of these processes corresponds to one of mathematician George Polya's four phases identified in 1956, namely (1) understanding the problem; (2) devising a plan; (3) carrying out the plan; and (4) looking back. In the course of solving problems, students should experience these different processes so they can identify steps to take when they are confronted with a new problem situation.

The 1987 *Mathematics Model Curriculum Guide, Kindergarten Through Grade Eight* also states:

> The fundamental premise on which this document is based is that every aspect of mathematics that students study should enhance their understanding of mathematical ideas and promote the growth of thinking. (p. 12)

This precept forms the basis for the development and selection of the remaining 44 percent of the questions on the eighth grade *Survey of Academic Skills*. They were primarily designed to assess the student's understanding of concepts and skills in all of the strands. For example, in computational items, rather than placing emphasis on the performance of a standard algorithmic procedure, students are required to demonstrate their understanding of the procedures and concepts. In fact, many of the questions can be answered without using paper and pencil, if the student has a clear understanding of the arithmetic operations and symbols involved.

DESCRIPTION OF THE TEST

The *Survey of Academic Skills: Grade 8* is divided into 36 unique forms, using a multiple-choice format. Each student takes one form. Each form contains 11 reading items, 11 written expression items, 13 mathematics items, and 20 history–social science items. Fifteen science items were added to the test in 1986. Each test form contains items from all major skill areas, and a balance is maintained between easy and difficult items. The following pages describe in detail the content and processes to be assessed in mathematics.

MATHEMATICS ASSESSMENT ADVISORY COMMITTEE*

Janet Abbott, Chula Vista City School District

Joan Akers, Office of the San Diego County Superintendent of Schools

James Caballero, University of California, Los Angeles

Joe Cooney, Office of the San Mateo County Superintendent of Schools

Clyde Corcoran, Whittier Union High School District, Chair

Richard Dean, California Institute of Technology

Sister Rose Eleanor Ehret, Holy Names College

Joan Gell, Palos Verdes Peninsula Unified School District

Ruth Hadley, Santa Maria

Bob Hamada, Los Angeles Unified School District

Roberta Koss, Tamalpais Union High School District

Thomas Lester, San Juan Unified School District

Gail Lowe, Conejo Valley Unified School District

Sandra Marshall, San Diego State University

Vance Mills, San Diego Unified School District

Susan Ostergard, University of California, Davis

Henry Palmer, Office of the Los Angeles County Superintendent of Schools

Annie Podesto, Stockton Unified School District

Gail Robinette, Fresno Unified School District

Ed Silver, San Diego State University

Linda Silvey, Los Angeles Unified School District

Tony Spears, Office of the Fresno County Superintendent of Schools

Jean Stenmark, EQUALS, University of California, Berkeley

Harold Taylor. San Mateo Union High School District

Shirley Trembley, Bakersfield College

Lee Webb, California State University, Bakersfield

Les Winters, Los Angeles Unified School District Board of Education

Dorothy Wood, Tamalpais Union High School District

Tej Pandey, State Department of Education, Consultant to the Committee

* This list represents the names of committee members at the time of test development.

SPECIAL ADVISERS AND REVIEWERS

Sheila Berman, Los Angeles Unified School District

Dwight Coblentz, Office of the San Diego County Superintendent of Schools

Sandra Cohick, Whittier Union High School District

Mary Kay Corbitt, East Tennessee State University

Alan R. Hoffer, University of Oregon

Robert MacFarland, Office of the Alameda County Superintendent of Schools

Thomas A. Romberg, University of Wisconsin

Art Schweitzer, Garden Grove Unified School District

Elizabeth Stage, University of California, Berkeley

Janet Trentacosta, San Diego City Unified School District

Dee Ward, San Juan Unified School District

Jim Wilson, University of Georgia

AREAS ASSESSED IN MATHEMATICS
(Total number of questions: 468)

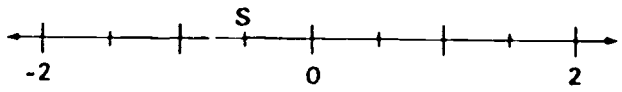
	Percent
I. Numbers	15
A. Skills/concepts	10
1. Order relations and classification	3
2. Number theory	4
3. Properties	3
B. Applications	5
II. Operations	15
A. Skills/concepts	7
1. Whole and rational numbers	4
2. Percents, proportions, and conversions	3
B. Applications	8
1. One-step	4
2. Two or more steps	4
III. Algebra	15
A. Skills/concepts	10
1. Expressions and equations	5
2. Graphs and functions	5
B. Applications	5
IV. Geometry	15
A. Skills/concepts	10
1. Geometric terms and figures	4
2. Geometric relationships and postulates	6
B. Applications	5
V. Measurement	9
A. Skills/concepts	6
1. Units and estimation	3
2. Measurement of perimeter, area, and volume	3
B. Applications	3
VI. Probability and Statistics	8
A. Probability	4
B. Statistics	4
VII. Tables, Graphs, and Integrated Applications	7
A. Tables and graphs	4
B. Integrated applications	3
VIII. Problem Solving	16
A. Formulation of a problem	4
B. Analysis of a problem	4
C. Strategies	5
D. Interpretation	3

MATHEMATICS CONTENT

Pages 1 through 40 include descriptions of the knowledge and concepts assessed in the mathematics content portion of the test. The illustrative test questions, although they represent the types of questions used on the test, do not appear on the actual test forms.

