

DOCUMENT RESUME

ED 064 165

SE 014 173

TITLE Mathematics Objectives, Level 9 [Project SPPED, System for Program and Pupil Evaluation and Development].

INSTITUTION New York State Education Dept., Albany. Bureau of School and Cultural Research.

PUB DATE 72

NOTE 71p.

EDRS PRICE MF-\$0.65 HC-\$3.29

DESCRIPTORS Algebra; Arithmetic; *Behavioral Objectives; *Curriculum; *Evaluation; Geometry; *Objectives; *Secondary School Mathematics; Trigonometry

ABSTRACT

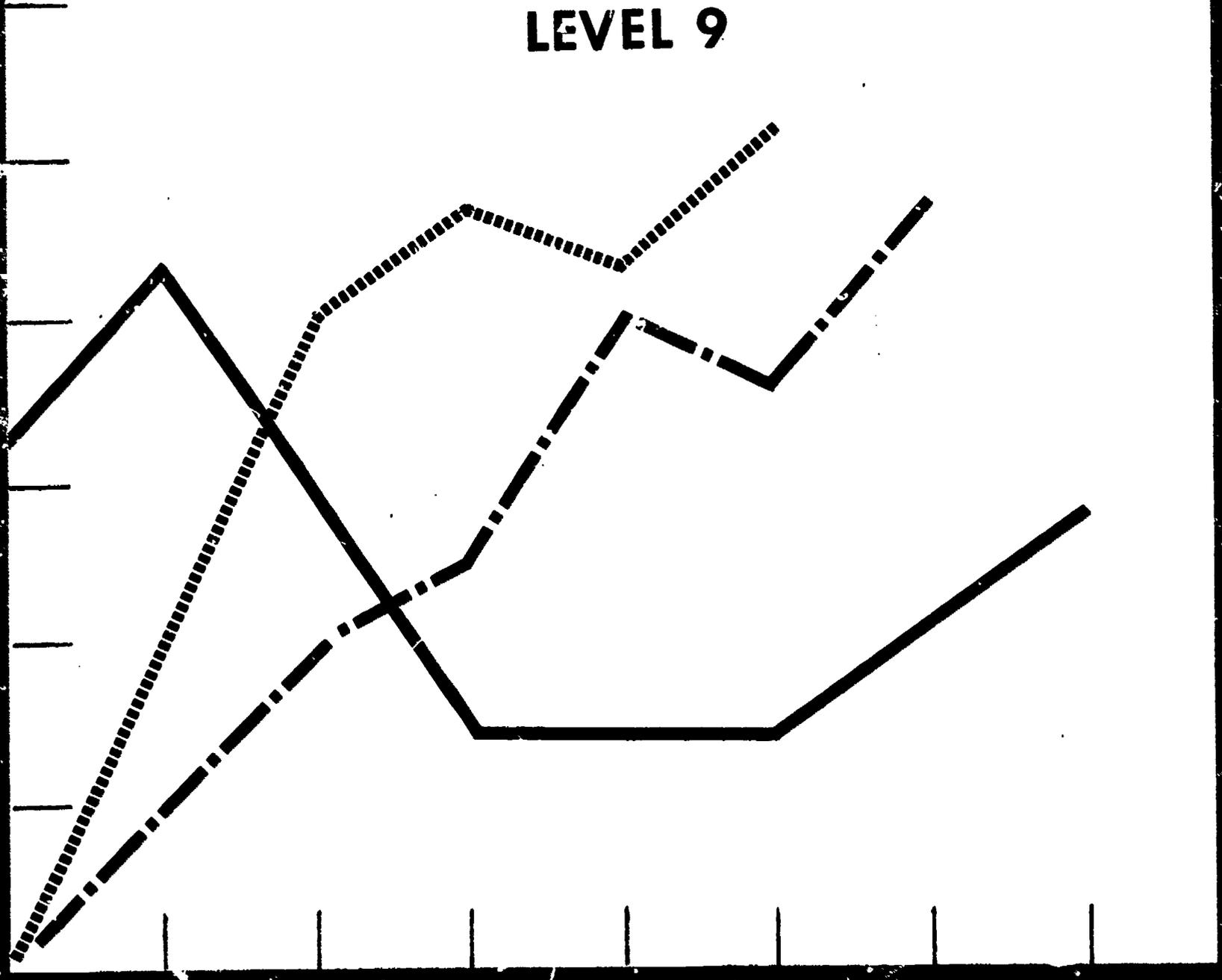
This is the sixth volume of a series produced by the State Education Department of the University of the State of New York. Mathematics objectives and sample items included were originally developed by four local school districts and are not intended to be official or comprehensive, but an aid to teachers in constructing curricula and making classroom goals clear and precise. The document presents a series of examples, each of which states an objective and gives a sample item. There are 13 sections: number, numerals, and numeration systems; whole numbers; fractions (positive rationals); decimals; integers; real numbers; ratio, proportion, and percent; measurement; geometry; problem solving/word problems; algebra; statistics and probability; and trigonometry functions. For related documents, see SE 014 174 and 014 175. (JM)

