ETS® PRAXIS®

The *PRAXIS*® Study Companion

Algebra I (5162)

ETS® Professional Educator PROGRAMS

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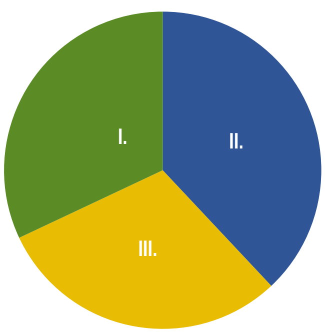
Algebra I (5162)

Test at a Glance

Test Name	Algebra I
Test Code	5162
Time	150 minutes
Number of Questions	60
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices. You can review the possible question types in Understanding Question Types.
Calculator	An on-screen graphing calculator is provided.
Test Delivery	Computer Delivered



Content Categories	Approximate Number of Questions*	Approximate Percentage of Examination
I. Principles of Algebra	23	38%
II. Functions	18	30%
III. Number and Quantity; Probability and Statistics	19	32%

** includes both scored and unscored (pretest) questions. Depending on the number of pretest questions included in each scoring category, the total number of questions in that category may vary from one form of the test to another.*

About The Test

The *Praxis* Algebra I test is designed to assess the mathematical knowledge and competencies necessary for a beginning Algebra I teacher. Examinees have typically completed a bachelor's program with an emphasis in mathematics or mathematics education. The examinee will be required to understand and work with mathematical concepts, to reason mathematically, to make conjectures, to see patterns, to justify statements using informal logical arguments, and to construct simple proofs. Additionally, the examinee will be expected to solve problems by integrating knowledge from different areas of mathematics, to use various representations of concepts, to solve problems that have several solution paths, and to develop mathematical models and use them to solve real-world problems.

The test is not designed to be aligned with any particular school mathematics curriculum, but it is intended to be consistent with the recommendations of national studies on mathematics education, such as the National Council of Teachers of Mathematics (NCTM) and the Council of the Accreditation of Educator Preparation (CAEP) *NCTM CAEP Standards* (2020), and the NCTM *Principles and Standards for School Mathematics* (2000).

This test may contain some questions that will not count toward your score.

On-Screen Graphing Calculator

During the test, test takers have access to an on-screen graphing calculator.

Please consult the Praxis Calculator Use web page for further information and review the directions for using the on-screen calculator.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

Note: The use of "e.g." to start a list of examples implies that only a few examples are offered and the list is not exhaustive, whereas the use of "i.e." to start a list of examples implies that the given list of examples is complete.

Discussion Questions

In this section, discussion questions provide examples of content that may be included in the questions you receive on testing day. They are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. We do **not** provide answers for the discussion questions but thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. They are written to help you gain increased understanding and facility with the test's subject matter. You may want to discuss these questions with a teacher or mentor.

I. Principles of Algebra

A. Understands how to write algebraic expressions in equivalent forms

1. Interprets the parts of an expression (e.g., terms, factors, coefficients)
2. Uses the structure of an expression to identify ways to rewrite it
3. Understands how to rewrite quadratic expressions for specific purposes (e.g., factoring/finding zeros, completing the square/finding maxima or minima)
4. Uses the properties of exponents to rewrite expressions for exponential functions

B. Understands how to perform arithmetic operations on polynomials

1. Adds, subtracts, and multiplies polynomials

C. Understands how to create equations and inequalities that describe relationships

1. Creates equations and inequalities in one variable and uses them to solve problems and graph solutions on the number line
2. Creates equations and inequalities to represent relationships between quantities, solves problems, and graphs them on the coordinate plane with labels and scales
3. Represents constraints by equations, inequalities, or systems of equations and/or inequalities and interprets solutions as viable or nonviable options in a modeling context

4. Rearranges formulas to highlight a quantity of interest (e.g., solve $d = rt$ for t)

D. Understands how to justify the reasoning process used to solve equations

1. Explains each step in solving a simple equation

E. Understands how varied techniques (e.g., graphical, algebraic) are used to solve equations and inequalities

1. Solves linear equations and inequalities, including equations with coefficients represented by letters
2. Uses the method of completing the square to transform any quadratic equation in *x* into the equivalent form $(x - p)^2 = q$
3. Solves equations using a variety of methods (e.g., using graphs, using the quadratic formula, factoring)
4. Uses different methods (e.g., discriminant analysis, graphical analysis) to determine the nature of the solutions of a quadratic equation

F. Understands how varied techniques (e.g., graphical, algebraic) are used to solve systems of equations and inequalities

1. Explains why, when solving a system of two equations using the elimination method, replacing one or both equations with a scalar multiple produces a system with the same solutions as the solutions of the original system
2. Solves a system consisting of two linear equations in two variables algebraically and graphically
3. Solves a system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically
4. Explains why the *x*-coordinates of the intersection points of the graphs of $y = f(x)$ and $y = g(x)$ are the solutions of $f(x) = g(x)$
5. Finds the solutions of $f(x) = g(x)$ approximately (e.g., uses technology to graph the functions, makes tables of values, finds successive approximations); includes cases where $f(x)$ and/or $g(x)$ are linear, quadratic, or exponential functions
6. Graphs the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality) and graphs the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes

G. Understands the concept of rate of change of nonlinear functions

1. Calculates and interprets the average rate of change of a function presented symbolically, numerically, or graphically over a specified interval

H. Understands the concepts of intercept(s) of a line and slope as a rate of change

1. Calculates and interprets the intercepts of a line
2. Calculates and interprets the slope of a line presented symbolically, numerically, or graphically

