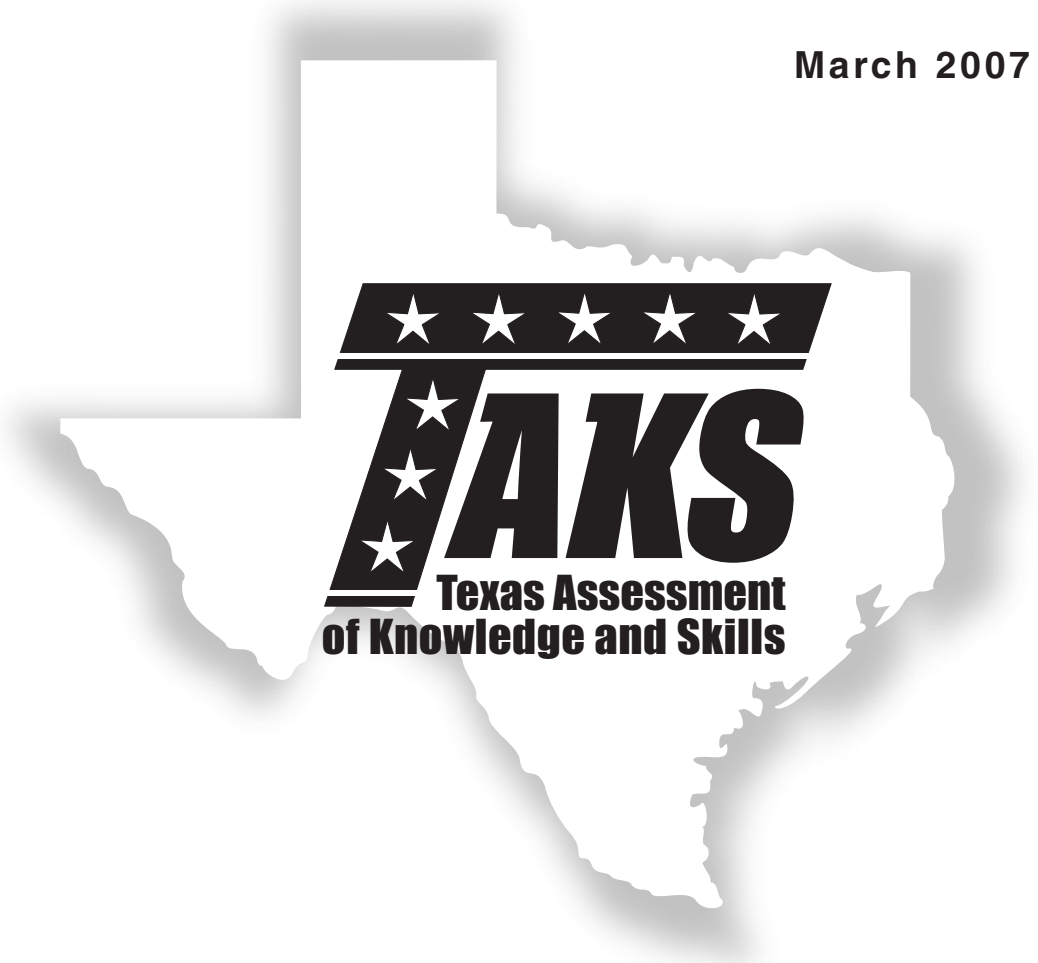
March 2007



Information Booklet

MATHEMATICS

Grade 10

Revised based on TEKS Refinements

Texas Education Agency • Student Assessment Division

INTRODUCTION

The Texas Assessment of Knowledge and Skills (TAKS) is a completely reconceived testing program. It assesses more of the Texas Essential Knowledge and Skills (TEKS) than the Texas Assessment of Academic Skills (TAAS) did and asks questions in more authentic ways. TAKS has been developed to better reflect good instructional practice and more accurately measure student learning. We hope that every teacher will see the connection between what we test on this state assessment and what our students should know and be able to do to be academically successful. To provide you with a better understanding of TAKS and its connection to the TEKS and to classroom teaching, the Texas Education Agency (TEA) has developed this newly revised version of the TAKS information booklet based on the TEKS refinements. The information booklets were originally published in January 2002, before the first TAKS field test. After several years of field tests and live administrations, the information booklets were revised in August 2004 to provide an even more comprehensive picture of the testing program. Since that time the TEKS for secondary mathematics have been refined. These TEKS refinements were approved by the State Board of Education in February 2005. In December 2005, the Student Assessment Division produced an online survey to obtain input as to whether the new TEKS content should be eligible for assessment on TAKS mathematics tests at grades 6–10 and exit level. The results of the survey from 1,487 groups composed of 17,221 individuals were compiled and analyzed. Then the TEA math team from the Curriculum and Student Assessment Divisions, with input from educational service center math specialists, used the survey data to guide decisions on what new content should be assessed on the secondary TAKS math tests. This new content, as well as the original content, can be found in this newly revised information booklet. We hope this revised version of the TAKS information booklet will serve as a user-friendly resource to help you understand that the best preparation for TAKS is a coherent, TEKS-based instructional program that provides the level of support necessary for all students to reach their academic potential.

BACKGROUND INFORMATION

The development of the TAKS program included extensive public scrutiny and input from Texas teachers, administrators, parents, members of the business community, professional education organizations, faculty and staff at Texas colleges and universities, and national content-area experts. The agency involved as many stakeholders as possible because we believed that the development of TAKS was a responsibility that had to be shared if this assessment was to be an equitable and accurate measure of learning for all Texas public school students.

The three-year test-development process, which began in summer 1999, included a series of carefully conceived activities. First, committees of Texas educators identified those TEKS student expectations for each grade and subject area assessed that should be tested on a statewide assessment. Then a committee of TEA Student Assessment and Curriculum staff incorporated these selected TEKS student expectations, along with draft objectives for each subject area, into exit level surveys. These surveys were sent to Texas educators at the middle school and secondary levels for their review. Based on input we received from more than 27,000 survey responses, we developed a second draft of the objectives and TEKS student expectations. In addition, we used this input during the development of draft objectives and student expectations for grades 3 through 10 to ensure that the TAKS program, like the TEKS curriculum, would be vertically aligned. This vertical alignment was a critical step in ensuring that the TAKS tests would become more rigorous as students moved from grade to grade.

For example, the fifth grade tests would be more rigorous than the fourth grade tests, which would be more rigorous than the third grade tests. Texas educators felt that this increase in rigor from grade to grade was both appropriate and logical since each subject-area test was closely aligned to the TEKS curriculum at that grade level.

In fall 2000 TEA distributed the second draft of the objectives and TEKS student expectations for eleventh grade exit level and the first draft of the objectives and student expectations for grades 3 through 10 for review at the campus level. These documents were also posted on the Student Assessment Division's website to encourage input from the public. Each draft document focused on two central issues: first, whether the objectives included in the draft were essential to measure on a statewide assessment; and, second, whether students would have received enough instruction on the TEKS student expectations included under each objective to be adequately prepared to demonstrate mastery of that objective in the spring of the school year. We received more than 57,000 campus-consensus survey responses. We used these responses, along with feedback from national experts, to finalize the TAKS objectives and student expectations. Because the state assessment was necessarily limited to a "snapshot" of student performance, broad-based input was important to ensure that TAKS assessed the parts of the TEKS curriculum most critical to students' academic learning and progress.

In the thorough test-development process that we use for the TAKS program, we rely on educator input to develop items that are appropriate and valid measures of the objectives and TEKS student expectations the items are designed to assess. This input includes an annual educator review and revision of all proposed test items before field-testing and a second annual educator review of data and items after field-testing. In addition, each year panels of recognized experts in the fields of English language arts (ELA), mathematics, science, and social studies meet in Austin to critically review the content of each of the high school level TAKS assessments to be administered that year. This critical review is referred to as a content validation review and is one of the final activities in a series of quality-control steps designed to ensure that each high school test is of the highest quality possible. A content validation review is considered necessary at the high school grades (9, 10, and exit level) because of the advanced level of content being assessed.

ORGANIZATION OF THE TAKS TESTS

TAKS is divided into test objectives. It is important to remember that the objective statements are not found in the TEKS curriculum. Rather, the objectives are "umbrella statements" that serve as headings under which student expectations from the TEKS can be meaningfully grouped. Objectives are broad statements that "break up" knowledge and skills to be tested into meaningful subsets around which a test can be organized into reporting units. These reporting units help campuses, districts, parents, and the general public understand the performance of our students and schools. Test objectives are not intended to be "translations" or "rewordings" of the TEKS. Instead, the objectives are designed to be identical across grade levels rather than grade specific. Generally, the objectives are the same for third grade through eighth grade (an elementary/middle school system) and for ninth grade through exit level (a high school system). In addition, certain TEKS student expectations may logically be grouped under more than one test objective; however, it is important for you to understand that this is not meaningless repetition—sometimes the organization of the objectives requires such groupings. For example, on the TAKS writing tests for fourth and seventh grades, some of the same student expectations addressing the conventions of standard English usage are listed

under both Objective 2 and Objective 6. In this case, the expectations listed under Objective 2 are assessed through the overall strength of a student's use of language conventions on the written composition portion of the test; these same expectations under Objective 6 are assessed through multiple-choice items attached to a series of revising and editing passages.

ORGANIZATION OF THE INFORMATION BOOKLETS

The purpose of the information booklets is to help Texas educators, students, parents, and other stakeholders understand more about the TAKS tests. These booklets are not intended to replace the teaching of the TEKS curriculum, provide the basis for the isolated teaching of skills in the form of narrow test preparation, or serve as the single information source about every aspect of the TAKS program. However, we believe that the booklets provide helpful explanations as well as show enough sample items, reading and writing selections, and prompts to give educators a good sense of the assessment.

Each grade within a subject area is presented as a separate booklet. However, it is still important that teachers review the information booklets for the grades both above and below the grade they teach. For example, eighth grade mathematics teachers who review the seventh grade information booklet as well as the ninth grade information booklet are able to develop a broader perspective of the mathematics assessment than if they study only the eighth grade information booklet.

The information booklets for each subject area contain some information unique to that subject. For example, the mathematics chart that students use on TAKS is included for each grade at which mathematics is assessed. However, all booklets include the following information, which we consider critical for every subject-area TAKS test:

- an overview of the subject within the context of TAKS
- a blueprint of the test—the number of items under each objective and the number of items on the test as a whole
- information that clarifies how to read the TEKS
- the reasons each objective and its TEKS student expectations are critical to student learning and success
- the objectives and TEKS student expectations that are included on TAKS
- additional information about each objective that helps educators understand how it is assessed on TAKS
- sample items that show some of the ways objectives are assessed

TAKS MATHEMATICS
INFORMATION BOOKLET
GENERAL INTRODUCTION

Learning mathematics is essential to finding answers to real-life questions. The study of mathematics helps students think logically, solve problems, and understand spatial relationships. The concepts learned in mathematics courses help students communicate clearly and use logical reasoning to make sense of their world. TEKS instruction in mathematics throughout elementary, middle, and high school will build the foundation necessary for students to succeed in advanced math and science courses and later in their careers.

