



Mathematics Curriculum Standards
Diocese of Dallas
Grades K-8
2014

Mathematics Curriculum Standards

In January 2011, the Most Reverend Kevin J. Farrell, Bishop of Dallas, convened a Committee on Catholic schools, charging it to “surface and consider issues and challenges” facing Diocesan Catholic schools today, offer recommendations “to ensure the continued growth and sustainability of Catholic schools,” and “develop a comprehensive Strategic Plan on Catholic schools that will provide a blueprint for Catholic school education in the Diocese for many decades to come.” *Reach for the Future: A Blueprint for Excellence* represents a summary report of the Committee's full report submitted to Bishop Farrell and was published in November 2013. Goal 3 in this report addressed curriculum in the diocesan schools. The goal stated that the curriculum in all schools in the Diocese of Dallas be standards-based, challenging and forward-focused in meeting 21st Century content and skills, compatible with our students’ diverse learning needs, and rooted in the teachings of the Catholic faith.

The National Standards and Benchmarks for Effective Catholic Schools clearly outline the Defining Characteristics of Catholic schools. The characteristics provide the foundation for teaching and learning in all of the schools in the Diocese of Dallas. Purposeful and deliberate integration of these characteristics in all lesson planning defines our schools as Catholic Schools.

Defining Characteristics of Catholic Schools¹

The Defining Characteristics flow directly from the Holy See’s teaching on Catholic schools as compiled by Archbishop J. Michael Miller, CSB (*The Holy See’s Teaching on Catholic Schools*, 2006), and from statements by Pope Benedict XVI and the American bishops. The characteristics define the deep Catholic identity of Catholic schools and serve as the platform on which the standards and benchmarks rest. The defining characteristics authenticate the standards and benchmarks, justifying their existence and providing their meaning.

Centered in the Person of Jesus Christ

Catholic education is rooted in the conviction that Jesus Christ provides the most comprehensive and compelling example of the realization of full human potential. (*The Catholic School*, 34, 35) In every aspect of programs, life, and activities, Catholic schools should foster personal relationship with Jesus Christ and communal witness to the Gospel message of love of God and neighbor and service to the world, especially the poor and marginalized. (Miller, 2006, pp. 25–26).

Contributing to the Evangelizing Mission of the Church

By reason of its educational activity, Catholic schools participate directly and in a privileged way in the evangelizing mission of the church (The Catholic School, 9; The Catholic School on the Threshold of the Third Millennium, 5, 11; The Religious Dimensions of Education in a Catholic School, 33). As an ecclesial entity where faith, culture, and life are brought into harmony, the Catholic school should be a place of real and specified pastoral ministry in communion with the local Bishop. (The Catholic School, 44; The Catholic School on the Threshold of the Third Millennium, 14; The Religious Dimension of Education in a Catholic School, 34;) The environment in Catholic schools should express the signs of Catholic culture, physically, and visibly (The Religious Dimension of Education in a Catholic School; Miller, 2006, p. 40).

Distinguished by Excellence

Church documents, history, and practices, supported by Canon Law, establish that first and foremost a Catholic school is characterized by excellence. Consistent with the defining characteristics, Catholic schools should implement on-going processes and structures and gather evidence to ensure excellence in every aspect of its programs, life, and activities (Gravissimum Educationis 8 and 9; Code of Canon Law, Canon 806 #2).

Committed to Educate the Whole Child

Catholic school education is rooted in the conviction that human beings have a transcendent destiny, and that education for the whole person must form the spiritual, intellectual, physical, psychological, social, moral, aesthetic and religious capacities of each child. Catholic schools should develop and implement academic, co-curricular, faith-formation, and service/ministry programs to educate the whole child in all these dimensions (The Catholic School, 29).

Steeped in a Catholic Worldview

Catholic education aims at the integral formation of the human person, which includes “preparation for professional life, formation of ethical and social awareness, developing awareness of the transcendental and religious education” (The Catholic School, 31). All curriculum and instruction in a Catholic school should foster: the desire to seek wisdom and truth, the preference for social justice, the discipline to become self-learners, the capacity to recognize ethical and moral grounding for behavior, and the responsibility to transform and enrich the world with Gospel values. The Catholic school should avoid the error that its distinctiveness rests solely on its religious education program (Miller, 2006, pp. 43–45, 52).

Sustained by Gospel Witness

Catholic schools pay attention to the vocation of teachers and their participation in the Church's evangelizing mission. (The Catholic School on the Threshold of the Third Millennium, 19; Lay Catholics in Schools, 37) A Catholic educator is a role model for students and gives testimony by his or her life and commitment to mission (Benedict XVI, June, 2005; Miller, 2006, p. 53). As much as possible, Catholic schools should recruit teachers who are practicing Catholics, who can understand and accept the teachings of the Catholic Church and the moral demands of the Gospel, and who can contribute to the achievement of the school's Catholic identity and apostolic goals, including participation in the school's commitment to social justice and evangelization. (United States Conference of Catholic Bishops, National Directory for Catechesis, 231)

Shaped by Communion and Community

Catholic school education places an emphasis on the school as community—an educational community of persons and a genuine community of faith. (Lay Catholics in Schools, 22, 41) Catholic schools should do everything they can to promote genuine trust and collaboration among teachers, with parents as the primary educators of their children, and with governing body members to foster appreciation of different gifts that build up a learning and faith community and strengthen academic excellence (Lay Catholics in Schools, 78). The Catholic school should pay especially close attention to the quality of interpersonal relations between teachers and students, ensuring that the student is seen as a person whose intellectual growth is harmonized with spiritual, religious, emotional, and social growth (The Catholic School on the Threshold of the Third Millennium, 18).

Accessible to All Students

By reason of their evangelizing mission, Catholic schools should be available to all people who desire a Catholic school education for their children (Gravissimum Educationis, 6; Code of Canon Law, Canons 793 #2; Renewing Our Commitment to Catholic Elementary and Secondary Schools in the Third Millennium, Introduction). Catholic schools in concert with the Catholic community should do everything in their power to manage available resources and seek innovative options to ensure that Catholic school education is geographically, programmatically, physically, and financially accessible.

Established by the Expressed Authority of the Bishop

Canon Law states, "Pastors of souls have the duty of making all possible arrangements so that all the faithful may avail themselves of a Catholic education" (Code of Canon Law, Canon 794). Bishops need to put forward the mission of Catholic schools, support and enhance the work of Catholic schools, and see that the education in the schools is based on principles of Catholic doctrine (John Paul II, Pastores Gregis, 52). Catholic schools have a formal and defined relationship with the Bishop guided by a spirituality of ecclesial communion, and should work to establish a relationship marked by mutual trust, close cooperation, continuing dialogue, and respect for the Bishop's legitimate authority (Code of Canon Law, Canon 803 #1 and #3; Miller, 2006, p. 33).

In addition to indicating that all curriculum in the Diocese be rooted in the teachings of the Catholic faith, recommendations following the goal also delineated a process by which curriculum redesign should occur.

In March, 2014, a committee of teachers and administrators from the Diocese of Dallas met to discuss the math curriculum in the elementary schools. Teachers and administrators from high school and elementary school met to discuss and to determine what an 8th grader should know and be able to do in math at the end of the 8th grade year. Committee members studied the recommendations, standards, and focal points from the National Council of Teachers of Mathematics. From this research and discussion, a pre-algebra course outline was developed. Students who successfully complete the pre-algebra course will have the skills needed for success in the next math course in the curriculum sequence, Algebra I.

Diocesan middle school teachers, elementary teachers and administrators continued to meet to study the National Council of Teachers of Mathematics recommendation for course content at each grade level. The committee developed outlines for grades K-7. Additional teachers joined the committee to review the course content and to develop lessons and activities to accompany the units of study. That group of teachers served as trainers at a staff development training day open to all campuses in the diocese to present the new standards, units, and lessons to teachers at all participating campuses. Units, exemplar lessons, and accompanying activities will be posted in a secure diocesan site so that teachers can collaborate and share ideas as the exemplar lessons and activities are developed to accompany the standards.