ILLUSTRATIVE TEST QUESTIONS

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8*

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
I. Numbers	72		*Example 1:*
A. Skills/concepts	50		What number corresponds to point S on the number line?
1. Order relations and classification	15	The student will: • Count by 100s. • Identify missing number or integer on a number line (ex. 1). • Identify relational symbols (<, =, >, ≠, ≥, ≤). • Identify order relations involving whole numbers, decimals, or fractions (ex. 2). • Identify integer expressions.	 o $-\frac{1}{2}$ o $-1\frac{1}{2}$ o $\frac{1}{2}$ o 1 *Example 2:* Which shows the correct order relation of 7, 9, and 16? o $7 < 9 < 16$ o $7 > 9 > 16$ o $16 < 9 < 7$ o $16 > 9 < 7$

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
2. Number theory	20	The student will: • Read and write whole numbers and decimals. • Identify the place value of a given digit in a whole or decimal number. • Identify numerals in exponential form and expanded notation (ex. 3). • Identify a fraction as a decimal. • Identify odd, even, prime, and composite numbers. • Use rules of divisibility. • Identify multiples, factors, prime factors, least common multiple (LCM), and greatest common factor (GCF) (ex. 4). • Approximate the square root of whole numbers.	*Example 3:* $3 \times 10^2 + 9 \times 10^1 + 2 \times 10^0 =$ o 39 o 39.2 o 392 o 300902 *Example 4:* Which shows the prime factorization of 12? o 3×4 o 1×12 o 3×2^2 o $2 \times 3 \times 2^2$ *Example 5:* $5 (4 + 3) =$ o $5 + (4 \times 3)$ o $(5 + 4) (5 + 3)$ o $5 \times 4 + 3$ o $(5 \times 4) + (5 \times 3)$
3. Properties	15	The student will: • Identify commutative, associative, and distributive properties (ex. 5).	

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
		• Identify identity or inverse elements (ex. 6).	*Example 6:* $100 \div n = 100$ What value for n makes the sentence above true? o 0 o 0.01 o 1 o 100
B. Applications	22	The student will use his or her knowledge of order relations, classification, number theory, and the properties of addition and multiplication to solve problems in the context of real-life situations (ex. 7, 8, 9).	*Example 7:* Monday 3.8 km Tuesday 2.95 km Wednesday 3 km Thursday 3.57 km Friday 3.83 km The chart above shows how far Megan ran each day. On which day did she run the longest distance? o Monday o Wednesday o Thursday o Friday

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
I. Numbers (cont'd.)			*Example 8:* Thirty-seven girls and 43 boys each sold 29 tickets to the school carnival. Which of these shows a way to calculate the total number of tickets sold? o (29) (37 + 43) o (29 + 37) o (29) (37) (43) o 29 + 37 + 43 *Example 9:* The tokens in a game can be divided into equal groups of 5 or 12. What is the least number of tokens that could be in the game? o 17 o 60 o 120 o 600

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
II. Operations	**72**		*Example 10:* $5 - \frac{3}{4} =$
A. Skills/concepts	36		o $\frac{3}{4}$
1. Whole and rational numbers	22	The student will: • Identify terms that represent addition, subtraction, multiplication, or division. • Identify missing numerals to indicate understanding of the addition, subtraction, multiplication, and division algorithms. • Add and subtract rational numbers in fraction and decimal forms (ex. 10). • Multiply and divide rational numbers in fraction and decimal forms (ex. 11). • Estimate products and quotients of whole numbers or decimals by rounding the numbers to simpler numbers (ex. 12).	o $3\frac{3}{4}$ o $4\frac{1}{4}$ o $5\frac{1}{4}$ *Example 11:* $10 \div 0.2 =$ o 0.05 o 0.5 o 5 o 50 *Example 12:* Which is the best way to estimate the product (698) (413) ? o (690) (410) o (699) (410) o (700) (420) o (700) (400)

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
2. Percents, proportions, and conversions	14	The student will: • Identify equivalent fractions, decimals, and percents. • Identify equal ratios. • Identify a given percent of a given number (ex. 13). • Calculate the percent that a given number is of another given number (ex. 14). • Identify the number that is a given percent of another number.	*Example 13:* 0.05 = o 5% o 50% o 0.5% o 0.05% *Example 14:* 15 is what percent of 75? o 15% o 20% o 50% o 80%
B. Applications	36		
1. One-step	20	The student will use his or her knowledge of operations involving whole numbers, fractions, or decimals to solve simple one-step problems in the context of real-life situations (ex. 15).	*Example 15:* A basketball team has won its first 3 games. It must play 12 games in all. What percent of the total games has the team played? o 3% o 25% o 33% o 75%