The mathematics concepts of algebra and geometry are important for life outside the classroom. The six strands identified in the mathematics curriculum for kindergarten through eighth grade contain the foundation skills necessary for high school mathematics courses. In third through eighth grade, the six TAKS assessment objectives are closely aligned with the six strands identified in the TEKS curriculum. For example, in third through eighth grade mathematics Objective 1, students are to "demonstrate an understanding of numbers, operations, and quantitative reasoning"; in the TEKS curriculum the first strand identified is "number, operation, and quantitative reasoning." In ninth, tenth, and eleventh grades, students take specific math courses, including Algebra I and Geometry, rather than grade-level math courses. For the TAKS high school mathematics assessments, there are ten objectives. At these grade levels, Objectives 1–5 contain student expectations from the Algebra I curriculum. Objectives 6–8 are composed of knowledge and skills from the geometry and measurement strands of the curriculum. Objective 9 consists of percents, proportional relationships, probability, and statistics. The final objective, Objective 10, pertains to students' understanding of mathematical processes. For the ninth, tenth, and eleventh grades in TAKS mathematics Objective 1, students are asked to "describe functional relationships in a variety of ways"; in the TEKS curriculum the first strand of Algebra I is identified as "foundations for functions." This close alignment reflects the important link between TAKS and the TEKS curriculum. In fact, the TAKS mathematics tests are based on those TEKS student expectations Texas educators have identified as the most critical to student achievement and progress in mathematics.

Because the high school TEKS are based on courses and because there is no state-mandated course sequence, some of the high school TAKS mathematics objectives contain student expectations from eighth grade. This was done so that students would have an opportunity to learn the concepts before being tested on them. For example, no student expectations from the Geometry curriculum are included in the TAKS objectives until the exit level test because it is not certain that every Texas student would be exposed to these concepts before the eleventh grade. For the ninth and tenth grade assessments, only those eighth grade student expectations that closely align with the Geometry TEKS will be tested. Close inspection should reveal a natural progression as students advance from the eighth grade to the exit level assessment.

The TEKS were developed to provide educators with instructional goals at each grade level. Although some student expectations are not tested, they are nonetheless critical for student understanding and must be included in classroom instruction. For each strand of learning, the mathematics TEKS provide more rigorous expectations as students master skills and progress through the curriculum. It is important for educators to vertically align their instructional programs to reinforce the unifying strands of learning each year through grade-level-appropriate instruction. To understand how student learning progresses, educators are encouraged to become familiar with the curriculum at all grade levels. Educators may find it helpful to examine sample items at each grade level to gain a greater understanding of what students need to know and be able to do in mathematics as they move from grade to grade.

A system of support has been designed to ensure that all students master the TEKS. The Student Success Initiative (SSI) requires that students meet the standard on TAKS to be eligible for promotion to the next grade level as specified below:

- the reading test at grade 3, beginning in the 2002–2003 school year;
- the reading and mathematics tests at grade 5, beginning in the 2004–2005 school year; and
- the reading and mathematics tests at grade 8, beginning in the 2007–2008 school year.

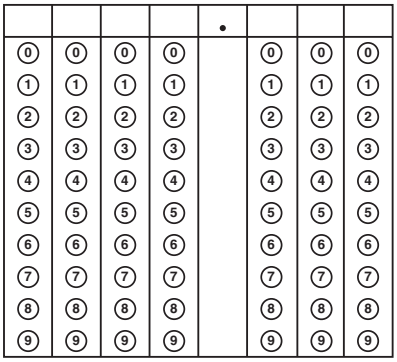
To prepare students for the SSI requirements and to promote vertical alignment, it is essential that teachers collaborate and coordinate across grade levels.

TAKS MATHEMATICS
INFORMATION BOOKLET
GRADE 10

The tenth grade mathematics TAKS Objectives and TEKS Student Expectations describe what students should know and be able to do in tenth grade. Teachers need to be aware of the "big picture"—an understanding of the TEKS curriculum for the lower grades, Algebra I, and geometry. Awareness of this curriculum will enable teachers to more effectively help their students develop mathematics knowledge and skills.

TEST FORMAT

- The tenth grade test includes a test booklet and a separate machine-scorable answer document. Enough room is left around each item in the booklet for students to work each problem. However, student responses must be recorded on the separate answer document.
- Any item may include application context and extraneous information.
- Most items will be in a multiple-choice format with four answer choices.
- *Not here* or a variation of this phrase may be used as the fourth answer choice when appropriate.
- There will be a limited number of open-ended griddable items. For these items an eight-column grid (with one column designated as a fixed decimal point) will be provided on the answer document for students to record and bubble in their answers. Digits must be in the correct column(s) with respect to the fixed decimal point. This griddable format is intended to allow students to work a problem and determine the correct answer without being influenced by answer choices. An example of a blank grid is shown below.



MATHEMATICS CHART

- For tenth grade the Mathematics Chart found on pages 9 and 10 will have measurement conversions and formulas.
- A metric ruler and a customary ruler will be provided on the separate Mathematics Chart.
- Items that require students to measure with a ruler from the Mathematics Chart may be found in any objective as appropriate.

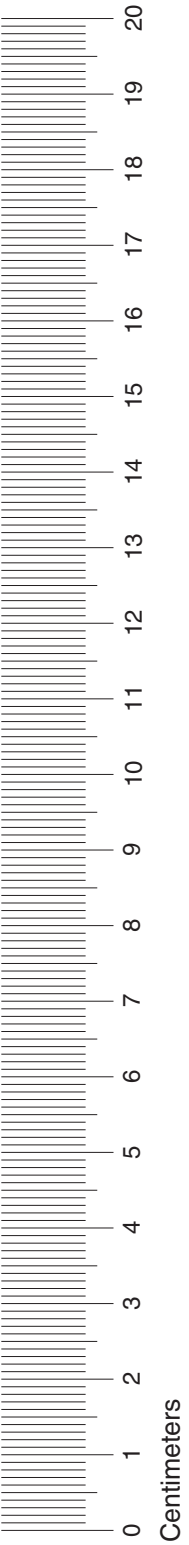
GRAPHING CALCULATORS

- Districts must ensure that each student has a graphing calculator during the entire administration of the mathematics test.
- Any graphing calculator may be used except one with a typewriter-style keypad (known as QWERTY) or one that includes a computer algebra system (CAS). Handheld minicomputers, personal digital assistants, or laptop computers may not be used.
- All types of memory, including standard memory, RAM, ROM, and Flash ROM, must be cleared to factory default both before and after testing. In addition, any programs or applications must be removed or disabled prior to testing.
- For specific assistance in effectively preparing calculators for use during testing, please contact the calculator manufacturer.

Texas Assessment of Knowledge and Skills (TAKS)
Blueprint for Grade 10 Mathematics

TAKS Objectives	Number of Items
Objective 1: Functional Relationships	5
Objective 2: Properties and Attributes of Functions	5
Objective 3: Linear Functions	5
Objective 4: Linear Equations and Inequalities	5
Objective 5: Quadratic and Other Nonlinear Functions	5
Objective 6: Geometric Relationships and Spatial Reasoning	5
Objective 7: 2-D and 3-D Representations	5
Objective 8: Measurement	7
Objective 9: Percents, Proportions, Probability, and Statistics	5
Objective 10: Mathematical Processes and Tools	9
Total number of items	**56**

Grades 9, 10, and Exit Level Mathematics Chart



LENGTH

Metric	Customary
1 kilometer = 1000 meters	1 mile = 1760 yards
1 meter = 100 centimeters	1 mile = 5280 feet
1 centimeter = 10 millimeters	1 yard = 3 feet
	1 foot = 12 inches

CAPACITY AND VOLUME

Metric	Customary
1 liter = 1000 milliliters	1 gallon = 4 quarts
	1 gallon = 128 fluid ounces
	1 quart = 2 pints
	1 pint = 2 cups
	1 cup = 8 fluid ounces

MASS AND WEIGHT

Metric	Customary
1 kilogram = 1000 grams	1 ton = 2000 pounds
1 gram = 1000 milligrams	1 pound = 16 ounces

TIME

1 year = 365 days

1 year = 12 months

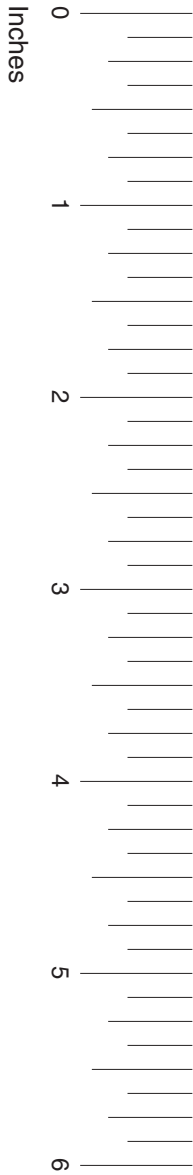
1 year = 52 weeks

1 week = 7 days

1 day = 24 hours

1 hour = 60 minutes

1 minute = 60 seconds



Grades 9, 10, and Exit Level Mathematics Chart

Perimeter	rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	circle	$C = 2\pi r$ or $C = \pi d$
Area	rectangle	$A = lw$ or $A = bh$
	triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
	trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1 + b_2)h}{2}$
	regular polygon	$A = \frac{1}{2}aP$
	circle	$A = \pi r^2$
P represents the Perimeter of the Base of a three-dimensional figure.		
B represents the Area of the Base of a three-dimensional figure.		
Surface Area	cube (total)	$S = 6s^2$
	prism (lateral)	$S = Ph$
	prism (total)	$S = Ph + 2B$
	pyramid (lateral)	$S = \frac{1}{2}Pl$
	pyramid (total)	$S = \frac{1}{2}Pl + B$
	cylinder (lateral)	$S = 2\pi rh$
	cylinder (total)	$S = 2\pi rh + 2\pi r^2$ or $S = 2\pi r(h + r)$
	cone (lateral)	$S = \pi rl$
	cone (total)	$S = \pi rl + \pi r^2$ or $S = \pi r(l + r)$
	sphere	$S = 4\pi r^2$
Volume	prism or cylinder	$V = Bh$
	pyramid or cone	$V = \frac{1}{3}Bh$
	sphere	$V = \frac{4}{3}\pi r^3$
Special Right Triangles	30°, 60°, 90°	$x,\ x\sqrt{3},\ 2x$
	45°, 45°, 90°	$x,\ x,\ x\sqrt{2}$
Pythagorean Theorem		$a^2 + b^2 = c^2$
Distance Formula		$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Slope of a Line		$m = \frac{y_2 - y_1}{x_2 - x_1}$
Midpoint Formula		$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
Quadratic Formula		$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Slope-Intercept Form of an Equation		$y = mx + b$
Point-Slope Form of an Equation		$y - y_1 = m(x - x_1)$
Standard Form of an Equation		$Ax + By = C$
Simple Interest Formula		$I = prt$

A Key to Understanding the TEKS Included on TAKS

Example from Objective 2

(A.2) **Foundations for functions.** The student uses the properties and attributes of functions. The student is expected to

(C) interpret situations in terms of given graphs [or create situations that fit given graphs].