3. Estimates the rate of change of a linear function from a graph

Discussion Questions: Principles of Algebra

- Can you identify the difference between an equation and an expression?
- Can you use properties of exponents to rewrite exponential expressions?
- Can you rewrite quadratic expressions to find zeros and relative extrema of functions?
- Can you add, subtract, and multiply polynomials?
- Can you factor polynomials?
- Can you recognize, use, and verify polynomial identities?
- Can you use the graph of a quadratic function to identify the types and multiplicities of the zeros of the function?
- Can you find and use zeros to sketch the graph of a function?
- Can you add, subtract, multiply, and divide rational expressions?
- Can you use linear equations or linear inequalities to model real-life problems?
- Can you solve linear equations and linear inequalities algebraically?
- Can you graph the solution of a linear inequality in one variable on the number line and the solution of a linear inequality in two variables on the coordinate plane?
- Can you solve for the variable of interest in a formula?
- Can you identify when extraneous solutions may occur in equations and eliminate those extraneous solutions?
- Can you solve quadratic equations with real solutions and complex solutions?
- Can you solve quadratic equations by factoring or using the quadratic formula?
- Can you use the discriminant to identify the types and multiplicities of the roots of a quadratic equation?
- Can you solve a system consisting of two linear equations in two variables algebraically?
- Can you solve a system consisting of two linear equations in two variables by graphing?
- Can you solve a system consisting of a linear equation and a quadratic equation in two variables algebraically?
- Can you solve a system consisting of a linear equation and a quadratic equation in two variables by graphing?
- Can you graph the solution of a system of inequalities in two variables in the coordinate plane?
- Can you find the intersection(s) of two curves algebraically or using technology?
- Can you calculate the average rate of change for functions?
- Can you calculate and interpret the intercepts and slope of a line?

II. Functions

A. Understands the function concept and the use of function notation

1. Understands that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range
2. Uses function notation, evaluates functions, and interprets statements that use function notation in terms of a context
3. Recognizes that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers
4. Determines the domain and range of a function from a function rule (e.g., $f(x) = 2x + 1$), graph, set of ordered pairs, or table

B. Understands how function behavior is analyzed using different representations (e.g., graphs, mappings, tables)

1. For a function that models a relationship between two quantities, interprets key features of graphs and tables (e.g., increasing/ decreasing, maximum/minimum) in terms of the quantities
2. Given a verbal description of a relation, sketches graphs that show key features of that relation
3. Graphs functions (i.e., linear, quadratic, exponential, piecewise, absolute value, step) expressed symbolically and identifies key features of the graph
4. Writes a function that is defined by an expression in different but equivalent forms to reveal different properties of the function (e.g., zeros, extreme values, symmetry of the graph)
5. Interprets the behavior of exponential functions (e.g., growth, decay)
6. Understands how to determine whether a function is odd, even, or neither, and any resulting symmetries

C. Understands how functions and relations are used to model relationships between quantities

1. Writes a function that relates two quantities
2. Determines an explicit expression or a recursive process that builds a function from a context
3. Writes arithmetic and geometric sequences both recursively and with an explicit formula, and uses them to model situations
4. Translates between recursive and explicit forms of arithmetic and geometric sequences

D. Understands how new functions are obtained from existing functions (e.g., transformations, inverses)

1. Describes how the graph of $g(x)$ is related to the graph of $f(x)$, where $g(x) = f(x) + k$, $g(x) = kf(x)$, $g(x) = f(kx)$, or $g(x) = f(x + k)$ for specific values of k (both positive and negative) and finds the value of k given the graphs
2. Determines whether a function has an inverse and writes an expression for the inverse

3. Combines standard function types using arithmetic operations
4. Performs domain analysis on functions resulting from arithmetic operations

E. Understands differences between linear, quadratic, and exponential models, including how their equations are created and used to solve problems

1. Understands that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals
2. Recognizes situations in which one quantity changes at a constant rate per unit interval relative to another
3. Recognizes situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another
4. Constructs linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two ordered pairs (including reading these from a table)
5. Observes that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function
6. Interprets the parameters in a linear or exponential function in terms of a context (e.g., $A(t) = Pe^{rt}$)
7. Uses quantities that are inversely related to model phenomena

Discussion Questions: Functions

- Can you recognize function notation and understand that for each input, the function produces one and only one output?
- Can you determine whether a relation is a function numerically, algebraically, as a set of ordered pairs, and graphically?
- Can you recognize the domain as the set of valid inputs for a function and the range as the set of resulting outputs, and can you find these for a given function?
- Can you evaluate a function that is given algebraically or graphically?
- Can you find the zeros, extreme values, intervals of increasing or decreasing, and symmetry of a function given a graph, algebraic representation, or verbal description?
- Can you graph linear, quadratic, polynomial, exponential, square root, piecewise, absolute value, and step functions?
- Can you determine whether an exponential function will grow or decay and at what rate?
- Can you determine if a function is even, odd, or neither?
- Can you create a function that models a relationship between two described quantities?
- Can you recognize and define sequences as recursive or explicit functions?
- Can you take one or more functions and create another function using functional operations, function composition, and transformations?

- Can you identify the domain and range of the sum, product, difference, quotient, or composition of two functions?
- Can you find the inverse of a given function?
- Can you determine whether two functions are inverses graphically and analytically?
- Can you determine if two functions, given as sets of ordered pairs, are inverse functions of each other?
- Can you determine the type of function (linear, quadratic, exponential) that best fits a given scenario or situation?
- Can you do problems involving direct, inverse, and other proportional relationships between two or more quantities?