ED 064165

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MATHEMATICS OBJECTIVES

LEVEL 9



014 112

MATHEMATICS OBJECTIVES FOR LEVEL 9

Project SPPED

System for Pupil and Program Evaluation and Development

Volume VI

The University of the State of New York
The State Education Department
Albany, New York 12224

FOREWORD

The mathematics objectives and items in this packet were originally developed by four local school districts who were participating in CAM projects sponsored by the New York State Education Department. They were refined, checked for quality, and organized by Gerlach van Gendt of the Bureau of School and Cultural Research with assistance from Lee Negus of the Bureau of Mathematics Education.

These objectives are not an official or endorsed set of Mathematics Objectives. Nor do they claim to be comprehensive (i.e., covering all material in the relevant grade levels).

Nonetheless, it is our hope that many teachers will find these objectives useful and helpful in constructing curricula for their classes. These objectives can help you, as a teacher, make vague classroom goals clear and precise. But, the responsibility for what is taught is still the teacher's.

LEVEL 9

733

4

Number, Numeral, and Numeration Systems

734

5

Whole Numbers

738

9

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OBJECTIVE: Given a number written in exponential form, the student will find the value.

SAMPLE ITEM: Find the value of 3^3 .

Answer: 27

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| Level 9 Classification - Whole Numbers, Exponents and Powers | 41 Descriptor - Exponents (Evaluating) Role, Student |
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Fractions (Positive Rationals)

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OBJECTIVE: Given a proper fraction not in lowest terms, the student will reduce it to lowest terms.

SAMPLE ITEM: Reduce $\frac{16}{24}$ to the lowest terms.

Answer: $\frac{2}{3}$

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| Level 9 Classification - Fractions (Positive Rationals) Simplifying/Reducing Fractions | 41 Descriptor - Reducing Fractions Role, Student |
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OBJECTIVE: Given an improper or mixed fraction, the student will change the fraction to a mixed or improper fraction as indicated.

SAMPLE ITEM: Change $\frac{32}{7}$ to a mixed fraction.

Answer: $4\frac{4}{7}$

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| Level 9 Classification - Fractions (Positive Rationals), Proper/Improper/Mixed Fractions / Complex | 41 Descriptor - Changing Mixed to Improper Fractions Role, Student |
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| | | 6 5 6 8 5 | |
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OBJECTIVE: Given two or more fractions, the student will find the sum in lowest terms.

SAMPLE ITEM: Add: $\frac{3}{4} + \frac{2}{3}$

Answer: $\frac{17}{12}$ or $1\frac{5}{12}$

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| Level 9 Classification - Fractions (Positive Rationals), Addition | 41 Descriptor - Adding Unlike Fractions Role, Student |
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| | 6 5 6 9 0 |

OBJECTIVE: Given two fractions, the student will find their difference in lowest terms.

SAMPLE ITEM: Subtract: $\frac{3}{4} - \frac{2}{3}$

Answer: $\frac{1}{12}$

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| Level 9 Classification - Fractions (Positive Rationals), Subtraction | 41 Descriptor - Subtracting Unlike Fractions Role, Student |
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Decimals

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| | | 6 5 7 5 5 | |
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OBJECTIVE: Given a set of decimal fractions, the student will arrange them in either increasing or decreasing order.

SAMPLE ITEM: Arrange $\{.32, 1.7, .3, .88\}$ in increasing order.

Answer: $\{.3, .32, .88, 1.7\}$

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| Level 9 Classification - Decimals, Order (comparing fractions) | 41 Descriptor - Comparing Decimal Fractions Role, Student |
|--|---|

Integers

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| | | 6 5 7 6 0 | |
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OBJECTIVE: Given two or more integers, the student will find the sum of the integers.

SAMPLE ITEM: Find the sum:

$$+6 + (-3) + (-2)$$

Answer: +1

Level 9
Classification - Integers,
Addition

41 Descriptor - Addition of
Integers with Like Signs
Role, Student

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| | | 6 5 7 6 5 | |
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OBJECTIVE: Given two integers, the student will find the difference of the two integers.

SAMPLE ITEM: Subtract: $+11 - (-4)$

Answer: 15

Level 9
Classification - Integers,
Subtraction

41 Descriptor - Subtraction of
Integers
Role, Student:

Real Numbers

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| | | 6 5 7 8 0 | |
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OBJECTIVE: Given a number, the student will find its square root to the nearest tenth.