Example from Objective 9

(8.13) **Probability and statistics.** The student evaluates predictions and conclusions based on statistical data. The student is expected to

(B) recognize misuses of graphical or numerical information and evaluate predictions and conclusions based on data analysis.

KEY

A. Knowledge and Skills Statement

This broad statement describes what students should know and be able to do. For the eighth grade curriculum, the number preceding the statement identifies the instructional level and the number of the knowledge and skills statement. For the Algebra I curriculum, the *A* preceding the statement identifies the course, and the number identifies the knowledge and skills statement.

B. Student Expectation

This specific statement describes what students should be able to do to demonstrate proficiency in what is described in the knowledge and skills statement. Students will be tested on skills outlined in the student expectation statement.

C. [bracketed text]

Although the entire student expectation has been provided for reference, text in brackets indicates that this portion of the student expectation will not specifically be tested on TAKS.

NOTE: The full TEKS curriculum can be found at http://www.tea.state.tx.us/teks/.

TEKS STUDENT EXPECTATIONS—IMPORTANT VOCABULARY

For every subject area and grade level, two terms—*such as* and *including*—are used to help make the TEKS student expectations more concrete for teachers. However, these terms function in different ways. To help you understand the effect each of the terms has on specific student expectations, we are providing the following:

- a short definition of each term;
- an example from a specific student expectation for this subject area; and
- a short explanation of how this term affects this student expectation.

Such as

The term *such as* is used when the specific examples that follow it function only as representative illustrations that help define the expectation for teachers. These examples are just that—examples. Teachers may choose to use them when teaching the student expectation, but there is no requirement to use them. Other examples can be used in addition to those listed or as replacements for those listed.

Example from Objective 9

(8.3) (B) estimate and find solutions to application problems involving percents and other proportional relationships, such as similarity and rates.

This student expectation lists application problems *such as similarity and rates.* Other application problems exist that involve percents and proportional relationships.

Including

The term *including* is used when the specific examples that follow it must be taught. However, other examples may also be used in conjunction with those listed.

Example from Objective 10

(8.14) (C) select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem.

This student expectation lists several examples of problem-solving strategies. There are many other strategies that may be taught.

Remember

- Any example preceded by the term *such as* in a particular student expectation may or may not provide the basis for an item assessing that expectation. Because these examples do not necessarily have to be used to teach the student expectation, it is equally likely that other examples may be used in assessment items. The rule here is that an example will be used only if it is central to the knowledge, concept, or skill the item assesses.
- It is more likely that some of the examples preceded by the term *including* in a particular student expectation will provide the basis for items assessing that expectation, since these examples must be taught. However, it is important to remember that the examples that follow the term *including* do not represent all the examples possible, so other examples may also provide the basis for an assessment item. Again, the rule here is that an example will be used only if it is central to the knowledge, concept, or skill the item assesses.

Grade 10 TAKS Mathematics—Objective 1

Understanding **functional relationships** is critical for algebra and geometry. Students need to understand that functions represent ordered pairs of numbers in which the value of one number is dependent on the value of the other. This basic idea has major significance in areas such as science, social studies, and economics. From their understanding of functions, students should be able to communicate information using models, tables, graphs, diagrams, verbal descriptions, and algebraic equations or inequalities. Making inferences and drawing conclusions from functional relationships are also important skills for students because these skills will allow students to understand how functions relate to real-life situations and how real-life situations relate to functions. Mastering the knowledge and skills in Objective 1 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 1 groups together the basic ideas of **functional relationships** included within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 1.

TAKS Objectives and TEKS Student Expectations

Objective 1

The student will describe functional relationships in a variety of ways.

(A.1) **Foundations for functions.** The student understands that a function represents a dependence of one quantity on another and can be described in a variety of ways. The student is expected to

(A) describe independent and dependent quantities in functional relationships;

(B) [gather and record data and] use data sets to determine functional relationships between quantities;

(C) describe functional relationships for given problem situations and write equations or inequalities to answer questions arising from the situations;

(D) represent relationships among quantities using [concrete] models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities; and

(E) interpret and make decisions, predictions, and critical judgments from functional relationships.

Objective 1—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 1. At tenth grade, students should be able to

- work with linear and quadratic functions;
- describe a functional relationship by selecting an equation or inequality that describes one variable in terms of another variable;
- match a representation of a functional relationship with an interpretation of the results for a given situation;
- translate functional relationships among numerous forms; and
- work with linear equations in different forms, such as slope-intercept, standard, etc.

Objective 1 Sample Items

1 In the equation $V = \frac{4}{3}\pi r^3$, the volume of a sphere, V, is a function of r, the sphere's radius. What is the independent quantity in this function?

A V

B $\frac{4}{3}$

C π

D* r

Note: Students must be able to distinguish between independent and dependent quantities and variables.

2 Which set of coordinates describes a function?

A $\{(2, -3), (-2, -6), (2, 3), (-2, 6)\}$

B* $\{(5, 2), (3, 4), (1, 2), (-1, 4)\}$

C $\{(-6, -1), (-4, -3), (-2, -5), (-6, -7)\}$

D $\{(3, 4), (3, -4), (5, 8), (7, 2)\}$

Note: Students should be able to distinguish between functional and nonfunctional relationships that are represented in various ways, such as tables, ordered pairs, graphs, and equations.

3 The total cost of an item at a store is the price of the item, p, plus 8.25% sales tax. Which of the following best represents c, the total cost of the item?

A $c = 8.25p$

B $c = 0.0825p$

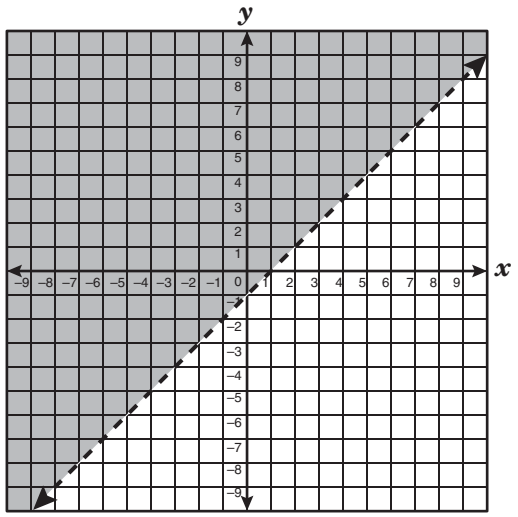
C $c = p + 0.0825$

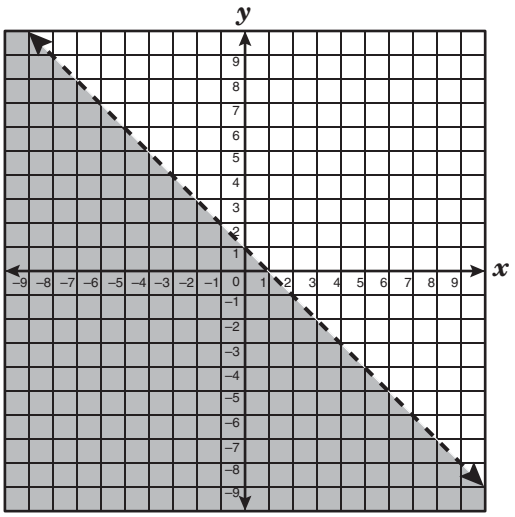
D* $c = 1.0825p$

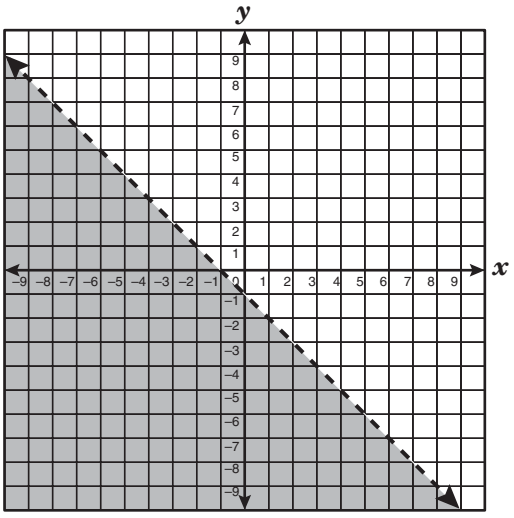
Note: Students should recognize that the total cost of an item can be written as $p + 0.0825p$ or $1.0825p$.

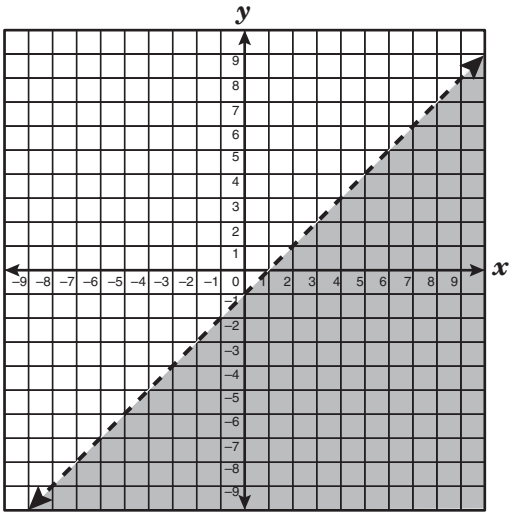
Objective 1 Sample Items

4 Which graph best represents the inequality $x - y < 1$?

A* 

C 

B 

D 

Grade 10 TAKS Mathematics—Objective 2

Understanding the **properties and attributes of functions** is critical for algebra and geometry. Recognizing the similarities and differences between linear and quadratic functions is useful when evaluating and analyzing statistical data. The ability to work with and solve algebraic equations is useful for creating effective personal and business budgets that include shopping, fuel efficiency, car payments, etc. Mastering the knowledge and skills in Objective 2 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 2 groups together the **properties and attributes of functions** found within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 2.

TAKS Objectives and TEKS Student Expectations

Objective 2

The student will demonstrate an understanding of the properties and attributes of functions.

(A.2) **Foundations for functions.** The student uses the properties and attributes of functions. The student is expected to

- (A) identify [and sketch] the general forms of linear ($y = x$) and quadratic ($y = x^2$) parent functions;
- (B) identify mathematical domains and ranges and determine reasonable domain and range values for given situations, both continuous and discrete;
- (C) interpret situations in terms of given graphs [or create situations that fit given graphs]; and
- (D) [collect and] organize data, [make and] interpret scatterplots (including recognizing positive, negative, or no correlation for data approximating linear situations), and model, predict, and make decisions and critical judgments in problem situations.