III. Number and Quantity; Probability and Statistics

A. Understands the properties of radicals and exponents

1. Performs operations involving exponents, including negative and rational exponents
2. Demonstrates an understanding of the properties of exponential expressions
3. Uses the properties of radicals and exponents to rewrite expressions that have radicals or rational exponents
4. Represents and compares very large and very small numbers (e.g., scientific notation, orders of magnitude)
5. Uses order of magnitude to estimate very large and very small numbers
6. Performs calculations on numbers in scientific notation

B. Understands the properties of rational and irrational numbers

1. Recognizes that the sum or product of two rational numbers is rational
2. Recognizes that the sum of a rational number and an irrational number is irrational
3. Recognizes that the product of a nonzero rational number and an irrational number is irrational
4. Recognizes that the sum or product of two irrational numbers can be rational or irrational

C. Understands how to reason quantitatively and use units to solve problems

1. Uses units as a way to understand problems and guide the solution of multistep problems
2. Chooses and interprets units consistently in formulas
3. Chooses and interprets the scale and the origin in graphs and data displays
4. Recognizes the reasonableness of results within the context of a given problem
5. Chooses a level of accuracy appropriate to limitations on measurement when reporting quantities

D. Understands how to summarize, represent, and interpret data collected from measurements on a single variable (e.g., boxplots, dotplots, normal distributions)

1. Represents data with plots on the real number line (e.g., dotplots, histograms, and boxplots)
2. Uses statistics appropriate to the shape of the data distribution to compare center (e.g., median, mean) and spread (e.g., interquartile range, standard deviation) of two or more different data sets
3. Interprets differences in shape, center, and spread in the context of the data sets, accounting for possible effects of outliers

E. Understands how to summarize, represent, and interpret data collected from measurements on two variables, either categorical or quantitative (e.g., scatterplots, time series)

1. Summarizes and interprets categorical data for two categories in two-way frequency tables (e.g., joint, marginal, conditional relative frequencies)
2. Recognizes possible associations and trends in the data
3. Represents data for two quantitative variables on a scatterplot, and describes how the variables are related

F. Understands how to create and interpret linear regression models (e.g., rate of change, intercepts, correlation coefficient)

1. Uses technology to fit a function to data (i.e., linear regression) and determines a linear correlation coefficient
2. Uses functions fitted to data to solve problems in the context of the data
3. Assesses the fit of a function by plotting and analyzing residuals
4. Interprets the slope and the intercept of a regression line in the context of the data
5. Interprets a linear correlation coefficient
6. Distinguishes between correlation and causation

G. Understands how to compute probabilities of simple and compound events

1. Calculates probabilities of simple and compound events

Discussion Questions: Number and Quantity; Probability and Statistics

- Can you use the properties of positive, negative, and rational exponents to simplify and rearrange expressions?
- Can you simplify expressions that contain radicals or rational exponents?
- Can you define and use negative exponents?
- Can you apply the order of operations in arithmetic computations?

- Can you identify and represent very small and very large numbers in scientific notation?
- Can you do calculations involving scientific notation?
- Can you identify the result of arithmetic operations on rational and irrational numbers as either rational or irrational?
- Can you compute or identify a ratio or rate?
- Can you use proportional relationships to compute percents?
- Can you convert between units—for example, converting inches to meters?
- Can you solve problems using units to guide the solution?
- Can you solve measurement problems involving time, length, temperature, volume, and mass?
- Can you recognize the reasonableness of results within the context of a problem?
- Can you create graphs such as histograms, line graphs, bar graphs, dotplots, circle graphs, scatterplots, stem-and-leaf plots, and boxplots from a given set of data?
- Can you understand and interpret simple diagrams of data sets presented in various forms, including tables, charts, histograms, line graphs, bar graphs, dotplots, circle graphs, scatterplots, stem-and-leaf plots, timelines, number lines, and boxplots?
- Can you determine measures of center and spread for single-variable data presented in a variety of formats?
- Can you determine the differences between mean, median, and mode, including advantages and disadvantages of each?
- Can you identify possible effects of outliers on the shape, center, and spread of data sets?
- Can you analyze data presented in scatterplots and use this analysis to predict associations or trends between two variables?
- Can you use functions fitted to data to solve problems?
- Can you construct and interpret two-way frequency tables?
- Can you calculate the correlation coefficient between two variables and discuss the possibility of causation, causation by a third event, and coincidence?
- Can you use the correlation coefficient and explain what various values of that number mean?
- Can you calculate probabilities of compound events and understand the idea of independent events?
- Can you compute the probability of a single outcome occurring, one of multiple outcomes occurring, and an outcome occurring given certain conditions?
- Can you use appropriate counting principles to determine probabilities?

Algebra I (5162) Sample Test Questions

Information about Questions That Is Specific to the Algebra I Test

- **General**
  - All numbers used are real numbers.
  - Rectangular coordinate systems are used unless otherwise stated.
  - Figures that accompany questions are intended to provide information that is useful in answering questions.
    - Figures are drawn to scale unless otherwise stated.
    - Lines shown as straight are straight, and angle measures are positive.
    - Positions of points, angles, regions, etc., exist in the order shown.
- **Types of questions that may be on the test**
  - Selected-response questions—select one answer choice
    - These are questions that ask you to select only one answer choice from a list of four choices. In the computer delivered test, these questions are marked with ovals beside the answer choices. See question 1 in the Sample Test Questions.
  - Selected-response questions—select one or more answer choices
    - These are questions that ask you to select one or more answer choices from a list of choices. A question may or may not specify the number of choices to select. In the computer delivered test, these questions are marked with square boxes beside the answer choices, not circles or ovals. See question 3 in the Sample Test Questions.
    - A question of this type will have at least one correct answer choice. For example, if a question of this type has exactly three answer choices, one, two, or three of the choices may be correct.
  - Fraction questions
    - These questions ask you to enter your answer as a fraction in two separate boxes—one box for the numerator and one box for the denominator. Enter integers in each of the two boxes. A negative sign can be entered in either box. Equivalent forms of the correct answer, such as $\frac{1}{2}$ and $\frac{6}{12}$, are all correct, though there may be cases in which you need to simplify your fraction so that it fits in the boxes.