SAMPLE ITEM: Find $\sqrt{359}$ to the nearest tenth.

Answer: 18.9

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| Level 9 Classification - Real Numbers, Square/Root/Irrational Numbers | 41 Descriptor - Finding Square Root Role, Student |
|---|---|

Ratio, Proportion, and Percent

Measurement

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| | | 6 5 8 4 5 | |
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OBJECTIVE: Given measures of liquid or dry measure and an indicated operation, the student will perform the indicated operation and express the result in simplest form.

SAMPLE ITEM: Subtract: 2 lb. 1 oz.
-1 lb. 8 oz.

Answer: 9 oz.

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| Level 9 Classification - Measurement, Mixed Measure/Compound Measures/Tables | 41 Descriptor - Operations with Liquid Measure Role, Student |
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Geometry

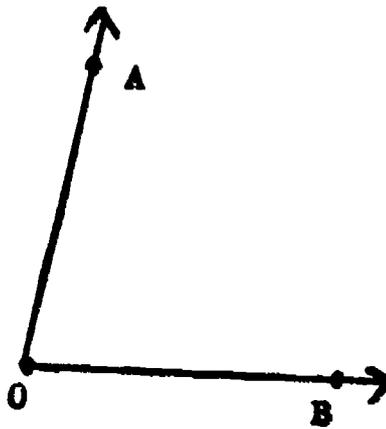
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| | | 6 5 8 5 0 | |
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OBJECTIVE: Given an angle, the student will find the measure of the angle in degrees using a protractor.

SAMPLE ITEM: Measure $\angle AOB$ with a protractor.



Answer: 80°

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| Level 9 Classification - Geometry, Angles | | 41 Descriptor - Measuring Angles Using Protractor | |
| | | Role, Student | |
| | | 6 5 8 5 5 | |

OBJECTIVE: Given the radius or diameter of a circle, the student will find the circumference. (Use $\pi = 3.14$)

SAMPLE ITEM: Find the circumference of a circle with a radius 7 feet.

Answer: 44 ft. or 43.96 ft.

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| Level 9 Classification - Geometry, Circles | | 41 Descriptor - Circumference of a Circle | |
| | | Role, Student | |

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OBJECTIVE: Given the radius or diameter of a circle, the student will find the area.

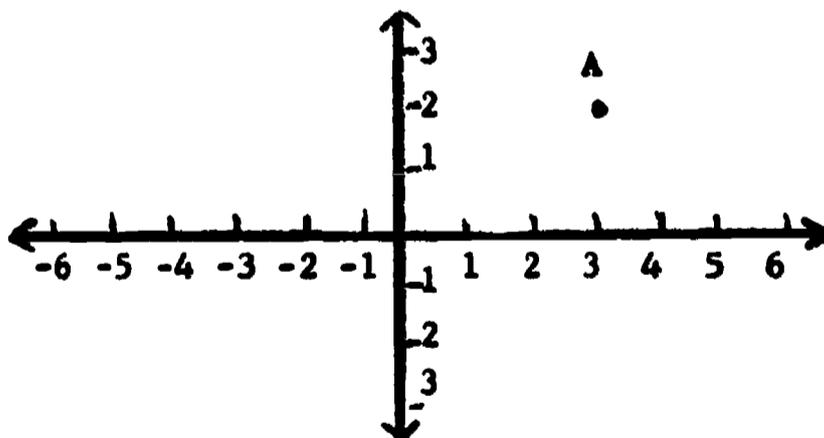
SAMPLE ITEM: Find the area of a circle with a diameter of 7 feet.

Answer: $38\frac{1}{2}$ sq. ft. or 38.465 sq. ft.

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| Level 9 Classification - Geometry, Circles | | 41 Descriptor - Area of a Circle | |
| | | Role, Student | |
| | | 6 5 8 6 5 | |

OBJECTIVE: Given points graphed on the coordinate plane, the student will name the required points as order pairs.

SAMPLE ITEM: What ordered pair does point A represent?