(A.3) **Foundations for functions.** The student understands how algebra can be used to express generalizations and recognizes and uses the power of symbols to represent situations. The student is expected to

- (A) use symbols to represent unknowns and variables; and
- (B) look for patterns and represent generalizations algebraically.

(A.4) **Foundations for functions.** The student understands the importance of the skills required to manipulate symbols in order to solve problems and uses the necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations. The student is expected to

(A) find specific function values, simplify polynomial expressions, transform and solve equations, and factor as necessary in problem situations;

(B) use the commutative, associative, and distributive properties to simplify algebraic expressions; and

(C) connect equation notation with function notation, such as $y = x + 1$ and $f(x) = x + 1$.

Objective 2—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 2. At tenth grade, students should be able to

- work with linear and quadratic functions;
- identify a valid decision or judgment based on a given set of data;
- write an expression or equation describing a pattern; and
- work with linear equations in different forms, such as slope-intercept, standard, etc.

Objective 2 Sample Items

1 Which of the following best represents the parent function of $y = \frac{3}{7}x^2 - 8$?

A $y = \frac{3}{7}x$

B $y = \frac{3}{7}x^2$

C* $y = x^2$

D $y = x$

2 Given the function $y = -\frac{3}{4}x^2 + 15$, what is the value of y when $x = -3$?

A* $8\frac{1}{4}$

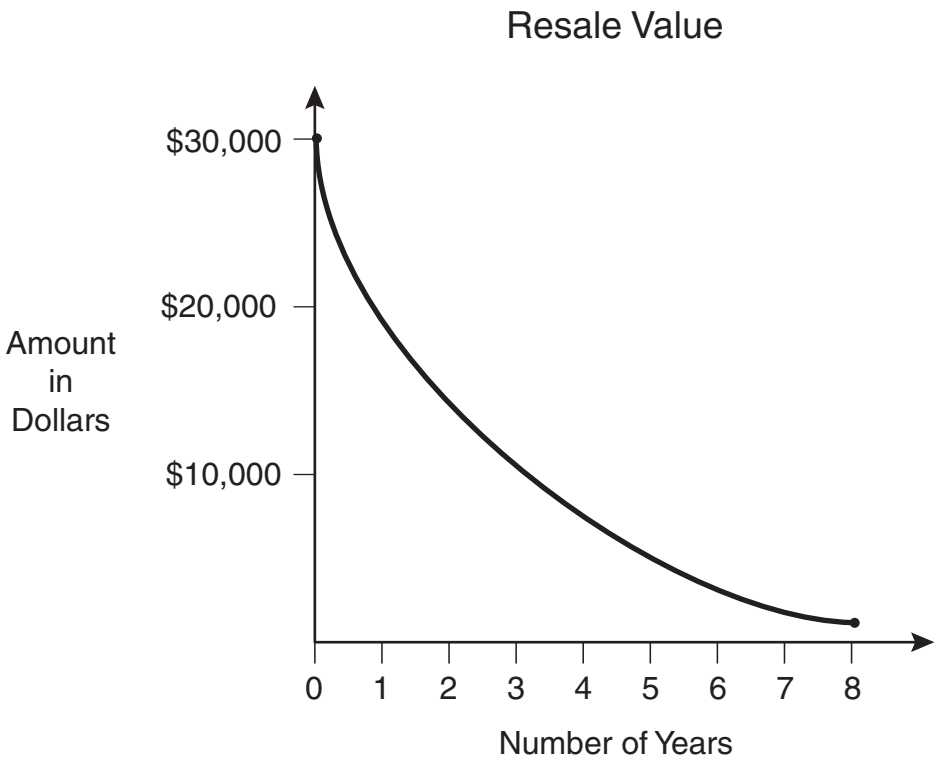
B $5\frac{1}{4}$

C $21\frac{3}{4}$

D $19\frac{1}{2}$

Objective 2 Sample Items

3 Johnson's Appliance Center purchased a communications system. The original purchase price was $30,000, but the system lost resale value each year. The graph shows the resale value of the system during a period of several years.



Which is a reasonable conclusion about the resale value of the system?

A The system lost the same number of dollars in resale value each year.

B* The system lost resale value more rapidly the first year than it did after the seventh or eighth year.

C The system lost resale value more slowly the first year than it did after the seventh or eighth year.

D The system lost half of its resale value each year after purchase.

---

4 Which expression is equivalent to $\frac{3}{7}(28a^2bc^3 + 35a^2bc^2) - \frac{4}{5}(20a^2bc^2 - 15a^2bc^3)$?

A a^2bc^2

B $23a^2bc^3$

C $-4a^2bc^3 + 27a^2bc^2$

D* $24a^2bc^3 - a^2bc^2$

Grade 10 TAKS Mathematics—Objective 3

Understanding **linear functions** is critical for algebra and geometry. Students should understand that linear functions are relationships that exhibit a constant rate of change and can be represented by the graph of a line. Linear functions are an integral part of science, geography, and economics. The concept of rate of change between data points is used in everyday situations such as calculating taxicab or telephone-billing rates. Mastering the knowledge and skills in Objective 3 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 3 groups together concepts of **linear functions** found within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 3.

TAKS Objectives and TEKS Student Expectations

Objective 3

The student will demonstrate an understanding of linear functions.

(A.5) **Linear functions.** The student understands that linear functions can be represented in different ways and translates among their various representations. The student is expected to

- (A) determine whether or not given situations can be represented by linear functions; and
- (C) use, translate, and make connections among algebraic, tabular, graphical, or verbal descriptions of linear functions.

(A.6) **Linear functions.** The student understands the meaning of the slope and intercepts of the graphs of linear functions and zeros of linear functions and interprets and describes the effects of changes in parameters of linear functions in real-world and mathematical situations. The student is expected to

- (A) develop the concept of slope as rate of change and determine slopes from graphs, tables, and algebraic representations;
- (B) interpret the meaning of slope and intercepts in situations using data, symbolic representations, or graphs;
- (C) investigate, describe, and predict the effects of changes in m and b on the graph of $y = mx + b$;
- (D) graph and write equations of lines given characteristics such as two points, a point and a slope, or a slope and y-intercept;
- (E) determine the intercepts of the graphs of linear functions and zeros of linear functions from graphs, tables, and algebraic representations;

(F) interpret and predict the effects of changing slope and y-intercept in applied situations; and

(G) relate direct variation to linear functions and solve problems involving proportional change.

Objective 3—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 3. At tenth grade, students should be able to

- translate linear relationships among various forms;
- work with linear equations in different forms, such as slope-intercept, standard, etc.; and
- work with both *x*- and *y*-intercepts.

Objective 3 Sample Items

1 Which of the following does not represent a linear function?

A The distance traveled in x hours at a constant speed of 70 miles per hour

B The perimeter of a square with a side length of x inches

C* The area of a rectangle with a width of x units and a length of $(x + 3)$ units

D The circumference of a circle with a radius of x units

2 The height, h, and base, b, measurements for three similar triangles are shown in the table.

Triangle	Base (centimeters)	Height (centimeters)
ΔFGH	3.8	17.1
ΔJKL	5.4	24.3
ΔPQR	1.6	7.2

Which function represents the relationship between the height and base of each of these triangles?

A $h = \frac{1}{4}b$

B $h = \frac{5}{2}b$

C $h = 5b - 1.9$

D* $h = 4.5b$

Objective 3 Sample Items

3 What is the rate of change of the function shown below?

$$y = -\frac{3}{4}$$

A* 0

B $\frac{3}{4}$

C $-\frac{3}{4}$

D Undefined

4 The cost, c, of engine repair on a car at Fix-N-Go is represented by the function $c = 125 + 18h$, where \$125 is the service charge and h represents the number of hours of labor. If the service charge were increased, how would the graph of the line representing the customer's cost for engine repair be affected?

A The slope of the graph of the new line would be steeper than the graph of the original line.

B* The graph of the new line would be translated above the graph of the original line.

C The graph of the new line would be translated to the right of the graph of the original line.

D The slope of the graph of the new line would be less steep than the graph of the original line.

Grade 10 TAKS Mathematics—Objective 4

Understanding how to **formulate and use linear equations and inequalities** is critical for algebra and geometry. The ability to organize contextual problems into equations and inequalities or systems of equations allows students to find and evaluate reasonable solutions in daily situations. For example, as students become more knowledgeable consumers, they may want to use a system of equations to determine which car-insurance company offers a better rate. Mastering the knowledge and skills in Objective 4 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 4 groups together the ideas of how to **formulate and use linear equations and inequalities** found within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 4.

TAKS Objectives and TEKS Student Expectations

Objective 4

The student will formulate and use linear equations and inequalities.

(A.7) **Linear functions.** The student formulates equations and inequalities based on linear functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. The student is expected to

- (A) analyze situations involving linear functions and formulate linear equations or inequalities to solve problems;
- (B) investigate methods for solving linear equations and inequalities using [concrete] models, graphs, and the properties of equality, select a method, and solve the equations and inequalities; and
- (C) interpret and determine the reasonableness of solutions to linear equations and inequalities.

(A.8) **Linear functions.** The student formulates systems of linear equations from problem situations, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. The student is expected to

- (A) analyze situations and formulate systems of linear equations in two unknowns to solve problems;
- (B) solve systems of linear equations using [concrete] models, graphs, tables, and algebraic methods; and
- (C) interpret and determine the reasonableness of solutions to systems of linear equations.