The curriculum is based on the Principles, Standards, and Focal Points of the National Council of Teachers of Mathematics. It is designed to be challenging and forward-focused to ensure that students in the Diocese of Dallas have the 21st century skills needed to achieve success in high school and beyond. There is a strong emphasis on collaboration, critical thinking, and creative problem-solving. Committee members examined the current research related to designing mathematics instruction and studied many ways to organize the standards into cohesive units of study. The committee reviewed the new Texas Essential Knowledge and Skills that were adopted in 2013 in an attempt to better prepare students for college and career. It is important that the curriculum standards in our Catholic schools are designed to help our students accomplish all the goals that they have set for the future.

Teachers will be called together four times during the 2014-2015 school year to continue to review existing lessons, develop additional lessons, collect lessons from colleagues, and post resources so that they can be shared by all teachers in the Diocese of Dallas. At the end of the first year of implementation, the committee will be called together to evaluate the effectiveness of the new curriculum design and will make recommendations for modifications which would to enhance the learning experience of students. Formative data, summative data, and standardized test data will be used to evaluate the effectiveness of the design and implementation of the curriculum. A review process will be conducted yearly to ensure that the curriculum remains contemporary, relevant, and at the appropriate level of rigor. During the development and review phases, appropriate uses of

technology, and STEM and STREAM connections will be included in the unit activities and descriptions. A series of exemplar unit assessments will be added to ensure that all teachers in the diocese understand the recommended level of rigor for each unit.

All mathematics instruction in the Diocese of Dallas is based on the Content Standards and the Problem-Solving Standards of the National Council of Teachers of Mathematics. These standards are part of every mathematics lesson that is taught. It is by applying the math skills and solving problems with math that students truly understand the mathematical concepts that are presented in class and begin to apply solving math problems to solving problems in real-world situations.

The following process standards are emphasized at every level of instruction in mathematics. Instructional programs at all levels of instruction from kindergarten through grade 12 should enable students to interact effectively with mathematics concepts. Teachers incorporate the process standards when planning lessons based on the content standards listed in this document for every grade level.

National Council of Teachers of Mathematics Process Standards²

Problem Solving	<ul style="list-style-type: none"> • Build a new mathematical knowledge through problem solving. • Solve problems that arise in mathematics and in other contexts. • Apply and adapt a variety of appropriate strategies to solve problems. • Monitor and reflect on the process of mathematical problem solving.
Reasoning and Proof	<ul style="list-style-type: none"> • Recognize reasoning and proof as fundamental aspects of mathematics. • Make and investigate mathematical conjectures. • Develop and evaluate mathematical arguments and proofs. • Select and use various types of reasoning and methods of proof.
Communication	<ul style="list-style-type: none"> • Organize and consolidate their mathematical thinking through communication. • Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. • Analyze and evaluate the mathematical thinking and strategies of others. • Use the language of mathematics to express mathematical ideas precisely.
Connections	<ul style="list-style-type: none"> • Recognize and use connections among mathematical ideas. • Understand how mathematical ideas interconnect and build on one another to produce a coherent whole. • Recognize and apply mathematics in contexts outside of mathematics.
Representation	<ul style="list-style-type: none"> • Create and use representations to organize, record, and communicate mathematical ideas. • Select, apply, and translate among mathematical representations to solve problems. • Use representations to model and interpret physical, social, and mathematical phenomena.

The mathematics committees made up of teachers and administrators in the Diocese of Dallas worked through the spring and summer of 2014 to design the standards-based curriculum presented in this document. Additional teachers from the diocese will join this committee to continue the work of generating lesson activities, integrating technology and STEM activities, and designing model assessments to attach the existing unit sequences.

We are grateful to the committee members who have dedicated many hours to creating the revised mathematics curriculum standards for the Diocese of Dallas.

Committee Members

Denise Bartlett ¹
Mathematics Teacher
St. Monica Catholic School

Dianne Ostermann ⁴
5th Grade Teacher
St. Mark's Catholic School

Anne Blackford ²
Mathematics Department Co-Chair
Jesuit College Preparatory School

Molly O'Sullivan ²
Principal
Bishop Dunne Catholic School

Mary Beth Briskey ¹
Mathematics Teacher
St. Rita Catholic School

Tom Perez ²
Mathematics Department Chair
Bishop Dunne Catholic School

Kathy Buroker ^{3,4}
Mathematics and Science Teacher
Holy Trinity Catholic School

Rachel Piazza ²
Mathematics Department Chair
Bishop Lynch Catholic School

Adrian Cantrell ⁴
2nd Grade Teacher
Santa Clara Academy

Dr. Ann E. Poore ¹
Associate Superintendent for Curriculum &
Instruction
Diocese of Dallas

Carlos Curry ^{3,4}
Math Teacher
Santa Clara Academy

Leslie Reeves ⁴
3rd Grade Teacher
St. Thomas Aquinas Catholic School

Christie Domingo ^{3,4}
4th Grade Teacher
St. Monica Catholic School

Val Reimer ⁴
4th Grade Teacher
Holy Family Catholic School

Amy Duke ²
Mathematics Teacher
Bishop Lynch

Rosie Restani ²
Mathematics Teacher
John Paul II High School

Debbie Falagradý ¹
Assistant Principal
St. Monica Catholic School

Terri Riley ^{3,4}
Mathematics Department Chair
St. Thomas Aquinas Catholic School

Dr. Marlene Hammerle ²
Associate Dean
John Paul II High School

Rachel Robb ¹
Principal
St. Elizabeth of Hungary Catholic School

Linda Hayden ¹
Mathematics Teacher
Prince of Peace Catholic School

Pam Steinkirchner ⁴
3rd Grade Teacher
St. Mark's Catholic School

Anne Hill ⁴
2nd Grade Teacher
St. Patrick Catholic School

Sr. Denise Thompson ³
Principal
All Saints Catholic School

Kaitlyn Kramer ⁴
Kindergarten Teacher
St. Mary of Carmel Catholic School

Emily Tucker ³
Learning Specialist
St. Paul Catholic School

Helene Mercado ^{3,4}
4th Grade Teacher
St. Mark's Catholic School

Linda Watson ²
Mathematics Department Chair
John Paul II High School

Debbie Merkel ^{3,4}
5th Grade Teacher
St. Pius X Catholic School

Melinda Williamson ⁴
1st Grade Teacher
St. Monica Catholic School

<p>1 – Steering Committee 2 – Summit Committee 3 – Curriculum Design Committee 4 – Presentation and Development Committee</p>

¹ Ozar, L. A., & Weitzel-O'Neill, P. (Eds.). (2012). *National standards and benchmarks for effective Catholic elementary and secondary schools*. Chicago, IL: Loyola University Chicago, Center for Catholic School Effectiveness.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 402.

Kindergarten Mathematics Curriculum Standards

KINDERGARTEN FOCAL POINTS NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS¹

Number and Operations: Representing, comparing, and ordering whole numbers and joining and separating sets

Geometry: Describing shapes and space

Measurement: Ordering objects by measureable attributes

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute fluently and make reasonable estimates.</p>	<ul style="list-style-type: none"> ➤ Identify objects by shape. ➤ Describe position names such as above, below, next to, around, inside, outside. ➤ Describe the positions of objects in the classroom. ➤ Describe how to move from one location to another. ➤ Relate position to number sequence—the first block, the second block. ➤ Sort and classify by size, shape, and color. ➤ Move objects in different directions. ➤ Identify shapes in the classroom. ➤ Recognize that shapes can be different sizes. ➤ Count by ones to 15. ➤ Describe how to move shapes from one location to another. ➤ Count orally to 20, 50, and 100. ➤ Count objects to 20. ➤ Count backwards from 20. ➤ Write numbers to 20. ➤ Count objects, rearrange, and count again. ➤ Represent the number of objects with a numeral. ➤ Count by fives to 100. ➤ Count by twos to 20. ➤ Count by tens to 100. ➤ Count from any number. ➤ Identify the next number more and the next number less than any named number. ➤ Model addition by joining two sets. ➤ Read, write, and represent numbers from 0-100. ➤ Model addition situations with objects, sounds, drawings, stories, and equations. ➤ Model subtraction situations by separating, comparing, or finding missing addends of sets.

