Appendix J: DC CAPE Mathematics Audio Guidelines

Version 3.3

Table of Contents

Visuals

Guidelines for Text-to-Speech Descriptions

Use these guidelines to describe visuals for text-to-speech scripts:

Read the title.

Provide a general overview of the image. (i.e., A map of South America, a graphic organizer with a center circle and four circles radiating outward)

Begin with the main section of the image.

Describe the details in a succinct manner using grade-level appropriate vocabulary. Omit minor details that are irrelevant (a box to the left of the person).

If facial expressions or body language are important, do not assume a blind student can interpret them. For example, it is better to describe a person as worried than to state they have furrowed brows.

When describing several people in an image, label each one clearly so they are not mixed up. (i.e., tall man, elderly man, little boy)

Describe only what is seen in the image, do not provide interpretation or additional information.

Reading Inline Choice Items

Test Nav 8.4 does not yet have the capability to read the options in an inline choice item, therefore, follow these directions for providing phonetic markup.

Use the drop-down menus to complete the sentence.

Example Stem:

A twenty-three point six K-G grocery cart is pushed away from and then rolls back toward a cart rack. Use the graph to complete the sentence describing the motion of the grocery cart.

Example of Inline Choice

The graph shows that the cart travels (Inline Choice dropdown menu) meters between zero and five seconds.

When accessing the dropdown menu, the following answer options are available.

Two point zero
Three point zero
Four point zero
Five point zero
Six point zero

Example of Phonetic Markup

The graph shows that the cart travels - blank - meters between zero and five seconds. The answer choices are: two point zero, three point zero, four point zero, five point zero, six point zero.

Classifications for Embed Coding Scheme for Text Descriptions

An embed code within the alt text will be included for all test items with visual elements. The embed code will be classified as a 1, 2 or 3. The description of each level is listed below:

[1] is not construct-relevant and can be eliminated (e.g., it is only there for engagement purposes). For example, a picture of an elephant added purely for engagement would has alt text that reads "elephant [1]" or "picture of elephant [1]."

[2] is construct-relevant and can be represented using accompanying textual description. Example of text where reading the graph is construct-relevant: The graph title is Roller Rink costs. Key, dashed line represents Roller Rink A, solid line represents Roller Rink B. The x-axis is labeled number of people. The y-axis is labeled cost in dollars. The dashed arrow starts at zero people, sixty dollars and points to a little less than sixteen people, midway between one hundred and one hundred ten dollars. The solid arrow starts at zero people, a little less than ten dollars and points to a little more than fourteen people, a little less than one hundred ten dollars. [2]

[3] is construct-relevant and can be represented using accompanying textual description together with a tactile representation or physical manipulative. Example of text where reading the graph is construct-relevant: The graph title is Roller Rink costs. Key, dashed line represents Roller Rink A, solid line represents Roller Rink B. The x-axis is labeled number of people. The y-axis is labeled cost in dollars. [3]

Accessibility experts will be trained on this embedded coding scheme during the item tagging phase of item development.

Symbols

Money ($)

Example 1

$4.35

Example 2

$2.50

Example 3

$5,390

Audio Guideline

Read dollars and cents if there is a decimal point.

Do not read shortcuts for numbers. For instance $.25 and $1.50 should be read as twenty-five cents instead of a quarter. This will allow a more standardized presentation of monetary quantities.

If the amount is less than one dollar, read "X cents" and do not read the zero ($0.35 is "thirty-five cents" not "zero dollars and thirty-five cents"). Likewise, do not read "and zero cents" ($4.00 is read "four dollars" and not "four dollars and zero cents").

Read the number place value unless the question is measuring place value (refer to the large number section for details).

Application of Audio Guideline

Example 1

Four dollars and thirty-five cents

Example 2

Two dollars and fifty cents

Example 3

Five thousand three hundred ninety dollars

Angles/Triangles (∠ and Δ)

Example 1

∠RST

Example 2

△RST

Example 3

△R'S'T'

Audio Guideline

Read angles and shapes by leading with "angle," "shape," etc. and then reading letters individually. When reading a transformed or reflected angle or shape that uses " ' ", describe as "prime."

Do not reference the case of the letter unless an item includes uppercase and lowercase letters. In this instance, make reference to the uppercase letters guideline.

Application of Audio Guideline

Example 1

Angle *RST*

Example 2

Triangle *RST*

Example 3

Triangle *R* prime *S* prime *T* prime

Ratios (:)

Example

3:2

Audio Guideline

Read as "the ratio x to y."

Sometimes the ratio symbol is used for fractions. This can usually be determined by context. If this is the case, refer to the fraction guideline.

If the "the ratio of" is used in the item, read as "x to y" to avoid being redundant.

Application of Audio Guideline

Example

The ratio three to two

Equal Signs (=)

Example

2 + 3 = 5

Audio Guideline

Read as "equals."

Application of Audio Guideline

Example

Two plus three equals five.

Pi (π)

Audio Guideline

Read as "pi."

Other Greek letters

Audio Guideline

Read as the Greek letter in most cases, unless using the closest English letter is clearer.

Application of Audio Guideline

Example

sin α = 0.5 is read "sine alpha equals zero point five" but the density formula,

$$\rho = \frac{m}{V}$$

where "ρ" is the Greek letter rho, should be read "P equals fraction with …" since (a) there is no "P" in the formula, (b) the Greek letter closely resembles the English letter, and (c) use of the word "rho" is likely to be more distracting than helpful for text-to-speech users, since English readers may not know what a "rho" is. It is advisable to avoid formulas like this in item development (a "D" replaces the rho is some US textbooks), but given an item with uncommon Greek letters (other than alpha, beta, delta, theta, and perhaps a few others as may be determined on a case-by-case basis), math content specialists have found it most helpful in the past to use the closest English equivalent.

Approximately equal to (≈)

Example

π ≈ 3.14

Audio Guideline

Read as "is approximately equal to."

Application of Audio Guideline

Example

Pi is approximately equal to three point one four.

Less than (<)

Example 1

3<5

Example 2

x<y<z

Audio Guideline

Read as "is less than."

If there is more than one "less than" sign in a string, then read the whole relationship together. Read the last part as "is less than."

Application of Audio Guideline

Example 1

Three is less than five.

Example 2

X is less than *y* is less than *z.*

Less than or equal to (≤)

Example

2x ≤ 6

Audio Guideline

Read as "is less than or equal to."

Application of Audio Guideline

Two x is less than or equal to six.

Greater than (>)

Example 1

7>5

Example 2

x>y>z

Audio Guideline

Read as "is greater than."

If there is more than one "greater than" sign read the whole relationship together. Start the last part as "is greater than."

Application of Audio Guideline

Example 1

Seven is greater than five.

Example 2

X is greater than *y* is greater than *z.*

Greater than or equal to (≥)

Example

3x ≥ 6

Audio Guideline

Read as "is greater than or equal to."

Application of Audio Guideline

Three *x* is greater than or equal to six.

Dashes (–)

Example 1

Pages 3–7

Audio Guideline

When the dash is used to reference material or as a group of conditions, use "through" for consecutive and non-consecutive numbers.

Application of Audio Guideline

Example 1

Pages three through seven

Temperatures (°F and °C)

Example 1

35°F

Example 2

25°C

Audio Guideline

Read as "degrees Fahrenheit" and "degrees Celsius."

Application of Audio Guideline

Example 1

Thirty-five degrees Fahrenheit

Example 2

Twenty-five degrees Celsius

Parallels ($\overline{RS}$ || $\overline{XY}$)

Audio Guideline

Read as "is parallel to."

Application of Audio Guideline

Line segment *RS* is parallel to line segment *XY.*

Perpendiculars (⊥)

Example

RS ⊥ XY

Audio Guideline

Read as "is perpendicular to."

Application of Audio Guideline

Line segment *RS* is perpendicular to line segment *XY.*

Abbreviations (ft., km)

Example 1

3ft.

Example 2

What is the correct abbreviation for kilometer?

    A. kl

    B. K

    C. km

    D. klm

Audio Guideline

Present abbreviations by speaking the whole word the abbreviation represents.

If the item measures the ability to identify the meaning of the abbreviation, then read the abbreviation letter by letter.

If speaking the abbreviation violates the construct being measured, then read letter by letter.

If the item has measurements that are all uppercase or lowercase, then it is not necessary to reference the cases.

Application of Audio Guideline

Example 1

Three feet

Example 2

What is the correct abbreviation for kilometer?

    A. kl

    B. K

    C. km

    D. klm

Measurement (" ' cm²)

Example 1

6”

Example 2

12’

Example 3

4 cm²

Example 4

5 cm³

Audio Guideline

Present measurements by speaking the whole word the symbol represents.

Application of Audio Guideline

Example 1

Six inches

Example 2

Twelve feet

Example 3

Four square centimeters

Example 4

Five cubic centimeters

Number Signs (#)

Example

Refer to step #5.

Audio Guideline

Read as "number."

Rule refers only to when symbol is being used to signify "number" as opposed to other non-mathematical uses of the symbol (for example, the pound key and the hash key).

Application of Audio Guideline

Example

Refer to step number five.

Empty/Unknown Boxes (□, ？)

Example 1

$4 + 2x = \square$

Example 2

$3 + y = \boxed{?}$

Audio Guideline

Refer to an empty box in a formula or equation as "blank." Refer to a box with a question mark in it as "question mark."

Application of Audio Guideline

Example 1

Four plus two *x* equals blank.

Example 2

Three plus *y* equals question mark.

Not equal to (≠)

Example

$2x \neq 7$

Audio Guideline

Read as "is not equal to."

Application of Audio Guideline

Two *x* is not equal to seven.

Arc (⌒)

Example

$\overset{\frown}{RT}$

Audio Guideline

Read as "arc."

Application of Audio Guideline

Example

Arc RT

Infinity (∞)

Example

As $x \rightarrow \infty$, $f(x) \rightarrow -\infty$

Audio Guideline

Read as "infinity."

Application of Audio Guideline

Example

As x approaches infinity, f of x approaches negative infinity.

Percent (%)

Example

35%

Audio Guideline

Read as "percent."

Application of Audio Guideline

Thirty-five percent

Lines: Line Segment, Line, and Ray Lines: Line Segment, Line, and Ray ($\overline{FG}$, $\overleftrightarrow{JK}$, $\overrightarrow{LM}$)

Example 1

Line Segment $\overline{FG}$

Example 2

Line $\overleftrightarrow{JK}$

Example 3

Ray $\overrightarrow{LM}$

Audio Guideline

Read as "line segment," "line," or "ray" when they appear above letters or numbers.

