

**New York State Mathematics Core Curriculum
2005
Content Standards**

Kindergarten

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

- K.N.1 Count the items in a collection and know the last counting word tells how many items are in the collection (1 to 10)
- K.N.2 Count out (produce) a collection of a specified size 1 to 10
- K.N.3 Numerically label a data set of 1 to 5
- K.N.4 Verbally count by 1's to 20
- K.N.5 Verbally count backwards from 10
- K.N.6 Represent collections with a finger pattern up to 10
- K.N.7 Draw pictures or other informal symbols to represent a spoken number up to 10
- K.N.8 Draw pictures or other informal symbols to represent how many in a collection up to 10
- K.N.9 Write numbers 1-10 to represent a collection
- K.N.10 Visually determine how many more or less, and then using the verbal counting sequence, match and count 1-10
- K.N.11 Use and understand verbal ordinal terms, first to tenth

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- K.N.12 Solve and create addition and subtraction verbal word problems (use counting-based strategies, such as counting on and to ten)
- K.N.13 Determine sums and differences by various means

Algebra Strand

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, and Functions

- K.A.1 Use a variety of manipulatives to create patterns using attributes of color, size, or shape
- K.A.2 Recognize, describe, extend, and create patterns that repeat (e.g., ABABAB or ABAABAAAB)

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Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

K.G.1 Describe characteristics and relationships of geometric objects

Students will identify and justify geometric relationships, formally and informally.

Geometric

K.G.2 Sort groups of objects by size and size order (increasing and decreasing) *Relationships*

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

K.G.3 Explore vertical and horizontal orientation of objects

K.G.4 Manipulate two- and three-dimensional shapes to explore symmetry

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

K.G.5 Understand and use ideas such as over, under, above, below, on, beside, next to, and between

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

K.M.1 Name, discuss, and compare attributes of length (longer than, shorter than)

K.M.2 Compare the length of two objects by representing each length with string or a paper strip

K.M.3 Relate specific times such as morning, noon, afternoon, and evening to activities and absence or presence of daylight

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

K.S.1 Gather data in response to questions posed by the teacher and students

Organization and Display of Data

K.S.2 Help to make simple pictographs for quantities up to 10, where one picture represents 1

K.S.3 Sort and organize objects by two attributes (e.g., color, size, or shape)

K.S.4 Represent data using manipulatives

Analysis of Data

K.S.5 Identify more, less, and same amounts from pictographs or concrete models

GRADE 1

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Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

- 1.N.1 Count the items in a collection and know the last counting word tells how many items are in the collection (1 to 100)
- 1.N.2 Count out (produce) a collection of a specified size (10 to 100 items), using groups of ten
- 1.N.3 Quickly see and label with a number, collections of 1 to 10
- 1.N.4 Count by 1's to 100
- 1.N.5 Skip count by 10's to 100
- 1.N.6 Skip count by 5's to 50
- 1.N.7 Skip count by 2's to 20
- 1.N.8 Verbally count from a number other than one by 1's
- 1.N.9 Count backwards from 20 by 1's
- 1.N.10 Draw pictures or other informal symbols to represent a spoken number up to 20
- 1.N.11 Identify that spacing of the same number of objects does not affect the quantity (conservation)
- 1.N.12 Arrange objects in size order (increasing and decreasing)
- 1.N.13 Write numbers to 100
- 1.N.14 Read the number words *one, two, three...ten*
- 1.N.15 Explore and use place value
- 1.N.16 Compare and order whole numbers up to 100
- 1.N.17 Develop an initial understanding of the base ten system:
$$10 \text{ ones} = 1 \text{ ten}$$
$$10 \text{ tens} = 1 \text{ hundred}$$
- 1.N.18 Use a variety of strategies to compose and decompose one-digit numbers
- 1.N.19 Understand the commutative property of addition
- 1.N.20 Name the number before and the number after a given number, and name the number(s) between two given numbers up to 100 (with and without the use of a number line or a hundreds chart)
- 1.N.21 Use before, after, or between to order numbers to 100 (with or without the use of a number line)
- 1.N.22 Use the words higher, lower, greater, and less to compare two numbers
- 1.N.23 Use and understand verbal ordinal terms, first to twentieth

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Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- 1.N.24 Develop and use strategies to solve addition and subtraction word problems
- 1.N.25 Represent addition and subtraction word problems and their solutions as number sentences
- 1.N.26 Create problem situations that represent a given number sentence
- 1.N.27 Use a variety of strategies to solve addition and subtraction problems with one- and two-digit numbers without regrouping
- 1.N.28 Demonstrate fluency and apply addition and subtraction facts to and including 10
- 1.N.29 Understand that different parts can be added to get the same whole

Students will compute accurately and make reasonable estimates.

Estimation

- 1.N.30 Estimate the number in a collection to 50 and then compare by counting the actual items in the collection

Algebra Strand

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, and Functions

- 1.A.1 Determine and discuss patterns in arithmetic (what comes next in a repeating pattern, using numbers or objects)

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

- 1.G.1 Match shapes and parts of shapes to justify congruency
- 1.G.2 Recognize, name, describe, create, sort, and compare two- dimensional and three-dimensional shapes

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

- 1.G.3 Experiment with slides, flips, and turns of two-dimensional shapes
- 1.G.4 Identify symmetry in two-dimensional shapes

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

- 1.G.5 Recognize geometric shapes and structures in the environment

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- 1.M.1 Recognize length as an attribute that can be measured

GRADE 1

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1.M.2 Use non-standard units (including finger lengths, paper clips, students' feet and paces) to measure both vertical and horizontal lengths

1.M.3 Informally explore the standard unit of measure, inch

Students will use units to give meaning to measurements.

Units

1.M.4 Know vocabulary and recognize coins (penny, nickel, dime, quarter)

1.M.5 Recognize the cent notation as ¢

1.M.6 Use different combinations of coins to make money amounts up to 25 cents

1.M.7 Recognize specific times (morning, noon, afternoon, evening)

1.M.8 Tell time to the hour, using both digital and analog clocks

1.M.9 Know the days of the week and months of the year in sequence

1.M.10 Classify months and connect to seasons and other events

Students will develop strategies for estimating measurements.

Estimation

1.M.11 Select and use non-standard units to estimate measurements

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

1.S.1 Pose questions about themselves and their surroundings

1.S.2 Collect and record data related to a question

Organization and Display of Data

1.S.3 Display data in simple pictographs for quantities up to 20 with units of one

1.S.4 Display data in bar graphs using concrete objects with intervals of one

1.S.5 Use Venn diagrams to sort and describe data

Analysis of Data

1.S.6 Interpret data in terms of the words: most, least, greater than, less than, or equal to

1.S.7 Answer simple questions related to data displayed in pictographs (e.g., category with most, how many more in a category compared)

Students will make predictions that are based upon data analysis.

Predictions from Data

1.S.8 Discuss conclusions and make predictions in terms of the words likely and unlikely

1.S.9 Construct a question that can be answered by using information from a graph

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

- 2.N.1 Skip count to 100 by 2's, 5's, 10's
- 2.N.2 Count back from 100 by 1's, 5's, 10's using a number chart
- 2.N.3 Skip count by 3's to 36 for multiplication readiness
- 2.N.4 Skip count by 4's to 48 for multiplication readiness
- 2.N.5 Compare and order numbers to 100
- 2.N.6 Develop an understanding of the base ten system:
- 10 ones = 1 ten
- 10 tens = 1 hundred
- 10 hundreds = 1 thousand
- 2.N.7 Use a variety of strategies to compose and decompose two-digit numbers
- 2.N.8 Understand and use the commutative property of addition
- 2.N.9 Name the number before and the number after a given number, and name the number(s) between two given numbers up to 100 (with and without the use of a number line or a hundreds chart)
- 2.N.10 Use and understand verbal ordinal terms
- 2.N.11 Read written ordinal terms (first through ninth) and use them to represent ordinal relations
- 2.N.12 Use zero as the identity element for addition
- 2.N.13 Recognize the meaning of zero in the place value system (0-100)

Number Theory

- 2.N.14 Use concrete materials to justify a number as odd or even

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- 2.N.15 Determine sums and differences of number sentences by various means (e.g., families, related facts, inverse operations, addition doubles, and doubles plus one)
- 2.N.16 Use a variety of strategies to solve addition and subtraction problems using one- and two-digit numbers with and without regrouping
- 2.N.17 Demonstrate fluency and apply addition and subtraction facts up to and including 18
- 2.N.18 Use doubling to add 2-digit numbers

GRADE 2

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- 2.N.19 Use compensation to add 2-digit numbers
- 2.N.20 Develop readiness for multiplication by using repeated addition
- 2.N.21 Develop readiness for division by using repeated subtraction, dividing objects into groups (fair share)

Students will compute accurately and make reasonable estimates.

Estimation

- 2.N.22 Estimate the number in a collection to 100 and then compare by counting the actual items in the collection

Algebra Strand

Students will perform algebraic procedures accurately.