- Numeric-entry questions
  - These questions ask you to enter your answer as an integer or a decimal in a single answer box. Equivalent forms of the correct answer, such as 2.5 and 2.50, are all correct. See question 6 in the Sample Test Questions. Note that in these questions, the exact answer should be entered unless the question asks you to round your answer. Therefore, if one of these questions does not ask you to round your answer, you should be able to enter the exact answer in the numeric-entry box. If you are unable to do so, this may indicate that your answer is incorrect.
- Multiple-numeric-entry questions
  - These questions ask you to enter your answer as an integer or a decimal in two or more answer boxes. Equivalent forms, such as 2.5 and 2.50, of the correct answer in each answer box are all correct. Note that in these questions, the exact answer should be entered unless the question asks you to round your answer.
- Drag-and-drop questions
  - These questions ask you to pair up given phrases or expressions by dragging (with your computer mouse) phrases or expressions from one location and matching them with given phrases or expressions in another location.
- Table grid questions
  - These questions refer to a table in which statements appear in the first column. For each statement, select the correct properties by selecting the appropriate cell(s) in the table.
- Text completion questions
  - These questions ask you to select one or more answer choices to complete one or more sentences. The choices may be located in columns of choices at the end of the question. You will select one answer choice from each column of choices.
- Selected-response questions—select an area
  - These are questions that ask you to select one or more locations on a picture or a figure (e.g., the *xy*-plane).
- Other types of questions
  - New question formats are developed from time to time to find new ways of assessing knowledge. If you see a format you are not familiar with, read the directions of the question carefully. The directions always give clear instructions on how you are expected to respond.

Sample Questions

The sample questions that follow illustrate the kinds of questions in the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: The sample consists of a variety of selected-response questions, where you select one or more answer choices, and questions where you enter a numeric answer in a box.

1. Which of the following is equivalent to the expression $2x^2 + 5x - 3$ for all numbers x?

   (A) $(2x - 3)(x + 1)$

   (B) $(2x - 1)(x + 3)$

   (C) $(2x + 1)(x - 3)$

   (D) $(2x + 3)(x - 1)$

2. In order to raise money for a class trip, students are selling chocolate bars for $3 each and cups of popcorn for $4 each at a basketball game. Their goal is to make at least $400 in revenue during the game. If x represents the number of chocolate bars sold and y represents the number of cups of popcorn sold, which of the following inequalities describes the situation where the students meet their goal?

   (A) $3x + 4y \leq 400$

   (B) $3x + 4y \geq 400$

   (C) $4x + 3y \leq 400$

   (D) $4x + 3y \geq 400$

For the following question, select all the answer choices that apply.

3. If the quadratic equation $x^2 + kx + 1 = 0$, where k is a real number constant, has no real solutions x, which of the following could be true?

   Select **all** that apply.