Application of Audio Guideline

Example 1

Line segment *FG*

Example 2

line *JK*

Example 3

ray *LM*

Similar to (~)

Example

$\triangle EFG \sim \triangle JKL$

Audio Guideline

Read as "is similar to."

Application of Audio Guideline

Example

Triangle *EFG* is similar to triangle *JKL*.

Therefore (∴)

Example

$A=B$ and $B=C \therefore A=C$

Audio Guideline

Read as "therefore."

Application of Audio Guideline

Example

A equals *B* and *B* equals *C*, therefore *A* equals *C*.

Congruent (≅)

Example

$\angle FGH \cong \angle JKL$

Audio Guideline

Read as "is congruent to."

Application of Audio Guideline

Example

Angle *FGH* is congruent to angle *JKL*.

Factorial (!)

Example 5

! = *x*

Audio Guideline

Read as "factorial."

Application of Audio Guideline

Example

Five factorial equals *x.*

Plus or Minus (±)

Example

The margin of error is 4.5 ± .8

Audio Guideline

Read as "plus or minus."

Application of Audio Guideline

Example

The margin of error is four point five plus or minus point eight.

Subscript (A_i)

Example

A_i represents the maximum amount of interest.

Audio Guideline

Read as "*x* subscript *y.*"

Application of Audio Guideline

A subscript *i* represents the maximum amount of interest.

Numbers

Negative/Positive Numbers

Example 1

–4

Example 2

4 – –5

Example 3

What is the distance between +4 and –3 on the number line?

Audio Guideline

Read as "negative." Do not read the negative sign as a minus sign.

In most cases, consecutive negatives that are intended to show the negative of a negative will be represented with a set of parentheses. If this is the case, then refer to the parentheses section.

If the negative of a negative does not include parentheses, read as "negative (pause) negative."

Two consecutive negatives should not be read as "negative negative *X*" if the operation is focused on subtraction. In this case, read as "minus negative *X*." Note that this rule refers to numbers only. If, instead of a number, *X* is actually a variable or expression that includes variables, refer to the section entitled "Variables/Letters" below for the correct reading of expressions like –*y*.

If a positive sign precedes a number and is not part of an operation, then read as "positive."

Application of Audio Guideline

Example 1

Negative four

Example 2

Four minus negative five

Example 3

What is the distance between positive four and negative three on the number line?

Large Whole Numbers

Example 1

103,457

Example 2

Item 2:

Virginia covers one hundred two thousand, five hundred fifty-eight square kilometers of land. Which shows this number?

A 1,258

B 12,558

C 102,558

D 1,200,558

Audio Guidelines

For items not measuring place value, read large numbers by referencing all of the number place values.

If the item measures place value knowledge, read the number digit by digit using commas.

If reading the number as a whole number violates the construct being measured, read the number digit by digit.

Application of Audio Guideline

Example 1

One hundred three thousand, four hundred fifty-seven

Note: Use this application unless cueing occurs; then use the application in Example 2.

Example 2

    A.   one comma two five eight
    B.   one two comma five five eight
    C.   one zero two comma five five eight
    D.   one comma two zero zero comma five five eight

Fractions/Improper Fractions

Example 1

$$\frac{1}{2} + \frac{3}{8}$$

Example 2

$$\frac{1}{14} + \frac{15}{100} - \frac{x}{2y}$$

Example 3

$$\frac{3x + y}{z}$$

Example 4

$$\frac{6}{3}$$

Example 5

$\frac{3x}{5} + x^2$

Audio Guidelines

Read common fractions by presenting the numerator as the number it represents and the denominator as the ordinal number using two words for the whole presentation.

Read any fraction with numerator of _____ (pause) and denominator of _____.

If the denominator is between 2 and 10 then read it is as one third, one fourth, one sixth, one sixth, one seventh, one eighth, one ninth, or one tenth.

An exception to the first guideline is $\frac{1}{2}$, which should always be read as one-half.

An exception to the first guideline is 1 in the denominator. For example, $\frac{3}{1}$ should be read as numerator of 3 (pause) and denominator of 1.

When a fraction is complex (e.g., has more than one number in the numerator/denominator, includes an arithmetic operation, or involves parentheses/exponents) denote the numerator and denominator using the language "fraction with numerator of … (pause) and denominator of …"

When an operation follows a fraction, pause between the fraction and the next operation.

Application of Audio Guidelines

Example 1

One-half plus three-eighths

Example 2

Fraction with numerator of 3 (pause) and denominator of 14 (pause) plus fraction with numerator of fifteen (pause) and denominator of one hundred (pause) minus fraction with numerator of *x* (pause) and denominator of two *y*

Example 3

Fraction with numerator of three *X* plus *Y* (pause) and denominator of *Z*

Example 4

Six-thirds

Example 5

Fraction with numerator of three *x* (pause) and denominator of 5 (pause) plus *x* squared

Mixed Numbers

Example 1

$4\frac{3}{4}$

Example 2

$5\frac{13}{28}$

Audio Guidelines

Read with "and" between the whole number and the fraction.

Use fraction audio guidelines for reading fraction portion of mixed numbers.

Application of Audio Guidelines

Example 1

Four and three fourths

Example 2

Five and (pause) fraction with numerator of thirteen (pause) and denominator of 28

Decimal Points

Example 1

40.6500

Example 2

0.100000

Example 3

0.0000000002

Example 4

0.333. . .

Example 5

3,450.0844397

Audio Guidelines

If there are up to six repeating zeroes or numbers before or after the decimal point, read them as "zero and three repeating."

If there are more than six repeating zeroes or numbers after the decimal point (beyond millionths), say "point" and read the digits in order from left to right.

Read "repeating" where "…" represents the number of group of numbers that repeats.

Application of Audio Guidelines

Example 1

Forty point six five zero zero

Example 2

Zero point one zero zero zero zero zero

Example 3

Zero point zero zero zero (pause) zero zero zero (pause) zero zero zero two

Example 4

Zero point three repeating

Example 5

Three thousand four hundred fifty point zero eight four (pause) four three nine seven

Roman Numerals

Example 1

Find the point in quadrant II that is furthest from the origin.

Example 2

V. Three students walked to school taking different routes.

Example 3

What is the numeric value of Roman numeral VII?

Audio Guidelines

If an item uses Roman numerals but is not measuring knowledge of Roman numerals, read the Roman numeral reference and then the number.

If the item measures knowledge of Roman numeral value, read "Roman numeral" followed by the letters one at a time.

Application of Audio Guidelines

Example 1

Find the point in quadrant two that is furthest from the origin.

Example 2

Question five. Three students walked to school taking different routes.

Example 3

What is the numeric value of Roman numeral V I I?

Time

Example 1
6:30

Example 2
9 a.m.

Example 3
5:45

Example 4
5:00 p.m.

Audio Guidelines
Read the time literally without using shortcuts or reading the time in reference to a different version of time (e.g., noon, quarter of six, ten after five).

Read a.m. and p.m. without adding language about the time of day (e.g., "in the morning" or "at night.")

Application of Audio Guidelines
Example 1
Six thirty

Example 2
Nine a m

Example 3
Five forty five

Example 4
Five o'clock p m

Date

Example 1
1976

Example 2
Feb. 5, 2003

Example 3

Population of Two Cities from 1975 to 2025

City	1975	2000	2010	2025
Tokyo	26.6 million	34.4 million	36.9 million	37.1 million
Delhi	4.4 million	15.7 million	21.9 million	28.6 million

Audio Guidelines

Read years as they would be read in plain language usage. For years after 1999, read "two thousand six" (for example) before 2010 and "twenty twelve" for years after 2009. However, when years comprise the axis of a graph or a sequence of table cells, maintain consistency in going from 2009 … 2010 … 2011 and use either convention (both are acceptable usage), except do not use the "two-thousand" style for years after 2019. For years after 2099, use the same style as for years between 1900 and 1999.

Read months as the full name even if abbreviations are presented in text.

Read days as you would when reading a date instead of reading the day as number (e.g., "second" instead of "two," "third" instead of "three," or "fourth" instead of "four").

Application of Audio Guidelines

Example 1

Nineteen seventy six

Example 2

February sixth, two thousand three

Example 3

… city … nineteen seventy five … two thousand … two thousand ten … twenty twenty five … (Refer to the section entitled "Tables" for more information.)

Ordered Pairs

Example

Point *X* is (−2, 4)

Audio Guideline

Read coordinate pairs as "ordered pair X, Y."

Application of Audio Guideline

Point X is ordered pair negative two, four.

Probability

Example

P(orange) = $\frac{1}{6}$

Audio Guideline

"P(text)" is the notation for probability. When reading a probability, do not read parentheses as "open parenthesis/close parenthesis." Read as "P of" word in parentheses "is" remaining text.

Application of Audio Guideline

Example

P of orange is one-sixth

Expressions/Equations/Operations

Multiplication

Example 1

3 x 5 = *X*

Example 2

xy + 4*x* = 10

Example 3

(3 + *x*)(*y* − 2)

Audio Guidelines

Read the multiplication symbol as "times" when it appears in a math item.

When a number, symbol, or another set of parentheses appears before a set of parentheses, read the number or symbol as is and "open parenthesis" before what is within the parentheses. When multiple sets of parentheses appear consecutively, read as "open parenthesis" and "close parenthesis."

If there are two variables or a variable and a number consecutively, do not read "times" to represent implied multiplication.

Application of Audio Guidelines

Example 1

Three times five equals *X*.

Example 2

Xy plus four x equals ten.

Example 3

Open parenthesis three plus *x*, close parenthesis, (pause) open parenthesis *y* minus two, close parenthesis.

Addition

Example

4 + 2 + 3

Audio Guideline

Read as "plus."

Application of Audio Guideline

Four plus two plus three

Subtraction

Example

5 − 3

Audio Guideline

Read as "minus."

Application of Audio Guideline

Five minus three

Division

Example 1

12 ÷ 4

Example 2

What is 57 ÷ 5

       A.   10 R7

       B.   11 R2

       C.   12

Audio Guideline

Read as "divided by."

If the item presents the remainder as "R" read as "remainder" unless the item is measuring the meaning of "R." In this case, read it as "R."

Application of Audio Guideline

Example 1

Twelve divided by four

Example 2

What is fifty-seven divided by five?

