

Illinois Certification Testing System

STUDY GUIDE

Mathematics (115)



Illinois State Board of Education

An Equal Opportunity/Affirmative Action Employer
Printed by the Authority of the State of Illinois

TABLE OF CONTENTS

GENERAL INFORMATION ABOUT THE ILLINOIS CERTIFICATION TESTING SYSTEM

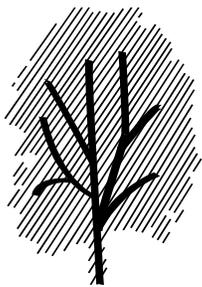
PROGRAM OVERVIEW	1-1
For Further Information	1-2
Description of the Tests	1-3
Test Administration	1-4
Score Reports	1-4
HOW TO PREPARE FOR THE TEST	1-5
Assess Your Knowledge and Test Skills	1-5
Practice Your Test-Taking Skills	1-5
THE DAY OF THE TEST: HELPFUL HINTS	1-5
Preparation	1-5
Test-Taking Tips	1-5
TEST DIRECTIONS	1-7

FIELD-SPECIFIC INFORMATION

INTRODUCTION	2-1
Test Subareas and Objectives	2-1
Calculators	2-2
Practice Test Questions	2-2
TEST OBJECTIVES	2-3
PRACTICE TEST QUESTIONS	2-10
ANSWER KEY	2-25
EXPLANATION OF THE TEST SCORE REPORT	2-26
Overview	2-26
Reading Your Report: A Sample	2-27

Readers should be advised that this study guide, including many of the excerpts used herein, is protected by federal copyright law.

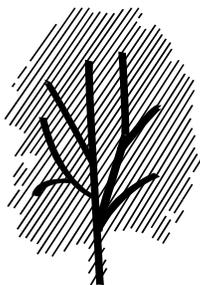
Copyright © 2006 by the Illinois State Board of Education
NES and its logo are trademarks in the U.S. and/or other countries of Pearson Education, Inc. or its affiliate(s).



General Information About the Illinois Certification Testing System

The first section of the study guide is available in a separate PDF file. Click the link below to view or print this section.

[General Information About the Illinois Certification Testing System](#)



Field-Specific Information

- **Test Subareas and Objectives**
- **Practice Test Questions**
- **Explanation of the Test Score Report**

INTRODUCTION

The content tests are designed to assess a candidate's knowledge of content in the specific teaching, school service personnel, or administrative field in which certification is sought. The tests are based on current and relevant expectations for teacher preparation students and for teachers in Illinois as defined by the Illinois Content Area Standards for Educators. This study guide is designed to focus your preparation by helping you become familiar with the format and content to be covered on the tests.

This section includes a list of the test subareas and objectives, practice test questions for the field covered by this study guide, an answer key, and an explanation of the test score report.

TEST SUBAREAS AND OBJECTIVES

The content covered by the test is organized into subareas. You will find a list of subareas at the beginning of the list of test objectives. Within each subarea, the content is further defined by a set of objectives. Each objective comprises two major parts:

1. the *objective statement*, which broadly defines the knowledge and skills that an entry-level educator needs to know; and
2. the *descriptive statements*, which describe in greater detail the types of knowledge and skills covered by the test objective.

The test objectives are broad, conceptual, and meaningful statements, written in language that reflects the skills, knowledge, and understanding that an entry-level teacher needs in order to teach effectively in an Illinois classroom. A test consists of test questions that measure an examinee's mastery of these test objectives.

Below is an example of a test objective statement and its accompanying descriptive statements for the Elementary/Middle Grades test.

Objective Statement

Understand word analysis strategies and vocabulary development and how to use effective, developmentally appropriate approaches to promote students' word analysis and vocabulary skills.

Descriptive Statements

- Demonstrate knowledge of phonics and its role in decoding; of ways to assess students' phonic skills; and of effective instructional strategies, activities, and materials for promoting students' phonetic analysis skills.
- Demonstrate knowledge of word analysis strategies, including syllabication, morphology (e.g., use of affixes and roots), and context clues; of ways to assess students' use of word analysis strategies; and of effective instructional strategies, activities, and materials for promoting students' word analysis and contextual analysis skills.
- Demonstrate knowledge of the role of vocabulary development in reading; of ways to assess students' vocabulary development; and of effective instructional strategies, activities, and materials for promoting students' vocabulary development.

CALCULATORS

Examinees taking the Mathematics test must bring their own graphing calculator but may **not** bring a calculator manual. No graphing calculators will be provided to examinees by the Illinois State Board of Education or National Evaluation Systems (NES®). Please consult the current version of the ICTS Registration Bulletin for a list of approved calculators and more information.

PRACTICE TEST QUESTIONS

The practice test questions included in this section are designed to give the examinee an introduction to the nature of the test questions included on the ICTS test for each field. The practice test questions represent the various types of test questions you may expect to see on an actual test; however, they are **not** designed to provide diagnostic information to help you identify specific areas of individual strengths and weaknesses or predict your performance on the test as a whole. Use the answer key located after the practice test questions to check your answers.