	<ul style="list-style-type: none"> ➤ Decompose numbers less than or equal to 10 into pairs in multiple ways. ➤ Add and subtract within 5. ➤ Solve addition and subtraction word problems – add and subtract within 10. ➤ Discuss addition and subtraction problems associated with school and home situations. ➤ Explore the concept of unknown numbers using manipulatives and games. ➤ Combine groups and determine quantity. ➤ Put together and take apart models. ➤ Decompose teen numbers in multiple ways. ➤ Use word problems, drawings, and equations when working with numbers from 11-20, 11-50, and 11-100. ➤ Explore the use of numbers in written equations. ➤ Name a penny, nickel, dime, and quarter. ➤ Identify the value of a penny, nickel, dime, and quarter. ➤ Use the cent sign. ➤ Begin to determine and compare and/or create values of sets of coins. ➤ Add and subtract coins to 10 cents. Discuss and identify fair share, equal parts of a whole; Divide into two, three and four parts.
<p>ALGEBRA</p> <p>Understand patterns, relations, and functions.</p> <p>Represent and analyze mathematical situations and structures using algebraic symbols.</p> <p>Use mathematical models to represent and understand quantitative relationships.</p> <p>Analyze change in various contexts.</p>	<ul style="list-style-type: none"> ➤ Explain the relationships of equations to the value of the numbers. ➤ Sort and classify objects by size, color, and shape. ➤ Identify patterns using people, objects, and numbers. ➤ Extend and create patterns using people, objects and numbers. ➤ Identify repeated and growing patterns. ➤ Learn language to describe qualitative change (taller, smaller) and quantitative change (2 feet more, three inches less).
<p>GEOMETRY</p> <p>Analyze characteristics and properties of two- and three-</p>	<ul style="list-style-type: none"> ➤ Name, trace, build, and sort two-dimensional shapes—triangle, square, circle, rectangle. ➤ Play with, analyze and compare a wide variety of two and three-dimensional shapes.

dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

- Draw, construct, and combine simple shapes.
- Trace, cut, and fold seasonal shapes.
- Identify shapes in the classroom and at home.
- Compose simple shapes to form larger shapes.
- Define attributes of flat shapes.
- Draw shapes. (circle, square, rectangle, triangle, hexagon)
- Describe and compare objects using names of shapes.
- Describe the positions of objects using terms such as above, below, beside, in front of, behind, and next to.
- Name shapes of varying size and location.
- Identify shapes as two -dimensional or three- dimensional.
- Make designs and demonstrate shapes changing positions using manipulatives.
- Build shapes from components of similar and different shape and size.
- Model shapes in the world by building shapes from components and drawing shapes.

MEASUREMENT

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

IDENTIFYING AND COMPARING MEASUREMENT

- Determine whether one group has more or less objects than another group.
- Match and write the numeral for a group of 10 or less objects
- Explore topics in measurement such as weight, area, time, length, volume, and money.
- Use appropriate comparison words such as heavy, light, long, short
- Order objects by attribute of weight, volume, and length and sort the by count.
- Explore measurement with non-standard and standard devices.
- Explore measurement using metric and customary units.
- Explore the use of tools and units used for different kinds of measure.
- Measure with multiple copies of a unit.
- Recognize the appropriate unit for the object being measured.
- Tell and show time to the hour using both analog and digital clocks.
- Tell and show time to the half hour using both analog and digital clocks.
- Write time in standard notation.
- Identify days of the week, months of the year, and the current year.
- Use a calendar to identify dates.
- Read and write the date.
- Identify the number of days in a month.
- Describe in terms like: today, yesterday, next week, last week, and tomorrow.
- Begin to read Fahrenheit and Celsius thermometers.
- Identify seasons of the year.

DATA ANALYSIS

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Develop and evaluate inferences and predictions that are based on data.

Understand and apply basic concepts of probability.

- Collect data in response to simple questions and surveys such as types of pets.
- Discuss ways to organize data.
- Collect data in lists, tables, charts, and other graphic organizers.
- Display and sort data in multiple ways.
- Discuss the probability of the likelihood that an event will occur, such as rain, sunshine, cold temperature, or hot temperature.

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 12.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.

Grade 1 Mathematics Curriculum Standards

GRADE 1 FOCAL POINTS
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS¹

Number and Operations and Algebra: Developing understandings of addition and subtraction and strategies for basic addition facts and related subtraction facts

Number and Operations: Developing an understanding of whole number relationships, including grouping in tens and ones

Geometry: Composing and decomposing geometric shapes

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute fluently and make reasonable estimates.</p>	<p>COUNTING AND PLACE VALUE</p> <ul style="list-style-type: none"> ➤ Count, read, write, order, compare, expand, and represent numbers to 120. ➤ Count on from a given amount orally and with models. ➤ Count on from any given number to 120. ➤ Relate counting to addition and subtraction. ➤ Recognize that the two digits of a two digit number represent amounts of tens and ones. ➤ Count by 2, 5, and 10. ➤ Explain the value of each digit in a two digit number. ➤ Select a reasonable answer to a problem reflecting a change in place value. ➤ Identify and name place values to the hundreds place. <p>ADDITION AND SUBTRACTION OF WHOLE NUMBERS</p> <ul style="list-style-type: none"> ➤ Fluently add and subtract within 20. ➤ Create number sentences by counting on, composing and decomposing within 20, and using the relationship between addition and subtraction. ➤ Use the commutative and associative properties in addition and subtraction. ➤ Identify and apply the symbol of equality (=). ➤ Determine whether equations containing (=) are true or false. ➤ Solve for the unknown number in an addition or subtraction equation relating to three whole numbers. ➤ Recognize that addition and subtraction are related/inverse operations. ➤ Use multiple problem solving strategies to solve addition and subtraction problems. (i.e. make a ten, use doubles, doubles plus one, number lines)

- Identify 10 more and 10 less than a number.
- Use addition and subtraction within 120 to solve one and two-step word problems.
- Use a written numeral to represent the quantity of a given set of objects ranging in number from 1 to 120.
- Compose and decompose numbers from 11 to 50 into ten ones and some further ones.
- Represent a problem situation, involving addition of two-digit numbers, using any combination of words, numbers, physical objects, or symbols.
- Mentally add ten to a given 2-digit number on and off decade.
- Mentally take ten from a given 2-digit number on and off decade.
- Explain how to find ten more or ten less than a given two-digit number.
- Subtract multiples of 10 in the range of 10-120.
- Add and subtract within 50.
- Add and subtract within 100.
- Use concrete models or drawings and strategies to add and subtract within 120.

WHOLE NUMBER RELATIONSHIPS

- Identify ordinal words to the twentieth.
- Identify even and odd numbers to 120.
- Compare two digit numbers based on meanings of the tens and ones digit and use the symbols for greater than, less than, and equal to record the comparisons.
- Use the commutative and associative properties and demonstrate decomposing and representing numbers within equations.

MONEY

- Name a penny, nickel, dime, quarter and dollar bill.
- Identify the value of a penny, nickel, dime, quarter and dollar bill.
- Find the value of combinations of coins.
- Use the cents sign.
- Determine and compare values of sets of coins.
- Trade with sets of pennies and dimes.
- Count and show money to \$1.00.
- Use the \$ sign.
- Add and subtract money to 25 cents.
- Model real-life situations that involve addition and subtraction of money amounts using word problems.

ALGEBRA

Understand patterns, relations, and functions.

Represent and analyze mathematical situations and structures using algebraic symbols.

Use mathematical models to represent and understand quantitative relationships.

Analyze change in various contexts.

- Solve word problems within 20 involving situations of adding to, taking from, putting together, taking apart, and comparing using objects, drawings, and equations.
- Solve word problems that call for addition of three whole numbers where the sum is less than or equal to 20.
- Solve problems in which the unknowns are in various locations (start, change, result) in equations.
- Understand subtraction as an unknown addend problem.
- Determine the unknown number in an addition or subtraction equation relating to three whole numbers.
- Choose the correct operation in a word problem.
- Identify reasonable answers to problems that reflect real-world experience.
- Use addition and subtraction to create equivalent number sentences.