    A.   ten, remainder seven

    B.   eleven, remainder two

    C.   twelve

Parentheses

Example 1

$3(x + y) = 6$

Example 2

$2(x + 3) + \left(\dfrac{-y - 2}{3}\right) = 9$

Example 3

$(x + 4)[(x + 4) - (x - 2)]$

Audio Guideline

Read the parentheses by referring to the opening of the parentheses using the language "open parenthesis" and the closing of the parentheses using the language "close parenthesis."

It is important to reference the close of the parentheses to be clear on when the parenthetical expression ends.

When reading an equation or expression with multiple parts and sets of parentheses, pause to help differentiate between sections.

Read brackets using the same language as parentheses in the first guideline.

Application of Audio Guideline

Example 1

Three (pause) open parenthesis *x* plus *y* close parenthesis (pause) equals six.

Example 2

Two (pause) open parenthesis *x* plus three close parenthesis (pause) plus (pause) fraction with numerator of open parenthesis *y* minus two close parenthesis (pause) and denominator of three (pause) equals nine.

Example 3

Open parenthesis *x* plus four close parenthesis, open bracket, open parenthesis, *x* plus four close parenthesis minus open parenthesis x minus two close parenthesis, close bracket.

Mathematical Exponents (x^2, x^3, 4^5)

Example 1

$y = x^2$

Example 2

$y = 4^5 + 2$

Example 3

$y = 2^{x+5} + 3$

Example 4

$16^{3/2} = 8^2$

Example 5

$3^{5.5} = (z+8)^{x/z}$

Audio Guidelines

Read the base first—the base can be either a numeral or the variable.

If the exponent has a value of 2, then read "squared." If the exponent has a value of 3, read "cubed;" otherwise, read "raised to the _power" where _denotes either the ordinal of the number (fourth, sixth, negative seventy-sixth, etc.) if the exponent is an integer or the expression, as specified elsewhere in these guidelines, if the exponent is anything other than an integer.

To indicate a return to the base, use a pause.

Read fraction exponents following the fractions rule.

Application of Audio Guidelines

Example 1

Y equals *x* squared.

Example 2

Y equals four raised to the sixth power (pause) plus two.

Example 3

Y equals two raised to the *x* plus five power (pause) plus three.

Example 4

Sixteen raised to the three halves power equals eight squared.

Example 5

Three raised to the five point five power equals open parenthesis *Z* plus 8 close parenthesis, raised to the fraction with numerator of *x* and denominator of 2 power.

Variables/Letters

Example 1

$x + y = 3$

Example 2

In the triangle, what is the measurement of angle A that is opposite side a?

Example 3

$N + 4$

Example 4

$-x^3$

Audio Guideline

Read lowercase variables in a math item without referring to case.

If uppercase variables are used in a math item along with lowercase variables, then specify both cases using the language "lowercase" and "uppercase."

If an uppercase variable appears in a math item without a lowercase variable, then do not specify uppercase.

If a variable is preceded by a negative sign, read as "opposite of" the variable, rather than the "negative of" the variable.

Application of Audio Guideline

Example 1

X plus y equals three.

Example 2

In the triangle below, what is the measurement of angle uppercase A that is opposite side lowercase a?

Example 3

N plus four

Example 4

Opposite of x cubed

Logs

Example 1

$Log_{10}100 = 2$

Example 2

69 If $\log 2 \approx 0.301$ and $\log 3 \approx 0.477$, what is the approximate value of $\log 72$?

   A   0.051

   B   0.778

   C   0.861

   D   1.857

Example 3

ln x

Audio Guidelines

Read "log" followed by the base, the word "of," and then the number or variable.

If the log is shown without an explicit base, then read as "log" and the number or variable shown. Do not interpret the implied base of 10 if it is not written.

Read "ln x" as "natural log of x."

Application of Audio Guidelines

Example 1

Log base ten of one hundred equals two.

Example 2

If log two is approximately equal to zero point three zero one and log three is approximately equal to zero point four seven seven, what is the approximate value of log seventy-two?

Example 3

Natural log of x

Radicals

Example 1

$\sqrt{2}$

Example 2

$\sqrt[4]{144} = \sqrt[x]{288}$

Example 3

$\sqrt[m+n]{x+y}$

Example 4

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Audio Guidelines

For radicals with an implied radical index of two, read as "the square root of *x*."

For radicals with a radical index of three, read as "the cube root of *x*."

For radicals with a number for a radical index other than two or three, start by reading the index as "the *X*th root of."

If the radical index is a variable, read as "the *x* root of *y*."

When multiplying numbers by radicals (e.g.,), say "*x* times the square root of *y*."

Application of Audio Guidelines

Example 1

The square root of two

Example 2

The fourth root of one hundred forty-four equals the x root of two hundred eighty-eight.

Example 3

The *m* plus n root of quantity *x* plus *y*

Example 4

X equals, fraction with numerator of, opposite of *B*, plus or minus the square root of quantity, *B* squared minus four *A C*, and denominator of two *A*.

Absolute Values

Example 1

|−16|

Example 2

|2 + 7|

Example 3

|*x*| + 1

Audio Guidelines

Read as "the absolute value of."

Pause if an absolute value is part of a larger expression or equation.

Application of Audio Guidelines

Example 1

The absolute value of negative sixteen

Example 2

The absolute value of quantity two plus seven

Example 3

The absolute value of x (pause) plus one.

Functions ($f(x)$)

Example 1

$f(x) = 5$

Example 2

$f(x + 1)$

Example 3

$f(g(x))$

Example 4

$f^{-1}(x) = -x - 2$

Audio Guidelines

For function notation in general, read the first letter shown then the word "of," followed by the variable and/or number in parentheses.

When the expression inside the parentheses is more complex or includes another function, use the same rule of reading the letter first, then the word "of," followed by the variable or expression in parentheses.

When the inverse of a function is presented, read it as "f inverse of x."

Application of Audio Guidelines

Example 1

F of *x* equals five

Example 2

F of open parenthesis *x* plus one close parenthesis

Example 3

F of g of *x*

Example 4

The inverse of *f* of *x* equals negative two-thirds *x* minus two.

For function tables where one column/row is paired with one row/column

The table should be read as it is organized, as (*x*, *y*) pairs, according to p. 44 (If the orientation of the table lends itself to reading the table information column by column and this is a more logical manner to present the table, then do so.)

Example

This table shows a relationship between x and y:

x	y
3	14
7	30
9	38

"The table has two columns and three rows. The first column heading is, *x*; the second column heading is, *y*. First row, 3, 14; second row, 7, 30; third row, 9, 38."

Example

This table shows a relationship between *x* and *y*:

x	3	7	9
y	14	30	38

"The table has two rows and three columns. The first row heading is, *x*; the second row heading is, *y*. First column, 3, 14; second column, 7, 30; third column, 9, 38."

System of Equations/Inequalities

Example 1

$$\begin{cases} x + y = 4 \\ x - y = 2 \end{cases}$$

What is the solution to the system of equations?

Example 2

7 | Which point lies in the solution set for the

$$\text{system } \begin{cases} 2y - x \geq -6 \\ 2y - 3x < -6 \end{cases}?$$

A $(-4, -1)$
B $(3, 1)$
C $(0, -3)$
D $(4, 3)$

Audio Guidelines

Start by reading "system of equations" or "system of inequalities." Then read the information in the system starting from the top to the bottom; reference the row position and insert a pause between rows.

Read equations and inequalities according to equation and inequality guidelines above.

Application of Audio Guidelines

Example 1

System of equations. Top row, x plus y equals four (pause) bottom row, *x* minus *y* equals two. What is the solution to the system of equations?

Example 2

Which point lies in the solution set for the system, top row, two *y* minus *x* is greater than or equal to negative six (pause) bottom row, two *y* minus three *x* is less than negative six.

Trigonometry

Example 1

$\sin 15° = \cos 75°$

Example 2

$\tan \theta = -1$

Audio Guidelines

Read the abbreviated versions of trigonometry functions in full words if doing so does not violate the construct being measured.

If the item is measuring knowledge of these abbreviations read letter by letter.

Use the Greek alphabet in reading trigonometric functions and items. The most used letter is theta (θ)

Application of Audio Guidelines

Example 1

Sine fifteen degrees equals cosine seventy five degrees

Example 2

Tangent theta equals negative 1

Tables

Example 1

Seashell Collection

Size	Number of Seashells
Small	3
Medium	6
Large	4

Example 2

Rock Types

	Shiny	Air Holes	Flat Layers	Fossils
Metamorphic	X		X	X
Igneous	X	X		
Sedimentary			X	X

Audio Guideline

Text Only

Read the table title only. Allow for all content elements in the table to be read on demand.

Text and Graphics

Read the table title, and then state the number of rows and columns. Then read the column headings from left to right followed by reading the information in each row from left to right.

If the orientation of the table lends itself to reading table information column by column and this is a more logical manner to present the table, then do so.

Read the units of measure for each cell unless they are not specified in the table.

When reading a data table that has blank cells, skip over them if they are unnecessary to answer the question. Blank cells should be read if this information is essential to answer the item.

Remain consistent with the style of reading from table to table. Using a standardized version will help students better understand the patterns of the descriptions.

Many charts that are set up in a table format can be read in the manner described. Determine the layout of such charts before deciding the best way to read the information being presented.

Application of Audio guidelines

Example 1

The table title is Seashell Collection. The table has two columns and three rows. The first column heading is Size, the second column heading is Number of Seashells; first row, Small, three seashells; second row, Medium, six seashells; third row, Large, four seashells.

Example 2

The table title is Rock Types. The table has four columns and three rows. The first column heading is Shiny, the second column heading is Air Holes, the third column heading is Flat Layers, and the fourth column heading is Fossils; first row, Metamorphic, Shiny, Flat Layers, Fossils; second row, igneous, Shiny, Air Holes; third row, Sedimentary, Flat Layers, Fossils.

Tally Charts

Example

Name	Number of Votes
Tigers	ⵌ I
Rockets	III
Sharks	ⵌ II
Bobcats	IIII

Audio Guideline

Text Only

Read the tally chart title only. Allow for all content elements in the chart except for the tally marks to be read on demand.

Text and Graphics

Read the tally chart title, column headings, and row headings.

Read the number of tally marks only if it does not violate the construct being measured. If reading tally marks does violate the construct being measured, tactile representation is required to make this item accessible to blind students and some low-vision students.

Application of Text and Graphics Guidelines

Example

The tally chart has two columns and four rows. The first column heading is Name, and the second column heading is Number of Votes; first row, Tigers, six votes; second row, Rockets, three votes; third row, Sharks, seven votes; fourth row, Bobcats, four votes.