To help you identify which test objective is being assessed, the objective statement to which the question corresponds is listed in the answer key. When you are finished with the practice test questions, you may wish to go back and review the entire list of test objectives and descriptive statements once again.

MATHEMATICS TEST OBJECTIVES

- I. Processes and Applications
- II. Number Sense and Measurement
- III. Algebraic Patterns, Symbols, Functions, and Models
- IV. Geometric Methods
- V. Probability and Statistics

SUBAREA I—PROCESSES AND APPLICATIONS

0001 Understand how to communicate mathematical content and concepts, and develop and utilize a variety of problem-solving techniques.

For example:

- Demonstrate an understanding of learning styles and learning strategies in mathematics.
- Recognize how to create effective learning environments in which mathematics students work collaboratively in one-on-one, small-group, and large-group contexts.
- Demonstrate an understanding of strategies for teaching reading in the content area of mathematics.
- Demonstrate knowledge of how to communicate verbally and in written, visual, and symbolic forms using appropriate technology.
- Demonstrate an understanding of problem-solving strategies (e.g., using a diagram, making an organized list, working backwards using logical reasoning, making a simpler problem, acting out or using objects, systematic guessing and checking, looking for patterns, estimating, eliminating extraneous information).
- Recognize how to use problem explorations and modeling to extend the mathematical knowledge of all students.
- Generalize the results of problems and extend them to other problem situations.

0002 Understand how to apply appropriate reasoning techniques to concepts, procedures, and conjectures, and make connections with and among the various branches of mathematics and other disciplines.

For example:

- Recognize valid justifications for the application of concepts, procedures, and theorems in a given situation.
- Distinguish between inductive and deductive reasoning.
- Demonstrate an understanding of how to develop conjectures and evaluate their validity.
- Identify and apply connections within the mathematics curriculum (e.g., geometric substantiations of algebraic formulae such as demonstrating the connection of the distance formula in coordinate geometry via the Pythagorean Theorem, geometric interpretation of the integral, applications of matrices to geometric figures).
- Demonstrate knowledge of mathematical connections to other disciplines (e.g., rate of change as applied to business, economics, physics, chemistry, biology).
- Demonstrate knowledge of the historical development of mathematics, including contributions of men and women from various cultures.

0003 Understand how to select, integrate, and use appropriate technologies.

For example:

- Demonstrate an understanding of the capabilities and benefits of current and emerging technologies in the content area of mathematics.
- Select appropriate technology (e.g., spreadsheet, graphing calculator, manipulatives) to solve problems throughout the mathematics curriculum.
- Demonstrate an understanding of how to select and integrate appropriate technology for mathematics instruction.
- Demonstrate knowledge of CAS (computer algebra systems).
- Develop and apply algorithms to solve problems using technology.

SUBAREA II—NUMBER SENSE AND MEASUREMENT

0004 Understand the concepts of number, number theory, and numeration systems.

For example:

- Demonstrate an understanding of place value, order, magnitude, absolute value, and estimation.
- Represent and operate upon numbers using a variety of methods.
- Perform operations in any number base and convert between different number bases.
- Solve problems involving prime and composite numbers, least common multiples, modular arithmetic, and greatest common factors.
- Solve problems involving integers, fractions, decimals, percents, and ratios and proportions.

0005 Understand properties of the real and complex number systems as they apply to algorithms of operations.

For example:

- Demonstrate an understanding of real number properties and operations and how they apply to algorithms and algebraic expressions.
- Use polar and vector representations of complex numbers.
- Compute and interpret the results of computations using complex numbers and matrices.
- Demonstrate an understanding of iterative (e.g., infinite decimals, fractals) processes as they relate to fractals and other applications.
- Use numeric approximations as a basis for numeric integration and numeric-based proofs.

0006 Understand customary, metric, and nonstandard measurement.

For example:

- Demonstrate knowledge of standard, nonstandard, and emerging units (e.g., graphic screen pixels, font size) of measurement.
- Apply attributes of length, area, volume, capacity, time, temperature, angles (degree and radian measure), weight, and mass to solve problems.
- Solve problems using derived measures (e.g., density, work, velocity), conversion factors, and dimensional analysis.
- Use nonlinear measuring scales (e.g., Richter, decibel, pH) to solve practical problems.
- Determine acceptable measures of accuracy and calculate relative error in a given situation.

0007 Understand procedures for computing or estimating measures of multidimensional objects.

For example:

- Read and interpret scale drawings, topographical maps, and architectural drawings.
- Explain how changing one measure of a multidimensional object may affect other measures.
- Use trigonometric ratios to solve a variety of problems.
- Apply measurement formulas to irregular shapes, regions, and solids.
- Solve problems involving indirect measurement.
- Use modeling and visualization to predict, estimate, and determine measurements.