Equations and Inequalities

- 2.A.1 Use the symbols $<$, $>$, $=$ (with and without the use of a number line) to compare whole numbers up to 100

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, and Functions

- 2.A.2 Describe and extend increasing or decreasing (+,-) sequences and patterns (numbers or objects up to 100)

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

- 2.G.1 Experiment with slides, flips, and turns to compare two- dimensional shapes
- 2.G.2 Identify and appropriately name two-dimensional shapes: circle, square, rectangle, and triangle (both regular and irregular)
- 2.G.3 Compose (put together) and decompose (break apart) two- dimensional shapes

Students will identify and justify geometric relationships, formally and informally.

Geometric Relationships

- 2.G.4 Group objects by like properties

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

- 2.G.5 Explore and predict the outcome of slides, flips, and turns of two- dimensional shapes
- 2.G.6 Explore line symmetry

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Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- 2.M.1 Use non-standard and standard units to measure both vertical and horizontal lengths
- 2.M.2 Use a ruler to measure standard units (including whole inches and whole feet)
- 2.M.3 Compare and order objects according to the attribute of length
- 2.M.4 Recognize mass as a qualitative measure (e.g., Which is heavier? Which is lighter?)
- 2.M.5 Compare and order objects, using lighter than and heavier than

Students will use units to give meaning to measurements.

Units

- 2.M.6 Know and recognize coins (penny, nickel, dime, quarter) and bills (\$1, \$5, \$10, and \$20)
- 2.M.7 Recognize the whole dollar notation as \$1, etc.
- 2.M.8 Identify equivalent combinations to make one dollar
- 2.M.9 Tell time to the half hour and five minutes using both digital and analog clocks

Students will develop strategies for estimating measurements.

Estimation

- 2.M.10 Select and use standard (customary) and non-standard units to estimate measurements

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

- 2.S.1 Formulate questions about themselves and their surroundings
- 2.S.2 Collect and record data (using tallies) related to the question

Organization and Display of Data

- 2.S.3 Display data in pictographs and bar graphs using concrete objects or a representation of the object

Analysis of Data

- 2.S.4 Compare and interpret data in terms of describing quantity (similarity or differences)

Students will make predictions that are based upon data analysis.

Predictions from Data

- 2.S.5 Discuss conclusions and make predictions from graphs differences)

GRADE 3

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

- 3.N.1 Skip count by 25's, 50's, 100's to 1,000
- 3.N.2 Read and write whole numbers to 1,000
- 3.N.3 Compare and order numbers to 1,000
- 3.N.4 Understand the place value structure of the base ten number system:
 - 10 ones = 1 ten
 - 10 tens = 1 hundred
 - 10 hundreds = 1 thousand
- 3.N.5 Use a variety of strategies to compose and decompose three-digit numbers
- 3.N.6 Use and explain the commutative property of addition and multiplication
- 3.N.7 Use 1 as the identity element for multiplication
- 3.N.8 Use the zero property of multiplication
- 3.N.9 Understand and use the associative property of addition
- 3.N.10 Develop an understanding of fractions as part of a whole unit and as parts of a collection
- 3.N.11 Use manipulatives, visual models, and illustrations to name and represent unit fractions ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, and $\frac{1}{10}$) as part of a whole or a set of objects
- 3.N.12 Understand and recognize the meaning of numerator and denominator in the symbolic form of a fraction
- 3.N.13 Recognize fractional numbers as equal parts of a whole
- 3.N.14 Explore equivalent fractions ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$)
- 3.N.15 Compare and order unit fractions ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$) and find their approximate locations on a number line

Number Theory

- 3.N.16 Identify odd and even numbers
- 3.N.17 Develop an understanding of the properties of odd/even numbers as a result of addition or subtraction

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- 3.N.18 Use a variety of strategies to add and subtract 3-digit numbers (with and without regrouping)
- 3.N.19 Develop fluency with single-digit multiplication facts

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- 3.N.20 Use a variety of strategies to solve multiplication problems with factors up to 12×12
- 3.N.21 Use the area model, tables, patterns, arrays, and doubling to provide meaning for multiplication
- 3.N.22 Demonstrate fluency and apply single-digit division facts
- 3.N.23 Use tables, patterns, halving, and manipulatives to provide meaning for division
- 3.N.24 Develop strategies for selecting the appropriate computational and operational method in problem solving situations

Students will compute accurately and make reasonable estimates.

Estimation

- 3.N.25 Estimate numbers up to 500
- 3.N.26 Recognize real world situations in which an estimate (rounding) is more appropriate
- 3.N.27 Check reasonableness of an answer by using estimation

Algebra Strand

Students will perform algebraic procedures accurately.

Equations and Inequalities

- 3.A.1 Use the symbols $<$, $>$, $=$ (with and without the use of a number line) to compare whole numbers and unit fractions ($1/2$, $1/3$, $1/4$, $1/5$, $1/6$, and $1/10$)

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, and Functions

- 3.A.2 Describe and extend numeric (+, -) and geometric patterns

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

- 3.G.1 Define and use correct terminology when referring to shapes (circle, triangle, square, rectangle, rhombus, trapezoid, and hexagon)
- 3.G.2 Identify congruent and similar figures
- 3.G.3 Name, describe, compare, and sort three-dimensional shapes: cube, cylinder, sphere, prism, and cone
- 3.G.4 Identify the faces on a three-dimensional shape as two-dimensional shapes

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

- 3.G.5 Identify and construct lines of symmetry

GRADE 3

NYS Mathematics Core Curriculum 2005 Content Standards

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- 3.M.1 Select tools and units (customary) appropriate for the length measured
- 3.M.2 Use a ruler/yardstick to measure to the nearest standard unit (whole and $\frac{1}{2}$ inches, whole feet, and whole yards)
- 3.M.3 Measure objects, using ounces and pounds
- 3.M.4 Recognize capacity as an attribute that can be measured
- 3.M.5 Compare capacities (e.g., Which contains more? Which contains less?)
- 3.M.6 Measure capacity, using cups, pints, quarts, and gallons

Students will use units to give meaning to measurements.

Units

- 3.M.7 Count and represent combined coins and dollars, using currency symbols (\$0.00)
- 3.M.8 Relate unit fractions to the face of the clock: Whole = 60 minutes
 - $\frac{1}{2}$ = 30 minutes
 - $\frac{1}{4}$ = 15 minutes

Students will develop strategies for estimating measurements.

Estimation

- 3.M.9 Tell time to the minute, using digital and analog clocks
- 3.M.10 Select and use standard (customary) and non-standard units to estimate measurements

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

- 3.S.1 Formulate questions about themselves and their surroundings
- 3.S.2 Collect data using observation and surveys, and record appropriately

Organization and Display of Data

- 3.S.3 Construct a frequency table to represent a collection of data
- 3.S.4 Identify the parts of pictographs and bar graphs
- 3.S.5 Display data in pictographs and bar graphs
- 3.S.6 State the relationships between pictographs and bar graphs

Analysis of Data

- 3.S.7 Read and interpret data in bar graphs and pictographs

Students will make predictions that are based upon data analysis.

Predictions from Data

- 3.S.8 Formulate conclusions and make predictions from graphs

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

- 4.N.1 Skip count by 1,000's
- 4.N.2 Read and write whole numbers to 10,000
- 4.N.3 Compare and order numbers to 10,000
- 4.N.4 Understand the place value structure of the base ten number system:
- 10 ones = 1 ten
 - 10 tens = 1 hundred
 - 10 hundreds = 1 thousand
 - 10 thousands = 1 ten thousand
- 4.N.5 Recognize equivalent representations for numbers up to four digits and generate them by decomposing and composing numbers
- 4.N.6 Understand, use, and explain the associative property of multiplication
- 4.N.7 Develop an understanding of fractions as locations on number lines and as divisions of whole numbers
- 4.N.8 Recognize and generate equivalent fractions (halves, fourths, thirds, fifths, sixths, and tenths) using manipulatives, visual models, and illustrations
- 4.N.9 Use concrete materials and visual models to compare and order unit fractions or fractions with the same denominator (with and without the use of a number line)
- 4.N.10 Develop an understanding of decimals as part of a whole
- 4.N.11 Read and write decimals to hundredths, using money as a context
- 4.N.12 Use concrete materials and visual models to compare and order decimals (less than 1) to the hundredths place in the context of money

Number Theory

- 4.N.13 Develop an understanding of the properties of odd/even numbers as a result of multiplication

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- 4.N.14 Use a variety of strategies to add and subtract numbers up to 10,000
- 4.N.15 Select appropriate computational and operational methods to solve problems
- 4.N.16 Understand various meanings of multiplication and division
- 4.N.17 Use multiplication and division as inverse operations to solve problems
- 4.N.18 Use a variety of strategies to multiply two-digit numbers by one-digit numbers (with and without regrouping)

GRADE 4

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- 4.N.19 Use a variety of strategies to multiply two-digit numbers by two-digit numbers (with and without regrouping)
- 4.N.20 Develop fluency in multiplying and dividing multiples of 10 and 100 up to 1,000
- 4.N.21 Use a variety of strategies to divide two-digit dividends by one-digit divisors (with and without remainders)
- 4.N.22 Interpret the meaning of remainders
- 4.N.23 Add and subtract proper fractions with common denominators
- 4.N.24 Express decimals as an equivalent form of fractions to tenths and hundredths
- 4.N.25 Add and subtract decimals to tenths and hundredths using a hundreds chart

Students will compute accurately and make reasonable estimates.