Bar Graphs

Example 1

Buttons in a Box

Example 2

Buttons in a Box
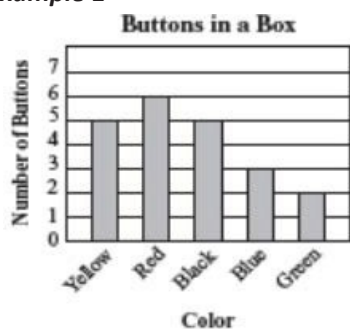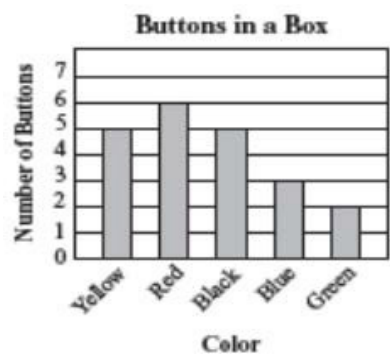
How many red buttons are in the box?

Example 3

Kate asked the students in her class what their favorite fruit was. The results of her survey are shown in the graph below.

Students' Favorite Fruits
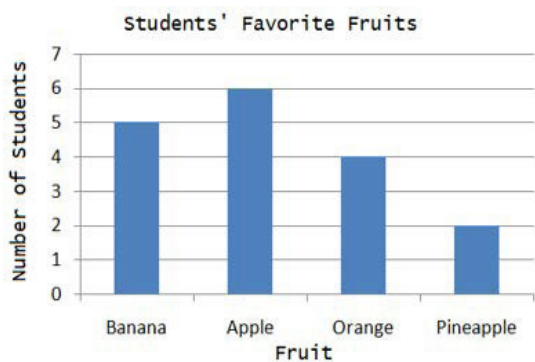
Audio Guideline

Text Only

Read the bar graph title. Allow for all words and numbers on the bar graph to be available to be read on demand.

Text and Graphics

Read the bar graph title first, followed by the x-axis label and the y-axis label. Do not read values on either axes until describing the bars.

Describe each bar, being careful to take into account the question, so as not to violate the construct being measured. In each description, use the units of measure for the values on the x- and y- axes if applicable.

If a bar is between two horizontal lines, then do not estimate or approximate numbers. Instead, use more general language such as "a little less than," "a little more than," and "midway between."

If the item measures the student's ability to identify the number associated with the bar, then describe the graph without noting the heights of the bars. In this case, tactile representation is required to make this item accessible to blind students and some low-vision students.

Application of Text and Graphics Guidelines

Example 1

The bar graph title is Buttons in a Box. The x-axis label is Color and the y-axis label is Number of Buttons; Yellow bar, five buttons; Red bar, six buttons; Black bar, five buttons; Blue bar, three buttons; Green bar, two buttons.

Example 2 (item specifically asks students to identify the value associated with a bar)

The bar graph title is Buttons in a Box. The x-axis label is Color and shows five colors: Yellow, Red, Black, Blue, and Green. The y-axis label is Number of Buttons.

Example 3

The bar graph title is Students' favorite fruits. The x-axis label is Fruit, and the y-axis label is Number of students. Four bars are shown, from left to right, banana, apple, orange, pineapple.

Three functions plotted on a graph
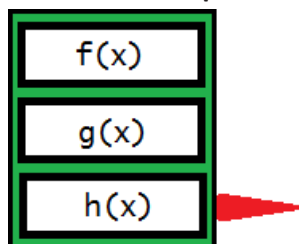
If this graph is described with a tool like that above used to select different graphs on the same coordinate plane, it should be read as follows:

First row, F of X; second row, G of X; third row, H of X.

Note: If only two types of graph can be selected with the tool, it may be appropriate to read according to instructions beginning on page 43 for systems of equations (top row … bottom row …).

Histograms

Example 1

13 Abe tested 85 Brand X light bulbs to determine their life spans. The histogram below shows the results of his test.

**Life Spans of
85 Brand X Light Bulbs**

Number of Light Bulbs
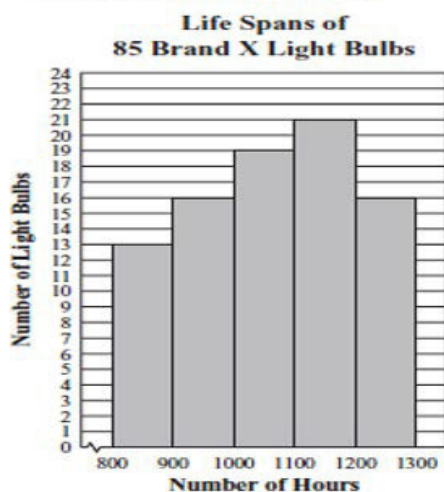
Number of Hours

What was the total number of Brand X light bulbs that had life spans greater than or equal to 1000 hours?

A. 72
B. 56
C. 51
D. 21

Example 1

13 Abe tested 85 Brand X light bulbs to determine their life spans. The histogram below shows the results of his test.

**Life Spans of
85 Brand X Light Bulbs**

Number of Light Bulbs (y-axis)

Number of Hours (x-axis)
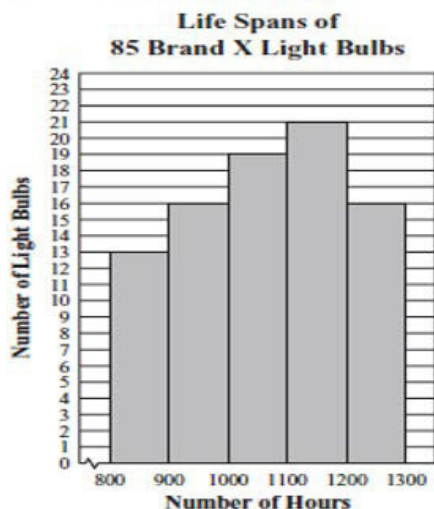
What was the total number of Brand X light bulbs that had life spans greater than or equal to 1000 hours?

A. 72

B. 56

C. 51

D. 21

Audio Guideline

Text Only

Read the histogram title. Allow for all words and numbers on the histogram to be available to be read on demand.

Text and Graphics

Read the histogram title first, followed by the x-axis label and the y-axis label.

Describe each bar range on the x-axis, being careful to take into account the question, so as not to violate the construct being measured. In each description use the units of measure on the x- and y-axis labels if applicable.

If a bar is between two horizontal lines, then do not estimate or approximate numbers. Instead, use more general language such as "a little less than," "a little more than," and "midway between."

If the item measures the student's ability to identify the number associated with the bar, then describe the graph without noting the heights of the bars. In this case, this item is not accessible to blind and some low-vision students without tactile representation.

If there are a large number of bars (more than 10) consider associating bars together or focusing on trends or more general frequency in your description.

**Application of Text and Graphics Guidelines**

Example 1

The histogram title is Life Spans of Eighty-Five Brand X Light Bulbs. The x-axis label is Number of Hours and the y-axis label is Number of Light Bulbs; bar one, eight hundred through eight hundred ninety nine hours, thirteen light bulbs; bar two, nine hundred through nine hundred ninety nine hours, sixteen light bulbs; bar three, one thousand through one thousand ninety nine hours, nineteen light bulbs; bar four, one thousand one hundred through one thousand one hundred ninety nine hours, twenty one light bulbs; bar five, one thousand two hundred through one thousand two hundred ninety nine hours, sixteen light bulbs.

Example 2 (item specifically asks student to read information from one of the bars)

The histogram title is Life Spans of Eighty-Five Brand X Light Bulbs. The x-axis label is Number of Hours and the y-axis label is Number of Light Bulbs. Five bars show the number of light bulbs with a life span of eight hundred through eight hundred ninety nine hours, nine hundred through nine hundred ninety nine hours, one thousand through one thousand ninety nine hours, one thousand one hundred through one thousand one hundred ninety nine hours, one thousand two hundred through one thousand two hundred ninety nine hours.

Line Graphs

Example 1
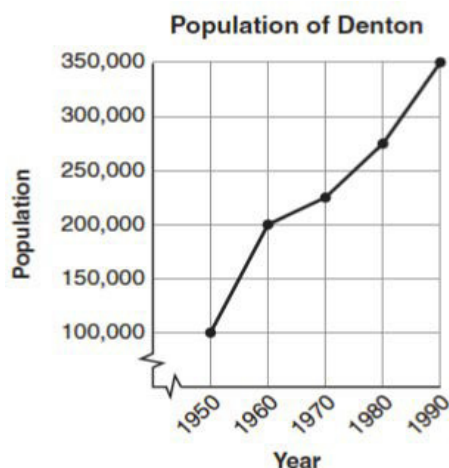
Example 1
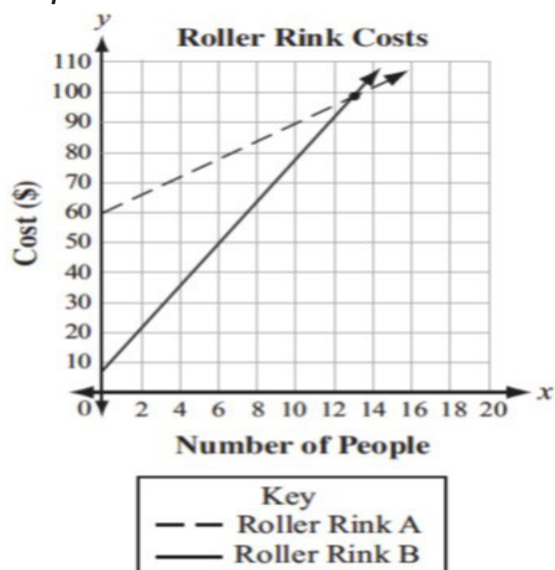
Audio Guidelines

Text Only

Read the graph title only. Allow for all words and numbers in the graph area to be available to be read on demand.

Text and Graphics

For all graphs, read the title first.

Read the Key title and then key section (refer to Key rule specifically).

Read the axis labels.

When describing the graph, be as concise as possible while providing the necessary information to understand and answer the question.

If a line or point being described falls between two marked x- or y-axis values, then do not estimate or approximate numbers Instead, use more general language such as "a little less than," "a little more than," and "midway between."

It is not necessary to describe the visual attributes of the graph unless there is an explicit need, such as a key that references line types or an item referencing the attributes or if doing so would help the student is reading a tactile or a magnified version of the test.

If the description violates the construct being measured, then consider amending it to give less specific information. In this case, tactile representation is required to make this item accessible to blind students and some low-vision students.