SUBAREA III—ALGEBRAIC PATTERNS, SYMBOLS, FUNCTIONS, AND MODELS

0008 Understand concepts, representations, and relationships of variables and patterns.

For example:

- Represent mathematical situations symbolically, numerically, and graphically.
- Identify, complete, and extend patterns, sequences, and series and analyze their properties.
- Use recursion and the principle of mathematical induction to solve problems.
- Translate between word situations and algebraic sentences.
- Apply properties of real numbers in algebraic contexts to manipulate and simplify algebraic expressions and solve equations.
- Use the properties of relations and functions (e.g., domain, range) and their symbolic, numeric, graphic, and verbal representations.
- Use a formal axiomatic system to construct and analyze proofs.
- Demonstrate an understanding of group structures and their application to symmetry.
- Demonstrate an understanding of rings and fields and their relation to algebraic properties of real numbers.

0009 Understand and apply concepts and representations of linear relations and functions.

For example:

- Represent linear relations and functions in symbolic, numeric, graphic, and verbal forms.
- Recognize and apply slopes and intercepts to construct, analyze, and interpret linear equations and inequalities and their graphs.
- Apply linear relations, functions, and systems to model and solve a variety of problems.
- Represent and solve systems of linear equations and inequalities graphically and algebraically, including matrix methods.
- Apply principles and properties of linear algebra (e.g., vectors, matrix algebra, vector spaces) to solve problems.

0010 Understand and apply concepts and representations of quadratic relations (including conic sections) and functions.

For example:

- Represent quadratic functions and relations in symbolic, numeric, graphic, and verbal forms.
- Recognize and apply properties of symmetry, roots, intercepts, and vertices to construct, analyze, and interpret quadratic relations and their graphs.
- Recognize and apply the properties of hyperbolas, parabolas, circles, and ellipses to model and solve problems.
- Solve systems of quadratic equations and inequalities graphically and algebraically.
- Apply quadratic relations, functions, and systems to model and solve a variety of problems.

0011 Understand and apply concepts and representations of polynomial, absolute value, radical, and rational functions and inequalities.

For example:

- Represent polynomial, absolute value, radical, and rational functions and relations in symbolic, numeric, graphic, and verbal forms.
- Recognize and apply symmetry, roots, intercepts, critical points, asymptotes, and vertices to construct, analyze, and interpret polynomial, absolute value, radical, and rational functions and inequalities and their graphs.
- Recognize and apply the properties of polynomial, absolute value, radical, and rational functions and equations to solve problems.
- Solve systems of polynomial, absolute value, radical, and rational equations and inequalities graphically, algebraically, and numerically.
- Apply polynomial, absolute value, radical, and rational relations, functions, and systems to model and solve a variety of problems.
- Recognize and apply the algebraic properties of polynomial and rational functions (e.g., factoring, partial fractions).

0012 Understand and apply concepts and representations of exponential, logarithmic, and trigonometric functions.

For example:

- Represent exponential, logarithmic, and trigonometric functions in symbolic, numeric, graphic, and verbal forms.
- Recognize and apply properties of symmetry, roots, intercepts, critical points, and asymptotes to construct, analyze, and interpret exponential, logarithmic, and trigonometric functions and inequalities and their graphs.
- Apply the equations of exponential, logarithmic, and trigonometric functions and systems to model and solve a variety of problems (e.g., periodic motion, compound interest, exponential growth and decay).
- Solve systems of exponential, logarithmic, and trigonometric equations and inequalities graphically and algebraically.

0013 Understand the historical development and applications of calculus.

For example:

- Demonstrate knowledge of the history of mathematics leading up to calculus (e.g., slope of tangent line as rate of change, using geometric methods to determine the area under a curve).
- Apply the concept of a limit to analyze properties of functions (e.g., continuity, asymptotes) and series.
- Apply principles of differential calculus to solve a variety of problems (e.g., rates of change, optimization, analyzing functions).
- Apply principles of integral calculus to solve a variety of problems (e.g., finding areas and volumes, describing the motion of an object).
- Represent limits, derivatives, and integrals symbolically, numerically, graphically, and verbally.

SUBAREA IV—GEOMETRIC METHODS

0014 Understand properties of points, lines, planes, and space and their relationship to Euclidean and non-Euclidean geometry.

For example:

- Demonstrate an understanding of points, lines, planes, and space and their geometric applications.
- Apply definitions, axioms, and theorems of Euclidean geometry to develop different types of proofs (e.g., direct, indirect, flow, paragraph).
- Solve a variety of problems in Euclidean geometry (e.g., justify geometric constructions).
- Use the formal axiomatic system of geometry to construct and analyze proofs.
- Compare and contrast the structures of Euclidean and non-Euclidean geometries (e.g., hyperbolic, elliptic).

0015 Understand properties of two- and three-dimensional shapes.

For example:

- Apply characteristics of two- and three-dimensional figures to describe, analyze, and categorize two- and three-dimensional figures.
- Apply the principle of congruence to explore properties of geometric figures and prove theorems.
- Apply concepts of similarity and congruence to analyze the properties and compare the measures (e.g., perimeter, area, volume) of two- and three-dimensional figures.