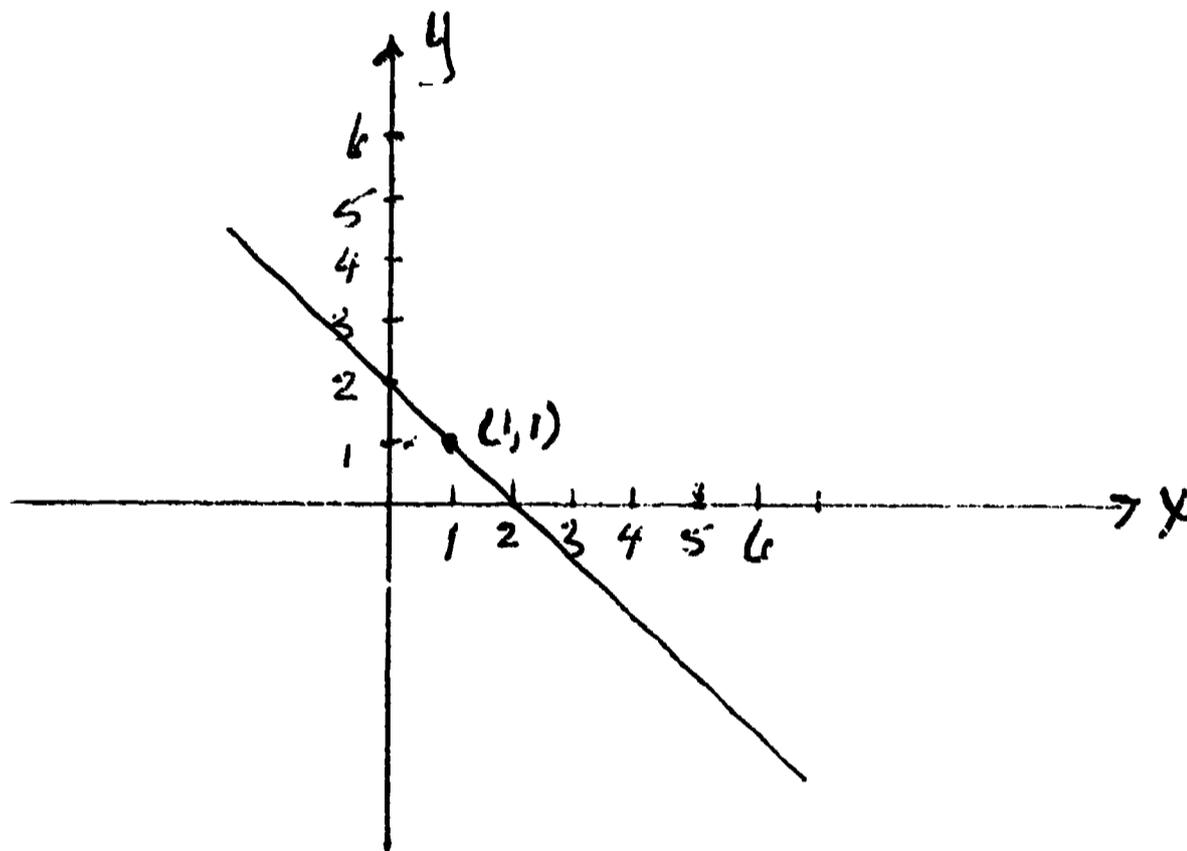
Answer: (3,2)

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| Level 9 Classification - Geometry, Coordinate Geometry | | 41 Descriptor - Plotting Points on Coordinate Axes | |
| | | Role, Student | |

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| | | 6 5 8 7 0 | |
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OBJECTIVE: Given the graph of a straight line, the student will find a linear equation which names the given line.

SAMPLE ITEM: Write an equation of the line:



Answer: $x + y = 2$ or any equivalent equation.

Level 9
Classification - Geometry,
Coordinate Geometry

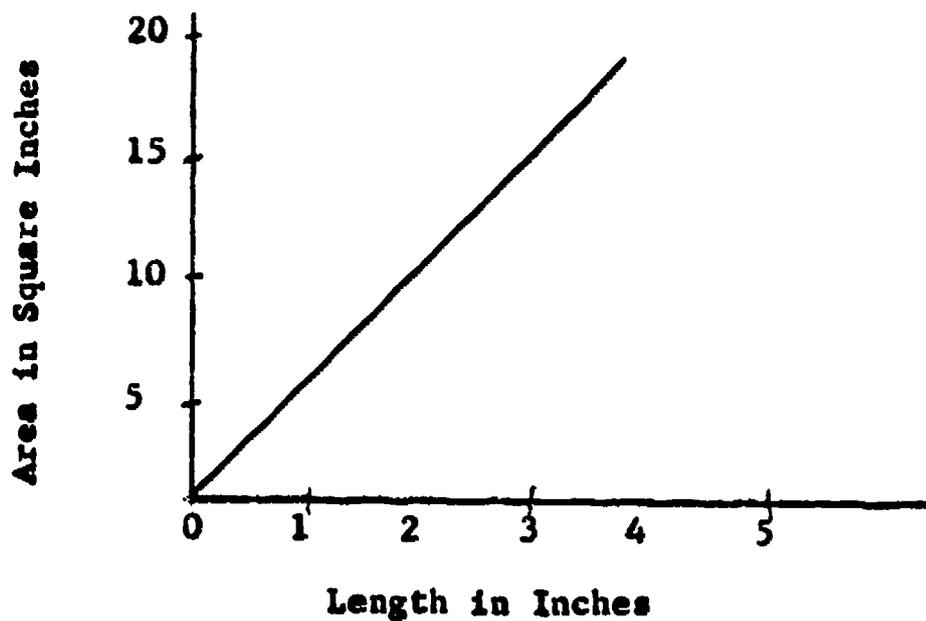
41 Descriptor - Graphing Linear
Equations
Role, Student

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| | | 6 5 8 7 5 | |
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OBJECTIVE: Given the graph of a formula of two variables with one variable held constant, the student will find the range of the graph for a given domain.