When possible, reference the starting and ending point of the line segments or starting points of rays to provide context to the student.

Application of Text and Graphics Guidelines

Example 1

The graph title is Population of Denton. The *x*-axis label is Year and the *y*-axis label is Population. The line starts at nineteen fifty, one hundred thousand, rises to nineteen sixty, two hundred thousand, then nineteen seventy, midway between two hundred and two hundred fifteen thousand, then nineteen eighty, midway between two hundred fifty and three hundred thousand, and ends at nineteen ninety, three hundred fifty thousand.

Example 2

The graph title is Roller Rink Costs. Key, dashed line represents Roller Rink A, solid line represents Roller Rink B. The *x*-axis is labeled Number of People. The *y*-axis is labeled Cost (in dollars). The dashed line starts at zero people, sixty dollars and moves up through midway between twelve and fourteen people, one hundred dollars and fourteen people, a little more than one hundred dollars. The solid line starts at zero people, a little less than ten dollars and moves up through between twelve and fourteen people, one hundred dollars and fourteen people, a little less than one hundred ten dollars.

Box Plots

Example 1

The box plot shows the distribution of the daily high temperatures, in degrees Fahrenheit, in the town of Clifton during the year 2004.

Daily High Temperatures (in degrees Fahrenheit)

30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
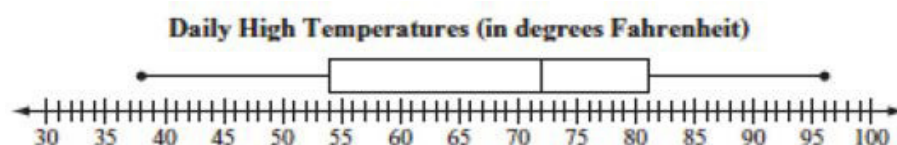
Based on the box plot, in which of the intervals of temperatures is it most likely that exactly 50% of the daily high temperatures are located?

Example 2

The box plot represents the daily high temperatures at a beach in April

Daily High Temperatures

60°F 70°F 80°F 90°F 100°F
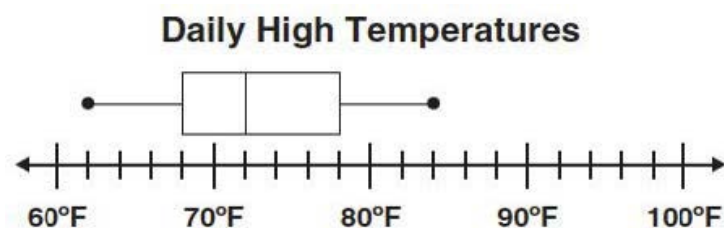
What was the median daily high temperature?

Example 3

Heights of Plants (cm)
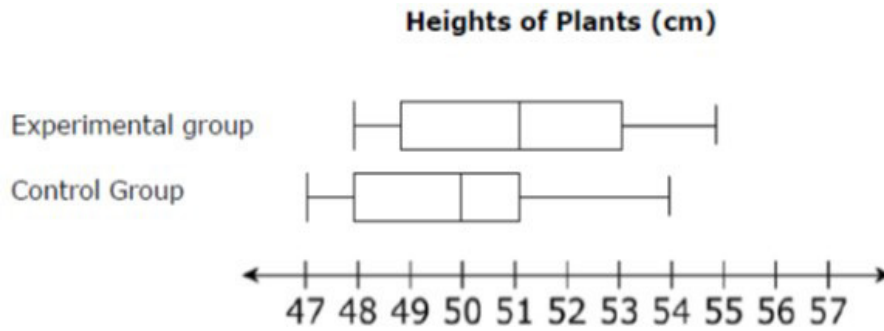
Audio Guidelines

Read the box plot title. Allow for all words and numbers on the box plot to be available to be read on demand.

Text and Graphics

Start by reading the title of the plot and reference that it is a box plot. Read the box titles or any other words on the plot if applicable.

Read the information along the bottom of the graph from left to right.

If the item measures knowledge of the box plot or if the description violates the construct being measured, then describe the box plot without using specific terminology (e.g., whiskers, quartiles, or median). In this case, tactile representation is required to make this item accessible to blind students and some low-vision students.

If a line or point being described falls between two marked values, then do not estimate or approximate number. Instead use more general language such as "a little less than," "a little more than," and "midway between."

Describe the graph elements using specific box plot terminology—including whiskers, quartiles, box, and median—unless doing so violates the construct being measured.

Application of Text and Graphics Guidelines

Example 1

The title of the box plot is Daily High Temperatures (in degrees Fahrenheit). The number line ranges from thirty degrees Fahrenheit to one hundred degrees Fahrenheit. The whiskers range from thirty-eight degrees to ninety-six degrees and the box ranges from fifty-four to eighty-one degrees with a median of seventy-two degrees.

Example 2

The title of the box plot is Daily High Temperatures. The number line ranges from sixty degrees Fahrenheit to one hundred degrees Fahrenheit with markers every ten degrees. The whiskers range from sixty-two degrees to eighty-four degrees and the box ranges from sixty-eight degrees to seventy-eight degrees with an **interior vertical line segment** at seventy-two degrees.

Example 3

The title of the box plot is Heights of Plants (centimeters). The number line ranges from 47 to 57 with markers every whole number. For the experimental group, the whiskers range from 48 centimeters to 55 centimeters and the box ranges from 49 centimeters to 53 centimeters with a median of 51 centimeters. For the control group, the whiskers range from 47 centimeters to 54 centimeters and the box ranges from 48 centimeters to 51 centimeters with a median of 50 centimeters.

Scatter Plots

Example 1

Shipping Shoes

Example 2

RAINFALL AND PLANT GROWTH
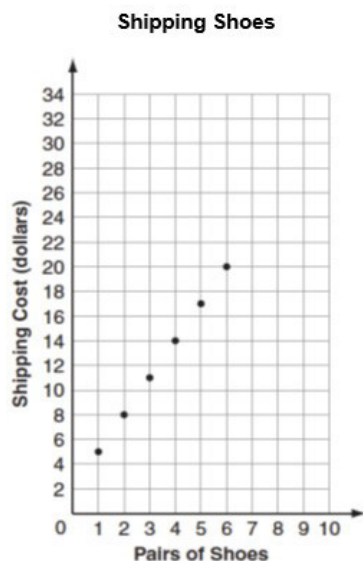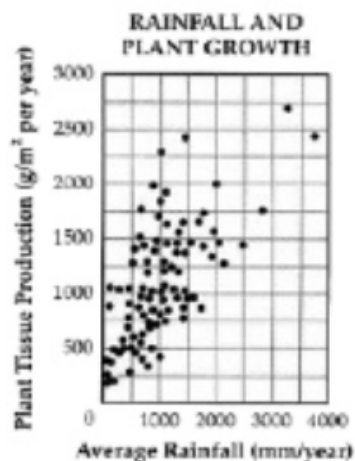
Audio Guidelines

Text Only

Read the title of the scatter plot. Allow for all words and numbers on the scatter plot to be available to be read on demand.

Text and Graphics

For scatter plots, start by reading the title and x-axis and y-axis labels. Include the x- and y-axes ranges if necessary to access the item. In some cases, the rightmost extension of the x-axis and/or topmost extension of the y-axis has no value specified. When specifying the ranges, use either the greatest number listed or the actual value at the rightmost or topmost extension of the axes, whichever is more appropriate.

For a scatter plot with fewer than ten data points, reference each data point. Include units of measure while describing data points only if deemed relevant.

If a line or point being described falls between two marked x- or y-axes values do not estimate or approximate numbers. Instead use more general language such as "a little less than," "a little more than," and "midway between."

If a scatter plot has more than ten data points, then focus on the change of concentration. When possible, read at least a couple of data points (first and last preferably) to put the plot into context.

For some items with scatter plots, tactile representation is required to make the item accessible to blind students and some low-vision students.

Application of Text and Graphics Guidelines

Example 1

The graph is a scatter plot titled "Shipping Shoes." The x-axis is labeled Pairs of Shoes and ranges from zero to ten in increments of one. The y-axis is labeled Shipping Cost (dollars) and ranges from zero to thirty-four in increments of two. The scatter plot has points at one, midway between four and six; two, eight; three, midway between ten and eleven, four, fourteen; five, midway between sixteen and eighteen; and six, twenty.
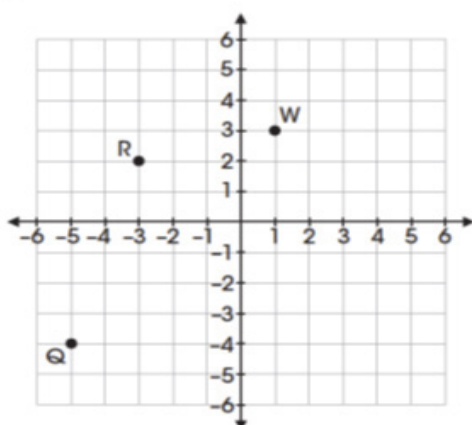
Example 2

The graph is a scatter plot titled Rainfall and Plant Growth. The x-axis is labeled Average Rainfall and ranges from zero to four thousand, in units of millimeters per year, in increments of one thousand. The y-axis is labeled Plan Tissue Production in units of grams per meter squared per year, ranging from zero to three thousand, in increments of five hundred. The graph has approximately eighty-five points scattered in a pattern beginning in the lower-left corner where Plant Tissue Production and Average Rainfall are the lowest. The pattern extends toward the upper-right corner where Plant Tissue Production and Average Rainfall are the highest. The majority of points is concentrated in the lower-left corner and diminishes in concentration as the pattern extends toward the upper-right corner.

Coordinate Planes

Example 1

23. Points *Q*, *R*, and *W* are plotted on the coordinate grid.

Where should point *Z* be plotted so that parallelogram *QRWZ* is formed?

A. (−2, −6)

B. (−1, −3)

C. (3, −2)

D. (2, −1)

Example 2

18. Mr. Yang is driving to the school located at (2, 0) on the coordinate grid.
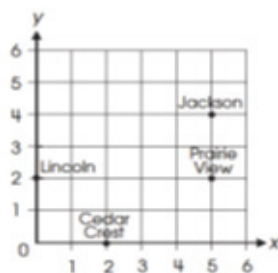
Which school is located at (2, 0)?