0016 Understand and apply spatial visualization skills.

For example:

- Translate between two- and three-dimensional representations of geometric figures (e.g., cross sections, nets, projections, perspective drawings).
- Apply procedures for generating solids of revolution from two-dimensional figures.
- Apply techniques of graph theory (e.g., Eulerian and Hamiltonian circuits) to characterize geometric relationships.
- Apply the properties of two- and three-dimensional figures to solve real-world problems.

0017 Understand and apply geometric methods to model mathematical concepts and solve real-world problems.

For example:

- Use coordinate geometry and transformational methods to model mathematical concepts and solve problems involving similarity (including scale and size change), congruence, symmetry, and tessellations.
- Describe and analyze connections among Euclidean, coordinate, and transformational representations of geometric figures.
- Use two- and three-dimensional coordinate systems to represent and analyze geometric figures.
- Describe the relationships between geometry and algebra (e.g., transformations as a geometric equivalence of the function concept).
- Illustrate the applications of recursion and iteration geometrically (e.g., fractals).
- Use a variety of geometric methods (e.g., trigonometric ratios, similarity, proportionality) to solve real-world problems.

SUBAREA V—PROBABILITY AND STATISTICS

0018 Understand counting techniques and the theory of probability.

For example:

- Apply properties of sets and Venn diagrams.
- Determine probabilities in counting situations involving combinations and permutations.
- Find the probability of dependent and independent events.
- Use random variables to interpret and apply probability distributions.
- Analyze problem situations (e.g., fairness of games, lotteries) and determine the probability of events.
- Choose an appropriate simulation to model simple theoretical and experimental probabilities.
- Use probability models and simulations to make and interpret predictions.

0019 Understand the process of posing questions and collecting, organizing, and representing data to answer those questions.

For example:

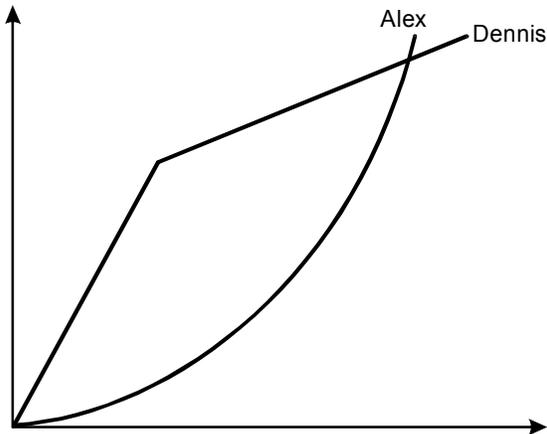
- Apply criteria for data collection (e.g., random sample, survey techniques).
- Recognize potential sample bias in a given collection technique.
- Calculate and interpret measures of central tendency (mean, median, mode) and variation (e.g., range, standard deviation) to characterize a given set of data.
- Analyze the relationship between data transformations and measures of central tendency and variation.
- Organize and interpret data using a variety of graphs (e.g., bar graphs, line graphs, pictographs, scatter plots, box plots, stem-and-leaf diagrams, histograms, frequency distributions).
- Apply procedures (e.g., geometric, algebraic, calculus) for determining lines of fit and transformations (power and logarithmic transformations) to achieve linearity.

0020 Understand the process of analyzing and interpreting data to make predictions.

For example:

- Draw conclusions about data given summary statistics.
- Identify, analyze, and interpret discrete and continuous data distributions (e.g., binomial, normal distribution).
- Describe the link between probability theory and inferential statistics.
- Identify characteristics of appropriate observations and experiments used in hypothesis testing.
- Compare and contrast concepts of reliability and validity of results.
- Interpret correlation and regression.

1. Use the graph below to answer the question that follows.



Dennis and his brother Alex leave home together to go to school. Dennis starts out running, then walks the rest of the way. Alex starts out walking, but gradually increases his speed and is running when he reaches the school. The graph above correctly represents the progress of Dennis and Alex if:

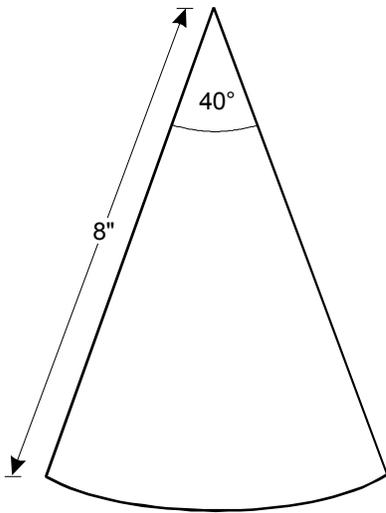
- A. the vertical axis shows their distance from home and the horizontal axis shows the time elapsed since they left home.
- B. the vertical axis shows their distance from school and the horizontal axis shows their speed.
- C. the vertical axis shows their speed and the horizontal axis shows the time remaining before they arrive at school.
- D. the vertical axis shows their speed and the horizontal axis shows the time elapsed since they left home.