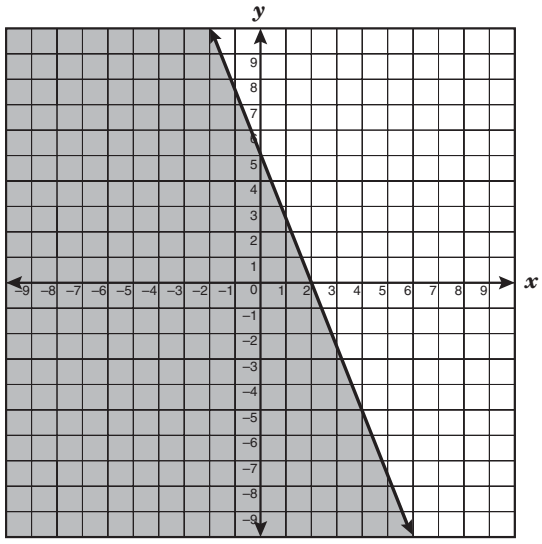
Objective 4—For Your Information

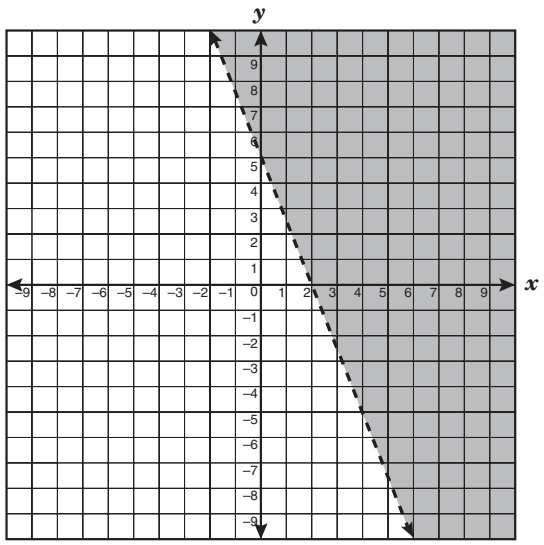
The following list provides additional information for some of the student expectations tested in Objective 4. At tenth grade, students should be able to

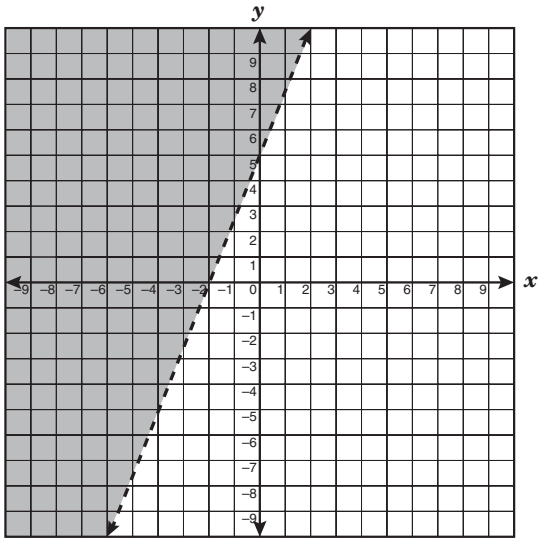
- work with linear equations in different forms, such as slope-intercept, standard, etc.;
- select an equation or inequality that can be used to find the solution;
- find a solution expressed as a number or a range of numbers; and
- evaluate a solution in terms of a given context and determine whether the solution is reasonable.

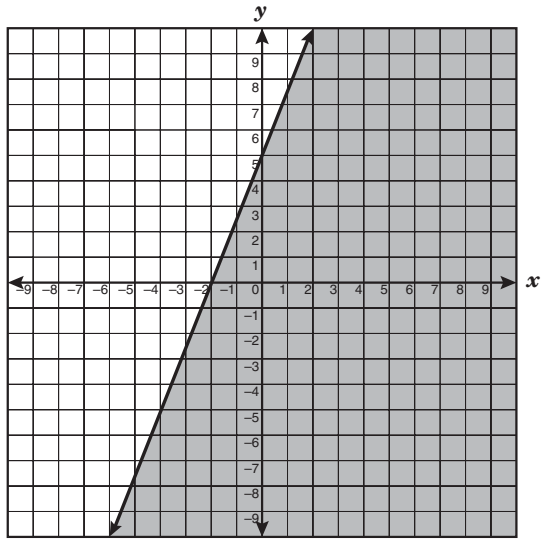
Objective 4 Sample Items

1 Which graph best represents the solution set of the linear inequality $5x + 2y \leq 10$?

A* 

C 

B 

D 

Objective 4 Sample Items

2 Let x and y represent the measures of a pair of complementary angles. If x is 17 degrees less than twice y, which system of equations can be used to determine the measure in degrees of each angle?

A $x + y = 90$
$x + 2y = -17$

B* $x + y = 90$
$x - 2y = -17$

C $x + y = 90$
$x + 2y = 17$

D $x + y = 90$
$x - 2y = 17$

3 Taylor purchased a computer system that costs \$1276.94, including tax. When she purchased the computer, she opened an interest-free credit account and made a down payment of 10% of the total cost of the computer. If she makes monthly payments of \$75, which of the following can be used to find a, the amount that she would owe on the computer after m months?

A $a = 0.10(1276.94) - 75m$

B* $a = 0.90(1276.94) - 75m$

C $a = 0.90(1276.94) + 75m$

D $a = 0.10(1276.94) + 75m$

Note: Students should recognize that there are several ways to find the amount owed on the computer after the 10% down payment. One method is to find 90% of the original cost.

Grade 10 TAKS Mathematics—Objective 5

Understanding **quadratic and other nonlinear functions** is critical for algebra and geometry. Students should understand that quadratic functions can be represented by the graph of a parabola. Graphs of quadratic functions can be used to represent data, such as projectile motion in physics, wind chill predictions in meteorology, and profit margins in economics. In these and other examples, students should understand how changes in the functional situation affect the graph of the parabola. Understanding the correct use of exponents is essential in scientific fields such as medicine, astronomy, and microbiology. Mastering the knowledge and skills in Objective 5 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 5 groups together the concepts of **quadratic and other nonlinear functions** found within the TEKS. The concepts of **patterns, relationships, and algebraic thinking** found in the lower grades form the foundation for Objective 5.

TAKS Objectives and TEKS Student Expectations

Objective 5

The student will demonstrate an understanding of quadratic and other nonlinear functions.

(A.9) **Quadratic and other nonlinear functions.** The student understands that the graphs of quadratic functions are affected by the parameters of the function and can interpret and describe the effects of changes in the parameters of quadratic functions. The student is expected to

(B) investigate, describe, and predict the effects of changes in a on the graph of $y = ax^2 + c$;

(C) investigate, describe, and predict the effects of changes in c on the graph of $y = ax^2 + c$; and

(D) analyze graphs of quadratic functions and draw conclusions.

(A.10) **Quadratic and other nonlinear functions.** The student understands there is more than one way to solve a quadratic equation and solves them using appropriate methods. The student is expected to

(A) solve quadratic equations using [concrete] models, tables, graphs, and algebraic methods; and

(B) make connections among the solutions (roots) of quadratic equations, the zeros of their related functions, and the horizontal intercepts (x-intercepts) of the graph of the function.

(A.11) **Quadratic and other nonlinear functions.** The student understands there are situations modeled by functions that are neither linear nor quadratic and models the situations. The student is expected to

(A) use [patterns to generate] the laws of exponents and apply them in problem-solving situations.

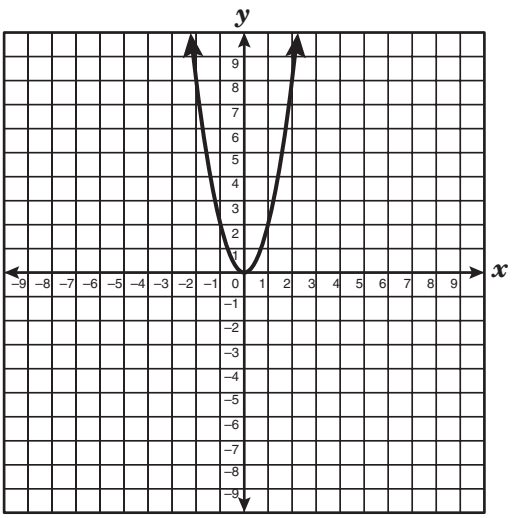
Objective 5—For Your Information

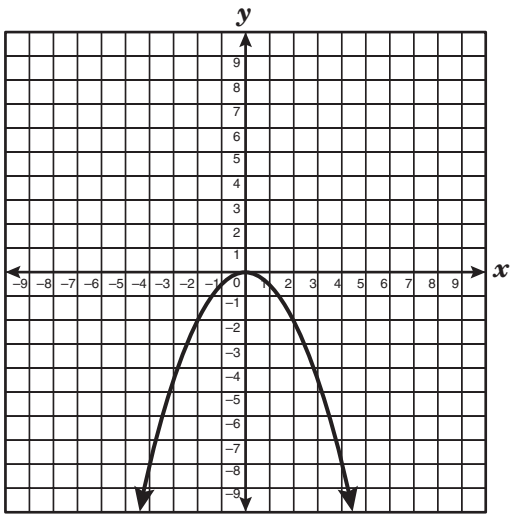
The following list provides additional information for some of the student expectations tested in Objective 5. At tenth grade, students should be able to

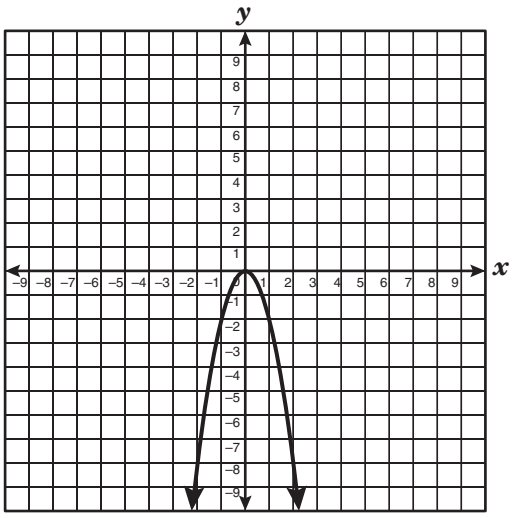
- recognize how the graph of the parabola is modified when the quadratic equation changes; and
- determine reasonable solutions to quadratic equations based on the given context of the problem.

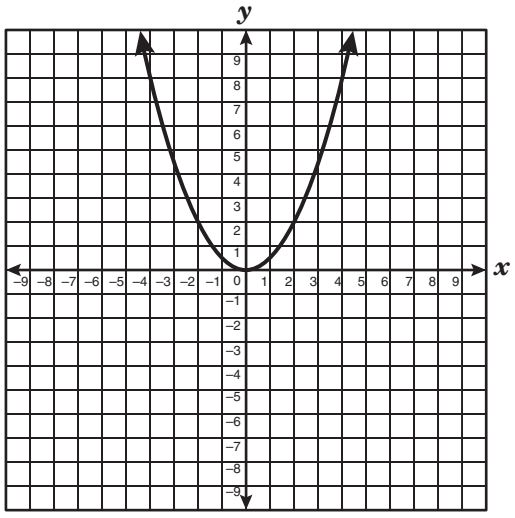
Objective 5 Sample Items

1 The graphs below represent functions of the form $y = ax^2$. In which graph does a have the greatest value?

A* 

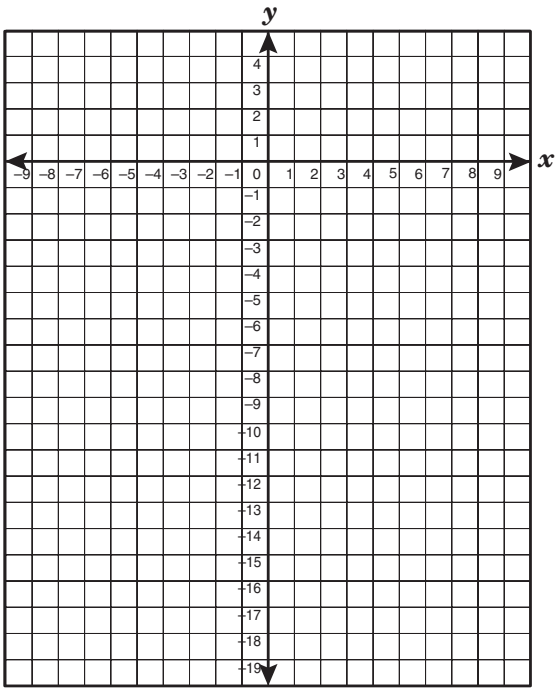
C 

B 

D 

Objective 5 Sample Items

2 Mrs. Pundt asked her math class to correctly identify the line of symmetry of a quadratic function. The class was told that the coordinate points $(-1, -7)$, $(-4, -16)$, and $(0, -8)$ lie on the graph of the quadratic function. They were also told that one of these three points is the vertex of the function.