○ A. Cedar Crest

○ B. Jackson

○ C. Lincoln

○ D. Prairie View

Example 3

Use the diagram below to answer question 7.
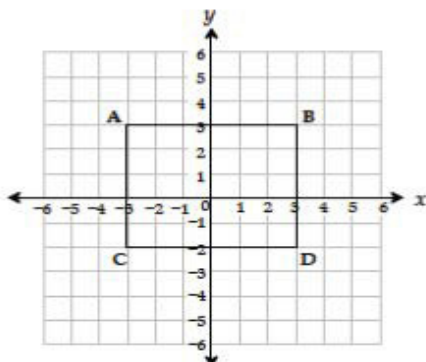
7. Which ordered pair identifies the location of vertex C?

A (⁻3, ⁻2) *

B (⁻3, 3) | vertex A |

C (3, ⁻2) | vertex D |

D (⁻2, ⁻3) | vertex C reversed |

Audio Guidelines

Text Only

Start by reading the title of the coordinate plane. Allow for all words and numbers on the coordinate plane to be available to be read on demand.

Text and Graphics

Read the title of the coordinate plane first.

Read the range of each axis. In some cases, the extensions of the *x*- and/or *y*-axis have no value specified. When specifying the ranges, use either the greatest (or least for bottom and left extensions) number listed or the actual value at the furthest extension of the axes, whichever is more appropriate.

Read the points or words on the grid in a logical manner (clockwise, following the listing of a shape, etc.) referencing their location on the grid.

If a line or point being described falls between two marked *x*- or *y*-axis values, then do not estimate or approximate numbers. Instead, use more general language such as "a little less than," "a little more than," and "midway between."

If reading the location of the points violates the construct being measured, do not read the point, but reference that they are on the grid. In this case, tactile representation is required to make the item accessible to blind students and some low-vision students.

If there is a shape on the grid, then read the type of shape or name of it first, and then reference the axis points of all sides, if relevant. If referencing the axis points violates the construct being measured, then provide a description of the shape without these points.

If an empty grid is presented in an item as part of the prompt, question. Or answer, then read the title and the *x*- and *y*- axes scale.

Application of Text and Graphic Guidelines

Example 1

A coordinate plane with *x*- and *y*-axes ranging from negative six to six; point *Q*, negative five, negative four; point R, negative three, two; and point *W*, one, three.

Example 2

A coordinate plane with x- and y-axes ranging from zero to six. The grid shows the location of the four schools: Jackson, Prairie View, Cedar Crest, and Lincoln.
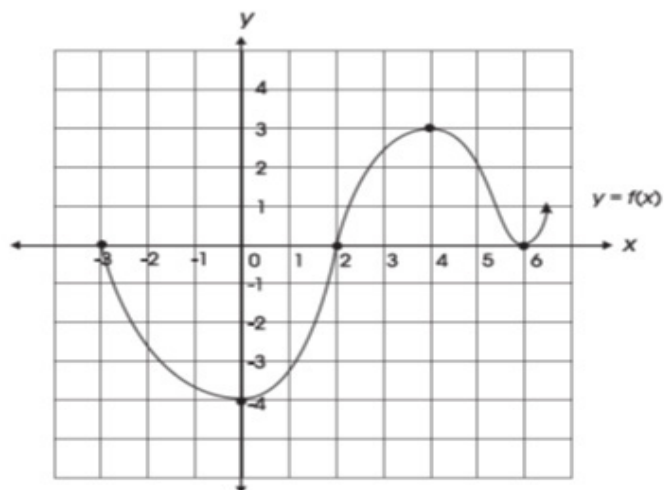
Example 3

A coordinate plane with *x*- and *y*-axes ranging from negative six to six. Rectangle *ABCD* is shown on the grid.

Exponential/Linear Function Graphs

Example 1

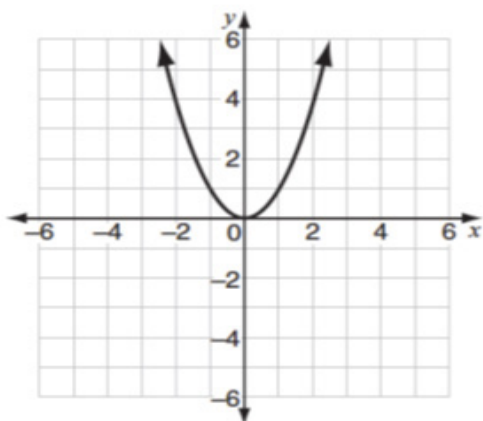31. The graph of the function $f(x)$ is shown below.

Which of the following is NOT a zero of $f(x)$?

A. -4

B. -3

C. 2

D. 6

Example 2

10 Look at this graph of $y = x^2$.

If $y = x - 2$ is graphed on the same coordinate plane, at how many points would the two graphs intersect?

A. 0

B. 1

C. 2

D. 3

Audio Guidelines

Text Only

Start by reading the title of the graph. Allow for all words and numbers on the graph to be available to be read on demand.

Text and Graphics

Read the title of the graph first.

Read the range of each axes and any words or symbols that are on the graph. In some cases, the extensions of the x- and/or y-axis have no value specified. When specifying the ranges, use either the greatest (or least for bottom and left extensions) number listed or the actual value at the furthest extension of the axes, whichever is more appropriate.

Describe the shape of the graph. Use relevant points including starting and ending points or x or y intersection points to aid the description.

If a line or point being described falls between two marked x- or y-axes values, then do not estimate or approximate numbers. Instead use more general language such as "a little less than," "a little more than," and "midway between."

If reading the location of any points violates the construct being measured, then do not read these points. If describing the shape or direction of the graph violates the construct, then do not read the details of the shape of the graph. In this case, tactile representation is required to make the item accessible to blind students and some low-vision students.

Application of Text and Graphics Guidelines

Example 1

A graph showing the function *y* equals *f* of *x*. The x-axis ranges from negative four (or three) to seven (or six), and the *y*-axis ranges from negative six (or negative four) to five (or four). The graph is in the shape of a wave. The graph starts at negative three zero, goes through zero negative four, then two zero, then four three, then six zero, and ends with an arrow pointing up at a midway between six and seven, one.

Example 2

A graph showing y equals x squared. The *x*- and *y*-axes ranges from negative six to six. The graph is a parabola that starts with an arrow at midway between negative two and negative three, six, and then the line moves down through zero zero, and ends with an arrow at midway between two and three, six.
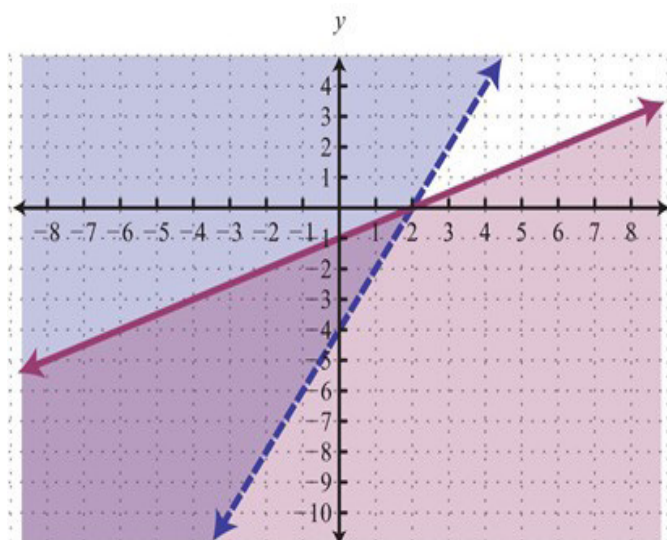
System of inequalities

Example

Which graph represents the solution to this system of inequalities?

y > 2x — 4

3x — 6y ≥ 6

### **Application of Audio Guidelines**

Text and Graphics

Which graph represents the solution to this system of inequalities, top row, Y is greater than 2 X minus 4; bottom row, 3 X minus 6 Y is greater than or equal to 6. A. A graph showing two lines and shaded regions. The X axis ranges from negative 9 to 9. The y axis ranges from negative 11 to 5. The purple line is solid and starts at negative 9, a little less than negative 5; rises to zero, negative 1; then 2, zero; and ends at 9, a little more than 3. The area below the solid line is shaded purple. The blue line is dashed and starts at a little less than negative 3, negative 11; rises to zero, negative 4; then 2, zero; and ends at a little more than 4, 5. The area to the left of the dashed line is shaded blue. The area in between the solid purple line and the dashed blue line is shaded light gray.

Diagrams/Figures/Keys

Tree Diagram

Example 1

11 The tree diagram below shows all of the outfits Jay can choose to wear today. An outfit has one color of shirt, one color of pants, and one color of shoes.
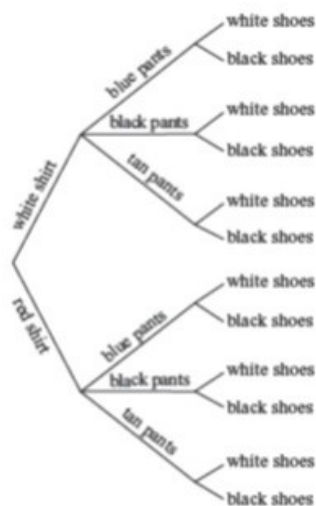
What is the total number of possible outfits with a white shirt?

A. 9
B. 6
C. 3
D. 1

Audio Guidelines

Text Only

Read the tree diagram title. Allow for all words and numbers on the tree diagram to be available to be read on demand.

Text and Graphics

Read the tree diagram title and brief description along with stating the direction of the tree diagram.

Start with the innermost parts of the tree and describe the different limbs in an order that is easy to follow.

Describe all of the elements of the tree diagram with standardized language.

Application of Text and Graphics Guidelines

A tree diagram showing outfit combinations of shirts, pants, and shoes. The diagram displays information from left to right starting with shirts on the leftmost branches. On the top half of the tree, white shirt branches to blue pants, black pants, and tan pants. Each of these pants branches stems to the outermost branches of white shoes and black shoes. On the bottom half of the tree, red shirt branches to blue pants, black pants, and tan pants. Each of these pants branches stems to the outermost branches of white shoes and black shoes.