SAMPLE ITEM: When the width is held constant, what is the change in area as the length goes from 2 inches to 4 inches?

$$\text{Area} = \text{Length} \times \text{Width}$$



Answer: 10 sq. in. to 20 sq. in.

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| Level 9 Classification - Geometry, Coordinate Geometry | 41 Descriptor - Graphing Linear Equations Role, Student |
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| | | 6 5 8 8 0 | |
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OBJECTIVE: Given a linear equation, the student will name the coordinates of two points which satisfy the given equation.

SAMPLE ITEM: Name two ordered pairs that satisfy the equation $x + y = 5$.

Answer: (1,4), (2,3), or any ordered pair whose coordinates have a sum of 5, that is, $\{(x,y) \mid x + y = 5\}$.

| Level 9 Classification - Geometry, Coordinate Geometry | 41 Descriptor - Graphing Linear Equations |
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| | Role, Student |
| | 6 5 8 8 5 |

OBJECTIVE: Given a verbal problem involving the area of any closed figure, the student will find the solution.

SAMPLE ITEM: Find the number of square feet of paint needed to cover a ceiling 15 ft. wide and 18 ft. long.

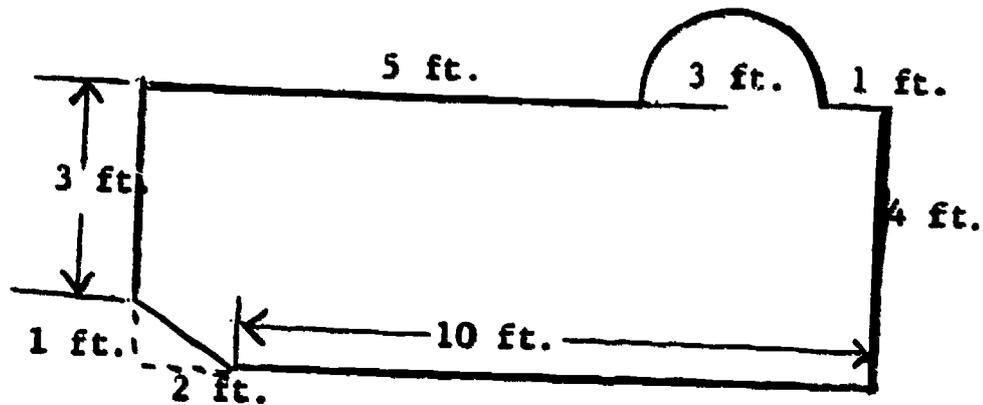
Answer: 270 sq. ft.

| Level 9 Classification - Geometry, Area/Perimeter/Volume | 41 Descriptor - Area of Polygon |
|--|---------------------------------|
| | Role, Student |
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| | | 6 5 8 9 0 | |
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OBJECTIVE: Given the diagram of a closed figure, and the necessary dimensions of that figure, the student will find the area.

SAMPLE ITEM: Find the area of the enclosed region:

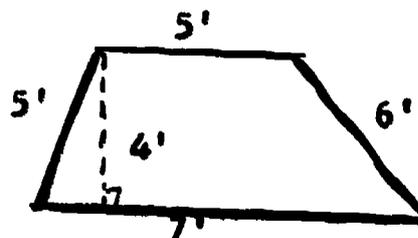


Answer: 61.13 sq. in. or $61\frac{1}{7}$ sq. in.

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| Level 9 Classification - Geometry, Area/Perimeter/Volume | | 41 Descriptor - Area of Polygon | |
| | | Role, Student | |
| | | 6 5 8 9 5 | |

OBJECTIVE: Given the required dimensions of a triangle or quadrilateral, the student will find the area.

SAMPLE ITEM: Find the area of the following trapezoid:



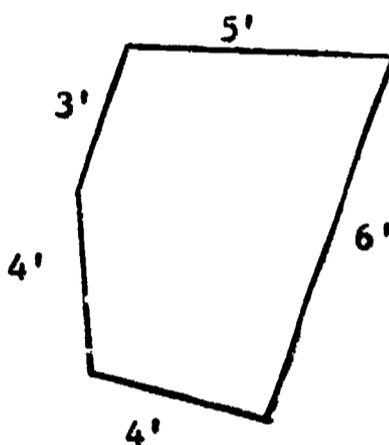
Answer: 24 sq. ft.