Estimation

- 4.N.26 Round numbers less than 1,000 to the nearest tens and hundreds
- 4.N.27 Check reasonableness of an answer by using estimation

Algebra Strand

Students will represent and analyze algebraically a wide variety of problem solving situations.

Variables and Expressions

- 4.A.1 Evaluate and express relationships using open sentences with one operation

Students will perform algebraic procedures accurately.

Equations and Inequalities

- 4.A.2 Use the symbols $<$, $>$, $=$, and \neq (with and without the use of a number line) to compare whole numbers and unit fractions and decimals (up to hundredths)
- 4.A.3 Find the value or values that will make an open sentence true, if it contains $<$ or $>$

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, and Functions

- 4.A.4 Describe, extend, and make generalizations about numeric ($+$, $-$, \times , \div) and geometric patterns
- 4.A.5 Analyze a pattern or a whole-number function and state the rule, given a table or an input/output box

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

- 4.G.1 Identify and name polygons, recognizing that their names are related to the number of sides and angles (triangle, quadrilateral, pentagon, hexagon, and octagon)
- 4.G.2 Identify points and line segments when drawing a plane figure
- 4.G.3 Find perimeter of polygons by adding sides

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4.G.4 Find the area of a rectangle by counting the number of squares needed to cover the rectangle

4.G.5 Define and identify vertices, faces, and edges of three-dimensional shapes

Students will identify and justify geometric relationships, formally and informally.

Geometric Relationships

4.G.6 Draw and identify intersecting, perpendicular, and parallel lines

4.G.7 Identify points and rays when drawing angles

4.G.8 Classify angles as acute, obtuse, right, and straight

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

4.M.1 Select tools and units (customary and metric) appropriate for the length being measured

4.M.2 Use a ruler to measure to the nearest standard unit (whole, $\frac{1}{2}$ and $\frac{1}{4}$ inches, whole feet, whole yards, whole centimeters, and whole meters)

4.M.3 Know and understand equivalent standard units of length:

$$12 \text{ inches} = 1 \text{ foot}$$

$$3 \text{ feet} = 1 \text{ yard}$$

4.M.4 Select tools and units appropriate to the mass of the object being measured (grams and kilograms)

4.M.5 Measure mass, using grams

4.M.6 Select tools and units appropriate to the capacity being measured (milliliters and liters)

4.M.7 Measure capacity, using milliliters and liters

Students will use units to give meaning to measurements.

Units

4.M.8 Make change, using combined coins and dollar amounts

4.M.9 Calculate elapsed time in hours and half hours, not crossing A.M./P.M.

4.M.10 Calculate elapsed time in days and weeks, using a calendar

GRADE 4

NYS Mathematics Core Curriculum 2005 Content Standards

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

- 4.S.1 Design investigations to address a question from given data
- 4.S.2 Collect data using observations, surveys, and experiments and record appropriately

Organization and Display of Data

- 4.S.3 Represent data using tables, bar graphs, and pictographs

Analysis of Data

- 4.S.4 Read and interpret line graphs

Students will make predictions that are based upon data analysis.

Predictions from Data

- 4.S.5 Develop and make predictions that are based on data
- 4.S.6 Formulate conclusions and make predictions from graphs

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

- 5.N.1 Read and write whole numbers to millions
- 5.N.2 Compare and order numbers to millions
- 5.N.3 Understand the place value structure of the base ten number system
- 10 ones = 1 ten
10 tens = 1 hundred
10 hundreds = 1 thousand
10 thousands = 1 ten thousand
10 ten thousands = 1 hundred thousand
10 hundred thousands = 1 million
- 5.N.4 Create equivalent fractions, given a fraction
- 5.N.5 Compare and order fractions including unlike denominators (with and without the use of a number line) *Note: Commonly used fractions such as those that might be indicated on ruler, measuring cup, etc.*
- 5.N.6 Understand the concept of ratio
- 5.N.7 Express ratios in different forms
- 5.N.8 Read, write, and order decimals to thousandths
- 5.N.9 Compare fractions using $<$, $>$, or $=$
- 5.N.10 Compare decimals using $<$, $>$, or $=$
- 5.N.11 Understand that percent means part of 100, and write percents as fractions and decimals

Number Theory

- 5.N.12 Recognize that some numbers are only divisible by one and themselves (prime) and others have multiple divisors (composite)
- 5.N.13 Calculate multiples of a whole number and the least common multiple of two numbers
- 5.N.14 Identify the factors of a given number
- 5.N.15 Find the common factors and the greatest common factor of two numbers

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- 5.N.16 Use a variety of strategies to multiply three-digit by three-digit numbers *Note: Multiplication by anything greater than a three-digit multiplier/ multiplicand should be done using technology*

GRADE 5

NYS Mathematics Core Curriculum 2005 Content Standards

- 5.N.17 Use a variety of strategies to divide three-digit numbers by one- and two-digit numbers *Note: Division by anything greater than a two-digit divisor should be done using technology.*
- 5.N.18 Evaluate an arithmetic expression using order of operations including multiplication, division, addition, subtraction and parentheses
- 5.N.19 Simplify fractions to lowest terms
- 5.N.20 Convert improper fractions to mixed numbers, and mixed numbers to improper fractions
- 5.N.21 Use a variety of strategies to add and subtract fractions with like denominators
- 5.N.22 Add and subtract mixed numbers with like denominators
- 5.N.23 Use a variety of strategies to add, subtract, multiply, and divide decimals to thousandths

Students will compute accurately and make reasonable estimates.

Estimation

- 5.N.24 Round numbers to the nearest hundredth and up to 10,000
- 5.N.25 Estimate sums and differences of fractions with like denominators
- 5.N.26 Estimate sums, differences, products, and quotients of decimals
- 5.N.27 Justify the reasonableness of answers using estimation

Algebra Strand

Students will represent and analyze algebraically a wide variety of problem solving situations.

Variables and Expressions

- 5.A.1 Define and use appropriate terminology when referring to constants, variables, and algebraic expressions
- 5.A.2 Translate simple verbal expressions into algebraic expressions

Students will perform algebraic procedures accurately.

Variables and Expressions

- 5.A.3 Substitute assigned values into variable expressions and evaluate using order of operations

Equations and Inequalities

- 5.A.4 Solve simple one-step equations using basic whole-number facts
- 5.A.5 Solve and explain simple one-step equations using inverse operations involving whole numbers
- 5.A.6 Evaluate the perimeter formula for given input values

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, and Functions

- 5.A.7 Create and explain patterns and algebraic relationships (e.g., 2, 4, 6, 8...) algebraically: $2n$ (doubling)

NYS Mathematics Core Curriculum 2005 Content Standards

- 5.A.8 Create algebraic or geometric patterns using concrete objects or visual drawings (e.g., rotate and shade geometric shapes)

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

- 5.G.1 Calculate the perimeter of regular and irregular polygons

Students will identify and justify geometric relationships, formally and informally.

Geometric Relationships

- 5.G.2 Identify pairs of similar triangles
- 5.G.3 Identify the ratio of corresponding sides of similar triangles
- 5.G.4 Classify quadrilaterals by properties of their angles and sides
- 5.G.5 Know that the sum of the interior angles of a quadrilateral is 360 degrees
- 5.G.6 Classify triangles by properties of their angles and sides
- 5.G.7 Know that the sum of the interior angles of a triangle is 180 degrees
- 5.G.8 Find a missing angle when given two angles of a triangle
- 5.G.9 Identify pairs of congruent triangles
- 5.G.10 Identify corresponding parts of congruent triangles

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

- 5.G.11 Identify and draw lines of symmetry of basic geometric shapes

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

- 5.G.12 Identify and plot points in the first quadrant
- 5.G.13 Plot points to form basic geometric shapes (identify and classify)
- 5.G.14 Calculate perimeter of basic geometric shapes drawn on a coordinate plane (rectangles and shapes composed of rectangles having sides with integer lengths and parallel to the axes)

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- 5.M.1 Use a ruler to measure to the nearest inch, $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ inch
- 5.M.2 Identify customary equivalent units of length
- 5.M.3 Measure to the nearest centimeter
- 5.M.4 Identify equivalent metric units of length
- 5.M.5 Convert measurement within a given system

GRADE 5

NYS Mathematics Core Curriculum 2005 Content Standards

Tools and Methods

5.M.6 Determine the tool and technique to measure with an appropriate level of precision: lengths and angles

Students will use units to give meaning to measurements.

Units

5.M.7 Calculate elapsed time in hours and minutes

5.M.8 Measure and draw angles using a protractor

Students will develop strategies for estimating measurements.

Estimation

5.M.9 Determine personal references for customary units of length (e.g., your pace is approximately 3 feet, your height is approximately 5 feet, etc.)