Which of the following student responses correctly identifies the line of symmetry of this quadratic function?

A $y = -8$

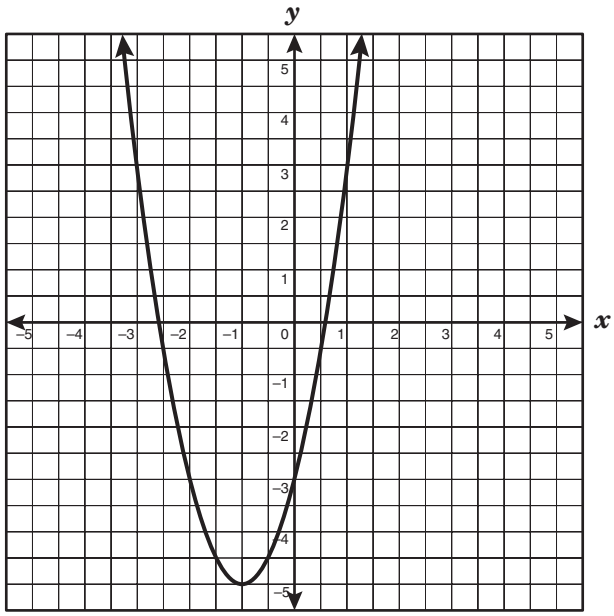
B* $x = -1$

C $x = 0$

D $y = -7$

Objective 5 Sample Items

3 The grid below shows the intercepts of the graph of a quadratic function.



Which of the following best represents the zeros of this function?

A $\{0, -3\}$

B $\{-1, -5\}$

C $\{-3.6, 0.6\}$

D* $\{-2.6, 0.6\}$

Note: Students should recognize that the zeros of the function are the same as the x-values of the x-intercepts.

Objective 5 Sample Items

4 Mr. Klein asked his algebra students to find an expression that is equivalent to $-\frac{48x^3z^4}{28x^{-2}y^2z}$. Which of the following student responses is correct?

A $\frac{12xz^3}{7y^2}$

B $\frac{12x^5z^3}{7y^2}$

C* $-\frac{12x^5z^3}{7y^2}$

D $-\frac{12xz^3}{7y^2}$

Grade 10 TAKS Mathematics—Objective 6

Understanding **geometric relationships and spatial reasoning** is important because the structure of the world is based on geometric properties. The concepts covered in this objective are an integral part of many fields, such as physics, navigation, geography, and construction. These concepts build spatial-reasoning skills that help develop an understanding of distance and location. The knowledge and skills contained in Objective 6 will allow students to understand how the basic concepts of geometry are related to the real world. Mastering the knowledge and skills in Objective 6 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 6 groups together the fundamental concepts of **geometric relationships and spatial reasoning** found within the TEKS. The concepts of **geometry and spatial reasoning** found in the lower grades form the foundation for Objective 6.

TAKS Objectives and TEKS Student Expectations

Objective 6

The student will demonstrate an understanding of geometric relationships and spatial reasoning.

(8.6) **Geometry and spatial reasoning.** The student uses transformational geometry to develop spatial sense. The student is expected to

(A) generate similar figures using dilations including enlargements and reductions; and

(B) graph dilations, reflections, and translations on a coordinate plane.

(8.7) **Geometry and spatial reasoning.** The student uses geometry to model and describe the physical world. The student is expected to

(D) locate and name points on a coordinate plane using ordered pairs of rational numbers.

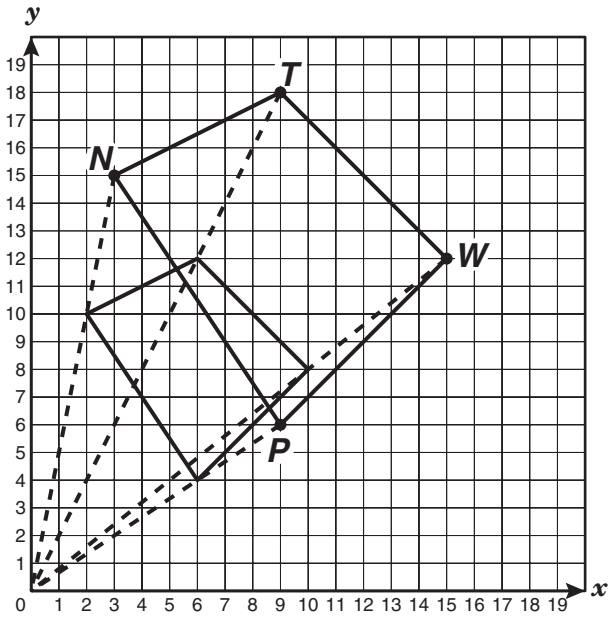
Objective 6—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 6. At tenth grade, students should be able to

- find and apply scale factors in problem-solving situations;
- use geometric concepts, properties, theorems, and definitions to solve problems; and
- graph points on coordinate grids using all four quadrants.

Objective 6 Sample Items

1 Quadrilateral $P'N'T'W'$ has vertices P' (6, 4), N' (2, 10), T' (6, 12), and W' (10, 8). It is a dilation of quadrilateral $PNTW$, with the origin as the center of dilation, as shown in the graph below.



Which scale factor was used to create quadrilateral $P'N'T'W'$?

A* $\frac{2}{3}$

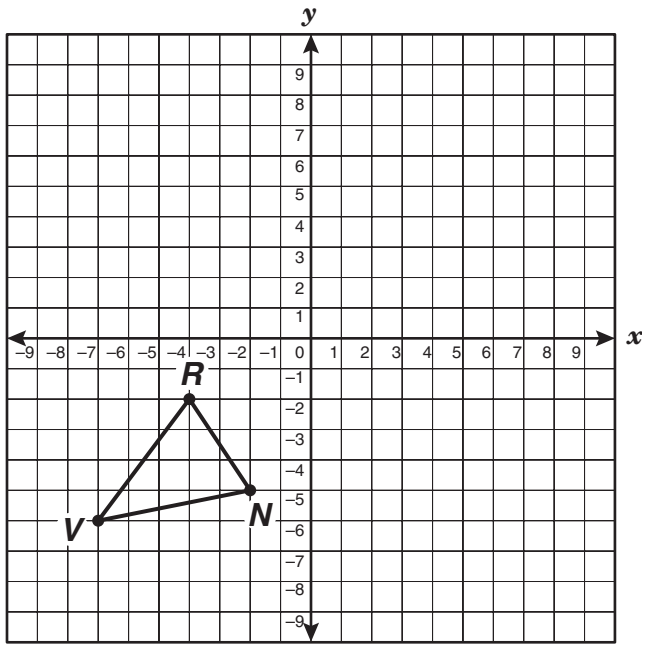
B $\frac{1}{5}$

C $\frac{3}{2}$

D 5

Note: Students should recognize that to create the dilation, each coordinate of the original ordered pair is multiplied by the scale factor.

2 ΔRNV is shown on the grid below.



If ΔRNV is reflected across the line $y = x$ to become $\Delta R'N'V'$, what will be the coordinates of V'?

A (−7, 6)

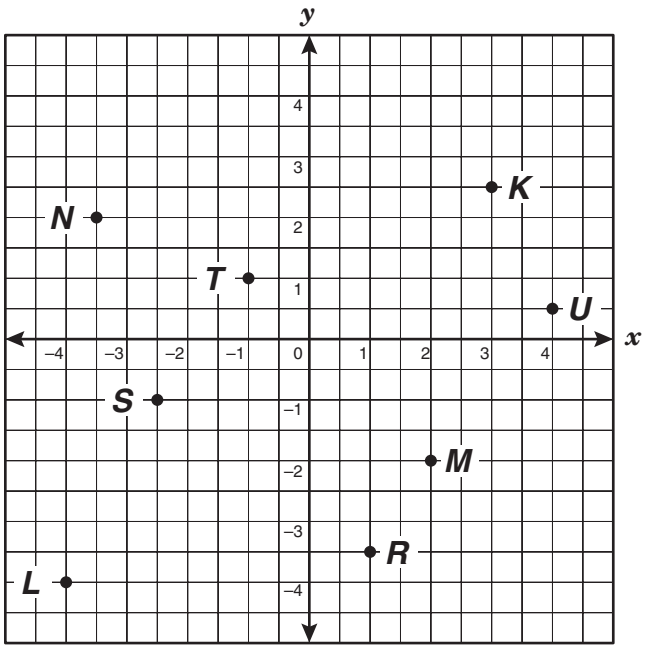
B* (−6, −7)

C (6, 7)

D (7, −6)

Objective 6 Sample Items

3 Which point on the grid satisfies the conditions $x < -\frac{5}{2}$ and $y > -\frac{3}{2}$?



A Point K

B* Point N

C Point L

D Point S

Grade 10 TAKS Mathematics—Objective 7

Understanding **two- and three-dimensional representations of geometric relationships and shapes** is important because the structure of the world is based on geometric properties. The concepts covered in this objective are an integral part of many fields, such as molecular chemistry, aviation, pattern design, etc. These concepts build spatial-reasoning skills that help develop an understanding of distance, location, area, and space. The knowledge and skills contained in Objective 7 will allow students to understand how the basic concepts of geometry are related to the real world. Mastering the knowledge and skills in Objective 7 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 7 groups together the fundamental concepts of **two- and three-dimensional shapes** found within the TEKS. The concepts of **geometry and spatial reasoning** found in the lower grades form the foundation for Objective 7.

TAKS Objectives and TEKS Student Expectations

Objective 7

The student will demonstrate an understanding of two- and three-dimensional representations of geometric relationships and shapes.

(8.7) **Geometry and spatial reasoning.** The student uses geometry to model and describe the physical world. The student is expected to

(A) draw three-dimensional figures from different perspectives;

(B) use geometric concepts and properties to solve problems in fields such as art and architecture; and

(C) use pictures or models to demonstrate the Pythagorean Theorem.