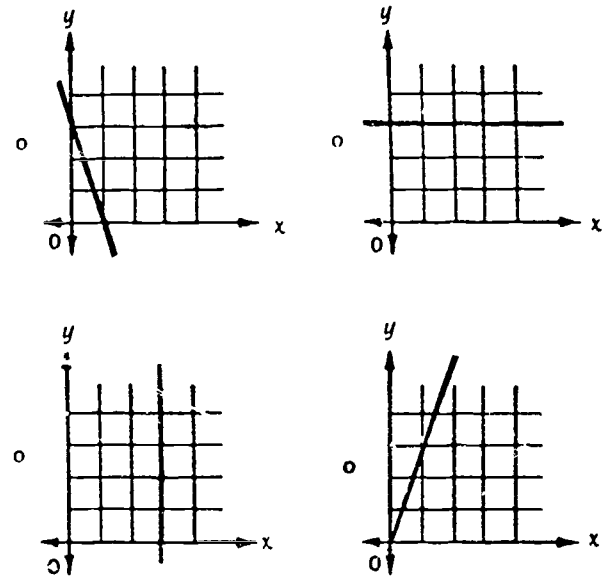
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
2. Two or more steps	16	The student will use his or her knowledge of operations on whole numbers, fractions, or decimals to solve two- (or more) step problems in the context of real-life situations (ex. 16, 17, 18).	*Example 16:* With 5 games to play, Steve had 187 hits. In his next four games he got 1, 4, 2, and 3 hits. How many hits must he get in his last game to have a 200-hit season? o 2 o 3 o 10 o 13 *Example 17:* Lucy had 12 baseball cards. She gave 1/3 of them to Laura. How many did Lucy have left? o 4 o 6 o 8 o 9 *Example 18:* It is 1.3 kilometers from Sharon's house to school. She rides her bicycle to and from school every day. How far does she ride in 5 days? o 6.3 kilometers o 6.5 kilometers o 10 kilometers o 13 kilometers

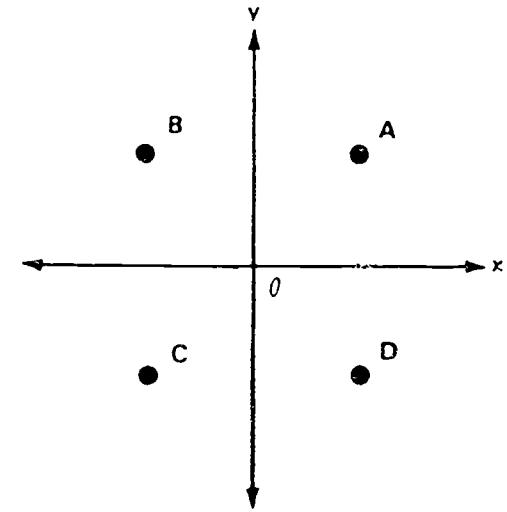
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
III. Algebra	72		*Example 19:*
A. Skills/concepts	50		If a = 2, b = 3, and c = 4, then a(c – b) =
1. Expressions and equations	30	The student will: • Translate simple English phrases and sentences into algebraic expressions or equations and vice versa. • Evaluate simple expressions involving one or more operations (ex. 19). • Identify equivalent simplified values of arithmetic expressions using the standard order of operations (ex. 20). • Add, subtract, multiply, and divide integers. • Solve for unknowns in simple linear equations (ex. 21).	o 2 o –4 o 9 o 14 *Example 20:* Using the order of operations, $18 - 4 \times 3 + 2 =$ o $(18 - 4) \times 3 + 2$ o $18 - (4 \times 3) + 2$ o $(18 - 4) \times (3 + 2)$ o $18 - 4 \times (3 + 2)$ *Example 21:* If $6y - 3 = 27$, then y = o 30 o 5 o 4 o 3

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
2. Graphs and functions	20	The student will: • Identify coordinates of points of the coordinate plane. • Identify the missing number in a function table of ordered pairs of numbers. • Identify a function rule from a given table of ordered pairs of numbers that satisfies a given linear equation. • Identify the graph of a simple linear equation (ex. 22). • Identify the ordered pair that satisfies a given equation (ex. 23).	*Example 22:* Which is a graph of $y = 3x$? 