Keys

Example

Museum Visitors
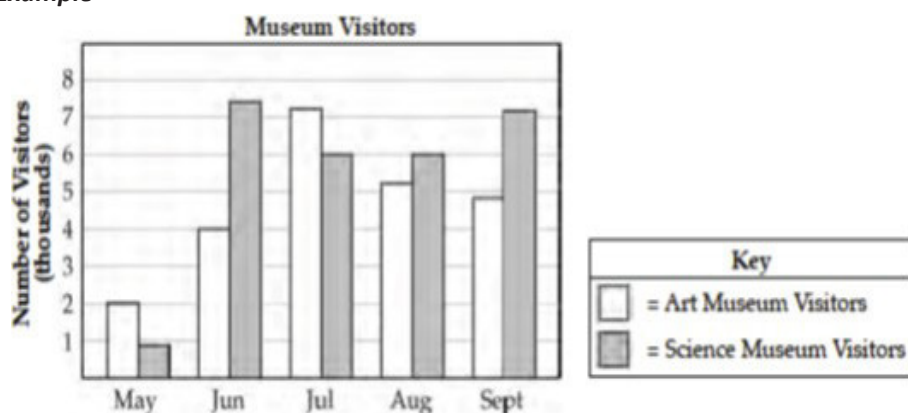
Audio Guidelines

Text Only

Read the word Key after reading the graph/diagram title. Allow for all words and numbers in the key to be available to be read on demand.

Text and Graphics Guidelines

Read the graph/diagram title and then the key.

Describe the key in detail, including shapes, shades, and so on. Use "represents" to associate icon with text. (e.g., –10 miles. Dashed line represents ten miles.)

Read the graph/diagram using the key symbols. (e.g., May, white bar, two; May, gray bar, a little less than one)

Application of Text and Graphics Guidelines

Example

The bar graph title is Museum Visitors. In the Key, the white bar represents Art Museum Visitors, while the gray bar represents Science Museum Visitors. The x-axis shows five months; the y-axis is labeled Number of Visitors (thousands); May, white bar, two; May, gray bar, a little less than one; June, white bar, four; June, gray bar, midway between seven and eight; July, white bar, a little more than seven; July, gray bar, six; August, white bar, a little more than five; August, gray bar, six; September, white bar, a little less than five; September, gray bar, a little more than seven.

Line Plots

Example

16 Look at this line plot.

Books We Read in May

Number of Books

Key

× represents 1 student
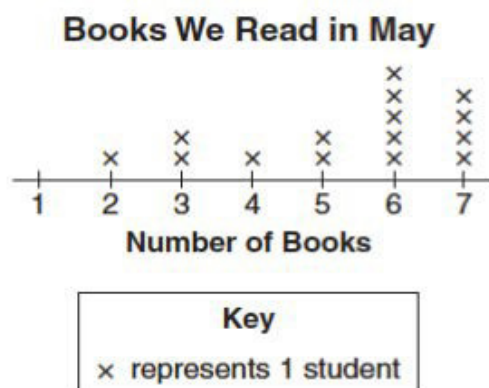
Audio Guideline

Text Only

Read the line plot title. Allow for all words and numbers on the line plot and on the key to be available to be read on demand.

Text and Graphics

Read the title of the line plot, the key, and then the *x*-axis title (refer to this as the number line plot title if the term "axes" has not been taught in the grade being assessed).

Use the key symbol to describe the line plot instead of interpreting the symbol.

If there are no x's or symbols above a number, then read this as zero instead of skipping it.

Be careful not to violate the construct being measured. Read the range of numbers on the *x*-axis without reading the data, if necessary. In this case, tactile representation is required to make the item accessible to blind students and some low-vision students.

Application of Text and Graphics Guidelines

Example

The title of the line plot is Books We Read in May. The key shows that an x represents one student. The number line title is Number of Books and ranges from one to seven in increments of one; at line plot one, zero x's are shown; at line plot two, one x is shown; at line plot three, two x's are shown; at line plot four, one x is shown; at line plot five, two x's are shown; at line plot six, five x's are shown; and at line plot seven, four x's are shown.

Shaded Figures (Grids, Bars, and Shapes)

Example

1 A fraction of the fish shown below are shaded gray.

Which grid is shaded gray to represent a fraction with the same value?

A.

B.

C.

D.
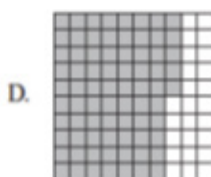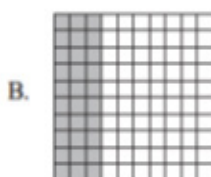
Audio Guidelines

Text Only

Read the title of the shaded figure. Allow for all words and numbers in the figure to be available to be read on demand.

Text and Graphics

Read the title if there is one, and then describe the dimensions of the figure first. If possible, read the dimensions of the figure (ten by ten) instead of just the number of boxes.

Explain how many boxes are shaded, but do not use the terminology "*x* of *y*" boxes are shaded. This creates the fraction for the student and will often violate the construct being measured.

Do not state the total number of boxes shaded when information can be provided that students should use to determine the number of boxes shaded. (e.g., seven columns of ten boxes shaded, instead of seventy boxes)

Application of Text and Graphics Guidelines

Example

A fraction of the fish shown below is shaded gray. The graphic shows four fish. Three of them are shaded gray.

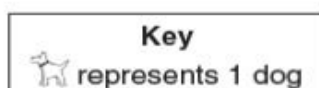Which grid below is shaded gray to represent a fraction with the same value?

- A. ten by ten box grid with seven boxes shaded
- B. ten by ten box grid with three columns of ten boxes shaded
- C. ten by ten box grid with eight columns of ten boxes shaded and five additional boxes shaded
- D. ten by ten box grid with seven columns of ten boxes shaded and five additional boxes shaded

Pictographs

Example

Dogs at the Park

Type of Dog	Number of Dogs
Beagle	🐕 🐕
Collie	🐕 🐕 🐕
Poodle	🐕
Dalmatian	🐕 🐕 🐕 🐕

Key
🐕 represents 1 dog

Audio Guidelines

Text Only

Read the title of the pictograph. Allow for all words and numbers in the pictograph or key to be available to be read on demand.

Text and Graphics

Start by reading the title of the pictograph and then the key.

If the pictograph is in a table format, then refer to the table guidelines.

If the pictograph is in a graph format, then refer to the graph guidelines.

Reference the picture being used in general terms without describing it in detail. Use the key to read the pictograph without interpreting it. When the pictograph, reference "picture of x," since the scale may not be one to one.

In some cases, tactile representation is required to make the item accessible to blind students and some low-vision students.

Application of Text and Graphics Guidelines

Example

The pictograph title is Dogs at the Park. The Key shows a picture of a dog represents one dog. The table has two columns and four rows; column heading one is Type of Dog; column heading two is Number of Dogs; row one, Beagle, picture of two dogs; row two, Collie, picture of three dogs; row three, Poodle, picture of one dog; row four, Dalmatian, picture of four dogs.
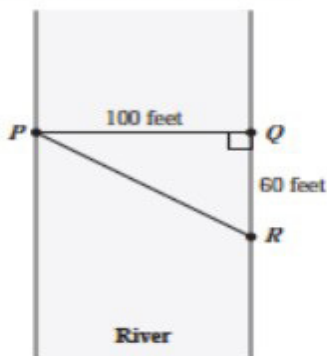
Figures/Illustrations

Example 1

Scale: 1 inch = 20 feet
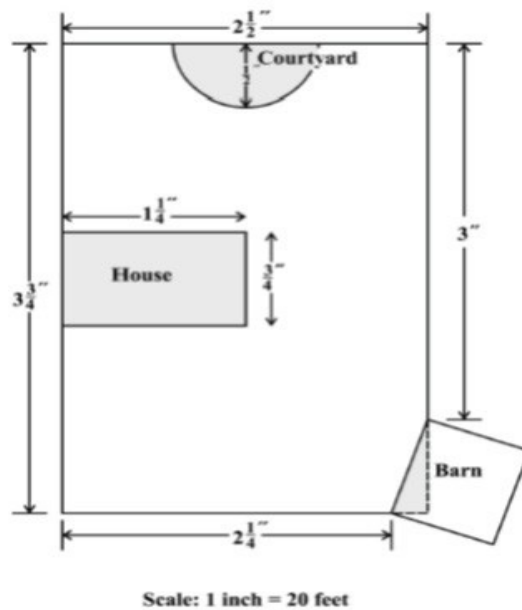
Use the scale to find the actual dimensions, in feet, of the house. Show or explain how you found your answer.

Example 2

40 Triangle *PQR* in the diagram below represents Pam's trip across a river.

In the diagram, $\overline{PQ}$ represents her planned trip across the river, and $\overline{PR}$ represents her actual trip across the river.

Based on the dimensions in the diagram, which of the following is closest to the length of $\overline{PR}$?

A. 104 feet
B. 117 feet
C. 120 feet
D. 160 feet

Audio Guidelines

Text Only

Read the title of the figure/illustration or any caption that is being used in the title format. Allow for all words and numbers in the pictograph or key to be available to be read on demand.

Text and Graphics

Read the title of the figure or illustration. Include the caption in the description if it is not included in the surrounding text.

Read any scale before describing parts of the figure.

Separate the information into pieces using sentences, bullet points, or lists.

Use similar language to describe all parts of the diagram or illustration. Standardized language will help ensure comprehension.

Remember that the goal is to help the student understand the pertinent information in the diagram. Try to include descriptions of all shapes and figures, but try not to overload the student with descriptions that are overly wordy or not needed to answer the question.

In some cases, tactile representation is required to make the item accessible to blind students and some low-vision students.

Application of Text and Graphics Guideline

Example 1

A drawing showing a rectangular plot of land is illustrated. The scale shows that one inch equals twenty feet. The left and right sides of the plot are three and three-fourths inches, and the top and bottom sides of the plot are two and a half inches. The rectangular house has side lengths of one and one-fourth inches and three-fourths of an inch. The barn is a square, mostly outside the plot, with a shaded right triangle inside the plot. The hypotenuse of the right triangle and the side of the square inside the plot are the same line segment. One corner of the triangle is at the two and one-fourth inch line at the bottom of the plot and another corner is at the three inch line on the side of the plot. The courtyard is a semicircle with a radius of one-half inch.
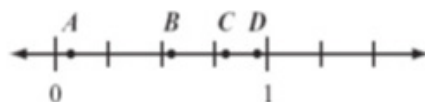
Example 2

A diagram showing a rectangular section of a river is illustrated. Triangle PQR shows Pam's trip across the river with all three points of the triangle touching a side of the river. Point P is on the left side of the river, and points Q and R are on the right side of the river. Point Q is the vertex of a right angle. The distance from P to Q is one hundred feet. The distance from Q to R is sixty feet.
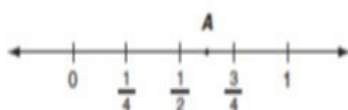
Number Lines

Example 1

Which point on the number line below best represents 0.8?