GEOMETRY

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Apply transformations and use symmetry to analyze mathematical situations.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

- Identify, compare, and sort two-dimensional shapes such as circle, square, triangle, rectangle, trapezoid, hexagon, and diamond, based on defining characteristics.
- Identify, compare, and sort 3-dimensional shapes such as sphere, cube, cone, cylinder, box, and pyramid.
- Describe, count, and compare corners and sides of plane figures.
- Describe count, and compare edges, bases, faces, and corners of three-dimensional shapes.
- Identify open or closed figures.
- Explore lines of symmetry.
- Create shapes and designs with symmetry.
- Divide circles and rectangles into two and four equal parts.
- Differentiate halves, thirds, and fourths from other parts.
- Recognize and model halves, thirds, and fourths of a whole or a set.
- Recognize that decomposing a whole or set into more equal shares creates smaller shares.
- Use the phrases half of, fourth of, and quarter of to describe parts of the whole.
- Put the pieces back together to make a whole. Describe the whole as 2 halves or 4 fourths.
- Read, write, and identify $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{2}{4}$, and $\frac{3}{4}$.
- Compare parts of a whole object and estimate whether they are closer to zero, one half, or one whole.

MEASUREMENT

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

IDENTIFYING AND COMPARING MEASUREMENT

- Recognize and describe the attributes of length, volume, weight, area, time, and money using manipulatives.
- Compare and order objects by their attributes, shortest to tallest.
- Measure length using non-standard units.
- Measure length, time, and temperature using standard units.
- Select an appropriate unit tool for the attribute being measured.
- Measure and record something larger than the unit with repetition of a single standard or non-standard unit.
- Read a clock in terms of hours and half hours.
- Read a calendar in terms of the day of the week and the month. Use the terms yesterday, today, and tomorrow.
- Understand and apply the terms degree, pound, day, week, inches, feet, cup, pint.
- Identify centimeter and liter as standard metric units.
- Estimate and measure length and height.
- Compare the mass of objects using a balance scale.
- Compare volume/capacity of given containers using concrete materials. (i.e. water, sand, beans)
- Read Fahrenheit and Celsius thermometers.

LINEAR MEASUREMENT

- Recognize and apply non-standard units of measure.
- Demonstrate approximate inch and approximate foot.
- Estimate and measure length and height in non-standard units.
- Estimate and measure length and height in inches and centimeters.

TIME

- Tell and write time in hours and half hours using analog and digital clocks.
- Write time in standard notation.
- Estimate elapsed or projected time in terms of an hour or a minute.
- Identify days of the week, months of the year and current year.
- Use a calendar to identify dates and sequence events.
- Read and write the date.
- Identify the number of days in a month.
- Describe time in terms like: today, yesterday, tomorrow, next week or last week.
- Estimate and compare the length of time needed to complete tasks using terms like shorter or longer.
- Tell and write time from analog and digital clocks using a.m. and p.m.
- Recognize the difference between the hour hand and the minute hand.
- Determine where the hour hand must be when the time is to the hour.
- Determine where the minute hand must be when the time is to

the hour.

DATA ANALYSIS

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Develop and evaluate inferences and predictions that are based on data.

Understand and apply basic concepts of probability.

- Collect data for questions that have multiple responses. (What is your favorite color?)
- Organize data in a tally sheet with manipulatives.
- Display and interpret data on pictographs, bar graphs, or charts.
- Recognize the numerical value represented by each bar on a graph and each image on a pictograph.
- Observe, record, graph, and describe the results of simple probability activities and games.
- Identify events as certain, possible, or impossible.
- Use lists, graphic organizers, and tables to organize data.
- Ask and answer quantity and comparison questions about the data represented in tables or graphs.

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 13.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.

Grade 2 Mathematics Curriculum Standards

GRADE 2 FOCAL POINTS¹

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Number and Operations: Developing an understanding of the base-ten numeration system and place-value concepts

Number and Operations and Algebra: Developing quick recall of addition facts and related subtraction facts and fluency with multi-digit addition and subtraction

Measurement: Developing an understanding of linear measurement and facility in measuring lengths

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute fluently and make reasonable estimates.</p>	<p>PLACE VALUE AND COUNTING</p> <ul style="list-style-type: none"> ➤ Represent three digit numbers as amounts of hundreds, tens, and ones using manipulatives, pictures and words. ➤ Represent 100 as a bundle of ten tens using manipulatives, pictures and words. ➤ Represent 200, 300, 400, 500, 600, 700, 800, and 900 as the appropriate number of hundreds using manipulatives, pictures and words. ➤ Count within 1000 starting from any number. ➤ Count by 5s, 10s and 100s. ➤ Skip count by various numbers to build foundations for understanding multiples and factors. ➤ Read numbers to 1000. ➤ Write numbers to 1000 in standard form and expanded form. ➤ Write number names to 1000. ➤ Compare two three-digit numbers based on place value of each digit. ➤ Use these symbols (<, =, >) correctly in comparisons. ➤ Use the hundreds chart to identify number patterns (i.e. odd and even numbers, counting by 5s and 10s etc). ➤ Determine if a group of objects, up to 20, is odd or even. ➤ Use place value and properties of operations to create equivalent representations of given numbers. ➤ Count the number of tiles in a rectangle to determine the total number of squares in the rectangle. ➤ Use a variety of methods and tools including manipulatives to compute. <p>ADDITION AND SUBTRACTION OF WHOLE NUMBERS</p> <ul style="list-style-type: none"> ➤ Demonstrate understanding of adding and subtracting whole

	<p>numbers.</p> <ul style="list-style-type: none"> ➤ Solve missing addends for components to 20. ➤ Demonstrate fluency for addition and subtraction of fact families and double facts up to 20. ➤ Develop and use strategies for adding and subtracting 2-digit numbers with or without regrouping. ➤ Use various representations to illustrate addition and subtraction in story problems. <p>MONEY</p> <ul style="list-style-type: none"> ➤ Solve word problems involving dollars within 100, and use the \$ symbol appropriately. ➤ Solve word problems involving cents within 100, and use the cents symbol appropriately.
<p>ALGEBRA</p> <p>Understand patterns, relations, and functions.</p> <p>Represent and analyze mathematical situations and structures using algebraic symbols.</p> <p>Use mathematical models to represent and understand quantitative relationships.</p> <p>Analyze change in various contexts.</p>	<ul style="list-style-type: none"> ➤ Write an equation using a symbol for the unknown number. ➤ Write an equation to represent an even number as the sum of 2 equal addends. ➤ Develop an initial understanding of multiplication as repeated addition. ➤ Write an equation to represent the repeated addition. ➤ Describe and extend numeric patterns. ➤ Extend both repeating and/or growing patterns. ➤ Solve problems involving multiplicative situations. ➤ Solve one-step and two-step word problems within 100 involving situations of adding to, taking from, putting together, taking apart, and comparing.
<p>GEOMETRY</p> <p>Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.</p> <p>Specify locations and describe spatial relationships using coordinate geometry and other representational</p>	<ul style="list-style-type: none"> ➤ Build and/or draw two- dimensional and three dimensional shapes (circle, square, triangle, rectangle, trapezoid, diamond, hexagon, sphere, cube, cone, cylinder, box and pyramid. ➤ Identify, compare and sort 2-dimensional and 3-dimensional shapes. ➤ Describe and compare corners, sides, and angles of two-dimensional shapes. ➤ Describe and compare edges, bases, faces, and corners of three-dimensional shapes. ➤ Divide circles and rectangles into 2, 3, or 4 equal parts. ➤ Identify shapes that have specified attributes. ➤ Identify triangles, quadrilaterals, pentagons, hexagons and cubes. ➤ Divide a rectangle into same size squares creating rows and columns.

systems.

Apply transformations and use symmetry to analyze mathematical situations.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

MEASUREMENT

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

TIME

- Read a clock in terms of hours, half hours, quarter hours and five minute increments.
- Write time using analog clocks and digital clocks.
- Identify and label when a.m. and p.m. occur.