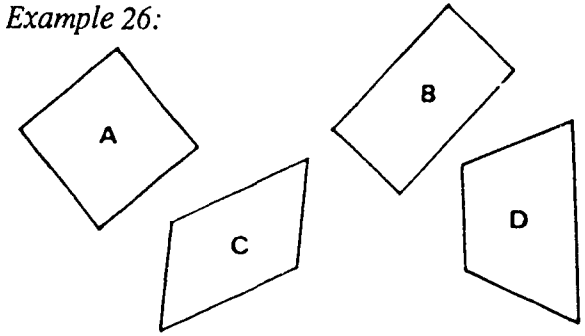
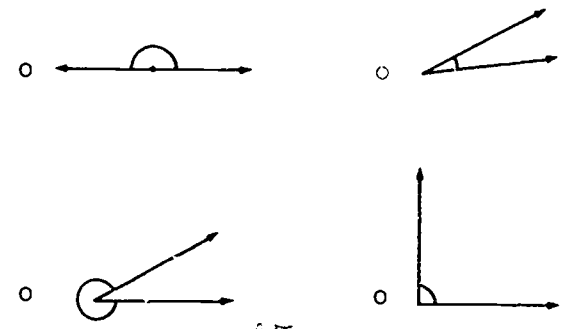
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
III. Algebra (cont'd.)			*Example 23:*  Which point could have the coordinates (3, –3)? o A o B o C o D

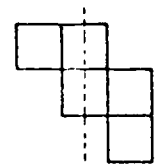
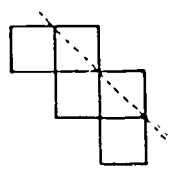
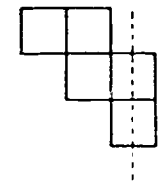
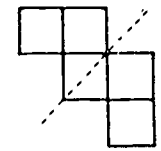
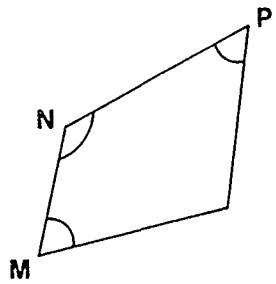
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
B. Applications	22	The student will apply his or her knowledge of algebraic expressions, equations, inequalities, coordinate graphs, or functions to solve problems in the context of real-life situations (ex. 24, 25).	*Example 24:* $P = 100 + \frac{A}{2}$ This formula can be used to find the normal blood pressure (P) for a person of a given age (A). According to the formula, what should be the blood pressure of a 38-year old person? o 138 o 129 o 119 o 69 *Example 25:* The cost of printing business cards includes a fixed rate of $1 (100 cents) per order and 6 cents for each card printed. Which of the following equations can be used to determine the cost of printing *n* cards? o cost = (100 + 6*n*) cents o cost = (106 + *n*) cents o cost = (6 + 100*n*) cents o cost = (106*n*) cents

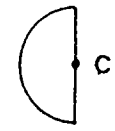
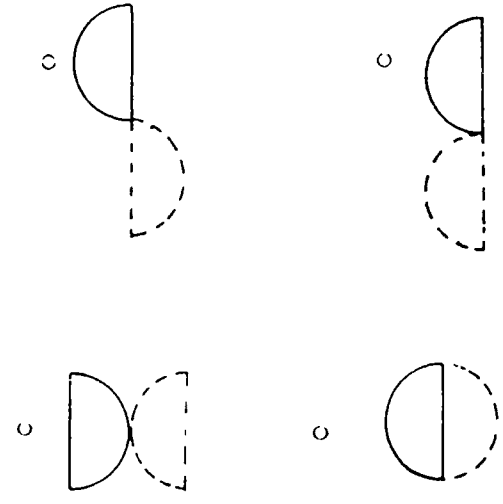
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
IV. Geometry	**72**		*Example 26:*  Which of the figures are parallelograms? o A and B only o C and D only o A, B, and C o B, C, and D
A. Skills/concepts	46		
1. Geometric terms and figures	20	The student will: • Identify two- and three-dimensional geometric figures (quadrilateral, parallelogram, rectangle, square, circle, hexagon, triangle, closed figure, cube, prism, cone, sphere) (ex. 26). • Identify geometric terms (diameter, radius, circumference, arc, chord, tangent, point, midpoint, endpoint, line, ray, line segment, intersection, union, perpendicular, parallel, vertical, diagonal, side, edge, axis, face, region, adjacent, interior). • Identify angles (right, acute, straight, obtuse, and adjacent) and triangles. • Identify approximate measure in degrees of angles (ex. 27).	*Example 27:* Which of these appears to be an obtuse angle? 

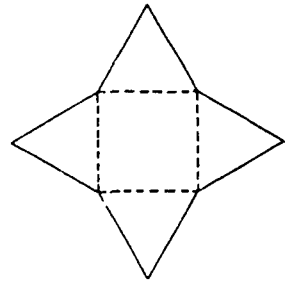
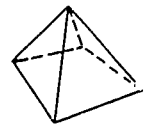
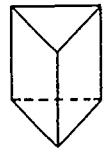
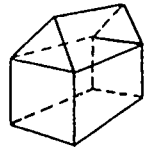
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
2. Geometric relationships and postulates	26	The student will: • Identify parallel or perpendicular lines and planes. • Identify figures that are congruent, similar, or have symmetry (ex. 28). • Identify spatial transformations—rotations, reflections (flips), and translations (slides) of shapes and figures (ex. 29). • Identify basic geometric postulates (sum of interior angles of a triangle is 180°, sum of interior angles of a quadrilateral is 360°, two points determine a line, three noncollinear points determine a plane) (ex. 30).	*Example 28:* Which shows a line of symmetry? o  o  o  o  *Example 29:*  The sum of the angles marked at M, N and P is: o greater than 360°. o less than 360°. o equal to 360°.