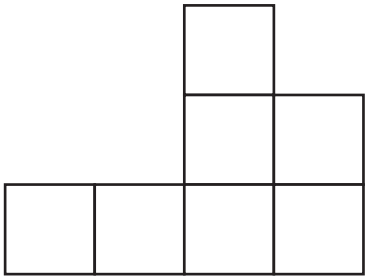
Objective 7—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 7. At tenth grade, students should be able to

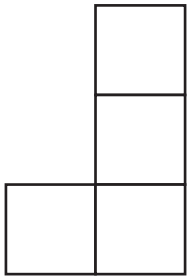
- match a two-dimensional representation of a solid with a three-dimensional representation of the same solid, using the top, front, and/or side views of the solid;
- find and apply scale factors in problem-solving situations;
- use geometric concepts, properties, theorems, and definitions to solve problems; and
- recognize a picture or model of the Pythagorean Theorem.

Objective 7 Sample Items

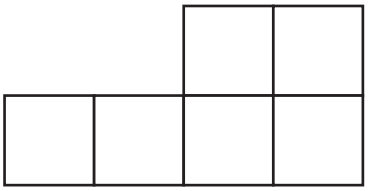
1 The drawings below show the front, right, and top views of a structure built with identical cubes.



Front view



Right view



Top view

How many identical cubes are needed to construct this solid?

A 17

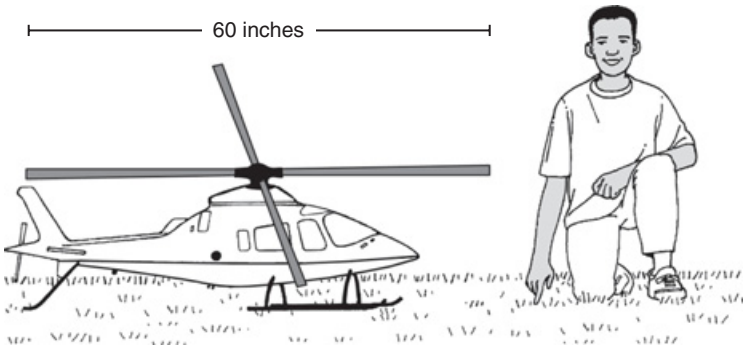
B* 9

C 14

D 7

Objective 7 Sample Items

2 The dimensions of Shaun's model helicopter are $\frac{1}{7}$ those of the actual helicopter that the model is based on. The picture below shows Shaun and his model helicopter.



If the blades on the model helicopter have a length of 60 inches, what is the length in feet of the actual helicopter blades?

A* 35 ft

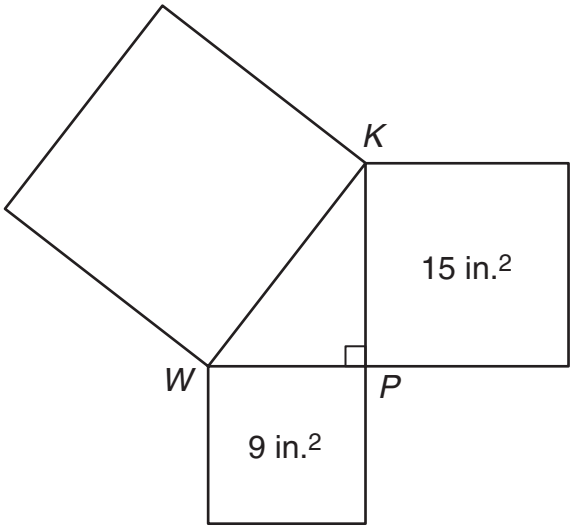
B 102.9 ft

C 8.6 ft

D 420 ft

Objective 7 Sample Items

3 ΔKPW is a right triangle formed by 3 squares joined at their vertices.



Which is closest to the length of $\overline{KW}$?

A 6 inches

B* 5 inches

C 24 inches

D 18 inches

Grade 10 TAKS Mathematics—Objective 8

Understanding the **concepts and uses of measurement and similarity** has many real-world applications and provides a basis for developing skills in geometry and in other academic disciplines. The concept of surface area is essential in everyday tasks, such as laying carpet, upholstering furniture, painting houses, etc. Businesses involved with packing and shipping find the effect of changes in area, perimeter, and volume critical in their work. Understanding the basic concepts included in Objective 8 will prepare students to apply measurement skills in various situations. Mastering the knowledge and skills found in Objective 8 at tenth grade will help students master the knowledge and skills found in other TAKS objectives at tenth grade.

Objective 8 groups together the **concepts and uses of measurement and similarity** found within the TEKS. The concepts and uses of **measurement** found in the lower grades form the foundation for Objective 8.

TAKS Objectives and TEKS Student Expectations

Objective 8

The student will demonstrate an understanding of the concepts and uses of measurement and similarity.

(8.8) **Measurement.** The student uses procedures to determine measures of three-dimensional figures. The student is expected to

- (A) find lateral and total surface area of prisms, pyramids, and cylinders using [concrete] models and nets (two-dimensional models);
- (B) connect models of prisms, cylinders, pyramids, spheres, and cones to formulas for volume of these objects; and
- (C) estimate measurements and use formulas to solve application problems involving lateral and total surface area and volume.

(8.9) **Measurement.** The student uses indirect measurement to solve problems. The student is expected to

- (A) use the Pythagorean Theorem to solve real-life problems; and
- (B) use proportional relationships in similar two-dimensional figures or similar three-dimensional figures to find missing measurements.

(8.10) **Measurement.** The student describes how changes in dimensions affect linear, area, and volume measures. The student is expected to

(A) describe the resulting effects on perimeter and area when dimensions of a shape are changed proportionally; and

(B) describe the resulting effect on volume when dimensions of a solid are changed proportionally.

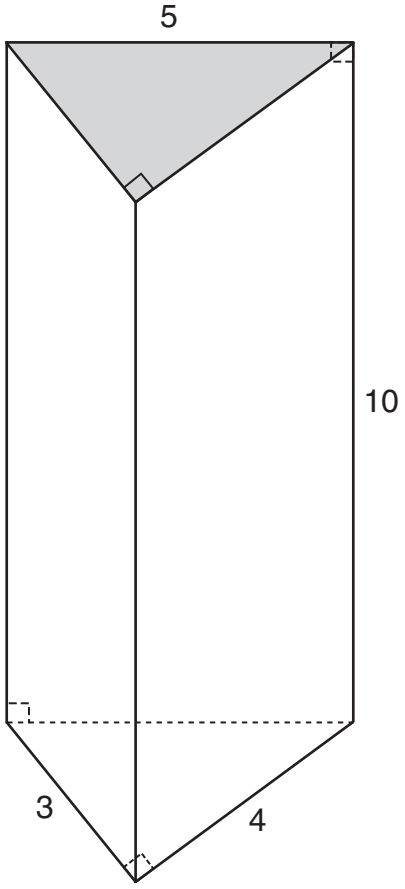
Objective 8—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 8. At tenth grade, students should be able to

- utilize the conversions and formulas on the Mathematics Chart to solve problems;
- measure with the ruler on the Mathematics Chart ***only if*** the item specifically instructs students to use the ruler;
- use the given dimensions of a figure to solve a problem;
- recognize abbreviations of measurement units;
- describe, in the form of a verbal or algebraic expression or a mathematical solution, the effect on perimeter, area, or volume when the dimensions of a figure are changed (for example, if the sides of a rectangle are doubled in length, then the perimeter is doubled, and the area is four times the original area; if the edges of a cube are doubled in length, then the volume is eight times the original volume); and
- use geometric concepts, properties, theorems, formulas, and definitions to solve problems.

Objective 8 Sample Items

1 Find the surface area of the prism below.



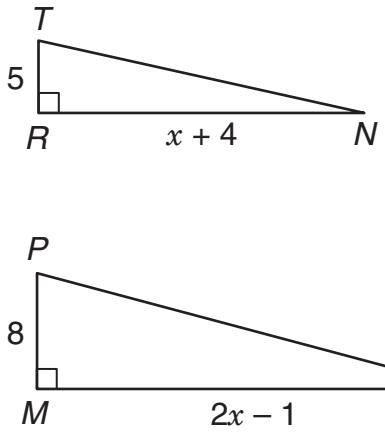
A 60 units^2

B 82 units^2

C* 132 units^2

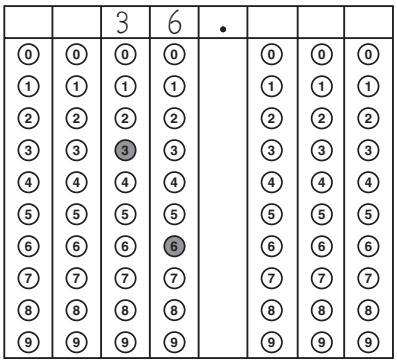
D 144 units^2

2 In the figures below, $\Delta KMP \sim \Delta NRT$. All measurements shown are in centimeters.



What is the length in centimeters of $\overline{MK}$?

Record your answer and fill in the bubbles on your answer document. Be sure to use the correct place value.



Note: Since 36 is the correct answer, it is acceptable, although not necessary, to grid the zeros before the 3 and/or after the decimal. These zeros will not affect the value of the correct answer.

Students should recognize that once the value of x is found, they must substitute that value to find the length of $\overline{MK}$.

Objective 8 Sample Items

3 The heating elements on an electric stove are circular. The radius of the small element is $\frac{2}{3}$ that of the large element. If the area of the large element is 450 square centimeters, what is the approximate area of the small element in square centimeters?

A* $200\ cm^2$

B $89\ cm^2$

C $133\ cm^2$

D $300\ cm^2$

Note: The scale factor is $\frac{2}{3}$. Therefore, the change in area is $(\frac{2}{3})^2$, or $\frac{4}{9}$, and $\frac{4}{9}(450) = 200$.

4 Anish purchased 2 similar boxes that are shaped like rectangular prisms. The corresponding dimensions of the larger box are triple those of the smaller box. How does the volume of the larger box compare to the volume of the smaller box?

A The volume of the larger box is 9 times the volume of the smaller box.

B The volume of the larger box is 3 times the volume of the smaller box.

C The volume of the larger box is 6 times the volume of the smaller box.

D* The volume of the larger box is 27 times the volume of the smaller box.

Note: The scale factor is 3. Therefore, the change in volume is $(3)^3$, or 27.

Grade 10 TAKS Mathematics—Objective 9

Understanding **percents, proportional relationships, probability, and statistics** will help students become informed consumers of data and information. Percent calculations are important in retail, real estate, banking, taxation, etc. As students become more skilled in describing and predicting the results of a probability experiment, they should begin to recognize and account for all the possibilities of a given situation. Students should be able to compare different graphical representations of the same data and solve problems by analyzing the data presented. Students must be able to recognize appropriate and accurate representations of data in everyday situations and in information related to science and social studies (for example, in polls and election results). The knowledge and skills contained in Objective 9 are essential for processing everyday information. Mastering the knowledge and skills in Objective 9 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 9 groups together the concepts of **percents, proportional relationships, probability, and statistics** found within the TEKS. The **probability and statistics** found in the lower grades form the foundation for Objective 9.