LINEAR MEASUREMENT

- Recognize and describe the attributes of length, volume, weight, area, perimeter, time and money using manipulatives.
- Demonstrate how to measure length and volume using non-standard and standard units.
- Select an appropriate tool for the attribute being measured and record the measurement using the appropriate units.
- Describe how two measurements using different units relate to the size of the unit chosen.
- Estimate length using units of inches, feet, centimeters and meters.
- Check for reasonableness of estimates.
- Compare objects visually, side by side, and measure the difference.
- Express the difference between lengths in terms of a standard length unit.
- Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, and 2.
- Use a number line to model sums and difference to 100.
- Generate measurement data by measuring lengths of several objects to the nearest whole unit or by making repeated measurements of the same object.
- Use number sentences or drawings to solve measurement word problems within 100.

FRACTIONAL CONCEPTS

- Describe the parts of the shape as halves, thirds, and fourths. Identify the combinations of the whole (2 halves = 1 whole, etc.).
- Use manipulatives, pictures and words to show that equal-sized sections of the same whole need not have the same shape.

DATA ANALYSIS

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Develop and evaluate inferences and predictions that are based on data.

Understand and apply basic concepts of probability.

- Solve put together, take-apart, and compare problems about information presented in a bar graph.
- Draw a picture graph to represent data with up to 4 categories. (including title, scale label, categories, category labels, and data)
- Draw a bar graph to represent data with up to 4 categories. (including title, scale label, categories, category labels, and data)

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 14.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.

Grade 3 Mathematics Curriculum Standards

GRADE 3 FOCAL POINTS
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS¹

Number and Operations and Algebra: Developing understandings of multiplication and division and strategies for basic multiplication facts and related division facts

Number and Operations: Developing an understanding of fractions and fraction equivalence

Geometry: Describing and analyzing properties of two-dimensional shapes

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute fluently and make reasonable estimates.</p>	<p>PLACE VALUE AND ROUNDING</p> <ul style="list-style-type: none"> ➤ Read and write any number less than or equal to one million. ➤ Identify the place value of each digit up to 100,000. ➤ Given a 6-digit number in standard form, express the number in expanded notation. ➤ Round whole numbers to the nearest 10, 100, 1,000, 10,000, and 100,000 using place value. <p>ADDITION AND SUBTRACTION OF WHOLE NUMBERS</p> <ul style="list-style-type: none"> ➤ Fluently add and subtract up to 100,000. ➤ Use multi-digit addition and subtraction with and without regrouping. ➤ Solve real world problems involving addition and subtraction. ➤ Identify and apply the commutative and associative properties. ➤ Add three or more multi-digit addends. <p>MULTIPLICATION AND DIVISION OF WHOLE NUMBERS</p> <ul style="list-style-type: none"> ➤ Solve problems involving multiplication and division. ➤ Represent and understand products of whole numbers. ➤ Represent and understand whole-number quotients of whole numbers. ➤ Utilize and identify properties of operations to multiply and divide whole numbers. ➤ Describe the relationship between multiplication and division and the properties of multiplication and division. ➤ Describe the relationship between addition and multiplication. ➤ Understand that the quotient and divisor are factors of the dividend. ➤ Multiply and divide within 144. ➤ Fluently multiply and divide within 144 using properties of operations to simplify and understand multiplication and division.

- Identify and apply the divisibility rules of 2, 5, and 10.
- Compute products for a 1-digit number times a 2-digit number and a 3-digit number.
- Use calculators and hundred charts to discover patterns and sequences generated from multiplication facts.
- Use the commutative and associative properties to solve equations.
- Model and interpret division with remainders.
- Divide with 2-digit dividends and 2-digit quotients.
- Solve one-step and two-step problems involving all operations.

FRACTIONS

- Read and write common fractional parts of a whole.
- Recognize fractions that are equivalent to whole numbers and express whole numbers as fractions.
- Recognize the equality of decimals and fractions that name tenths.
- Use models to add or subtract fractions with like and unlike denominators.
- Identify the denominator as the parts of a whole and the numerator as the number of parts.
- Use a ruler to determine $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ inch.
- Compare fractions with like numerators and like denominators.
- Use $>$, $<$, and $=$ when comparing fractions.
- Compare two fractions with the same numerator or the same denominator. Compare the results using the symbols $>$, $=$, or $<$, and justify the conclusions. (Relate to a ruler)
- Use rulers (marked with halves and fourths of an inch) to measure lengths to generate measurement data. Use the data to make a line plot marked in whole, half, and quarter units.
- Identify fractions that are equivalent to whole numbers.
- Express whole numbers as fractions
- Use models or diagrams to identify equivalent fractions and interpret whole and mixed numbers and position them on a number line. (Relate to a ruler)
- Recognize fractions as numbers on a number line. Represent fractions on a number line. (Relate to a ruler)

ALGEBRA

Understand patterns, relations, and functions.

Represent and analyze mathematical situations and structures using algebraic symbols.

- Describe, extend and make generalizations about simple geometric and numeric patterns.
- Write and explain the rule of a given geometric or numeric pattern.
- Use models to demonstrate the commutative, associative and distributive properties.
- Apply the commutative and associative properties to the addition of whole numbers.
- Represent an unknown quantity using a variable.
- Write simple equations using the symbols $+$, $-$, x , $=$, and n .
- Solve one-step and two-step problems involving addition and subtraction.

Use mathematical models to represent and understand quantitative relationships. Analyze change in various contexts.

- Use strategies to check for reasonableness (estimation, rounding, computation).
- Use a symbol to represent an unknown variable in an equation.
- Find the missing whole number in a multiplication or division equation with three numbers.
- Draw conclusions from representations involving graphs, tables and equations.

GEOMETRY

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Apply transformations and use symmetry to analyze mathematical situations.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

- Define and classify 2-dimensional and 3-dimensional shapes using appropriate vocabulary.
- Draw and build 2-dimensional and 3-dimensional shapes according to their properties.
- Explore the geometric properties of common shapes and related vocabulary (i.e. parallel, perpendicular).
- Recognize and draw a right angle, an obtuse angle, and other acute angles.
- Name, make and describe cylinders, cones, spheres and pyramids.
- Use manipulatives to depict square units (cm, m, in., ft.).
- Relate perimeter to addition and area to multiplication.
- Solve real world problems involving perimeter and area.
- Find the unknown side length in perimeter and area problems.
- Explore and discuss figures with multiple lines of symmetry.
- Create designs that show rotational symmetry.
- Dissect shapes into equal parts and identify each part as a unit fraction.
- Determine the transformations needed to convert an original figure to its new orientation using technology.
- Describe a motion or series of motions that will show that shapes are congruent.
- Construct simple three-dimensional shapes from two-dimensional nets (plans).
- Recognize that by altering a shape, its properties are also altered.
- Describe the difference between linear and area measurement.
- Categorize geometric figures such as rectangles, squares, rhombuses, parallelograms, quadrilaterals, and trapezoids.

MEASUREMENT

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

- Measure the area of rectangles on a coordinate grid.
- Measure the perimeter of rectangles.
- Distinguish between the area and the perimeter of a rectangle.
- Explain the attributes of length, area, weight and volume.
- Justify the need for measuring with standard units and apply standard unit in the customary and metric systems.
- Recognize a right angle.
- Determine the appropriate unit of measurement for an object.
- Convert between notations (i.e March 12, 2014 and 3/12/14)
- Tell time to the nearest minute.
- Solve problems involving intervals of time, liquid volumes, and

	<p>masses of objects.</p> <ul style="list-style-type: none"> ➤ Measure length of objects to nearest half inch, quarter inch and centimeter. ➤ Use a ruler to measure the sides of a rectangle to explore the concept of perimeter and area. ➤ Select and apply appropriate standard units and tools to measure length, weight, time and temperature. ➤ Locate fractional parts, whole numbers, and mixed numbers on a number line.
<p>DATA ANALYSIS</p> <p>Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.</p> <p>Select and use appropriate statistical methods to analyze data.</p> <p>Develop and evaluate inferences and predictions that are based on data.</p> <p>Understand and apply basic concepts of probability.</p>	<ul style="list-style-type: none"> ➤ Collect data by asking questions about the environment, the school or the community. ➤ Collect data to answer posed questions through surveys, using a tally sheet and/or published reviews. ➤ Decide how to best display data collected. ➤ Use tables, line plots, bar graphs, line graphs, circle graphs, and pictographs to display data. ➤ Represent the location of zero on a graph. ➤ Use data presented in graphs to solve problems. ➤ Explain the meaning of the terms median and mode. ➤ Given a set of ordered numbers, identify the median and the mode. ➤ Write story problems using information collected from a graph. ➤ Interpret picture graphs and bar graphs. ➤ Provide written or oral interpretation of the information represented by a graph. ➤ Use line graphs to make predictions in terms of increasing/decreasing trends. ➤ Explore probability as a measurement of the likelihood of an event. ➤ Explore probability through experiments with a few outcomes.