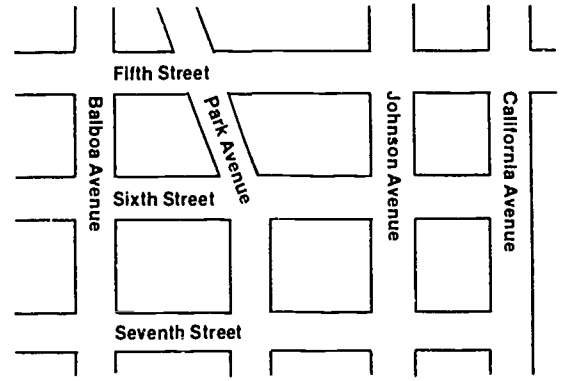
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
IV. Geometry (cont'd.)			 *Example 30:* The half circle is rotated 180° around the center C. What shape will be formed by the figure and its image? 

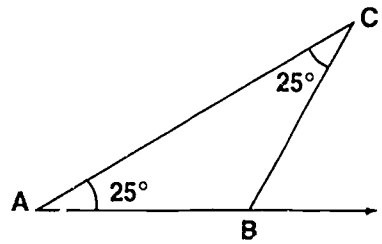
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
B. Applications	25	The student will use his or her knowledge of geometric terms, figures, relationships, or postulates to solve problems (ex. 31, 32, 33).	*Example 31:*  This pattern was cut out and folded on the dotted lines. Which of these models below would it make? ○  ○  ○  ○ 

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
IV. Geometry (cont'd.)			*Example 32:*  In the map shown above, Fifth Street and Seventh Street appear to be: o perpendicular. o parallel. o vertical. o adjacent.

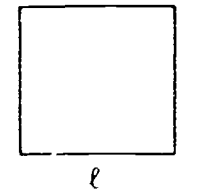
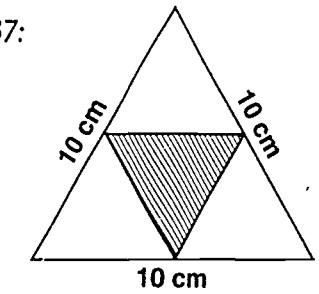
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
IV. Geometry (cont'd.)			*Example 33:*  In the figure above, B is 10 kilometers east of A. How many kilometers is C from B? o 5 o 10 o 15 o 20

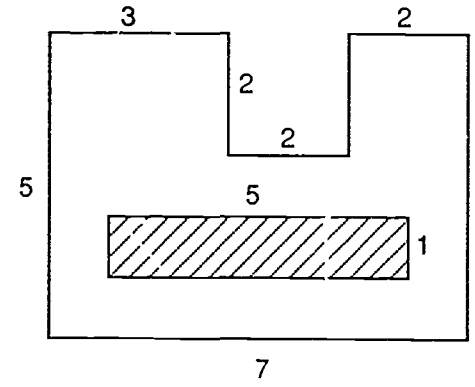
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
V. Measurement	**42**		*Example 34:*
A. Skills/concepts	24	The student will:	Which object is about 4 meters long?
1. Units and estimation (U.S. customary, metric)	12	• Estimate measures (linear and other than linear) of familiar objects in U.S. Customary or nonstandard units. • Estimate measures of familiar objects in the metric system (ex. 34). • Identify equivalent measures (for length, area, volume, and mass) in U.S. Customary units. • Identify equivalent measures (for length, area, volume, and mass) in the metric system (ex. 35). • Calculate the appropriate measure, given a basic conversion table.	o a bicycle o an automobile o a shoe o a baseball bat *Example 35:* 1 meter and 500 millimeters equal o 1500 meters o 15 meters o 1.5 meters o .5 meters

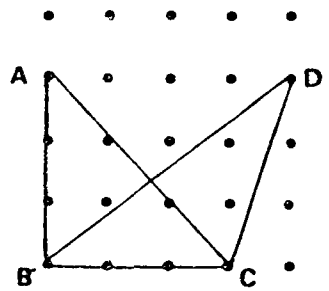
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
2. Measurement of perimeter, area, and volume	12	The student will: • Identify formulas for perimeter, area, and volume (ex. 36). • Calculate perimeter, circumference, area, and volume of geometric figures (ex. 37). • Use nonstandard units to measure length, area, and volume of geometric figures (ex. 38).	*Example 36:*  What is the formula for the area, A, of a square with sides of length l ? o $A = 4 \times l$ o $A = 2 \times l$ o $A = 2l + 2l$ o $A = l \times l$ *Example 37:*  Find the perimeter of the shaded triangle. (All of the small triangles are congruent equilateral triangles.) o 5 cm o 10 cm o 15 cm o 30 cm