2. Software that allows students to create regular tessellations of plane figures would be most appropriate for helping students learn about:
- A. dilations.
 - B. inversions.
 - C. isometries.
 - D. projections.
3. Which of the following inequalities describes the set of all numbers at a distance of 8 units or less from the number 6?
- A. $|x + 6| \leq 8$
 - B. $|x - 6| \leq 8$
 - C. $|x - 8| \leq 6$
 - D. $|x| - 6 \leq 8$
4. Which of the following statements best describes the infinite decimal expansion of $\frac{2}{3}$?
- A. geometric series with a common ratio of $\frac{1}{10}$
 - B. power series with a radius of convergence of $\frac{2}{3}$
 - C. harmonic p -series with $p = 0.6$
 - D. arithmetic series with a common difference of 6

5. A pint of paint covers a surface area of 45 square feet. What is the thickness of the wet paint on the surface (1 pint = 28.9 cubic inches)?

- A. $\frac{28.9}{45}$ inches
- B. $\frac{28.9}{549}$ inches
- C. $\frac{28.9}{6,480}$ inches
- D. $\frac{28.9}{7,7760}$ inches

6. Use the diagram below to answer the question that follows.



By attaching the edges of the circular sector of paper shown above, a right circular cone is formed. What is the lateral surface area of the cone?

- A. $\frac{2}{5}\pi \text{ in.}^2$
- B. $\frac{8}{9}\pi \text{ in.}^2$
- C. $\frac{8}{5}\pi \text{ in.}^2$
- D. $\frac{64}{9}\pi \text{ in.}^2$

7. Use the information below to answer the question that follows.

If R_θ is a clockwise rotation in the plane through an angle θ , and θ is an element of $\{0^\circ, 120^\circ, 240^\circ\}$, then the set, S , of these rotations in the plane has the following properties:

- R_{0° is the identity element.
- If R_α and R_β are two elements in the set, then their composition is in the set.
- For every R_θ there exists an inverse element.
- The composition of rotations obeys the associative law.

The set, S , of these rotations in the plane forms what kind of algebraic structure?

- A. group
- B. field
- C. ring
- D. vector space

8. Use the system of equations below to answer the question that follows.

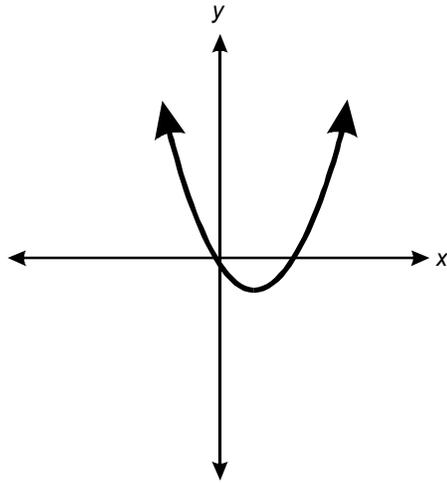
$$\begin{array}{l} 3x + 4y = 5 \\ x = 2y + 6 \end{array}$$

Which of the following matrix equations accurately represents the system of equations above?

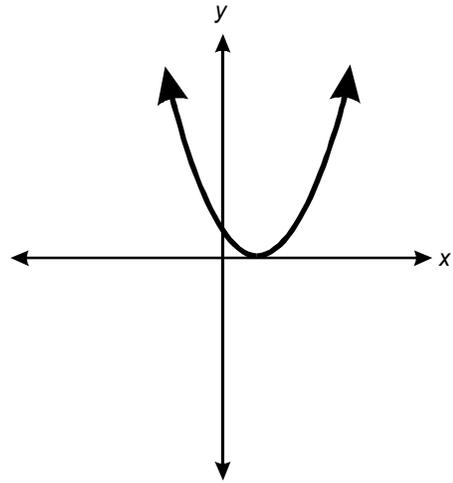
- A. $\begin{bmatrix} x \\ y \end{bmatrix} \begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \end{bmatrix}$
- B. $\begin{bmatrix} 3 & 4 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \end{bmatrix}$
- C. $\begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix} [x \ y] = [5 \ 6]$
- D. $[x \ y] \begin{bmatrix} 3 & 4 \\ 1 & -2 \end{bmatrix} = [5 \ 6]$

9. An equation of the form $ax^2 + bx + c = 0$, where a , b , and c are nonzero real numbers, has distinct complex conjugate solutions. Which of the following could represent the graph of $y = ax^2 + bx + c$?

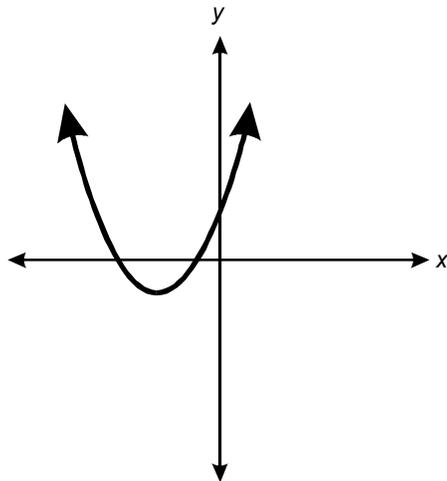
A.