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 15.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.

Grade 4 Mathematics Curriculum Standards

GRADE 4 FOCAL POINTS
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS¹

Number and Operations and Algebra: Developing quick recall of multiplication facts and related division facts and fluency with whole number multiplication

Number and Operations: Developing an understanding of decimals, including the connections between fractions and decimals

Measurement: Developing an understanding of area and determining the areas of two-dimensional shapes

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute fluently and make reasonable estimates.</p>	<p>WHOLE NUMBERS</p> <ul style="list-style-type: none"> ➤ Read and write any numeral less than or equal to one billion. ➤ Given a number in the millions period written in standard form, express the number in expanded notation. ➤ Recognize that place value is a multiple of 10; each digit represents ten times what it represents in the place to its right. ➤ Round numbers to the thousands place. ➤ Compare two multi-digit numbers using $>$, $=$ and $<$ symbols. ➤ Read and write negative numbers related to number lines and temperature. ➤ Develop an understanding of 1-, 2-, and 3-digit multiplication of whole numbers. ➤ Develop an understanding of division by 1- and 2-digit divisors of whole numbers. ➤ Recognize a variety of ways that addition, subtraction, multiplication and division can be expressed. ➤ Use the inverse operations of addition and multiplication to check subtraction and division problems. ➤ Use the four operations with whole numbers to solve problems. ➤ Demonstrate and use multiplication and division to solve word problems involving multiplicative comparison. ➤ Identify and find all factor pairs for a whole number in the range 1–100. ➤ Be able to identify all whole numbers in the range 1–100 as prime or composite. ➤ Demonstrate fluency of multiplication facts with factors less than or equal to twelve. ➤ Know the divisibility rules for 2, 3, 5 and 10. ➤ Estimate quotients using compatible numbers.

- Estimate products by rounding to the greatest common place.
- Find the Greatest Common Factor and Least Common Multiple of a set of 2 or more numbers.

FRACTIONS

- Recognize the need to have common denominators when adding and subtracting fractions.
- Recognize that multiplication can be used to create equivalent fractions.
- Recognize that division can be used to reduce (simplify) fractions to lowest terms.
- Use the GCF to reduce fractions to simplest form.
- Use the LCM to find the least common denominator of a set of fractions.
- Compare two fractions with different numerators and different denominators
- Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
- Break apart a fraction into a sum of fractions with the same denominator in more than one way.
- Understand and convert a mixed number to an improper fraction and vice versa.
- Add and subtract fractions and mixed numbers with like and unlike denominators.
- Multiply a fraction by a whole number and a fraction by a fraction.
- Make a number line to display fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$).

DECIMALS

- Annex zeroes to create equivalent decimal numbers.
- Relate decimals in tenths, hundredths, and thousandths to fractions and mixed numbers.
- Use decimal notation for fractions with denominators 10, 100 and 1000.
- Identify place value in decimal numbers and write decimals in expanded form.
- Locate, plot and order decimals on a number line.
- Compare and order decimals to thousandths by reasoning about their size.
- Relate decimals to money.
- Round decimals to different place positions within the decimal.
- Estimate decimal sums and differences.
- Construct and use models and pictures to add and subtract decimals.
- Add and subtract decimals to the thousandths.
- Build skills with multiplication and division of decimals in which one factor or the divisor is a whole number.

ALGEBRA

Understand patterns, relations, and functions.

Represent and analyze mathematical situations and structures using algebraic symbols.

Use mathematical models to represent and understand quantitative relationships.

Analyze change in various contexts.

- Recognize, describe, extend and create a wide variety of numeric and geometric patterns.
- Describe and represent a pattern in a table or graph.
- Use variables and open sentences to express relationships.
- Use graphical representation to discover patterns and relationships.
- Translate data from a table to a graph.
- Use models to demonstrate the commutative, associative and distributive properties.
- Apply the commutative and associative properties to whole numbers.
- Apply the distributive property to basic math facts.
- Represent an unknown quantity using a shape or a variable.
- Represent a number sentence with appropriate algebraic symbols.
- Solve word problems involving addition, subtraction and multiplication of fractions and mixed numbers.
- Create graphs and tables that can be used to represent the same relationship.
- Draw conclusions from representations involving graphs, tables and equations.
- Recognize constant and variable changes that occur over a period of time (i.e temperature and weight)

GEOMETRY

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Apply transformations and use symmetry to analyze mathematical situations.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

- Identify, describe and draw models of rays, parallel and perpendicular lines, as well as right, straight, acute and obtuse angles.
- Use models to explore the properties of parallelograms, rhombuses and trapezoids.
- Distinguish between congruence and similarity; recognize two figures that are congruent or similar.
- Name, make and describe properties of cylinders, cones, cubes, spheres and pyramids.
- Identify faces, edges, and vertices of 3-dimensional figures.
- Recognize and draw a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts.
- Identify and name the different types of polygons.
- Identify and name the different kinds of quadrilaterals.
- Understand the parts of a circle (chord, diameter, radius, and circumference).
- Make and use coordinate systems to specify locations and describe points.
- Given a point, identify the coordinate pair that describes its location in the first quadrant.
- Draw a shape that has been slid (translated) a given distance or flipped (reflected) above a given line.
- Recognize that figures may be congruent even though their

	<p>orientations are different.</p> <ul style="list-style-type: none"> ➤ Draw in all lines of symmetry in a given figure. ➤ Create complex shapes from a set of three or more simple shapes. ➤ Separate a given shape into smaller shapes (i.e. rectangle into smaller rectangles or two or more triangles). ➤ Select a three-dimensional object given illustrations from two or more different perspectives.
<p>MEASUREMENT</p> <p>Understand measurable attributes of objects and the units, systems, and processes of measurement.</p> <p>Apply appropriate techniques, tools, and formulas to determine measurements.</p>	<ul style="list-style-type: none"> ➤ Select appropriate units of measure to measure various objects. ➤ Estimate and measure the area of simple polygons on a coordinate grid. ➤ Estimate and measure the perimeter of simple polygons. ➤ Distinguish between the area and perimeter of simple polygons. ➤ Recognize right, obtuse and acute angles. ➤ Measure angles using a protractor. ➤ Determine the appropriate unit of measurement for an object. ➤ Recognize the reasonableness of an estimate. ➤ Given a specified amount of money, determine what could be bought and/or the amount of change received from the purchase. ➤ Add or subtract units of length that may or may not require renaming units. ➤ Memorize and be able to convert from one measurement to an equivalent measurement within the same system, customary and metric. ➤ Estimate and measure capacity in liters, quarts, and gallons. ➤ Choose the appropriate tool to find perimeter of an object. ➤ Recognize and apply the appropriate formula to determine area of rectangles and volume of rectangular prisms. ➤ Make appropriate estimates of size, quantity, temperature and passage of time. ➤ Estimate length and area prior to calculating the actual measurement. ➤ Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money.
<p>DATA ANALYSIS</p> <p>Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.</p> <p>Select and use appropriate statistical methods to analyze data.</p>	<ul style="list-style-type: none"> ➤ Pose questions relevant to themselves, their environment, school or community. ➤ Given a question, identify the data needed to obtain the answer. ➤ Collect data using surveys, a tally sheet and/or published resources. ➤ Make bar, line and pictographs. ➤ Recognize the difference between categorical (non-measurable) and numerical (measured) data. ➤ Explore graphs with intervals different than one. ➤ Label the horizontal and vertical axes appropriately. ➤ Explain the meaning of the terms mean, median and mode.