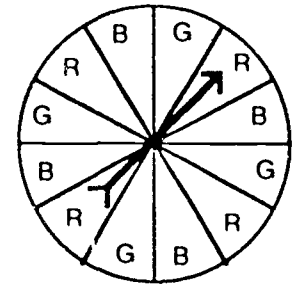
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
V. Measurement (cont'd.)			*Example 38:*  In the figure above, what is the area of the unshaded portion? o 35 o 30 o 28 o 26

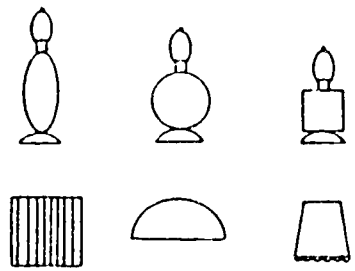
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
B. Applications	18	The student will use his or her knowledge of measurement to solve problems (ex. 39).	*Example 39:* Which of the following statements is true about the areas of triangles ABC and BCD? o Area of ΔABC is less than the area of ΔBCD. o Area of ΔABC is greater than the area of ΔBCD. o Area of ΔABC is equal to the area of ΔBCD.  $A=\frac{1}{2}bh$

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VI. Probability and Statistics	**36**		
A. Probability	18	The student will: • Identify the probability of a given event (ex. 40, 41). • Identify the probability of the complement of an event. • Identify the probability of an event that is certain to occur or an event that is certain not to occur. • Identify the probability of a disjoint (independent) event. • Identify the empirical probability of an event from a sample of observed outcomes. • Use fundamental counting procedure to determine the number of outcomes in an event (ex. 42).	*Example 40:*  The area of each sector on the spinner board is equal. The sectors are colored Red (R), Blue (B), and Green (G). What is the probability that the spinner will stop on Blue (B) if you spin it one time? o $\frac{1}{2}$ o $\frac{2}{3}$ o $\frac{1}{4}$ o $\frac{1}{3}$

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VI. Probability and Statistics (cont'd.)			*Example 41:* A box contains 1 racquet ball, 2 tennis balls and 3 handballs. Billy draws one ball from the box without looking. What is the probability that the ball will be either a tennis ball or a handball? o $\frac{1}{6}$ o $\frac{5}{6}$ o $\frac{2}{3}$ o $\frac{1}{2}$ *Example 42:*  There are three lamps and three shades. How many different lamp-shade combinations are there? o 3 o 4 o 6 o 9

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
B. Statistics	18	The student will: • Identify the mean or average of a given set of data (ex. 43). • Identify the range of a given set of data. • Identify the median of a given set of data. • Identify the mode of a given set of data (ex. 44). • Interpret the frequency distribution for a given set of data (ex. 45).	*Example 43:* Which day's temperature was closest to the mean temperature for the five days? Monday 68° Tuesday 74° Wednesday 76° Thursday 78° Friday 69° o Tuesday o Wednesday o Thursday o Friday *Example 44:* The hours worked by 13 part-time employees were: 3, 3, 3, 3, 4, 4, 5, 5, 5, 10, 12, 17, 30. What is the mode for the number of hours worked? o 3 o 5 o 8 o 27

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SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

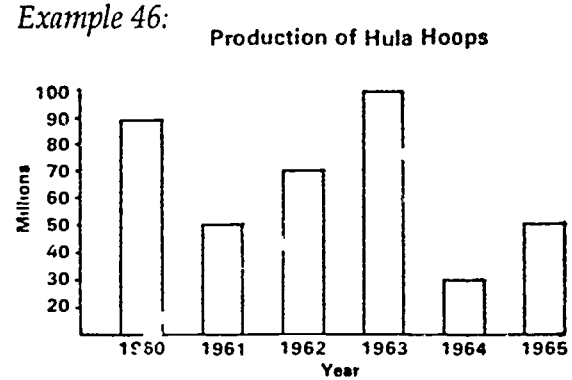
Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VI. Probability and Statistics (cont'd.)			*Example 45:*

Test score	Tally	Frequency
15	/	1
14	///	3
13	////	4
12	///	3
11	//	2
10	/	1

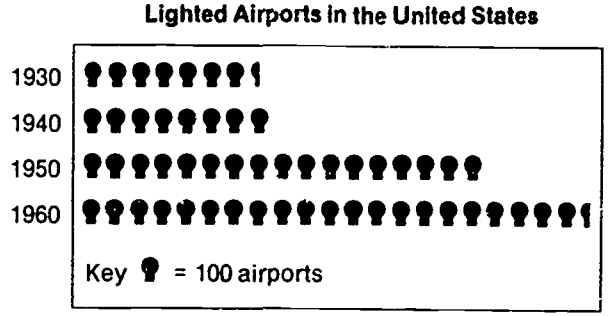
The table shows scores for a class of 14 students. How many students scored less than 13?

o 3
o 4
o 5
o 6

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VII. Tables, Graphs, and Integrated Applications	30		
A. Tables and graphs	15	The student will interpret data given in the form of line, bar, and circle graphs and pictographs (ex. 46, 47).	*Example 46:*  Which of the following is true? o Approximately the same number of hula hoops was produced in 1961 as in 1964. o Exactly twice as many hula hoops were produced in 1964 as in 1962. o Approximately one-half as many hula hoops were produced in 1965 as in 1963. o More hula hoops were produced in 1961 than in 1962.