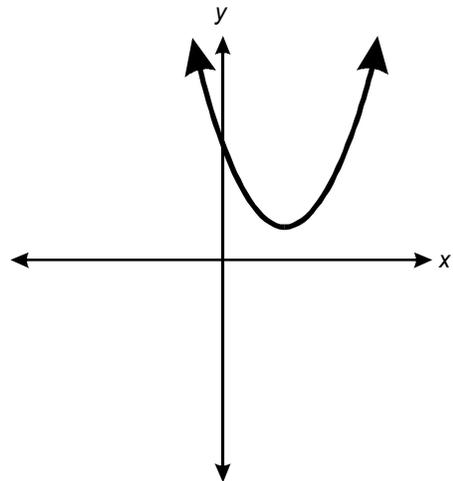
B.



C.



D.



10. Use the function below to answer the question that follows.

$$R(x) = \frac{x^2 - 9}{2x^2 - 5x - 3}$$

A graph of this function has which of the following sets of characteristics?

- A. one vertical asymptote, one horizontal asymptote, and two equal zeroes
 - B. two vertical asymptotes, two horizontal asymptotes, one distinct zero, and a removable discontinuity at $x = 3$
 - C. two vertical asymptotes, one horizontal asymptote, and two distinct zeroes
 - D. one vertical asymptote, one horizontal asymptote, one distinct zero, and a removable discontinuity at $x = 3$
11. How many solutions are there for the system of equations $y = \sin^2 x - \sqrt{2} \sin x - 1$ and $y = x - 3$ on the interval $[0, 2\pi)$?
- A. 1
 - B. 2
 - C. 3
 - D. 4

12. The radius of a spherical balloon is decreasing at the rate of 5 centimeters per second. At what rate is the volume of the balloon decreasing when the diameter of the balloon is 20 cm?

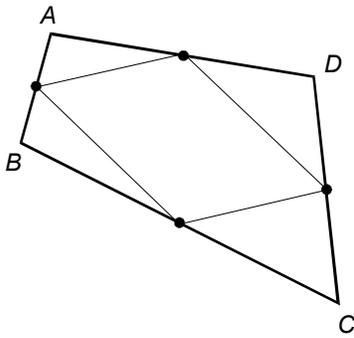
- A. $10,667\pi \text{ cm}^3/\text{s}$
- B. $4,500\pi \text{ cm}^3/\text{s}$
- C. $2,667\pi \text{ cm}^3/\text{s}$
- D. $2,000\pi \text{ cm}^3/\text{s}$

13. What is an appropriate first step in an indirect proof of the following?

ABC is an equilateral triangle with \overline{BD} perpendicular to \overline{AC} at D , and \overline{CE} perpendicular to \overline{AB} at E . Prove that \overline{CE} is congruent to \overline{BD} .

- A. $\triangle ABC$ is scalene.
- B. $\triangle ABC$ not equilateral.
- C. \overline{BD} is not perpendicular to \overline{AC} .
- D. \overline{CE} is not congruent to \overline{BD} .

Use the information below to answer the two questions that follow.

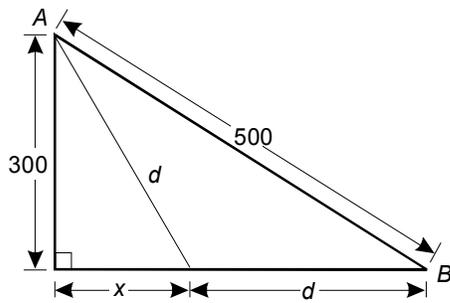


A student is experimenting with a software program that allows the user to draw quadrilateral $ABCD$ with sides of any length, find the midpoint of each side, and connect the midpoints in order to form another quadrilateral. After examining a number of quadrilaterals with sides of different lengths, the student makes the following conjecture:

The quadrilateral formed by connecting in order the midpoints of the sides of a quadrilateral is a parallelogram.

14. Which of the following was most likely used by the student in making this conjecture?
- A. inductive reasoning
 - B. deductive reasoning
 - C. an indirect proof
 - D. a conditional proof
15. If \overline{AC} and \overline{BD} are drawn, which of the following could the student use in demonstrating the validity of this conjecture?
- A. Corresponding parts of congruent triangles are congruent.
 - B. A midsegment of a triangle is parallel to the third side of the triangle.
 - C. Corresponding parts of similar triangles are proportional.
 - D. The diagonals of a parallelogram bisect each other.