   (A) $k = -1$

   (B) $k = 0$

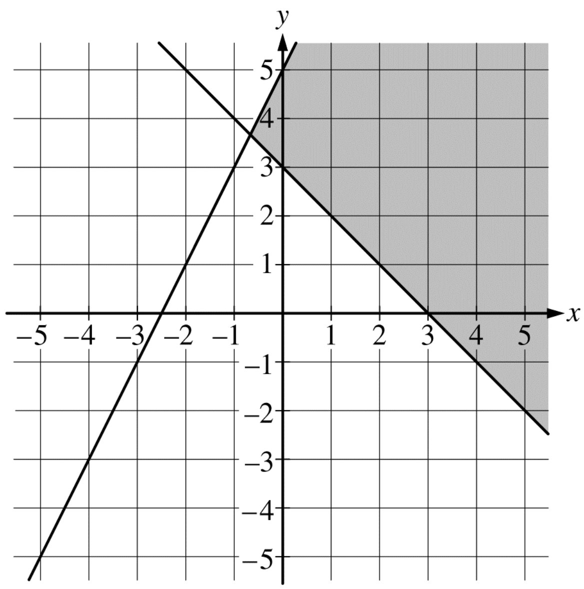
   (C) $k = 1$

   (D) $k = 2$

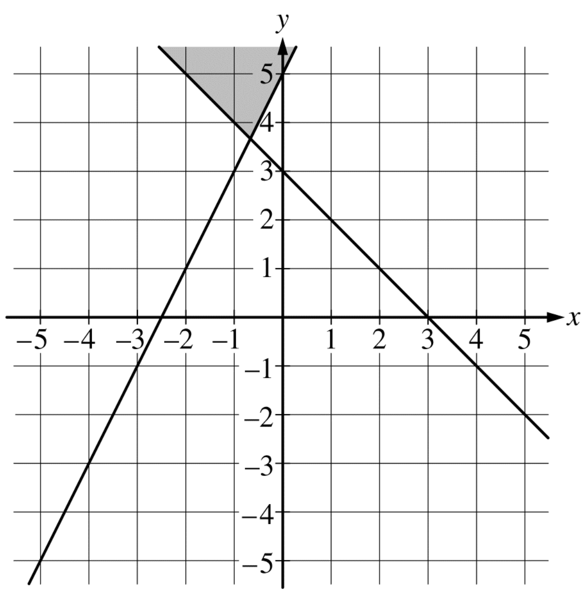
   (E) $k = 3$

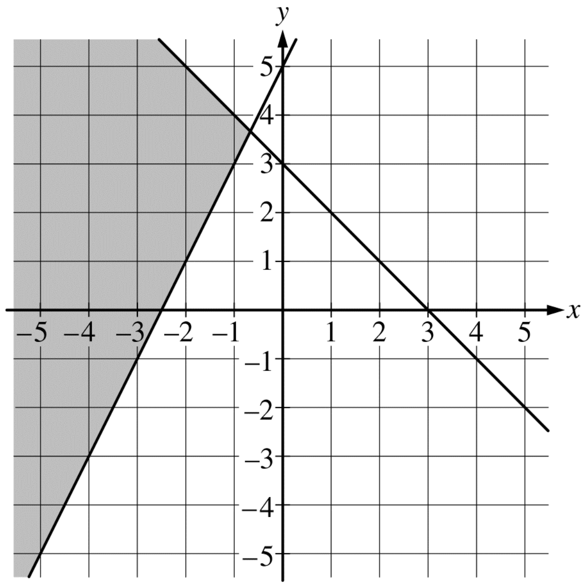
4. In which of the following *xy*-planes does the shaded region represent the solution set to the system of inequalities $y \le 2x + 5$ and $y \ge -x + 3$?

(A)

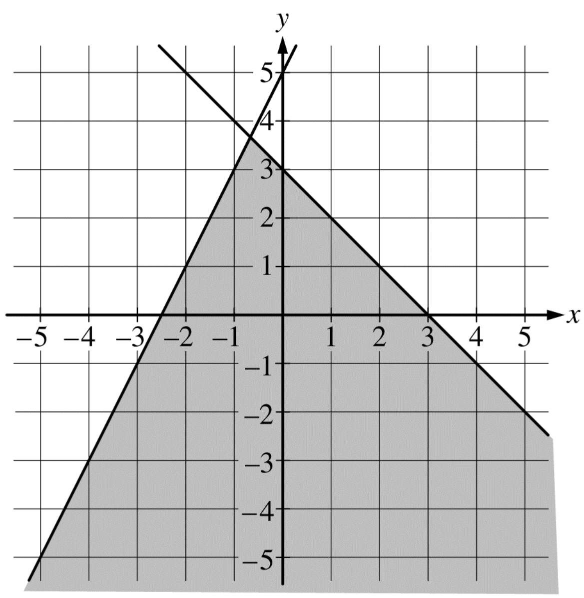


(B)





(C)



(D)

5. The graph of the equation $-6x + 8y = 24$ intersects

   (A) the x-axis at $(-3,0)$ and the y-axis at $(0,4)$

   (B) the x-axis at $(3,0)$ and the y-axis at $(0,-4)$

   (C) the x-axis at $(-4,0)$ and the y-axis at $(0,3)$

   (D) the x-axis at $(4,0)$ and the y-axis at $(0,-3)$

For the following question, enter your answer in the answer box.

$$f(x) = 0.2x + 34.5$$

6. The function above models the top speed f, in miles per hour, of various roller coasters at certain amusement parks in terms of the roller coaster's largest drop x, in feet. According to the model, if the largest drop for a roller coaster is 170 feet, what is the top speed, in miles per hour, of the roller coaster?

   [ ] miles per hour

$$d(t) = -4.9t^2 + v_0 t + d_0$$

7. The function shown relates the height d, in meters, of a ball thrown upward with an initial velocity v_0 and an initial height d_0 to the time t, in seconds, after it is thrown. What is the maximum height, to the nearest meter, reached by a ball thrown upward at an initial velocity of 20 meters per second from a height of 15 meters?

   (A) 20

   (B) 32

   (C) 35

   (D) 76

Hours	Population
0	100
1	250
2	625

8. A biologist is studying the growth rate of bacteria in a sample. The table above shows the number of bacteria at 1-hour intervals. The biologist determines that a recursive sequence model of the population is $p_0 = 100$ and $p_n = 2.5p_{n-1}$ for all integers $n \geq 1$, where p_n is the population after n hours. Which of the following equations is an explicit sequence model of the population of bacteria in the sample?

   (A) $p_n = 150n + 100$

   (B) $p_n = 100(2.5)^n$

   (C) $p_n = 100(2.5n)$

   (D) $p_n = 2.5(100)^n$

$$f(x) = 3x + 7,\ g(x) = \frac{1}{3x+7},\ h(x) = \frac{x}{3} - 7,\ k(x) = \frac{x-7}{3}$$

9. Functions *f*, *g*, *h*, and *k* are defined as shown for all real numbers *x*. Which of the following is the inverse function of function *f*?

   (A) f

   (B) g

   (C) h

   (D) k

For the following question, select all the answer choices that apply.

10. Which of the following situations can be modeled with a linear function?

Select **all** that apply.