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VII. Tables, Graphs, and Integrated Applications (cont'd.)			*Example 47:*  How many lighted airports were in the United States in 1930? o 7.5 o 750 o 850 o 1,700

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
B. Integrated applications	15	The student will: • Interpret information from maps or road signs. • Interpret information from advertisements or notices (ex. 48). • Interpret information from commercial charts or tables and schedules (ex. 49).	*Example 48:* Breakfast Menu (Price includes tax.) Juice $.60 Grapefruit .80 Melon .95 Oatmeal .75 French toast 1.75 1 egg with toast 1.60 2 eggs with toast 2.15 Milk .50 Carlos ordered French toast and milk. How much change did he get from $5.00? o $2.25 o $2.75 o $3.25 o $3.75

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VII. Tables, Graphs, and Integrated Applications (cont'd.)			*Example 49:*

Mac's Rental Rates

Bicycle style	Hour	Day (24 hours)	Week	Month
1 speed	$2.00	$ 9 00	$25.00	$60 00
3 speed	2 50	11.00	27 00	65.00
5 speed	2.75	12 00	32.00	70 00
10 speed	3 00	13 00	36 00	75.00
Cruiser 1 speed	3.50	14 00	36 00	75.00
Cruiser 5 speed	4 00	15 00	38.00	80 00
Standard Moto-Cross	3.00	13 00	36 00	75 00
Deluxe Moto-Cross	4 00	15.00	38.00	80.00
Child carrier	3.50	14 00	36 00	75 00

Rates are subject to change.
Baskets and locks are free of charge.

How much more would the total charge be if Kris rented a 10-speed bicycle for two hours than if she had rented a 3-speed?

- o $0.50
- o $1.00
- o $2.50
- o $3.00

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VIII. Problem Solving	**72**		
A. Formulation of a problem	14	The student will: • Identify questions arising from a described practical situation (ex. 50). • Identify problems arising from a mathematical model (graph, equation, diagram, table, or number line) (ex. 51). • Identify statements that can be made using information given or gathered (ex. 52). • Identify reasonable conclusions drawn from a mathematical model.	*Example 50:* JoAnn works 4 hours a day for 4 days a week. She earns $4.25 an hour. She wants to earn enough money to buy a refrigerator for $585. Which problem cannot be solved with the information given above? o How much money does JoAnn earn each week? o How many days must JoAnn work to buy the refrigerator? o How much more money would JoAnn earn each week if she were paid $5.00 an hour? o What is the capacity of the refrigerator that JoAnn will buy?

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VIII. Problem Solving (cont'd.)			*Example 51:* $6.20 + $3 = $9.20 Which question below is represented by the number sentence above? o Rick spent $6.20 and Lydia spent $3. How much more did Rick spend than Lydia? o Maria had $6.20 and lost $3. How much did she have left? o Denise sold 3 boxes of apples for $6.20 each. How much did she earn? o John earned $6.20 and $3 for mowing two lawns Saturday. How much did he earn in all?

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VIII. Problem Solving (cont'd.)			*Example 52:* There were 569 people in the auditorium. 235 were women. 186 people were wearing glasses. Which question can be answered with the above information? o How many women were <u>not</u> wearing glasses? o How many of these people were <u>not</u> women? o How many men were wearing glasses? o How many seats were <u>not</u> occupied?

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
B. Analysis of a problem	20	The student will: • Identify the facts in a given situation (ex. 53). • Identify (a) appropriate or additional information needed to solve a problem, or (b) extraneous information. • Identify a simpler problem having the same underlying mathematical processes in its solution (same steps in same sequence) as a given problem (ex. 54). • Clarify ideas within a problem, (a) forming a mental image of what must be done, (b) restating the problem in simpler form, and (c) identifying similarities and differences between two sets of information (ex. 55).	*Example 53:* Joe bought a shirt that regularly sells for $24 on sale for $18. What percent off the regular price was the sale price? What facts are given? o sale price and discount rate o sale price and regular price o regular price and discount rate o regular price, selling price, and discount rate

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VIII. Problem Solving (cont'd.)			*Example 54:* One packet of gelatin weighs 20 grams. What is the weight of 10 packets of gelatin? Which of the following problems can be solved using the same operations as the problem above? o Juanita runs 10 miles in 90 minutes. How long does it take for her to run each mile? o A felt pen costs 49 cents and a ballpoint pen costs 99 cents. How much does a felt pen and a ballpoint pen cost? o It takes 4 ounces of orange juice to fill a glass. How many glasses can be filled from a half-gallon bottle of orange juice? o A pencil costs 10 cents. What is the cost of 4 dozen pencils?