5.M.10 Determine personal references for metric units of length

5.M.11 Justify the reasonableness of estimates

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

5.S.1 Collect and record data from a variety of sources (e.g., newspapers, magazines, polls, charts, and surveys)

Organization and Display of Data

5.S.2 Display data in a line graph to show an increase or decrease over time

Analysis of Data

5.S.3 Calculate the mean for a given set of data and use to describe a set of data

Students will make predictions that are based upon data analysis.

Predictions from Data

5.S.4 Formulate conclusions and make predictions from graphs

Students will understand and apply concepts of probability.

Probability

5.S.5 List the possible outcomes for a single-event experiment

5.S.6 Record experiment results using fractions/ratios

5.S.7 Create a sample space and determine the probability of a single event, given a simple experiment (e.g., rolling a number cube)

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

- 6.N.1 Read and write whole numbers to trillions
- 6.N.2 Define and identify the commutative and associative properties of addition and multiplication
- 6.N.3 Define and identify the distributive property of multiplication over addition
- 6.N.4 Define and identify the identity and inverse properties of addition and multiplication
- 6.N.5 Define and identify the zero property of multiplication
- 6.N.6 Understand the concept of ratio
- 6.N.7 Express equivalent ratios as a proportion
- 6.N.8 Distinguish the difference between rate and ratio
- 6.N.9 Solve proportions using equivalent fractions
- 6.N.10 Verify the proportionality using the product of the means equals the product of the extremes
- 6.N.11 Read, write, and identify percents of a whole (0% to 100%)
- 6.N.12 Solve percent problems involving percent, rate, and base
- 6.N.13 Define absolute value and determine the absolute value of rational numbers (including positive and negative)
- 6.N.14 Locate rational numbers on a number line (including positive and negative)
- 6.N.15 Order rational numbers (including positive and negative)

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- 6.N.16 Add and subtract fractions with unlike denominators
- 6.N.17 Multiply and divide fractions with unlike denominators.
- 6.N.18 Add, subtract, multiply, and divide mixed numbers with unlike denominators
- 6.N.19 Identify the multiplicative inverse (reciprocal) of a number
- 6.N.20 Represent fractions as terminating or repeating decimals
- 6.N.21 Find multiple representations of rational numbers (fractions, decimals, and percents 0 to 100)
- 6.N.22 Evaluate numerical expressions using order of operations (may include exponents of two and three)
- 6.N.23 Represent repeated multiplication in exponential form
- 6.N.24 Represent exponential form as repeated multiplication
- 6.N.25 Evaluate expressions having exponents where the power is an exponent of one, two, or three

GRADE 6

NYS Mathematics Core Curriculum 2005 Content Standards

Students will compute accurately and make reasonable estimates.

Estimation

- 6.N.26 Estimate a percent of quantity (0% to 100%)
- 6.N.27 Justify the reasonableness of answers using estimation (including rounding)

Algebra Strand

Students will represent and analyze algebraically a wide variety of problem solving situations.

Variables and Expressions

- 6.A.1 Translate two-step verbal expressions into algebraic expressions

Students will perform algebraic procedures accurately.

Variables and Expressions

- 6.A.2 Use substitution to evaluate algebraic expressions (may include exponents of one, two and three)

Equations and Inequalities

- 6.A.3 Translate two-step verbal sentences into algebraic equations
- 6.A.4 Solve and explain two-step equations involving whole numbers using inverse operations
- 6.A.5 Solve simple proportions within context
- 6.A.6 Evaluate formulas for given input values (circumference, area, volume, distance, temperature, interest, etc.)

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

- 6.G.1 Calculate the length of corresponding sides of similar triangles, using proportional reasoning
- 6.G.2 Determine the area of triangles and quadrilaterals (squares, rectangles, rhombi, and trapezoids) and develop formulas
- 6.G.3 Use a variety of strategies to find the area of regular and irregular polygons
- 6.G.4 Determine the volume of rectangular prisms by counting cubes and develop the formula
- 6.G.5 Identify radius, diameter, chords and central angles of a circle
- 6.G.6 Understand the relationship between the diameter and radius of a circle

NYS Mathematics Core Curriculum 2005 Content Standards

- 6.G.7 Determine the area and circumference of a circle, using the appropriate formula
- 6.G.8 Calculate the area of a sector of a circle, given the measure of a central angle and the radius of the circle
- 6.G.9 Understand the relationship between the circumference and the diameter of a circle

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

- 6.G.10 Identify and plot points in all four quadrants
- 6.G.11 Calculate the area of basic polygons drawn on a coordinate plane (rectangles and shapes composed of rectangles having sides with integer lengths)

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- 6.M.1 Measure capacity and calculate volume of a rectangular prism
- 6.M.2 Identify customary units of capacity (cups, pints, quarts, and gallons)
- 6.M.3 Identify equivalent customary units of capacity (cups to pints, pints to quarts, and quarts to gallons)
- 6.M.4 Identify metric units of capacity (liter and milliliter)
- 6.M.5 Identify equivalent metric units of capacity (milliliter to liter and liter to milliliter)

Tools and Methods

- 6.M.6 Determine the tool and technique to measure with an appropriate level of precision: capacity

Students will develop strategies for estimating measurements.

Estimation

- 6.M.7 Estimate volume, area, and circumference (see figures identified in geometry strand)
- 6.M.8 Justify the reasonableness of estimates
- 6.M.9 Determine personal references for capacity

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

- 6.S.1 Develop the concept of sampling when collecting data from a population and decide the best method to collect data for a particular question

GRADE 6

NYS Mathematics Core Curriculum 2005 Content Standards

Organization and Display of Data

- 6.S.2 Record data in a frequency table
- 6.S.3 Construct Venn diagrams to sort data
- 6.S.4 Determine and justify the most appropriate graph to display a given set of data (pictograph, bar graph, line graph, histogram, or circle graph)

Analysis of Data

- 6.S.5 Determine the mean, mode and median for a given set of data
- 6.S.6 Determine the range for a given set of data
- 6.S.7 Read and interpret graphs

Students will make predictions that are based upon data analysis.

Predictions from Data

- 6.S.8 Justify predictions made from data

Students will understand and apply concepts of probability.

Probability

- 6.S.9 List possible outcomes for compound events
- 6.S.10 Determine the probability of dependent events
- 6.S.11 Determine the number of possible outcomes for a compound event by using the fundamental counting principle and use this to determine the probabilities of events when the outcomes have equal probability

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

- 7.N.1 Distinguish between the various subsets of real numbers (counting/natural numbers, whole numbers, integers, rational numbers, and irrational numbers)
- 7.N.2 Recognize the difference between rational and irrational numbers (e.g., explore different approximations of π)
- 7.N.3 Place rational and irrational numbers (approximations) on a number line and justify the placement of the
- 7.N.4 Develop the laws of exponents for multiplication and division
- 7.N.5 Write numbers in scientific notation
- 7.N.6 Translate numbers from scientific notation into standard form
- 7.N.7 Compare numbers written in scientific notation

Number Theory

- 7.N.8 Find the common factors and greatest common factor of two or more numbers
- 7.N.9 Determine multiples and least common multiple of two or more numbers
- 7.N.10 Determine the prime factorization of a given number and write in exponential form

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- 7.N.11 Simplify expressions using order of operations (Note: Expressions may include absolute value and/or integral exponents greater than 0.)
- 7.N.12 Add, subtract, multiply, and divide integers
- 7.N.13 Add and subtract two integers (with and without the use of a number line)
- 7.N.14 Develop a conceptual understanding of negative and zero exponents with a base of ten and relate to fractions and decimals (e.g., $10^{-2} = .01 = 1/100$)
- 7.N.15 Recognize and state the value of the square root of a perfect square (up to 225)
- 7.N.16 Determine the square root of non-perfect squares using a calculator
- 7.N.17 Classify irrational numbers as non-repeating/non-terminating decimals

Students will compute accurately and make reasonable estimates.

Estimation

- 7.N.18 Identify the two consecutive whole numbers between which the square root of a non-perfect square whole number less than 225 lies (with and without the use of a number line)
- 7.N.19 Justify the reasonableness of answers using estimation

GRADE 7

NYS Mathematics Core Curriculum 2005 Content Standards

Algebra Strand

Students will represent and analyze algebraically a wide variety of problem solving situations.

Variables and Expressions

7.A.1 Translate two-step verbal expressions into algebraic expressions

Students will perform algebraic procedures accurately.

Variables and Expressions

7.A.2 Add and subtract monomials with exponents of one

7.A.3 Identify a polynomial as an algebraic expression containing one or more terms

Students will perform algebraic procedures accurately.