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| Level 9 Classification - Geometry, Area/Perimeter/Volume | | 41 Descriptor - Area of Polygon | |
| | | Role, Student | |

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| | | 6 5 9 0 0 | |
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OBJECTIVE: Given the lengths of the sides of a polygon, the student will find the perimeter.

SAMPLE ITEM: Find the perimeter:



Answer: 22 ft.

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| Level 9 Classification - Geometry, Area/Perimeter/Volume | | 41 Descriptor - Perimeter | |
| | | Role, Student | |
| | | 6 5 9 0 5 | |

OBJECTIVE: Given a verbal problem involving the perimeter of any closed figure, the student will find the solution.

SAMPLE ITEM: A baseball diamond is a square whose sides are 90 feet long. How far must a ballplayer run if he hits a home run?

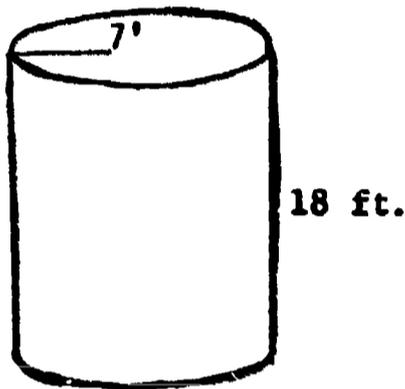
Answer: 360 feet.

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| Level 9 Classification - Geometry, Area/Perimeter/Volume | | 41 Descriptor - Perimeter | |
| | | Role, Student | |

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| | | 6 5 9 1 0 | |
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OBJECTIVE: Given the height and radius of a cylinder, the student will find its volume. ($\pi = \frac{22}{7}$)

SAMPLE ITEM: Find the volume of the following cylinder:

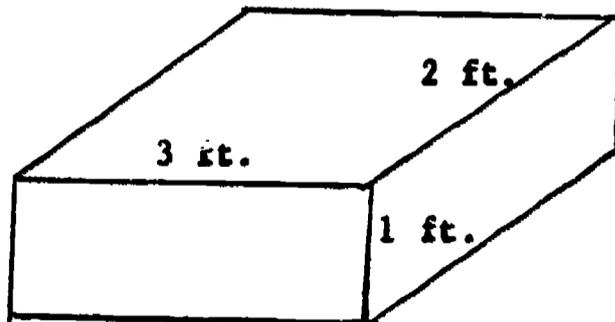


Answer: 2772 cu. ft.

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| Level 9 Classification - Geometry, Area/Perimeter/Volume | | 41 Descriptor - Volume | |
| | | Role, Student | |
| | | 6 5 9 1 5 | |

OBJECTIVE: Given the dimensions of a rectangular solid, the student will find its volume.

SAMPLE ITEM: Find the volume of the following rectangular solid:



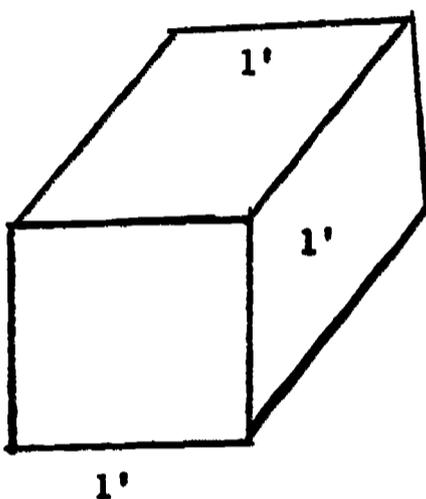
Answer: 6 cu. ft.

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| Level 9 Classification - Geometry, Area/Perimeter/Volume | | 41 Descriptor - Volume | |
| | | Role, Student | |

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| | | 6 5 9 2 0 | |
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OBJECTIVE: Given the dimensions of a rectangular solid, the student will determine its surface area.

SAMPLE ITEM: Find the surface area of the following rectangular solid:



Answer: 6 sq. ft.

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| Level 9 Classification - Geometry, Area/Perimeter/Volume | | 41 Descriptor - Surface Area | |
| | | Role, Student | |
| | | 6 5 9 2 5 | |

OBJECTIVE: Given the measures in degrees of two angles of a triangle, the student will find the measure in degrees of the third angle.

SAMPLE ITEM: In triangle ABC, $m\angle A = 31^\circ$, $m\angle B = 69^\circ$. Find the measure of angle C.