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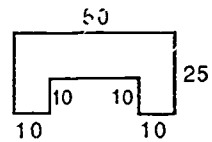
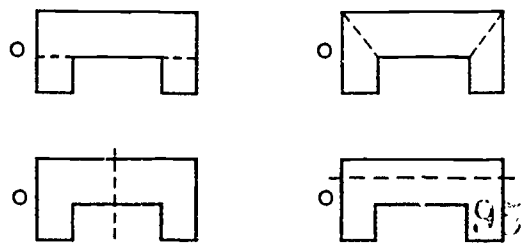
SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VIII. Problem Solving (cont'd.)			*Example 55:* Scott collected some old coins. Curt collected half as many as Scott. Which statement contains the same information? o Scott has half as many coins as Curt. o Curt has twice as many coins as Scott. o Scott has twice as many coins as Curt. o Curt has as many coins as Scott.

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
C. Strategies	24	The student will: • Use estimation to predict reasonable solutions for a given problem or identify other problem-solving tactics. • Identify (a) appropriate operations, (b) appropriate number sentence or equation, (c) subproblems, or (d) alternative strategies that will lead to a solution of a given problem (ex. 56). • Identify (a) appropriate drawings or diagrams, (b) appropriate graphs, (c) appropriate tables or charts, (d) appropriate "guess-and-check" strategies, (e) appropriate patterns, (f) simplifying strategies, (g) "working-backwards" strategies, or (h) mathematical reasoning that will lead to the solution of a given problem (ex. 57, 58, 59).	*Example 56:* The payroll of a grocery store for its 23 clerks is $395,421. What is the average salary of a clerk? Which expression shows the way to get the best estimate for the answer? o 390,000 ÷ 20 o 391,000 ÷ 20 o 390,000 × 20 o 391,000 × 20 *Example 57:* The Soviet Union produces about 3/20 of the world's oil. The Middle East countries produce about 2/3 of the world's oil. What is their combined production? How would you find the answer? o Multiply o Divide o Subtract o Add

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VIII. Problem Solving (cont'd.)			*Example 58:* 100 is divided by a number between 1 and 2. The answer has to be a number: o less than 50. o between 50 and 100. o between 100 and 200. o greater than 200. *Example 59:*  The drawing above shows the measurement of a backyard. Which of these drawings will help you find the area of the backyard in the simplest manner? 

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
D. Interpretation	14	The student will: • Recognize a sensible solution to a given problem. • Verify the accuracy of the problem analysis and the mathematical work by checking a solution in the context of a given problem (ex. 60). • Identify reasonable conclusions or interpretations from the solution of a problem (ex. 61). • Identify "simplifying assumptions" that were made in the analysis and solution of a problem (ex. 62). • Interpret the effect of "simplifying assumptions" that were made in the formation of a *mathematical model* upon the validity of a solution of a given problem. • Identify new relationships or generalizations based on given information.	*Example 60:* Martha bought two shirts at $7.99 each and three sweaters at $10.49 each. How much change should she get back from $50.00? Martha solved the problem the following way: Step 1: $7.99 × 2 = $15.98 Step 2: $10.49 × 2 = $20.98 Step 3: $15.98 + 20.98 = $36.96 Step 4: $50.00 − 36.96 = $13.04 What can you say about Martha's work? o She should have first added $7.99 and $10.49. o She should have multiplied $10.49 by 3. o She subtracted incorrectly in step 4. o There is no mistake. She should receive $13.04 in change.

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VIII. Problem Solving (cont'd.)			*Example 61:* Magdelena got 80 percent correct on a mathematics test and 85 percent correct on a science test. Ralph said that Magdelena got more right answers in the science test than in the mathematics test. Which of these conclusions about Ralph's statement is correct? o Ralph's statement is true under all conditions. o Ralph's statement <u>cannot</u> be true under any conditions. o Ralph's statement is true if the tests each have the same number of questions. o Ralph's statement <u>cannot</u> be true if the tests each have the same number of questions.

SKILL AREAS ASSESSED IN MATHEMATICS, *SURVEY OF ACADEMIC SKILLS: GRADE 8* (Continued)

Skill Area	Number of Items	Description of Skill Area	Illustrative Test Question
VIII. Problem Solving (cont'd.)			*Example 62:* The Evans family traveled 268 miles during the first day of its vacation and another 300 miles on the next day. Sally Evans said they were 568 miles from home. Which of the following facts did Sally assume? o They traveled faster on the first day and slower on the second day. o Each day they traveled in a straight line away from home. o Their car used more gasoline on the first day. o The Evans' car averaged 22 miles per gallon of gasoline.

Answer Key

1. A
2. A
3. C
4. C
5. D
6. C
7. D
8. A
9. B
10. C
11. D
12. D
13. A
14. B
15. B
16. B
17. C
18. D
19. A
20. B
21. B
22. D
23. D
24. C
25. A
26. C
27. A
28. D
29. B
30. D
31. A
32. B
33. B
34. B
35. C
36. D
37. D
38. D
39. C
40. D
41. B
42. D
43. A
44. A
45. D
46. C
47. B
48. B
49. B
50. D
51. D
52. B
53. B
54. D
55. C
56. A
57. D
58. B
59. A
60. B
61. C
62. B

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