Equations and Inequalities

7.A.4 Solve multi-step equations by combining like terms, using the distributive property, or moving variables to one side of the equation

7.A.5 Solve one-step inequalities (positive coefficients only) (See 7.G.10)

7.A.6 Evaluate formulas for given input values (surface area, rate, and density problems)

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, and Functions

7.A.7 Draw the graphic representation of a pattern from an equation or from a table of data

7.A.8 Create algebraic patterns using charts/tables, graphs, equations, and expressions

7.A.9 Build a pattern to develop a rule for determining the sum of the interior angles of polygons

7.A.10 Write an equation to represent a function from a table of values

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

7.G.1 Calculate the radius or diameter, given the circumference or area of a circle

7.G.2 Calculate the volume of prisms and cylinders, using a given formula and a calculator

7.G.3 Identify the two-dimensional shapes that make up the faces and bases of three-dimensional shapes (prisms, cylinders, cones, and pyramids)

7.G.4 Determine the surface area of prisms and cylinders, using a calculator and a variety of methods

NYS Mathematics Core Curriculum 2005 Content Standards

Students will identify and justify geometric relationships, formally and informally.

Geometric Relationships

- 7.G.5 Identify the right angle, hypotenuse, and legs of a right triangle
- 7.G.6 Explore the relationship between the lengths of the three sides of a right triangle to develop the Pythagorean Theorem
- 7.G.7 Find a missing angle when given angles of a quadrilateral
- 7.G.8 Use the Pythagorean Theorem to determine the unknown length of a side of a right triangle
- 7.G.9 Determine whether a given triangle is a right triangle by applying the Pythagorean Theorem and using a calculator

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

- 7.G.10 Graph the solution set of an inequality (positive coefficients only) on a number line (See 7.A.5)

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- 7.M.1 Calculate distance using a map scale
- 7.M.2 Convert capacities and volumes within a given system
- 7.M.3 Identify customary and metric units of mass
- 7.M.4 Convert mass within a given system
- 7.M.4 Calculate unit price using proportions
- 7.M.4 Compare unit prices
- 7.M.4 Convert money between different currencies with the use of an exchange rate table and a calculator
- 7.M.4 Draw central angles in a given circle using a protractor (circle graphs)

Tools and Methods

- 7.M.9 Determine the tool and technique to measure with an appropriate level of precision: mass

Students will develop strategies for estimating measurements.

Estimation

- 7.M.10 Identify the relationships between relative error and magnitude when dealing with large numbers (e.g., money, population)
- 7.M.11 Estimate surface area

GRADE 7

NYS Mathematics Core Curriculum 2005 Content Standards

- 7.M.12 Determine personal references for customary /metric units of mass
7.M.13 Justify the reasonableness of the mass of an object

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

- 7.S.1 Identify and collect data using a variety of methods

Organization and Display of Data

- 7.S.2 Display data in a circle graph
7.S.3 Convert raw data into double bar graphs and double line graphs

Analysis of Data

- 7.S.4 Calculate the range for a given set of data
7.S.5 Select the appropriate measure of central tendency
7.S.6 Read and interpret data represented graphically (pictograph, bar graph, histogram, line graph, double line/bar graphs or circle graph)

Students will make predictions that are based upon data analysis.

Predictions from Data

- 7.S.7 Identify and explain misleading statistics and graphs

Students will understand and apply concepts of probability.

Probability

- 7.S.8 Interpret data to provide the basis for predictions and to establish experimental probabilities
7.S.9 Determine the validity of sampling methods to predict outcomes
7.S.10 Predict the outcome of an experiment
7.S.11 Design and conduct an experiment to test predictions
7.S.12 Compare actual results to predicted results

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- 8.N.1 Develop and apply the laws of exponents for multiplication and division
- 8.N.2 Evaluate expressions with integral exponents
- 8.N.3 Read, write, and identify percents less than 1% and greater than 100%
- 8.N.4 Apply percents to:
- Tax
 - Percent increase/decrease
 - Simple interest
 - Sale price
 - Commission
 - Interest rates
 - Gratuities

Students will compute accurately and make reasonable estimates.

Estimation

- 8.N.5 Estimate a percent of quantity, given an application
- 8.N.6 Justify the reasonableness of answers using estimation

Algebra Strand

Students will represent and analyze algebraically a wide variety of problem solving situations.

Variables and Expressions

- 8.A.1 Translate verbal sentences into algebraic inequalities
- 8.A.2 Write verbal expressions that match given mathematical expressions
- 8.A.3 Describe a situation involving relationships that matches a given graph
- 8.A.4 Create a graph given a description or an expression for a situation involving a linear or nonlinear relationship
- 8.A.5 Use physical models to perform operations with polynomials

Students will perform algebraic procedures accurately.

Variables and Expressions

- 8.A.6 Multiply and divide monomials
- 8.A.7 Add and subtract polynomials (integer coefficients)
- 8.A.8 Multiply a binomial by a monomial or a binomial (integer coefficients)
- 8.A.9 Divide a polynomial by a monomial (integer coefficients) Note: The degree of the denominator is less than or equal to the degree of the numerator for all variables.
- 8.A.10 Factor algebraic expressions using the GCF

GRADE 8

NYS Mathematics Core Curriculum 2005 Content Standards

- 8.A.11 Factor a trinomial in the form $ax^2 + bx + c$; $a=1$ and c having no more than three sets of factors

Equations and Inequalities

- 8.A.12 Apply algebra to determine the measure of angles formed by or contained in parallel lines cut by a transversal and by intersecting lines
- 8.A.13 Solve multi-step inequalities and graph the solution set on a number line
- 8.A.14 Solve linear inequalities by combining like terms, using the distributive property, or moving variables to one side of the inequality (include multiplication or division of inequalities by a negative number)

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Relations, And Functions

- 8.A.15 Understand that numerical information can be represented in multiple ways: arithmetically, algebraically, and graphically
- 8.A.16 Find a set of ordered pairs to satisfy a given linear numerical pattern (expressed algebraically); then plot the ordered pairs and draw the line
- 8.A.17 Define and use correct terminology when referring to function (domain and range)
- 8.A.18 Determine if a relation is a function
- 8.A.19 Interpret multiple representations using equation, table of values, and graph

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Constructions

- 8.G.0 Construct the following using a straight edge and compass:
- Segment congruent to a segment
 - Angle congruent to an angle
 - Perpendicular bisector
 - Angle bisector

Students will identify and justify geometric relationships, formally and informally.

Geometric Relationships

- 8.G.1 Identify pairs of vertical angles as congruent
- 8.G.2 Identify pairs of supplementary and complementary angles
- 8.G.3 Calculate the missing angle in a supplementary or complementary pair
- 8.G.4 Determine angle pair relationships when given two parallel lines cut by a transversal
- 8.G.5 Calculate the missing angle measurements when given two parallel lines cut by a transversal
- 8.G.6 Calculate the missing angle measurements when given two intersecting lines and

NYS Mathematics Core Curriculum 2005 Content Standards

an angle

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

- 8.G.7 Describe and identify transformations in the plane, using proper function notation (rotations, reflections, translations, and dilations)
- 8.G.8 Draw the image of a figure under rotations of 90 and 180 degrees
- 8.G.9 Draw the image of a figure under a reflection over a given line
- 8.G.10 Draw the image of a figure under a translation
- 8.G.11 Draw the image of a figure under a dilation
- 8.G.12 Identify the properties preserved and not preserved under a reflection, rotation, translation, and dilation

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

- 8.G.13 Determine the slope of a line from a graph and explain the meaning of slope as a constant rate of change
- 8.G.14 Determine the y-intercept of a line from a graph and be able to explain the y-intercept
- 8.G.15 Graph a line using a table of values
- 8.G.16 Determine the equation of a line given the slope and the y-intercept
- 8.G.17 Graph a line from an equation in slope-intercept form ($y=mx+b$)
- 8.A.18 Solve systems of equations graphically (only linear, integral solutions, $y=mx+b$ format, no vertical/horizontal lines)
- 8.A.19 Graph the solution set of an inequality on a number line
- 8.A.20 Distinguish between linear and nonlinear equations $ax^2 + bx + c$; $a=1$ (only graphically)
- 8.A.21 Recognize the characteristics of quadratics in tables, graphs, equations, and situations

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- 8.M.1 Solve equations/proportions to convert to equivalent measurements within metric and customary measurement systems *Note: Also allow Fahrenheit to Celsius and vice versa.*

Integrated Algebra

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Theory

- A.N.1 Identify and apply the properties of real numbers (closure, commutative, associative, distributive, identity, inverse) *Note: Students do not need to identify groups and fields, but students should be engaged in the ideas.*

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- A.N.2 Simplify radical terms (no variable in the radicand)
- A.N.3 Perform the four arithmetic operations using like and unlike radical terms and express the result in simplest form
- A.N.4 Understand and use scientific notation to compute products and quotients of numbers greater than 100%
- A.N.5 Solve algebraic problems arising from situations that involve fractions, decimals, percents (decrease/increase and discount), and proportionality/direct variation
- A.N.6 Evaluate expressions involving factorial(s), absolute value(s), and exponential expression(s)
- A.N.7 Determine the number of possible events, using counting techniques or the Fundamental Principle of Counting
- A.N.8 Determine the number of possible arrangements (permutations) of a list of items

Algebra Strand

Students will represent and analyze algebraically a wide variety of problem solving situations.