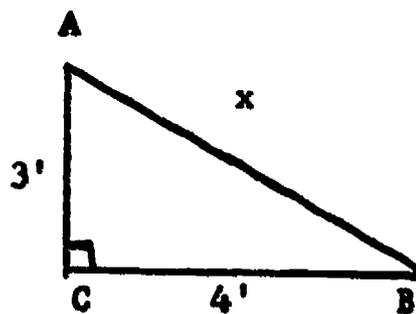
Answer: 80°

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| Level 9 Classification - Geometry, Triangles/Congruence/ Similarity | | 41 Descriptor - Sum of the Angles of a Triangle | |
| | | Role, Student | |

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| | | 6 5 9 3 0 | |
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OBJECTIVE: Given a right triangle and the lengths of two sides, the student will find the length of the third side using the Pythagorean theorem.

SAMPLE ITEM: Given right triangle ABC with right angle at C. Find the length of AB.



Answer: 5'

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| Level 9 Classification - Geometry, Triangles/Congruence/ Similarity | | 41 Descriptor - Pythagorean Theorem | |
| | | Role, Student | |
| | | 6 5 9 3 5 | |

OBJECTIVE: Given a problem involving similar triangles, the student will find the solution.

SAMPLE ITEM: A vertical pole casts a shadow of 15 ft. at the same time that a vertical 8 ft. rod casts a shadow of 2 ft. How high is the pole?

Answer: 60 ft.

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| Level 9 Classification - Geometry, Triangles/Congruence/ Similarity | | 41 Descriptor - Similarity | |
| | | Role, Student | |

Problem Solving/Word Problems

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OBJECTIVE: Given a verbal problem involving units of length, the student will find the solution.

SAMPLE ITEM: How many strips of wood $1\frac{1}{2}$ inches wide will it take to cover a width of 1 ft 6 in.?

Answer: 12

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| Level 9 Classification - Problem Solving/Word Problems, Measurement | 41 Descriptor - Word Problems - Involving Measurement Role, Student |
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Algebra

788

59

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| | | 6 6 0 1 5 | |
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OBJECTIVE: Given an algebraic expression, the student will simplify it by combining like terms.

SAMPLE ITEM: Simplify: $x + y + 4x - 3y$

Answer: $5x - 2y$

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| Level 9 Classification - Algebra, Grouping (Use of Parentheses) - Order of Operations | 41 Descriptor - Combining Terms Role, Student |
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| | 6 6 0 2 0 |

OBJECTIVE: Given an expression with whole numbers, using the operations of addition, subtraction, multiplication, and division, the student will find the result.

SAMPLE ITEM: Find the result: $3 - 4 \times 3 \div 6 + 1$

Answer: 2

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| Level 9 Classification - Algebra, Grouping (Use of Parentheses) - Order of Operations | 41 Descriptor - Order of Operations Role, Student |
|--|---|