TAKS Objectives and TEKS Student Expectations

Objective 9

The student will demonstrate an understanding of percents, proportional relationships, probability, and statistics in application problems.

(8.3) **Patterns, relationships, and algebraic thinking.** The student identifies proportional or non-proportional linear relationships in problem situations and solves problems. The student is expected to

(B) estimate and find solutions to application problems involving percents and other proportional relationships, such as similarity and rates.

(8.11) **Probability and statistics.** The student applies concepts of theoretical and experimental probability to make predictions. The student is expected to

(A) find the probabilities of dependent and independent events; and

(B) use theoretical probabilities and experimental results to make predictions and decisions.

(8.12) **Probability and statistics.** The student uses statistical procedures to describe data. The student is expected to

(A) select the appropriate measure of central tendency or range to describe a set of data and justify the choice for a particular situation; and

(C) select and use an appropriate representation for presenting and displaying relationships among collected data, including line plots, line graphs, [stem and leaf plots,] circle graphs, bar graphs, box and whisker plots, histograms, and Venn diagrams, with and without the use of technology.

(8.13) **Probability and statistics.** The student evaluates predictions and conclusions based on statistical data. The student is expected to

(B) recognize misuses of graphical or numerical information and evaluate predictions and conclusions based on data analysis.

Objective 9—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 9. At tenth grade, students should be able to

- distinguish between theoretical probability and experimental results;
- distinguish among mean, median, mode, and range to determine which is most appropriate for a particular purpose;
- identify the missing piece of data that will produce a target mean, median, mode, and/or range for a data set; and
- determine whether the graphical representation of the given data is appropriate and/or accurate.

Objective 9 Sample Items

1 In Mr. Optica's history class, 40% of the students have green eyes. Of the remaining students, 40% have brown eyes. If there are 25 students in Mr. Optica's history class, how many of these students have brown eyes?

A 15

B 10

C* 6

D Not here

2 The hours Cynthia worked last week are shown in the chart below.

Cynthia's Work Schedule

Monday	8 hours
Tuesday	6 hours
Wednesday	7 hours
Thursday	4 hours
Friday	6 hours

Which measure of these data would change if Cynthia worked 2 hours less on Wednesday?

A* Mean

B Median

C Mode

D Range

3 Victor conducted an experiment by tossing a fair number cube. The table below shows the results of his experiment.

Number-Cube Data

Outcome	Frequency
1	5
2	7
3	4
4	9
5	2
6	3

What is the difference between the experimental results and the theoretical probability of a number less than 3 landing faceup?

A $\frac{1}{30}$

B $\frac{2}{5}$

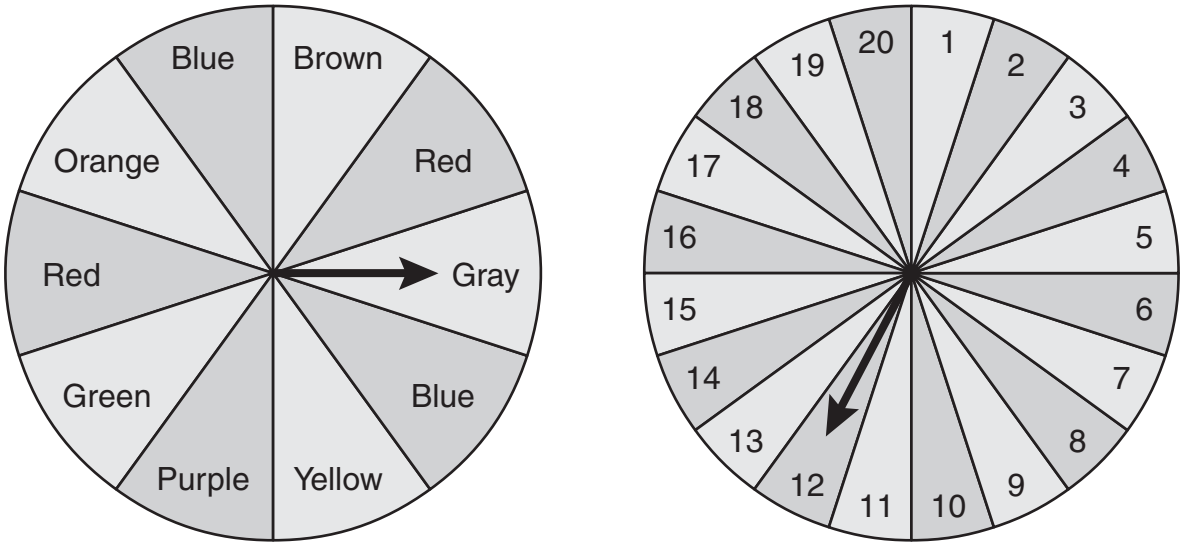
C $\frac{1}{3}$

D* $\frac{1}{15}$

Note: Students should realize that experimental results may be different than theoretical probability.

Objective 9 Sample Items

4 Each spinner shown below is divided into equal sectors.



If both arrows are spun, what is the probability that the arrow on the first spinner will land on blue and the arrow on the second spinner will land on a multiple of 3?

A $\frac{1}{2}$

B* $\frac{3}{50}$

C $\frac{4}{15}$

D $\frac{3}{100}$

Grade 10 TAKS Mathematics—Objective 10

Knowledge and understanding of **underlying processes and mathematical tools** are critical for students to be able to apply mathematics in their everyday lives. Problems that occur in the real world often require the use of multiple concepts and skills. Students should be able to recognize mathematics as it occurs in real-life problem situations, generalize from mathematical patterns and sets of examples, select an appropriate approach to solving a problem, solve the problem, and then determine whether the answer is reasonable. Expressing problem situations in mathematical language and symbols is essential to finding solutions to real-life questions. These concepts allow students to communicate clearly and use logical reasoning to make sense of their world. Students can then connect the concepts they have learned in mathematics to other disciplines and to higher mathematics. Through an understanding of the basic ideas found in Objective 10, students will be able to analyze and solve real-world problems. Mastering the knowledge and skills in Objective 10 at tenth grade will help students master the knowledge and skills in other TAKS objectives at tenth grade.

Objective 10 groups together the **underlying processes and mathematical tools** within the TEKS that are used in finding mathematical solutions to real-world problems. The **underlying processes and mathematical tools** found in the lower grades form the foundation for Objective 10.

TAKS Objectives and TEKS Student Expectations

Objective 10

The student will demonstrate an understanding of the mathematical processes and tools used in problem solving.

(8.14) **Underlying processes and mathematical tools.** The student applies Grade 8 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. The student is expected to

(A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics;

(B) use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness; and

(C) select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem.

(8.15) **Underlying processes and mathematical tools.** The student communicates about Grade 8 mathematics through informal and mathematical language, representations, and models. The student is expected to

(A) communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.

(8.16) **Underlying processes and mathematical tools.** The student uses logical reasoning to make conjectures and verify conclusions. The student is expected to

(A) make conjectures from patterns or sets of examples and nonexamples; and

(B) validate his/her conclusions using mathematical properties and relationships.

Objective 10—For Your Information

The following list provides additional information for some of the student expectations tested in Objective 10. At tenth grade, students should be able to

- select the description of a mathematical situation when provided with a written or pictorial prompt;
- identify the information that is needed to solve a problem;
- select or describe the next step or a missing step in a problem-solving situation;
- match informal language to mathematical language or symbols;
- identify the question that is being asked or answered;
- draw a conclusion by investigating patterns and/or sets of examples and nonexamples. A nonexample, or counterexample, proves a general statement to be false;
- understand that nonsensical words may be used to label sets of examples and/or nonexamples; and
- choose the correct supporting information for a given conclusion.

Objective 10 Sample Items

1 The conditions for x, y, and z are shown below.

x, y, and z are each positive integers.

The product of x, y, and z is an odd integer.

$x \neq y \neq z$

$z = x - 2$

Which pair of values for x and y meet the given conditions?

A $x = 5$ and $y = 4$

B $x = 3$ and $y = 1$

C $x = 4$ and $y = 3$

D* $x = 5$ and $y = 1$

2 Which of the following methods cannot be used to determine the roots of the quadratic equation shown below?

$$2x^2 - 7x + 1 = 5$$

A Set the equation equal to zero and solve for x by factoring

B* Graph the equation $y = 2x^2 - 7x - 4$ and locate any y-intercepts

C Graph the equation $y = 2x^2 - 7x - 4$ and locate any x-intercepts

D Create a table of values and identify the zeros of the function

3 Which of the following must be true about an equilateral triangle and an isosceles triangle?

A* An equilateral triangle is also isosceles.

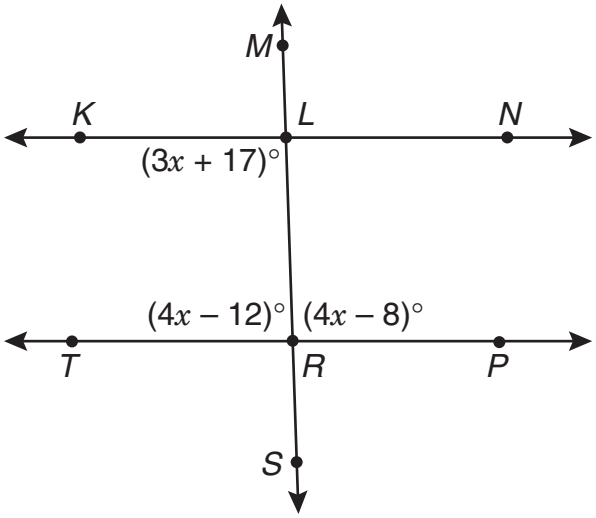
B An isosceles triangle is also equilateral.

C Both the equilateral and isosceles triangles have all acute angles.

D Both the equilateral and isosceles triangles are equiangular.

Objective 10 Sample Items

4 In the figure shown below, $\overleftrightarrow{KN} \parallel \overleftrightarrow{TP}$, and both are intersected by $\overleftrightarrow{MS}$.



Which of the following statements correctly justifies a way to help solve for x?

A $\angle KLR$ and $\angle PRL$ are same-side interior angles.

B $\angle TRL$ and $\angle KLR$ are corresponding angles.

C $\angle PRL$ and $\angle TRL$ are complementary angles.

D* $\angle KLR$ and $\angle TRL$ are supplementary angles.

5 Esmeralda has 2 cylinders of equal height but different radii. The smaller cylinder has a radius of $\frac{1}{2}x$ units, and the larger cylinder has a radius of x units. If the volume of the larger cylinder is approximately 120 cubic units, which is closest to the volume of the smaller cylinder?

A* 30 units^3

B 10 units^3

C 60 units^3

D 15 units^3

Note: Students should understand that some problems may involve more than one step. For example, this problem involves working backwards and using volume to find the height.