Develop and evaluate inferences and predictions that are based on data. Understand and apply basic concepts of probability.

- Identify mean, median and mode for a given set of data.
- Compare various representations of data and select the most suitable one.
- Write brief descriptions of graphs.
- Interpret, analyze bar, picture, circle and line graphs.
- Write story problems using information from a graph.
- Use line graphs to make predictions in terms of increasing/decreasing trends.
- Determine which is most likely or least likely to happen, whether one even is more likely than another and explain the reasoning.
- Explore the empirical probability of a simple even and record it as a ratio.

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 16.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.

Grade 5 Mathematics Curriculum Standards

GRADE 5 FOCAL POINTS
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS¹

Number and Operations and Algebra: Developing an understanding of and fluency with division of whole numbers

Number and Operations: Developing an understanding of and fluency with addition and subtraction of fractions and decimals

Geometry and Measurement and Algebra: Describing three-dimensional shapes and analyzing their properties, including volume and surface area

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute frequently and make reasonable estimates.</p>	<p>WHOLE NUMBERS AND INTEGERS</p> <ul style="list-style-type: none"> ➤ Read and write any numeral from zero through the trillions period. ➤ Identify the place value for any number from zero through the trillions period. ➤ Round whole numbers to a specific place value. ➤ Order a set of rational numbers. ➤ Demonstrate fluency in addition and subtraction of whole numbers. ➤ Demonstrate fluency of multiplication and division facts through 12 x 12. ➤ Proficiently multiply multi-digit whole numbers. ➤ Identify the square root of perfect squares. ➤ Rename numbers written in exponential notation and vice versa (i.e. $3^2 = 9$ and $16 = 4^2$). ➤ Identify prime and composite numbers using models and factor notation (factor tree). ➤ Identify multiples and factors of whole numbers. ➤ Use and apply the divisibility rules of 2, 5, and 10. ➤ Develop fluency in division of 1-digit, 2-digit and 3-digit divisors. ➤ Develop an understanding of the four operations of multi-digit whole numbers. ➤ Apply the order of operations to simplify numerical expressions using parentheses, brackets, or braces in numerical expressions. ➤ Identify prime and composite numbers. ➤ Determine prime factorization. ➤ Use inverse operations to check answers. ➤ Identify and graph integers on a number line. ➤ Compare and order integers. ➤ Read and write negative numbers related to practical applications.

FRACTIONS

- Convert a given fraction to equivalent fractions.
- Represent fractions using models.
- Add and subtract fractions with like and unlike denominators (including mixed numbers).
- Solve word problems involving addition and subtraction of fractions.
- Understand that a fraction is a division problem of the numerator by the denominator ($a/b = a \div b$).
- Solve word problems involving division of whole numbers leading to answers in form of fractions and mixed numbers.
- Review and apply multiplication of a fraction or a whole number by a fraction.
- Multiply fractions and mixed numbers to solve real world problems.
- Divide unit fractions by whole numbers and whole numbers by unit fractions.
- Divide a unit fraction by a non-zero whole number.
- Divide a whole number by a unit fraction.
- Solve real world problems by dividing unit fractions by whole numbers and whole numbers by unit fractions.
- Use division to reduce (simplify) fractions to lowest terms.
- Apply the four operations to fractions and mixed numbers to solve real world problems.

DECIMALS

- Read and identify decimals to the thousandths place.
- Write, order and compare decimals to the thousandths place.
- Identify the place value for any decimal through the thousandths.
- Round decimals to a specific place value.
- Represent decimals using models.
- Perform the four operations when using decimals through the thousandths.
- Apply the four operations with multi-digit whole numbers and with decimals to hundredths.
- Represent the conversion between simple decimals and fractions using models.
- Convert fractions to decimals to the hundredths place and decimals to fractions with denominators less than or equal to 10.
- Convert between simple ratios and percents with denominators of 100.
- Find the percent of a given number for whole number percents less than 100%.

ALGEBRA

Understand patterns, relations, and functions.

Represent and analyze mathematical situations and

- Describe, extend and make generalizations about geometric and numeric patterns.
- Represent and explain numeric and geometric patterns with concrete materials, tables and graphs and translate among them.
- Using appropriate algebraic symbols, write open sentences that describe everyday situations.
- Recognize and apply the commutative, associative and distributive

structures using algebraic symbols.

Use mathematical models to represent and understand quantitative relationships.

Analyze change in various contexts.

properties to compute with whole numbers.

- Express mathematical relationships using equations.
- Solve word problems involving addition and subtraction of fractions.
- Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers.
- Solve real world problems involving multiplication of fractions and mixed numbers.
- Understand and explain patterns involving powers of ten in our place value system by relating it to the movement of the decimal point.
- Analyze tables and graphs to identify algebraic relationships.
- Interpret tables and graphs for their practical implications.
- Recognize, describe and compare situations with constant or varying rates of change.
- Investigate how a change in one variable relates to change in a second variable.

GEOMETRY

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Apply transformations and use symmetry to analyze mathematical situations.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

- Sort and/or classify by properties, a selection of plane figures.
- Use appropriate vocabulary to describe properties of common 2-dimensional and 3-dimensional figures (i.e. edges, vertices, faces, etc.)
- Justify why two or more complex figures are congruent or similar.
- Recognize the characteristics that make up a Cartesian Plane (rectangular coordinate plane).
- Plot points on a number line and on a Cartesian Plane, identify the coordinate pair of each.
- Use technology to explore graphs of linear and non-linear relationships to make predictions or form conclusions.
- Find vertical and horizontal distances on coordinate systems.
- Draw a shape that has been rotated about a point or flipped (reflected) above a given line.
- Describe a series of transformations that will give two congruent shapes the same orientation.
- Identify and describe line and rotational symmetry.
- Create a given shape from a set of tangrams or other manipulatives.
- Separate a two-dimensional complex shape into similar shapes.
- Construct common three-dimensional shapes using manipulatives and/or two-dimensional nets.
- Construct a three-dimensional object from a set of two-dimensional plans.
- Draw a two-dimensional representation of a three-dimensional object.
- Understand and apply cubic units of measure when determining the volume of a solid.
- Apply volume problems in real world situations.
- Determine the volume of a right rectangular prism.
- Compare and contrast the formulas $V = l \times w \times h$ and $V = B \times h$ for rectangular prisms using whole numbers.
- Break apart irregularly shaped figures into right rectangular prisms and add their volumes.

MEASUREMENT

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

- Select an appropriate metric or customary unit to measure length and the area of a common figure.
- Describe the attributes and the units of measure for length, area, weight, volume and angles.
- Create a line graph to display a data set of measurements involving fractional parts.
- Estimate volume, weight and temperature using metric and customary units.
- Convert units within the same system, metric and customary.
- Perform simple conversions between metric and customary systems.
- Convert among units of time (i.e. seconds, minutes, hours, days, weeks, years).
- Estimate and measure the approximate area of an irregular polygon or complex figure.
- Estimate and measure the perimeter of an irregular polygon or complex figure.
- Explore standard and non-standard units of measure for length, volume, weight and temperature.
- Understand measurements are approximations and how differences in units affect precision.
- Recognize and apply the use of reasonable estimates.
- Make accurate measurements using appropriate tools for length, area, volume, weight, time, temperature and angles.
- Use formulas for finding the area of rectangles, related triangles and parallelograms.
- Find the perimeter of polygons and complex shapes.
- Use formulas to find the volume of rectangular solids.
- Develop strategies to determine the surface area of rectangular solids.
- Given a specified amount of money, determine what could be bought and/or the amount of change received from a purchase.
- Convert within customary and metric measurement systems and use these conversions in solving multi-step, real world problems.