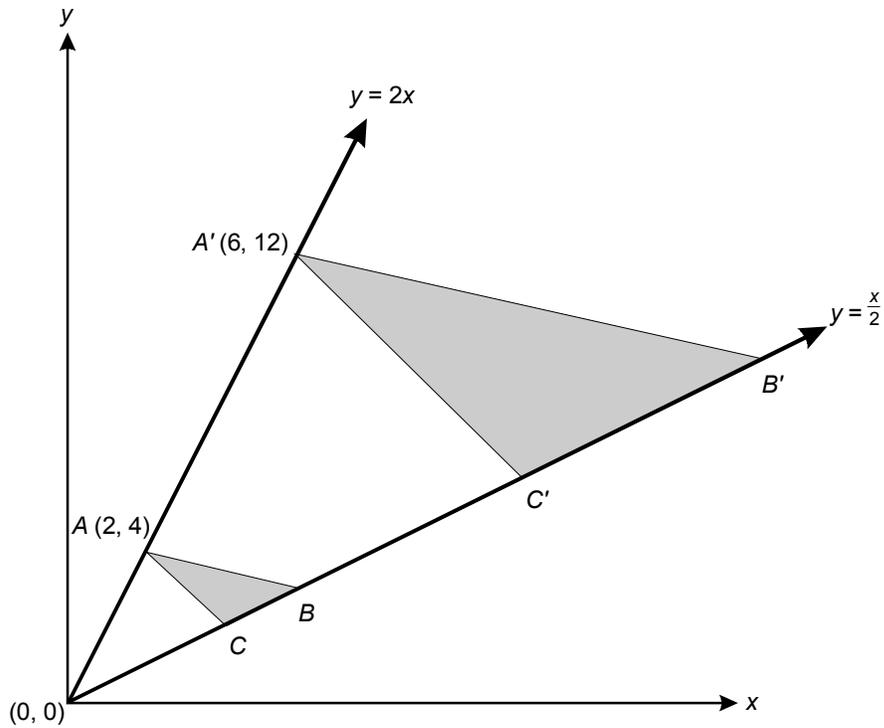
16. Use the diagram below to answer the question that follows.



House A is located 300 feet back from a road, and house B is located along the road, 500 feet from house A . The Department of Public Works wants to install a fire hydrant that is the same distance, d , from each house. Approximately how many feet should the hydrant be from each house?

- A. 308.0
- B. 309.5
- C. 311.0
- D. 312.5

17. Use the diagram below to answer the question that follows.



Triangle ABC is enlarged to triangle $A'B'C'$ by a point projection from the origin of the coordinate plane. What is the ratio of the area of $\triangle ABC$ to the area of $\triangle A'B'C'$?

- A. 1:4
- B. 1:9
- C. 2:3
- D. 4:9

18. If two numbers are selected at random and without replacement from the set $\{3, 5, 7, 11, 13\}$, what is the probability that their product is divisible by 7?

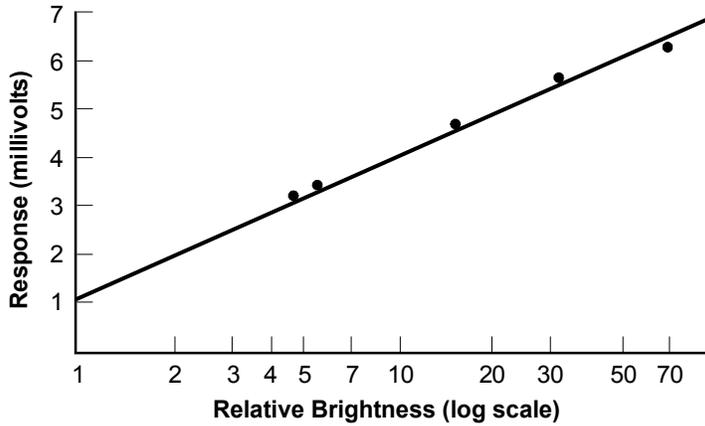
A. $\frac{1}{10}$

B. $\frac{1}{5}$

C. $\frac{2}{5}$

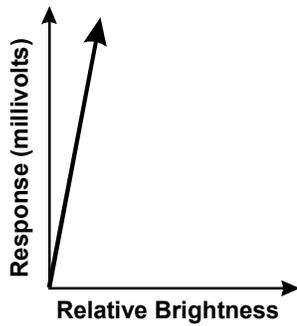
D. $\frac{1}{2}$

19. Use the graph below to answer the question that follows.

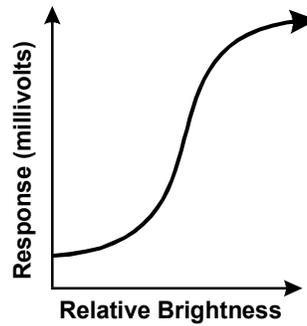


The graph shows the electrical response in an animal's eye, measured in millivolts, to different levels of illumination. When the data are plotted with the relative brightness on a log scale, the linear relationship shown in the graph results. Which of the following graphs could represent the shape of the original data plotted on an unscaled graph?

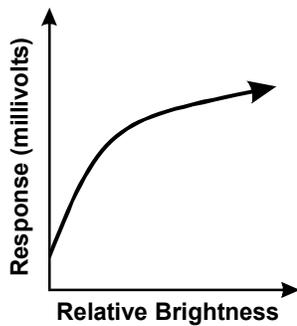
A.



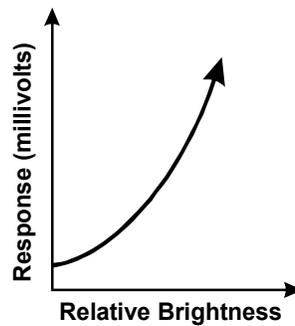
B.