(A) The amount of money in a savings account at the end of each year in terms of the number of years after 2016, when the amount of money in the account at the end of each year increases by 3 percent

(B) The number of books in a library at the end of each month in terms of the number of months after January 2016, when the number of books in the library increases by 30 every month

(C) The total charged by a mechanic in terms of the number of hours worked, when the mechanic charges a starting fee of \$50 plus \$90 for each hour worked

11. Which of the following is equivalent to $\dfrac{\left(\sqrt{x}\right)\left(x^{3}\right)}{\left(x^{-\frac{3}{2}}\right)\left(x^{-2}\right)}$ for all positive numbers x ?

(A) 1

(B) x^3

(C) x^5

(D) x^7

For the following question, select all the answer choices that apply.

12. Which of the following are irrational numbers?

Select **all** that apply.

(A) $\left(3-\sqrt{2}\right)+\left(5+\sqrt{2}\right)$

(B) $\frac{\pi}{2}+\left(\frac{-\pi}{2}\right)$

(C) $e^2+\frac{2}{3}$

(D) $\frac{4}{5}+\left(2+\sqrt{9}\right)$

(E) $\left(8-\sqrt{7}\right)+\frac{7}{8}$

13. A distance of $1\frac{1}{3}$ inches on a city map represents an actual distance of $1\frac{3}{5}$ miles. What is the actual distance, in miles, represented by a distance of 1 inch on the map?

(A) $1\frac{1}{8}$

(B) $1\frac{1}{6}$

(C) $1\frac{1}{5}$

(D) $1\frac{1}{4}$

14. Ms. Butler surveyed her class of students to see how many minutes they studied the night before a quiz. She created a scatterplot of the data, plotting the minutes each student studied on the *x*-axis and the students' grades on the quiz on the *y*-axis. The teacher found that the correlation coefficient between the two variables is 0.85. Which of the following is a correct interpretation of the correlation coefficient?

    (A) There is evidence that 85% of the students who studied for the quiz passed the quiz.

    (B) There is evidence that for every minute a student studied for the quiz, the student's grade on the quiz increased by 0.85 points.

    (C) There is evidence of a strong positive linear relationship between grades on the quiz and the time studied the night before.

    (D) There is evidence that a high grade on a quiz is caused by an increase in the time studied for the quiz the night before.

15. A company party is attended by 16 male and 9 female employees. Two door prizes are to be awarded by 2 random selections from those in attendance. No one can win both prizes. What is the probability that both winners will be females?

    (A) $\frac{2}{5}$

    (B) $\frac{3}{25}$

    (C) $\frac{8}{125}$

    (D) $\frac{81}{625}$

Answers

1. Option (B) is correct.

$$\begin{aligned} 2x^2+5x-3 &= 2x^2+6x-x-3 \\ &= 2x(x+3)-(x+3) \\ &= (2x-1)(x+3) \end{aligned}$$

Alternative Solution: The correct answer is (B). Consider each choice.

(A): $(2x-3)(x+1)=2x^2+2x-3x-3=2x^2-x-3$

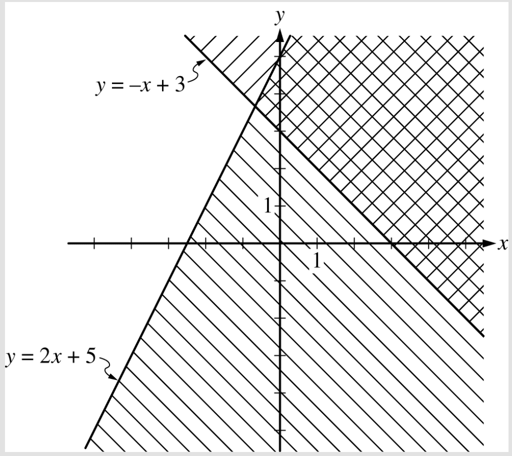
(B): $(2x-1)(x+3)=2x^2+6x-x-3=2x^2+5x-3$

(C): $(2x+1)(x-3)=2x^2-6x+x-3=2x^2-5x-3$

(D): $(2x+3)(x-1)=2x^2-2x+3x-3=2x^2+x-3$

2. Option (B) is correct. The revenue from the sale of chocolate bars is 3 dollars times the number of chocolate bars sold (which is x), or $3x$ dollars. The revenue from the sale of popcorn is 4 dollars times the number of cups of popcorn sold (which is *y*), or $4y$ dollars. So, the total revenue is $3x+4y$ dollars. Since the students must sell enough chocolate bars and cups of popcorn to make the total revenue at least 400 dollars, it follows that $3x+4y \geq 400$.

3. Options (A), (B), and (C) are correct. A general quadratic equation $ax^2+bx+c=0$, where $a \neq 0$ and a, b, and c are real number constants, has no real solutions if and only if the discriminant b^2-4ac is negative. The discriminant of the quadratic polynomial x^2+kx+1 is $k^2-4(1)(1)$, or k^2-4. So, $k^2-4<0$, which is equivalent to $-2<k<2$. The only values of *k* in the options that satisfy the inequalities $-2<k<2$ are −1, 0, and 1.



4. Option (A) is correct. The solution set of inequality $y \le 2x + 5$ consists of all the points in the *xy*-plane that are on or below the line $y = 2x + 5$. The solution set of inequality $y \ge -x + 3$ consists of all the points in the *xy*-plane that are on or above the line $y = -x + 3$. So, the solution set of the system of inequalities $y \le 2x + 5$ and $y \ge -x + 3$ consists of all the points in the *xy*-plane that are on or below the graph of $y = 2x + 5$ <u>and</u> on or above the graph of $y = -x + 3$ (see the cross-hatched area in the figure above).