Variables and Expressions

- A.A.1 Translate a quantitative verbal phrase into an algebraic expression
- A.A.2 Write verbal expressions that match given mathematical expressions

Equations and Inequalities

- A.A.3 Distinguish the difference between an algebraic expression and an algebraic equation
- A.A.4 Translate verbal sentences into mathematical equations or inequalities
- A.A.5 Write algebraic equations or inequalities that represent a situation
- A.A.6 Analyze and solve verbal problems whose solution requires solving a linear equation in one variable or linear inequality in one variable
- A.A.7 Analyze and solve verbal problems whose solution requires solving systems of linear equations in two variables

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- A.A.8 Analyze and solve verbal problems that involve quadratic equations
- A.A.9 Analyze and solve verbal problems that involve exponential growth and decay
- A.A.10 Solve systems of two linear equations in two variables algebraically (See A.G.7)
- A.A.11 Solve a system of one linear and one quadratic equation in two variables, where only factoring is required *Note: The quadratic equation should represent a parabola and the solution(s) should be integers.*

Students will perform algebraic procedures accurately.

Variables and Expressions

- A.A.12 Multiply and divide monomial expressions with a common base, using the properties of exponents *Note: Use integral exponents only.*
- A.A.13 Add, subtract, and multiply monomials and polynomials
- A.A.14 Divide a polynomial by a monomial or binomial, where the quotient has no remainder
- A.A.15 Find values of a variable for which an algebraic fraction is undefined.
- A.A.16 Simplify fractions with polynomials in the numerator and denominator by factoring both and renaming them to lowest terms
- A.A.17 Add or subtract fractional expressions with monomial or like binomial denominators
- A.A.18 Multiply and divide algebraic fractions and express the product or quotient in simplest form
- A.A.19 Identify and factor the difference of two perfect squares
- A.A.20 Factor algebraic expressions completely, including trinomials with a lead coefficient of one (after factoring a GCF)

Equations and Inequalities

- A.A.21 Determine whether a given value is a solution to a given linear equation in one variable or linear inequality in one variable
- A.A.22 Solve all types of linear equations in one variable
- A.A.23 Solve literal equations for a given variable
- A.A.24 Solve linear inequalities in one variable
- A.A.25 Solve equations involving fractional expressions *Note: Expressions which result in linear equations in one variable.*
- A.A.26 Solve algebraic proportions in one variable which result in linear or quadratic equations
- A.A.27 Understand and apply the multiplication property of zero to solve quadratic equations with integral coefficients and integral roots
- A.A.28 Understand the difference and connection between roots of a quadratic equation and factors of a quadratic expression

Integrated Algebra

NYS Mathematics Core Curriculum 2005 Content Standards

*Students will recognize, use, and represent algebraically patterns, relations, and functions.
Patterns, Relations, and Functions*

- A.A.29 Use set-builder notation and/or interval notation to illustrate the elements of a set, given the elements in roster form
- A.A.30 Find the complement of a subset of a given set, within a given universe
- A.A.31 Find the intersection of sets (no more than three sets) and/or union of sets (no more than three sets)

Coordinate Geometry

- A.A.32 Graph the Explain slope as a rate of change between dependent and independent variables
- A.A.33 Determine the slope of a line, given the coordinates of two points on the line
- A.A.34 Write the equation of a line, given its slope and the coordinates of a point on the line
- A.A.35 Write the equation of a line, given the coordinates of two points on the line
- A.A.36 Write the equation of a line parallel to the x- or y-axis
- A.A.37 Determine the slope of a line, given its equation in any form
- A.A.38 Determine if two lines are parallel, given their equations in any form
- A.A.39 Determine whether a given point is on a line, given the equation of the line
- A.A.40 Determine whether a given point is in the solution set of a system of linear inequalities
- A.A.41 Determine the vertex and axis of symmetry of a parabola, given its equation (See A.G.10)

Trigonometric Functions

- A.A.42 Find the sine, cosine, and tangent ratios of an angle of a right triangle, given the lengths of the sides
- A.A.43 Determine the measure of an angle of a right triangle, given the length of any two sides of the triangle
- A.A.44 Find the measure of a side of a right triangle, given an acute angle and the length of another side
- A.A.45 Determine the measure of a third side of a right triangle using the Pythagorean theorem, given the lengths of any two sides

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

- A.G.1 Find the area and/or perimeter of figures composed of polygons and circles or sectors of a circle *Note: Figures may include triangles, rectangles, squares, parallelograms, rhombuses, trapezoids, circles, semi-circles, quarter-circles, and regular polygons (perimeter only).*
- A.G.2 Use formulas to calculate volume and surface area of rectangular solids and cylinders

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

- A.G.3 Determine when a relation is a function, by examining ordered pairs and inspecting graphs of relations
- A.G.4 Identify and graph linear, quadratic (parabolic), absolute value, and exponential functions
- A.G.5 Investigate and generalize how changing the coefficients of a function affects its graph
- A.G.6 Graph linear inequalities
- A.G.7 Graph and solve systems of linear equations and inequalities with rational coefficients in two variables (See A.A.10)
- A.G.8 Find the roots of a parabolic function graphically *Note: Only quadratic equations with integral solutions.*
- A.G.9 Solve systems of linear and quadratic equations graphically *Note: Only use systems of linear and quadratic equations that lead to solutions whose coordinates are integers.*
- A.G.10 Determine the vertex and axis of symmetry of a parabola, given its graph (See A.A.41) *Note: The vertex will have an ordered pair of integers and the axis of symmetry will have an integral value.*

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- A.M.1 Calculate rates using appropriate units (e.g., rate of a space ship versus the rate of a snail)
- A.M.2 Solve problems involving conversions within measurement systems, given the relationship between the units

Integrated Algebra

NYS Mathematics Core Curriculum 2005 Content Standards

Students will understand that all measurement contains error and be able to determine its significance.

Error and Magnitude

- A.M.3 Calculate the relative error in measuring square and cubic units, when there is an error in the linear measure
- A.M.2 Solve problems involving conversions within measurement systems, given the relationship between the units

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Organization and Display of Data

- A.S.1 Categorize data as qualitative or quantitative
- A.S.2 Determine whether the data to be analyzed is univariate or bivariate
- A.S.3 Determine when collected data or display of data may be biased
- A.S.4 Compare and contrast the appropriateness of different measures of central tendency for a given data set
- A.S.5 Construct a histogram, cumulative frequency histogram, and a box-and-whisker plot, given a set of data
- A.S.6 Understand how the five statistical summary (minimum, maximum, and the three quartiles) is used to construct a box-and-whisker plot
- A.S.7 Create a scatter plot of bivariate data
- A.S.8 Construct manually a reasonable line of best fit for a scatter plot and determine the equation of that line

Analysis of Data

- A.S.9 Analyze and interpret a frequency distribution table or histogram, a cumulative frequency distribution table or histogram, or a box-and-whisker plot
- A.S.10 Evaluate published reports and graphs that are based on data by considering: experimental design, appropriateness of the data analysis, and the soundness of the conclusions
- A.S.11 Find the percentile rank of an item in a data set and identify the point values for first, second, and third quartiles
- A.S.12 Identify the relationship between the independent and dependent variables from a scatter plot (positive, negative, or none)
- A.S.13 Understand the difference between correlation and causation
- A.S.14 Identify variables that might have a correlation but not a causal relationship

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Students will make predictions that are based upon data analysis.

Predictions from Data

- A.S.15 Identify and describe sources of bias and its effect, drawing conclusions from data
- A.S.16 Recognize how linear transformations of one-variable data affect the data's mean, median, mode, and range
- A.S.17 Use a reasonable line of best fit to make a prediction involving interpolation or extrapolation

Students will understand and apply concepts of probability.

Probability

- A.S.18 Know the definition of conditional probability and use it to solve for probabilities in finite sample spaces
- A.S.19 Determine the number of elements in a sample space and the number of favorable events
- A.S.20 Calculate the probability of an event and its complement
- A.S.21 Determine empirical probabilities based on specific sample data
- A.S.22 Determine, based on calculated probability of a set of events, if:
- some or all are equally likely to occur
 - one is more likely to occur than another
 - whether or not an event is certain to happen or not to happen
- A.S.23 Calculate the probability of:
- a series of independent events
 - two mutually exclusive events
 - two events that are not mutually exclusive

Geometry

NYS Mathematics Core Curriculum 2005 Content Standards

Algebra Strand

Note: The algebraic skills and concepts within the Algebra process and content performance indicators must be maintained and applied as students are asked to investigate, make conjectures, give rationale, and justify or prove geometric concepts.