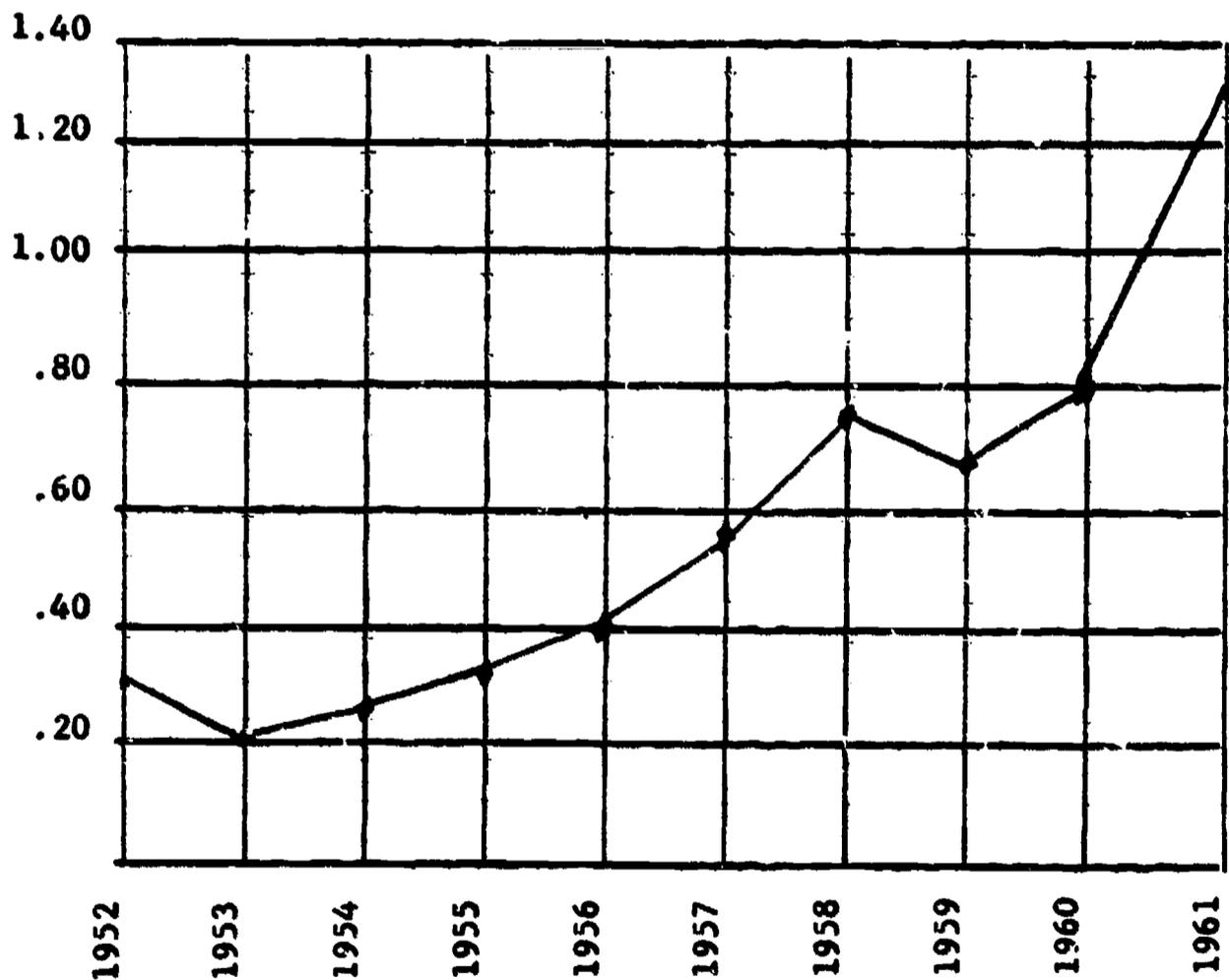
Statistics and Probability

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| | | 6 6 0 6 5 | |
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OBJECTIVE: Given a pictogram, bar graph, broken line graph, or circle graph, the student will interpret the graph as indicated.

SAMPLE ITEM: The accompanying graph shows the cash dividend per share that a large company paid to its shareholders during the years 1952 through 1961. On what year was the lowest dividend paid?

Cash Dividends Paid Per Share



Answer: 1953

Level 9
Classification - Statistics and
Probability,
Graphs and Tables

41 Descriptor - Interpretation of
all Graph Types

Role, Student

TRIGONOMETRY FUNCTIONS

797

68

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| | | 6 6 0 8 0 | |
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OBJECTIVE: Given a table of trigonometric values, the student will find the value of the sine, cosine, or tangent of a given angle from the table.

SAMPLE ITEM: Find $\sin 30^\circ$ by reading a trigonometric table.

Answer: .5000

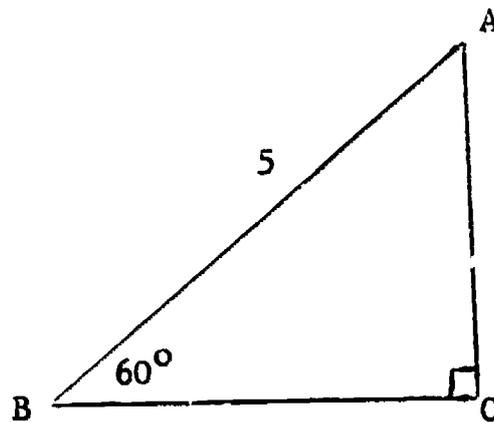
Level 9
Classification - Trigonometry Functions,
Tables

41 Descriptor - Reading a
Trigonometric Table
Role. Student

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OBJECTIVE: Given a problem involving the sine or cosine ratio, the student will solve the problem.

SAMPLE ITEM: In the following diagram find \overline{BC} to the nearest tenth of a foot.



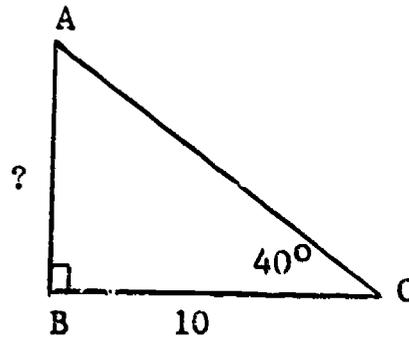
Answer: 2.5 ft.

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| Level 9 Classification - Trigonometry Functions, Functions | 41 Descriptor - Using Trigo- nometric Functions Role, Student |
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| | | 6 6 0 9 0 | |
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OBJECTIVE: Given a problem involving the tangent ratio, the student will solve the problem.

SAMPLE ITEM: In the following diagram find \overline{AB} to the nearest foot.



Answer: 8 ft.

Level 9
Classification - Trigonometry Functions,
Functions

41 Descriptor - Using
Trigonometric Functions
Role, Student