A. point *A*
B. point *B*
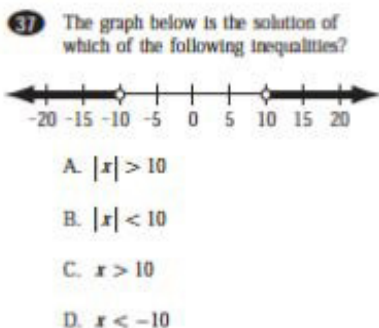C. point *C*
D. point *D*

Example 2

Look at this number line.

Point *A* is halfway between $\frac{1}{2}$ and $\frac{3}{4}$. What fraction does point *A* represent? Show your work or explain how you know.

Example 3

Audio Guidelines

Text Only

Read the title of the number line only or any caption that is being used in the title format. Allow all letters, words, and number on the number line to be available on demand.

Text and Graphics

Start by reading the title of the number line.

Read the range on the bottom along with the increments displayed.

Read the letters or words on the number line along with their location. Be careful not to violate the construct being measured in doing so. In some cases, tactile representation is required to make the item accessible to blind students and some low-vision students.

If a line or point being described falls between two marked values, then do not estimate or ap-proximate numbers. Instead, use more general language such as "is located a little after," "is located a little before," "is closer to," and "is midway between."

For bolded number lines, describe which parts are bolded.

Application of Text and Graphics Guidelines

Example 1

A number line is shown with points *A*, *B*, *C*, and *D* and three equally spaced tick marks between the values of zero and one. Point *A* is located between zero and the first tick mark, and is closer to zero; point B is located between the second and third tick marks, and is much closer to the second tick mark; while point *C* and point *D* are closer to the value one.

Example 2

A number line shows zero and one with three tick marks in between: one-fourth, one-half, and three-fourths. Point *A* is marked midway between one-half and three-fourths.

Example 3

A number line shows from negative twenty to positive twenty in increments of five. The areas from negative twenty to negative ten and positive ten to positive twenty are bolded with open circles at negative ten and positive ten. There are bolded arrows to the left of negative twenty and to the right of positive twenty.

Spinners

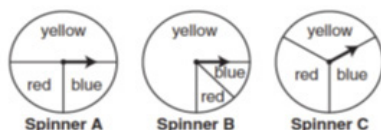### Example 1

⑩ Look at this spinner.

On what number is the arrow **least** likely to land?

○ A. 1
○ B. 2
○ C. 3
○ D. 4

Example 1

⑮ Look at these spinners.

yellow | yellow | yellow
Spinner A | Spinner B | Spinner C

Julie, Greg, and Lori each used a different spinner to record the results of 40 spins.

a. This table shows Julie's results.

Julie's Spinner Results

Color	Frequency
yellow	12
blue	14
red	14

Which spinner did Julie **most likely** use? Show your work or explain how you know.

b. This table shows Greg's results.

Greg's Spinner Results

Color	Frequency
yellow	30
blue	5
red	5

Which spinner did Greg **most likely** use? Show your work or explain how you know.

c. Lori used the remaining spinner. Make a table to show the **most likely** results of Lori's 40 spins. Explain your reasoning.

Audio Guidelines

Text Only

Read the title of the spinner only. Allow for all letters, words, and numbers on the spinner to be available on demand.

Text and Graphics

Read the title of the spinner and reference it as a spinner.

Read any words, symbols, or numbers in the spinner, starting at the top and moving clockwise.

If necessary, describe the sizes of each section. Be sure not to violate the construct being measured in doing so. In some cases, tactile representation is required to make the item accessible to blind students and some low-vision students.

When describing the size of sections, do not estimate or approximate a specific size if it is not labeled. Instead, use more general language such as "less than," "more than," and "half of." Exceptions are for one-fourth, one-third, one-half, two-thirds, and three-fourths that are immediately apparent.

Application of Text and Graphics Guidelines

Example 1

Grades 7 and lower: A spinner is divided into eight sections of the same size. One number in each section is shown. From the top moving clockwise, the sections read three, four, two, one, three, one, two, one.

Grades 8 and higher: A spinner divided into eight congruent sections. One number in each section is shown. From the top moving clockwise, the sections read three, four, two, one, three, one, two, one.

Example 2

There are three spinners shown labeled Spinner A, Spinner B, and Spinner C. Each spinner is divided into three sections. In Spinner A, one-half of the spinner is labeled yellow, one-fourth of the spinner is labeled blue, and one-fourth of the spinner is labeled red. In Spinner B, three-fourths of the spinner is labeled yellow, and the other part is divided evenly and labeled blue and red. In Spinner C, about one-third of the spinner is labeled yellow, about one-third of the spinner is labeled red, and about one-third of the spinner is labeled blue.

Coins and Dollars

Example

❺ Cindy had $1.00. Then she bought a pencil for $0.37. How much money does she have now?

Audio Guidelines

Text and Graphics

Describe the money using standard language (penny, dime, quarter, or dollar).

Be sure to read each currency symbol as a symbol and not to interpret the value. (e.g., two quarters instead of fifty cents, or three dimes instead of thirty cents)

If reading the currency symbols violates the construct being measured, tactile representation is required to make the item accessible to blind students and some low-vision students.

Application of Audio Guidelines

Example

A shows two quarters, one dime, and three pennies.
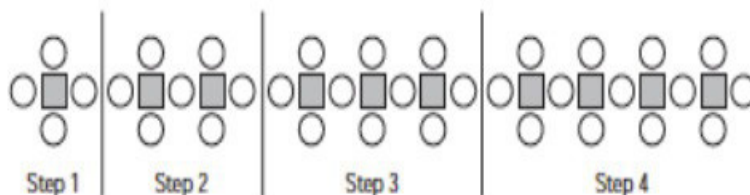
B shows two quarters, two dimes, and three pennies.

C shows three quarters and two pennies.

D shows one one-dollar bill, one quarter, one dime, and two pennies.

Numbered/Step Diagrams

Example

9 Don made a pattern using circles and squares. The first four steps of his pattern are shown below.

Step 1   Step 2   Step 3   Step 4

If Don continues his pattern, what is the total number of circles he will need to make Step 10?

A. 30

B. 31

C. 38

D. 40

Audio Guideline

Text Only

Read the title of the diagram only. Allow for all letters, words, and numbers on the diagram to be available to be read on demand.

Text and Graphics

Read the title of the diagram and a brief orientation of what the diagram shows.

In logical order (left to right or top to bottom), read the steps or diagram numbers along with a description of the figures in each step.

Describe the figures with enough detail to understand the item. Unless necessary, do not detail the specific characteristics of the figures being used. (e.g., color, size, location, shape, etc.)

If the description violates the construct being measured (e.g., if the question asked "How many circles are in step 1?"), then adjust the description to be vague. In this case, tactile representation is required to make the item accessible to blind students and some low-vision students.

Application of Audio Guidelines

Example

A diagram shows four steps of a pattern using circles and squares. Step one shows a square and four circles, step two shows two squares and seven circles, step three shows three squares and ten circles, and step four shows four squares and thirteen circles.

Geometric Figures

Example 1

These shapes are the 5 faces of a three-dimensional figure.
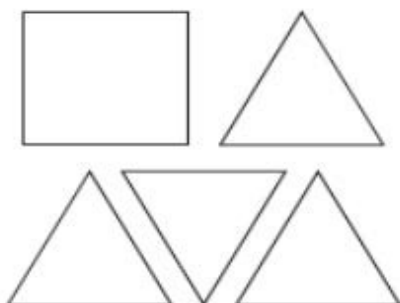
What is the three-dimensional figure?

A. cube
B. cone
C. prism
D. pyramid

Example 2

Look at this diagram.

What is the measure of ∠1?

A. 55°
B. 115°
C. 125°
D. 135°

Example 3
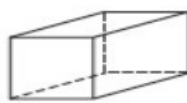
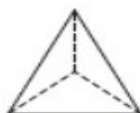Look at these figures.

Figure P   Figure Q

Figure R   Figure S

Which two figures have the same number of faces?

A. Figure P and Figure Q
B. Figure S and Figure R
C. Figure P and Figure R
D. Figure S and Figure Q

Audio Guidelines

Text Only

Read the title of the shape(s) only. Allow for all labels of sides or angles to be available on demand.

Text and Graphics

Simple shapes (any 2D shape with eight sides or fewer): Reference simple shapes as is, unless the item is measuring identification of a shape. If the item contains a simple shape, reference it without description. If there are unique attributes to the shape, describe what type of shape it is in as few words as possible. Be sure to reference labels of s ides, angles, and so on.

3D shapes/figures: Reference the type of figure. If relevant and does not violate the construct being measured, describe the figure including the number of sides. In some cases, if a certain description would violate the construct, tactile representation is required to make the item accessible to blind students and some low-vision students.

Be sure to reference labels of sides, angles, and so on.

Refer to the coordinate plane section for reading shapes on coordinate planes.

Application of Text and Graphics Guidelines

Example 1

A square and four equally sized triangles are shown.

Example 2

A diagram shows a right triangle. The triangle shows a right angle in the left corner, a thirty-five degree angle at the top, with no angle reference in the bottom-right corner. Outside the bottom-right corner of the triangle there is a symbol for angle one, which arcs from the unknown angle in the triangle to touch the ray.

Example 3

Four figures are shown. Figure P is a pentagonal pyramid, Figure Q is a rectangular prism, Figure R is a triangular prism, and Figure S is a triangular pyramid.

For geometric figures with multiple lines

Diagrams with internal angles should generally be described clockwise, beginning at the 12:00 position or a logical point of origin in the diagram.

Example

Bicyclists at National Park can choose one of three bike paths from the visitors' center, as shown in this diagram.
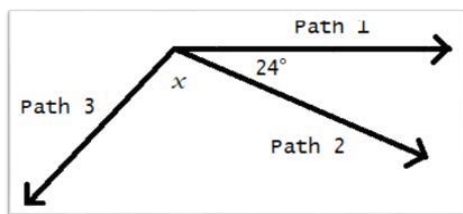
A diagram shows three rays, each originating at the same point. The first ray, drawn horizontally to the right, is labeled Path 1. The second ray, labeled Path 2, is drawn downward and toward the right. The angle that includes Path 1 and Path 2 is labeled 24 degrees. The third ray, labeled Path 3, is drawn downward and to the left. The angle that includes Path 2 and Path 3 is labeled x.

References

Smarter Balanced Assessment Consortium: Mathematics Audio Guidelines.

https://portal.smarterbalanced.org/library/en/mathematics-audio-guidelines.pdf.

APPENDIX J