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Geometric Relationships *Note: Two-dimensional geometric relationships are addressed in the Informal and Formal Proofs band.*

- G.G.1 Know and apply that if a line is perpendicular to each of two intersecting lines at their point of intersection, then the line is perpendicular to the plane determined by them
- G.G.2 Know and apply that through a given point there passes one and only one plane perpendicular to a given line
- G.G.3 Know and apply that through a given point there passes one and only one line perpendicular to a given plane
- G.G.4 Know and apply that two lines perpendicular to the same plane are coplanar
- G.G.5 Know and apply that two planes are perpendicular to each other if and only if one plane contains a line perpendicular to the second plane
- G.G.6 Know and apply that if a line is perpendicular to a plane, then any line perpendicular to the given line at its point of intersection with the given plane is in the given plane
- G.G.7 Know and apply that if a line is perpendicular to a plane, then every plane containing the line is perpendicular to the given plane
- G.G.8 Know and apply that if a plane intersects two parallel planes, then the intersection is two parallel lines
- G.G.9 Know and apply that if two planes are perpendicular to the same line, they are parallel
- G.G.10 Know and apply that the lateral edges of a prism are congruent and parallel
- G.G.11 Know and apply that two prisms have equal volumes if their bases have equal areas and their altitudes are equal
- G.G.12 Know and apply that the volume of a prism is the product of the area of the base and the altitude

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- G.G.13 Apply the properties of a regular pyramid, including:
- lateral edges are congruent
 - lateral faces are congruent isosceles triangles
 - volume of a pyramid equals one-third the product of the area of the base and the altitude
- G.G.14 Apply the properties of a cylinder, including:
- bases are congruent
 - volume equals the product of the area of the base and the altitude
 - lateral area of a right circular cylinder equals the product of an altitude and the circumference of the base
- G.G.15 Apply the properties of a right circular cone, including:
- lateral area equals one-half the product of the slant height and the circumference of its base
 - volume is one-third the product of the area of its base and its altitude
- G.G.16 Apply the properties of a sphere, including:
- the intersection of a plane and a sphere is a circle
 - a great circle is the largest circle that can be drawn on a sphere
 - two planes equidistant from the center of the sphere and intersecting the sphere do so in congruent circles
 - surface area is $4\pi r^2$
 - volume is $\frac{4}{3}\pi r^3$

Constructions

- G.G.17 Construct a bisector of a given angle, using a straightedge and compass, and justify the construction
- G.G.18 Construct the perpendicular bisector of a given segment, using a straightedge and compass, and justify the construction
- G.G.19 Construct lines parallel (or perpendicular) to a given line through a given point, using a straightedge and compass, and justify the construction
- G.G.20 Construct an equilateral triangle, using a straightedge and compass, and justify the construction

Locus

- G.G.21 Investigate and apply the concurrence of medians, altitudes, angle bisectors, and perpendicular bisectors of triangles
- G.G.22 Solve problems using compound loci
- G.G.23 Graph and solve compound loci in the coordinate plane

Geometry

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Students will identify and justify geometric relationships formally and informally.

Informal and Formal Proofs

- G.G.24 Determine the negation of a statement and establish its truth value
- G.G.25 Know and apply the conditions under which a compound statement (conjunction, disjunction, conditional, biconditional) is true
- G.G.26 Identify and write the inverse, converse, and contrapositive of a given conditional statement and note the logical equivalences
- G.G.27 Write a proof arguing from a given hypothesis to a given conclusion
- G.G.28 Determine the congruence of two triangles by using one of the five congruence techniques (SSS, SAS, ASA, AAS, HL), given sufficient information about the sides and/or angles of two congruent triangles
- G.G.29 Identify corresponding parts of congruent triangles
- G.G.30 Investigate, justify, and apply theorems about the sum of the measures of the angles of a triangle
- G.G.31 Investigate, justify, and apply the isosceles triangle theorem and its converse
- G.G.32 Investigate, justify, and apply theorems about geometric inequalities, using the exterior angle theorem
- G.G.33 Investigate, justify, and apply the triangle inequality theorem
- G.G.34 Determine either the longest side of a triangle given the three angle measures or the largest angle given the lengths of three sides of a triangle
- G.G.35 Determine if two lines cut by a transversal are parallel, based on the measure of given pairs of angles formed by the transversal and the lines
- G.G.36 Investigate, justify, and apply theorems about the sum of the measures of the interior and exterior angles of polygons
- G.G.37 Investigate, justify, and apply theorems about each interior and exterior angle measure of regular polygons
- G.G.38 Investigate, justify, and apply theorems about parallelograms involving their angles, sides, and diagonals
- G.G.39 Investigate, justify, and apply theorems about special parallelograms (rectangles, rhombuses, squares) involving their angles, sides, and diagonals
- G.G.40 Investigate, justify, and apply theorems about trapezoids (including isosceles trapezoids) involving their angles, sides, medians, and diagonals
- G.G.41 Justify that some quadrilaterals are parallelograms, rhombuses, rectangles, squares, or trapezoids
- G.G.42 Investigate, justify, and apply theorems about geometric relationships, based on the properties of the line segment joining the midpoints of two sides of the triangle

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- G.G.43 Investigate, justify, and apply theorems about the centroid of a triangle, dividing each median into segments whose lengths are in the ratio 2:1
- G.G.44 Establish similarity of triangles, using the following theorems: AA, SAS, and SSS
- G.G.45 Investigate, justify, and apply theorems about similar triangles
- G.G.46 Investigate, justify, and apply theorems about proportional relationships among the segments of the sides of the triangle, given one or more lines parallel to one side of a triangle and intersecting the other two sides of the triangle
- G.G.47 Investigate, justify, and apply theorems about mean proportionality:
- the altitude to the hypotenuse of a right triangle is the mean proportional between the two segments along the hypotenuse
 - the altitude to the hypotenuse of a right triangle divides the hypotenuse so that either leg of the right triangle is the mean proportional between the hypotenuse and segment of the hypotenuse adjacent to that leg
- G.G.48 Investigate, justify, and apply the Pythagorean theorem and its converse
- G.G.49 Investigate, justify, and apply theorems regarding chords of a circle:
- perpendicular bisectors of chords
 - the relative lengths of chords as compared to their
 - distance from the center of the circle
- G.G.50 Investigate, justify, and apply theorems about tangent lines to a circle:
- a perpendicular to the tangent at the point of tangency
 - two tangents to a circle from the same external point
 - common tangents of two non-intersecting or tangent circles
- G.G.51 Investigate, justify, and apply theorems about the arcs determined by the rays of angles formed by two lines intersecting a circle when the vertex is:
- inside the circle (two chords)
 - on the circle (tangent and chord)
 - outside the circle (two tangents, two secants, or tangent and secant)
- G.G.52 Investigate, justify, and apply theorems about arcs of a circle cut by two parallel lines
- G.G.53 Investigate, justify, and apply theorems regarding segments intersected by a circle:
- along two tangents from the same external point
 - along two secants from the same external point
 - along a tangent and a secant from the same external point
 - along two intersecting chords of a given circle

Geometry

NYS Mathematics Core Curriculum 2005 Content Standards

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

- G.G.54 Define, investigate, justify, and apply isometries in the plane (rotations, reflections, translations, glide reflections) Note: Use proper function notation.
- G.G.55 Investigate, justify, and apply the properties that remain invariant under translations, rotations, reflections, and glide reflections
- G.G.56 Identify specific isometries by observing orientation, numbers of invariant points, and/or parallelism
- G.G.57 Justify geometric relationships (perpendicularity, parallelism, congruence) using transformational techniques (translations, rotations, reflections)
- G.G.58 Define, investigate, justify, and apply similarities (dilations and the composition of dilations and isometries)
- G.G.59 Investigate, justify, and apply the properties that remain invariant under similarities
- G.G.60 Identify specific similarities by observing orientation, numbers of invariant points, and/or parallelism
- G.G.61 Investigate, justify, and apply the analytical representations for translations, rotations about the origin of 90° and 180° , reflections over the lines $x = 0$, $y = 0$, and $y = x$, and dilations centered at the origin

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

- G.G.62 Find the slope of a perpendicular line, given the equation of a line
- G.G.63 Determine whether two lines are parallel, perpendicular, or neither, given their equations
- G.G.64 Find the equation of a line, given a point on the line and the equation of a line perpendicular to the given line
- G.G.65 Find the equation of a line, given a point on the line and the equation of a line parallel to the desired line
- G.G.66 Find the midpoint of a line segment, given its endpoints
- G.G.67 Find the length of a line segment, given its endpoints
- G.G.68 Find the equation of a line that is the perpendicular bisector of a line segment, given the endpoints of the line segment
- G.G.69 Investigate, justify, and apply the properties of triangles and quadrilaterals in the coordinate plane, using the distance, midpoint, and slope formulas
- G.G.70 Solve systems of equations involving one linear equation and one quadratic equation graphically

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- G.G.71 Write the equation of a circle, given its center and radius or given the endpoints of a diameter
- G.G.72 Write the equation of a circle, given its graph
Note: The center is an ordered pair of integers and the radius is an integer.
- G.G.73 Find the center and radius of a circle, given the equation of the circle in center-radius form
- G.G.74 Graph circles of the form $(x - h)^2 + (y - k)^2 = r^2$

Algebra 2/ Trigonometry

NYS Mathematics Core Curriculum 2005 Content Standards

Number Sense and Operations Strand

Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

- A2.N.1 Evaluate numerical expressions with negative and/or fractional exponents, without the aid of a calculator (when the answers are rational numbers)
- A2.N.2 Perform arithmetic operations (addition, subtraction, multiplication, division) with expressions containing irrational numbers in radical form
- A2.N.3 Perform arithmetic operations with polynomial expressions containing rational coefficients
- A2.N.4 Perform arithmetic operations on irrational expressions
- A2.N.5 Rationalize a denominator containing a radical expression
- A2.N.6 Write square roots of negative numbers in terms of i
- A2.N.7 Simplify powers of i
- A2.N.8 Determine the conjugate of a complex number
- A2.N.9 Perform arithmetic operations on complex numbers and write the answer in the form $a + bi$

Note: This includes simplifying expressions with complex denominators.