C.



D.



20. A quality control engineer takes a random sample of canned beverages from 25,000 cans. The engineer reports that the mean volume of the liquid in the cans in the population is 15.9 ± 0.8 ounces, with a confidence level of 95%. If the size of the sample is increased and the engineer retains the 95% confidence level, which of the following will occur?
- A. The mean value will decrease.
 - B. The size of the confidence interval will decrease.
 - C. The mean value will increase.
 - D. The size of the confidence interval will increase.

ANSWER KEY

This section contains the answers to the practice test questions in the previous section.

After you have worked through the practice test questions, check the answers given in this section to see which questions you answered correctly.

Question Number	Correct Response	Test Objective
1.	A	Understand how to communicate mathematical content and concepts, and develop and utilize a variety of problem-solving techniques.
2.	C	Understand how to select, integrate, and use appropriate technologies.
3.	B	Understand the concepts of number, number theory, and numeration systems.
4.	A	Understand properties of the real and complex number systems as they apply to algorithms of operations.
5.	C	Understand customary, metric, and nonstandard measurement.
6.	D	Understand procedures for computing or estimating measures of multidimensional objects.
7.	A	Understand concepts, representations, and relationships of variables and patterns.
8.	B	Understand and apply concepts and representations of linear relations and functions.
9.	D	Understand and apply concepts and representations of quadratic relations (including conic sections) and functions.
10.	D	Understand and apply concepts and representations of polynomial, absolute value, radical, and rational functions and inequalities.
11.	A	Understand and apply concepts and representations of exponential, logarithmic, and trigonometric functions.
12.	D	Understand the historical development and applications of calculus.
13.	D	Understand properties of points, lines, planes, and space and their relationship to Euclidean and non-Euclidean geometry.
14.	A	Understand how to apply appropriate reasoning techniques to concepts, procedures, and conjectures, and make connections with and among the various branches of mathematics and other disciplines.
15.	B	Understand properties of two- and three-dimensional shapes.
16.	D	Understand and apply spatial visualization skills.
17.	B	Understand and apply geometric methods to model mathematical concepts and solve real-world problems.
18.	C	Understand counting techniques and the theory of probability.
19.	C	Understand the process of posing questions and collecting, organizing, and representing data to answer those questions.
20.	B	Understand the process of analyzing and interpreting data to make predictions.

OVERVIEW

The score report indicates whether or not you passed the test and how you performed on each test subarea. The passing scores for the Illinois Certification Testing System were established by the Illinois State Board of Education based on recommendations from panels of Illinois educators. The passing score for each content-area test is designed to reflect the level of content knowledge and skills required to perform the job of an educator receiving an initial certificate in Illinois.

Passing Score

To pass a content-area test you must obtain a scaled total test score of 240 or above.

Total Test Score

The total test score is based on your performance on the entire test, specifically the number of multiple-choice questions you answered correctly.

Subarea Scores

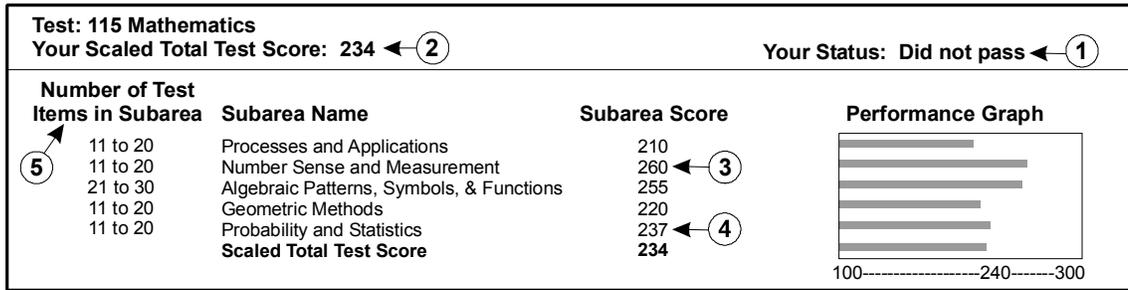
- Subarea scores are presented on the same scale as the total test score.
- Subarea scores contain different numbers of questions and are weighted differently in the computation of the total test score; therefore, the average of the subarea scaled scores generally will not equal the scaled total test score.
- Subarea scores will help you assess your areas of relative strength and weakness.

Reporting of Scores

Your results will be forwarded to the Illinois State Board of Education and to the Illinois institution(s) you indicate during the registration process. You should keep the score report you receive for your own records.

READING YOUR REPORT: A SAMPLE

A sample of a Mathematics test score report is provided below.



According to the above sample, the examinee did not pass the Mathematics test ①, because the examinee's total test score of 234 ② is below the passing score of 240.

The examinee did better on the Number Sense and Measurement section ③ of the test than on the Probability and Statistics section ④. The examinee will need to retake the test and achieve a total test score of 240 or higher to pass the test. The score report indicates the number of items for each subarea on the test ⑤.