5. Option (C) is correct. To find the *x*-coordinate of the point where the line with equation $-6x+8y=24$ intersects the *x*-axis, set $y=0$ in the equation $-6x+8y=24$ and solve for *x*.

$$\begin{gathered}-6x+8y=24\\ -6x+8(0)=24\\ -6x=24\\ x=-4\end{gathered}$$

To find the *y*-coordinate of the point where the line with equation $-6x+8y=24$ intersects the *y*-axis, set $x = 0$ in the equation $-6x+8y=24$ and solve for *y*.

$$\begin{gathered}-6x+8y=24\\ -6(0)+8y=24\\ 8y=24\\ y=3\end{gathered}$$

First alternative solution: The correct answer is (C). slope-intercept form of the equation $-6x+8y=24$ is $y=\frac{3}{4}x+3$, where the slope is $\frac{3}{4}$ and the *y*-intercept is 3. Only option (C) contains the correct *y*-intercept value.

Second alternative solution: The correct answer is (C). You can plug the coordinates of the points given in the options to see which points satisfy the equation. Only option (C) contains two points that satisfy the equation.

6. The correct answer is 68.5 miles per hour. The function $f(x)=0.2x+34.5$ models the top speed of a roller coaster, in miles per hour, where *x* is the largest drop, in feet. So, if the largest drop is 170 feet, the top speed would be $f(170)$, which equals $0.2(170)+34.5$, or 68.5 miles per hour.

7. Option (C) is correct. Recall that the vertex of the parabola with equation $y = ax^2 + bx + c$ has *x*-coordinate $-\frac{b}{2a}$. Since the ball is thrown upward with an initial velocity of 20 meters per second from a height of 15 meters, the height of the ball at time *t* seconds is $d(t) = -4.9t^2 + 20t + 15$. The maximum height is obtained when $t = -\frac{20}{2(-4.9)}$, or approximately $t = 2.04$. Since $d(2.04) = 35.40816$, the maximum height is approximately 35.4 meters.

   Alternative solution: The correct answer is (C). Recall that when the equation of a parabola in the *xy*-plane is written in the standard form $y = a(x-h)^2 + k$, the coordinates of the vertex of the parabola are (h,k). To find the maximum height, use the completing-the-square method to write $d(t) = -4.9t^2 + 20t + 15$ in the form $d(t) = a(t-h)^2 + k$, as shown below.

$$\begin{aligned} d(t) &= -4.9t^2 + 20t + 15 \\ &= -4.9\left(t^2 - 2\cdot\frac{10}{4.9}\cdot t\right) + 15 \\ &= -4.9\left(t^2 - 2\cdot\frac{10}{4.9}\cdot t + \left(\frac{10}{4.9}\right)^2\right) + 15 + 4.9\left(\frac{10}{4.9}\right)^2 \\ &= -4.9\left(t - \frac{10}{4.9}\right)^2 + 15 + \frac{100}{4.9} \end{aligned}$$

   The graph of the function *d* is a parabola that opens downward and that has a vertex at the point with coordinates $(h,k) = \left(\frac{10}{4.9}, 15 + \frac{100}{4.9}\right)$. So, the maximum height is reached at time $t = h = \frac{10}{4.9}$ seconds, or approximately $t = 2.04$ seconds. The maximum height is $d\left(\frac{10}{4.9}\right) = k = 15 + \frac{100}{4.9}$ meters, or approximately 35.4 meters.

8. Option (B) is correct.

$$\begin{aligned}
p_0 &= 100 = 100(2.5)^0 \\
p_1 &= 2.5p_0 = 2.5 \times 100(2.5)^0 = 100(2.5)^1 \\
p_2 &= 2.5p_1 = 2.5 \times 100(2.5)^1 = 100(2.5)^2 \\
p_3 &= 2.5p_2 = 2.5 \times 100(2.5)^2 = 100(2.5)^3 \\
p_4 &= 2.5p_3 = 2.5 \times 100(2.5)^3 = 100(2.5)^4 \\
&\vdots
\end{aligned}$$

So, in general, the population after *n* hours is $p_n = 100(2.5)^n$.

9. Option (D) is correct. Recall that if (a,b) is contained in the graph of a function, then if (b,a) is contained in the graph of the inverse function. Therefore, to find the inverse function of function *f* is to replace *x* with *y* and *y* with *x*, which gives you $x = 3y + 7$, and then to solve the new equation for *y*, as shown below.

$$\begin{aligned}
x &= 3y + 7 \\
3y &= x - 7 \\
y &= \frac{x-7}{3}
\end{aligned}$$

Therefore, $y = \frac{x-7}{3}$ is the inverse function of $y = 3x + 7$.

10. Options (B) and (C) are correct. Consider each choice.

Choice (A): The amount of money in the savings account increases each year by 3 percent, so the actual increase each year is not the same dollar amount. For example, if the balance in the account in 2016 was $10,000, the balance in 1 year would increase by $(0.03)(\$10{,}000)$, or $300, and the increase a year later would be $(0.03)(\$10{,}300)$, or $309. So, this situation cannot be modeled with a linear function.

Choice (B): The number of books in the library increases by 30 each month. If, for example, the initial number of books on January 2016 was *n*, and if *y* is the number of books after *x* months, then $y = 30x + n$, which is a linear function.

Choice (C): The total amount the mechanic charges increases by $90 for each hour worked, after an initial fee of $50. So, if *y* equals the mechanic's total charge, in dollars, for *x* hours of work, then $y = 90x + 50$, which is a linear function.