- A2.N.10 Know and apply sigma notation

Algebra Strand

Students will represent and analyze algebraically a wide variety of problem solving situations.

Equations and Inequalities

- A2.A.1 Solve absolute value equations and inequalities involving linear expressions in one variable
- A2.A.2 Use the discriminant to determine the nature of the roots of a quadratic equation
- A2.A.3 Solve systems of equations involving one linear equation and one quadratic equation algebraically Note: This includes rational equations that result in linear equations with extraneous roots.
- A2.A.4 Solve quadratic inequalities in one and two variables, algebraically and graphically
- A2.A.5 Use direct and inverse variation to solve for unknown values
- A2.A.6 Solve an application which results in an exponential function

Students will perform algebraic procedures accurately.

Variables and Expressions

- A2.A.7 Factor polynomial expressions completely, using any combination of the following techniques: common factor extraction, difference of two perfect squares, quadratic trinomials

Algebra 2/ Trigonometry

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- A2.A.8 Apply the rules of exponents to simplify expressions involving negative and/or fractional exponents
- A2.A.9 Rewrite algebraic expressions that contain negative exponents using only positive exponents
- A2.A.10 Rewrite algebraic expressions with fractional exponents as radical expressions
- A2.A.11 Rewrite algebraic expressions in radical form as expressions with fractional exponents
- A2.A.12 Evaluate exponential expressions, including those with base e
- A2.A.13 Simplify radical expressions
- A2.A.14 Perform addition, subtraction, multiplication, and division of radical expressions
- A2.A.15 Rationalize denominators involving algebraic radical expressions
- A2.A.16 Perform arithmetic operations with rational expressions and rename to lowest terms
- A2.A.17 Simplify complex fractional expressions
- A2.A.18 Evaluate logarithmic expressions in any base
- A2.A.19 Apply the properties of logarithms to rewrite logarithmic expressions in equivalent forms

Equations and Inequalities

- A2.A.20 Determine the sum and product of the roots of a quadratic equation by examining its coefficients
- A2.A.21 Determine the quadratic equation, given the sum and product of its roots
- A2.A.22 Solve radical equations
- A2.A.23 Solve rational equations and inequalities
- A2.A.24 Know and apply the technique of completing the square
- A2.A.25 Solve quadratic equations, using the quadratic formula
- A2.A.26 Find the solution to polynomial equations of higher degree that can be solved using factoring and/or the quadratic formula
- A2.A.27 Solve exponential equations with and without common bases
- A2.A.28 Solve a logarithmic equation by rewriting as an exponential equation

Students will recognize, use, and represent algebraically patterns, relations, and functions. *Patterns, Relations, and Functions*

- A2.A.29 Identify an arithmetic or geometric sequence and find the formula for its n th term
- A2.A.30 Determine the common difference in an arithmetic sequence
- A2.A.31 Determine the common ratio in a geometric sequence
- A2.A.32 Determine a specified term of an arithmetic or geometric sequence

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- A2.A.33 Specify terms of a sequence, given its recursive definition
- A2.A.34 Represent the sum of a series, using sigma notation
- A2.A.35 Determine the sum of the first n terms of an arithmetic or geometric series
- A2.A.36 Apply the binomial theorem to expand a binomial and determine a specific term of a binomial expansion
- A2.A.37 Define a relation and function
- A2.A.38 Determine when a relation is a function
- A2.A.39 Determine the domain and range of a function from its equation
- A2.A.40 Write functions in functional notation
- A2.A.41 Use functional notation to evaluate functions for given values in the domain
- A2.A.42 Find the composition of functions
- A2.A.43 Determine if a function is one-to-one, onto, or both
- A2.A.44 Define the inverse of a function
- A2.A.45 Determine the inverse of a function and use composition to justify the result
- A2.A.46 Perform transformations with functions and relations:
 $f(x + a)$, $f(x) + a$, $f(-x)$, $-f(x)$, $af(x)$

Coordinate Geometry

- A2.A.47 Determine the center-radius form for the equation of a circle in standard form
- A2.A.48 Write the equation of a circle, given its center and a point on the circle
- A2.A.49 Write the equation of a circle from its graph
- A2.A.50 Approximate the solution to polynomial equations of higher degree by inspecting the graph
- A2.A.51 Determine the domain and range of a function from its graph
- A2.A.52 Identify relations and functions, using graphs
- A2.A.53 Graph exponential functions of the form $y = b^x$ for positive values of b , including $b = e$
- A2.A.54 Graph logarithmic functions, using the inverse of the related exponential function

Trigonometric Functions

- A2.A.55 Express and apply the six trigonometric functions as ratios of the sides of a right triangle
- A2.A.56 Know the exact and approximate values of the sine, cosine, and tangent of 0° , 30° , 45° , 60° , 90° , 180° , and 270° angles
- A2.A.57 Sketch and use the reference angle for angles in standard position
- A2.A.58 Know and apply the co-function and reciprocal relationships between trigonometric ratios

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- A2.A.59 Use the reciprocal and co-function relationships to find the value of the secant, cosecant, and cotangent of 0° , 30° , 45° , 60° , 90° , 180° , and 270° angles
- A2.A.60 Sketch the unit circle and represent angles in standard position
- A2.A.61 Determine the length of an arc of a circle, given its radius and the measure of its central angle
- A2.A.62 Find the value of trigonometric functions, if given a point on the terminal side of angle θ
- A2.A.63 Restrict the domain of the sine, cosine, and tangent functions to ensure the existence of an inverse function
- A2.A.64 Use inverse functions to find the measure of an angle, given its sine, cosine, or tangent
- A2.A.65 Sketch the graph of the inverses of the sine, cosine, and tangent functions
- A2.A.66 Determine the trigonometric functions of any angle, using technology
- A2.A.67 Justify the Pythagorean identities
- A2.A.68 Solve trigonometric equations for all values of the variable from 0° to 360°
- A2.A.69 Determine amplitude, period, frequency, and phase shift, given the graph or equation of a periodic function
- A2.A.70 Sketch and recognize one cycle of a function of the form
 $y = A \sin Bx$ or $y = A \cos Bx$
- A2.A.71 Sketch and recognize the graphs of the functions
 $y = \sec(x)$, $y = \csc(x)$, $y = \tan(x)$, and $y = \cot(x)$
- A2.A.72 Write the trigonometric function that is represented by a given periodic graph
- A2.A.73 Solve for an unknown side or angle, using the Law of Sines or the Law of Cosines
- A2.A.74 Determine the area of a triangle or a parallelogram, given the measure of two sides and the included angle
- A2.A.75 Determine the solution(s) from the SSA situation (ambiguous case)
- A2.A.76 Apply the angle sum and difference formulas for trigonometric functions
- A2.A.77 Apply the double-angle and half-angle formulas for trigonometric functions

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

- A2.M.1 Define radian measure
- A2.M.2 Convert between radian and degree measures

Algebra 2/ Trigonometry

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Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

- A2.S.1 Understand the differences among various kinds of studies (e.g., survey, observation, controlled experiment)
- A2.S.2 Determine factors which may affect the outcome of a survey

Organization and Display of Data

- A2.S.3 Calculate measures of central tendency with group frequency distributions
- A2.S.4 Calculate measures of dispersion (range, quartiles, interquartile range, standard deviation, variance) for both samples and populations
- A2.S.5 Know and apply the characteristics of the normal distribution

Students will make predictions that are based upon data analysis.

Predictions from Data

- A2.S.6 Determine from a scatter plot whether a linear, logarithmic, exponential, or power regression model is most appropriate
- A2.S.7 Determine the function for the regression model, using appropriate technology, and use the regression function to interpolate and extrapolate from the data
- A2.S.8 Interpret within the linear regression model the value of the correlation coefficient as a measure of the strength of the relationship

Students will understand and apply concepts of probability.

Probability

- A2.S.9 Differentiate between situations requiring permutations and those requiring combinations
- A2.S.10 Calculate the number of possible permutations (${}_n P_r$) of n items taken r at a time
- A2.S.11 Calculate the number of possible combinations (${}_n C_r$) of n items taken r at a time
- A2.S.12 Use permutations, combinations, and the Fundamental Principle of Counting to determine the number of elements in a sample space and a specific subset (event)
- A2.S.13 Calculate theoretical probabilities, including geometric applications
- A2.S.14 Calculate empirical probabilities
- A2.S.15 Know and apply the binomial probability formula to events involving the terms exactly, at least, and at most
- A2.S.16 Use the normal distribution as an approximation for binomial probabilities