11. Option (D) is correct.

$$\begin{aligned}\frac{\left(\sqrt{x}\right)\left(x^3\right)}{\left(x^{-\frac{3}{2}}\right)\left(x^{-2}\right)} &= \frac{x^{\frac{1}{2}+3}}{x^{-\frac{3}{2}-2}} \\ &= \frac{x^{\frac{7}{2}}}{x^{-\frac{7}{2}}} \\ &= x^{\frac{7}{2}} \times x^{\frac{7}{2}} \\ &= x^{\frac{7}{2}+\frac{7}{2}} \\ &= x^7\end{aligned}$$

12. Options (C) and (E) are correct. Consider each choice.

Choice (A): $\left(3-\sqrt{2}\right)+\left(5+\sqrt{2}\right)=3-\sqrt{2}+5+\sqrt{2}=8$, which is a rational number.

Choice (B): $\frac{\pi}{2}+\frac{-\pi}{2}=\frac{\pi-\pi}{2}=\frac{0}{2}=0$, which is a rational number.

Choice (C): $e^2+\frac{2}{3}$, which is the sum of an irrational number and a rational number; therefore, the sum is an irrational number.

Choice (D): $\frac{4}{5}+\left(2+\sqrt{9}\right)=\frac{4}{5}+\left(2+3\right)=\frac{4}{5}+5=5.8$, which is a rational number.

Choice (E): $\left(8-\sqrt{7}\right)+\frac{7}{8}=\left(8+\frac{7}{8}\right)-\sqrt{7}=8.875-\sqrt{7}$, which is the difference between a rational number and an irrational number; therefore, the difference is an irrational number.

13. Option (C) is correct. The ratio between the distance, in inches, on the map and the actual distance, in miles, is $\dfrac{1\frac{1}{3}}{1\frac{3}{5}}$, which equals $\dfrac{\frac{4}{3}}{\frac{8}{5}} = \dfrac{4}{3} \times \dfrac{5}{8} = \dfrac{20}{24} = \dfrac{5}{6}$. So, every 5 inches on the map corresponds to 6 actual miles, which means that 1 inch on the map corresponds to $6 \div 5$, or $1\frac{1}{5}$, actual miles.

    Alternative solution: Create a proportion relating miles to inches, as shown below, and then solve for *x*.

$$\frac{x \text{ miles}}{1 \text{ inch}} = \frac{1\frac{3}{5} \text{ miles}}{1\frac{1}{3} \text{ inches}}$$

14. Option (C) is correct. It is given that the correlation between number of minutes of study and grades on a quiz is 0.85. There is no evidence that 85% of the students who studied for the quiz passed it. Since we do not actually have the linear regression line to analyze, we do not know what increase in a student's grade corresponds to the number of minutes of study time. And a correlation between any two variables does <u>not</u> in itself indicate that one variable <u>causes</u> change in the other, or vice versa. However, the correlation of 0.85 does indicate a strong positive linear relationship between grades on the quiz and the amount of time studying for the quiz.

15. Option (B) is correct. There are 16 male and 9 female employees at the party. Two random selections are to be made from those in attendance. The probability that the first selection will be a female is $\frac{9}{16+9}$, or $\frac{9}{25}$. And since no one can win both prizes, the probability that the second drawing will be a female is 8, the number of females who were not chosen on the first selection, divided by 24, the number of attendees who were not chosen on the first selection. So, the probability that both prizes will be won by females is $\left(\frac{9}{25}\right)\left(\frac{8}{24}\right)$, or $\frac{3}{25}$.

Alternative solution: The probability is the number of combinations of 2 females chosen from 9 females divided by the number of combinations of 2 people chosen from 25 people. The number of combinations of 2 females chosen from 9 females is “9 choose 2,” or equivalently $\binom{9}{2}=\frac{9\cdot 8}{2}=36$. The number of combinations of 2 people chosen from 25 people is “25 choose 2,” or equivalently $\binom{25}{2}=\frac{25\cdot 24}{2}=300$. So, the probability is

$$\frac{\binom{9}{2}}{\binom{25}{2}}=\frac{36}{300}=\frac{3}{25}.$$

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions, you respond by selecting an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Review a few sample essay topics:

- *Brown v. Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

  A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?

  B. What was the rationale given by the justices for their 1954 ruling?

- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*

  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- *"Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people because they need a job."*

  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep these things in mind when you respond to a constructed-response question:

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
5. **Take notes on scratch paper** so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.

Reread your response. Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

General Assistance For The Test

Praxis® Interactive Practice Test

This full-length *Praxis*® practice test lets you practice answering one set of authentic test questions in an environment that simulates the computer-delivered test.

- Timed just like the real test
- Correct answers with detailed explanations
- Practice test results for each content category

ETS provides a free interactive practice test with each test registration. You can learn more here.

Doing Your Best

Strategy and Success Tips

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Learn from the experts. Get practical tips to help you navigate your Praxis test and make the best use of your time. Learn more at Strategy and Tips for Taking a *Praxis* Test.

Develop Your Study Plan

Planning your study time is important to help ensure that you review all content areas covered on the test. View a sample plan and learn how to create your own. Learn more at Develop a Study Plan.

Helpful Links

Ready to Register – How to register and the information you need to know to do so.

Disability Accommodations – Testing accommodations are available for test takers who meet ETS requirements.

PLNE Accommodations (ESL) – If English is not your primary language, you may be eligible for extended testing time.

What To Expect on Test Day – Knowing what to expect on test day can make you feel more at ease.

Getting Your Scores – Find out where and when you will receive your test scores.

State Requirements – Learn which tests your state requires you to take.

Other Praxis Tests – Learn about other *Praxis* tests and how to prepare for them.

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