DATA ANALYSIS

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Develop and evaluate

- Pose questions to peers about themselves, the environment, the school, the community and other content areas.
- Given a question, identify the data needed to obtain the answer.
- Develop a plan to collect data using surveys, making observations or measurements, completing a tally sheet or referencing published resources.
- Represent data in tables, line plots, spreadsheets, pictographs, bar, circle and line graphs.
- Interpret tables and graphs for their practical implications.
- Use appropriate title, headings and scale when constructing graphs.
- Identify, construct and interpret a line or bar graph with an interrupted scale.
- Construct a stem and leaf or box and whisker plot for a given set of

inferences and predictions that are based on data. Understand and apply basic concepts of probability.

- data.
- Recognize categorical versus numerical data.
 - Explain the meaning of the terms mean (average), median, mode and range.
 - Identify mean, median, mode and range for a given set of data with and without technology.
 - Compare data displayed various ways and evaluate how well it represents the data.
 - Explore the concepts of sampling and biased data.
 - Propose and justify conclusions and predictions based on data represented as bar, line, circle and pictographs.
 - Use the mean, median, mode and range to make conclusions for a given set of data.
 - Explain how mean, median and mode can be used to define the middle of a set of data.
 - Generate additional questions based on their conclusions and predictions.
 - Recognize an event as either certain or impossible.
 - Use “zero” to describe an event that is impossible and “one” if it is certain.
 - Describe an event by its degree (i.e. certain, equally likely, impossible).
 - Recognize that the probability of an event is a number between zero and one.
 - Identify all possible outcomes for a simple sample space (i.e. tossing a die).
 - Conduct experiments to quantify the empirical (experimental) probability of simple events.
 - Create a line graph to display a data set of measurements involving fractional parts.
 - Make line graphs to display data sets of measurements in decimal units less than 1.
 - Create bar and line graphs.

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 17.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.

Grade 6 Mathematics Curriculum Standards

GRADE 6 FOCAL POINTS
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS¹

Number and Operations: Developing an understanding of and fluency with multiplication and division of fractions and decimals

Number and Operations: Connecting ratio and rate to multiplication and division

Algebra: Writing, interpreting, and using mathematical expressions and equations

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute fluently and make reasonable estimates.</p>	<ul style="list-style-type: none"> ➤ Compare and order fractions and decimals using $<$, $>$, and $=$, and on a number line. ➤ Compute using basic operations with fractions and mixed numbers. Express answers in simplest form. ➤ Use estimation strategies to determine the reasonableness of results in a variety of situations with decimals and fractions. ➤ Explain the meaning of multiplication and division of fractions and decimals. ➤ Determine the GCF and LCM of two or more numbers. ➤ Add, subtract, multiply and divide fractions and decimals. ➤ Graph rational numbers on a coordinate plane, both positive and negative. ➤ Plot rational numbers on a horizontal and vertical number line. ➤ Plot points on all four quadrants on a coordinate plane.
<p>ALGEBRA</p> <p>Understand patterns, relations, and functions.</p> <p>Represent and analyze mathematical situations and structures using algebraic symbols.</p> <p>Use mathematical models to</p>	<p>PROPORTIONALITY</p> <ul style="list-style-type: none"> ➤ Write ratios and use them to compare quantities. ➤ Find and use unit rates to find unit costs and relate them to ratios. ➤ Apply ratios and rates to solving real world problems using tables, diagrams and/or equations. ➤ Plot ratios on a coordinate plane. ➤ Apply unit rate problems to unit pricing and constant speed (gearing toward rate of change.) ➤ Solve problems involving the “3 Cases of Percent”, the percent, the part and the whole. ➤ Estimate with percents.

represent and understand quantitative relationships.

Analyze change in various contexts.

- Solve problems involving percent increase and percent decrease.
- Solve problems involving tax, tip and discounts.

FUNCTIONAL RELATIONSHIPS

- Define and understand the independent and dependent variables in a quantitative relationship.
- Understand the relationship(s) between an equation, table, graph and verbal description of a quantitative relationship.
- Use a graph to create a table, an equation and a verbal description of the quantitative relationship.
- Use an equation to create a table, a graph and a verbal description of the quantitative relationship.
- Use a table to create a graph, an equation and a verbal description of the quantitative relationship.
- Use a verbal description to create a table, an equation and a graph of the quantitative relationship.
- Use variables to represent two quantities that relate to each other.
- Understand and recognize independent and dependent variables in real world situations.
- Understand and recognize the relationship between two related quantities in a verbal description, table, graph and equation.
- Graph the relationship between two related quantities on a coordinate plane.

EXPRESSIONS AND EQUATIONS

- Apply integers, opposites, and absolute values to represent real world situations.
- Add, subtract, multiply and divide integers.
- Order and compare the absolute values of rational numbers.
- Find the distance between two points on a coordinate plane with the same first or the same second coordinates. (horizontal and vertical segments)
- Read and evaluate numerical expressions with exponents.
- Read and evaluate algebraic expressions.
- Translate words into algebraic symbols.
- Simplify expressions using like terms.
- Simplify expressions using the properties of operations.
- Apply properties to solve expressions in problem solving situations.
- Apply the distributive property to factoring a number out of a sum of two whole numbers between 1 and 100.
- Solve and check 1-step and 2-step equations and inequalities from a given solution set.
- Solve and check 1-step and 2-step equations and inequalities.
- Identify the variable when applying equations and inequalities to a real world situation.
- Apply equation and inequality skills to real world situations.
- Represent the solution of an inequality on a number line.

GEOMETRY

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Apply transformations and use symmetry to analyze mathematical situations.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

- Find the area of triangles and rectangles.
- Compose and decompose polygons to solve problems involving area.
- Identify three-dimensional figures.
- Compute the volume of a rectangular prism with whole number edge lengths and fractional edge lengths.
- Determine the area, volume and surface area in mathematical problems and real world situations.

MEASUREMENT

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

- Convert within the measurement systems using ratios and proportions.
- Determine the distance between two points on a coordinate plane with the same x and y coordinates.

DATA ANALYSIS

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Develop and evaluate inferences and predictions that are based on data. Understand and apply basic concepts of probability.

- Write a statistical question designed to collect data.
- Recognize that collected data has a distribution that can be described by the center, spread and shape.
- Recognize and understand the Measures of Central Tendency and how they relate to a set of data.
- Plot numerical data on a histograms, box-and-whisker, scatter plots and stem-and-leaf plots.
- Analyze numerical data sets by frequencies, Measures of Central Tendency, quartiles, and data distributions.
- Display numerical data on a coordinate plane.

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 18.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.

Grade 7 Mathematics Curriculum Standards

GRADE 7 FOCAL POINTS
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS¹

Number and Operations and Algebra and Geometry: Developing an understanding of and applying proportionality, including similarity

Measurement and Geometry and Algebra: Developing an understanding of and using formulas to determine surface areas and volumes of three-dimensional shapes

Number and Operations and Algebra: Developing an understanding of operations on all rational numbers and solving linear equations

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute fluently and make reasonable estimates.</p>	<ul style="list-style-type: none"> ➤ Add, subtract, multiply and divide rational numbers. ➤ Change a rational number in fraction form to its decimal form. ➤ Demonstrate that the distance between two numbers on a number line is the absolute value of their difference. ➤ Use the associative and commutative properties of addition and multiplication and the distributive property of multiplication over addition to simplify computations with rational numbers. ➤ Locate rational numbers on a number line. ➤ Compare rational numbers based on their position on the number line.
<p>ALGEBRA</p> <p>Understand patterns, relations, and functions.</p> <p>Represent and analyze mathematical situations and structures using algebraic symbols.</p>	<p>PROPORTIONALITY</p> <ul style="list-style-type: none"> ➤ Understand what proportions are and what they mean in the context of a real-world problem. ➤ Determine if two quantities form a proportional relationship. ➤ Create and interpret equivalent ratios. ➤ Understand the meaning of and compute the constant of proportionality (unit rate). ➤ Write and solve proportions. ➤ Use proportions to solve problems involving percent. ➤ Estimate and use common applications of percentages including tax,

Use mathematical models to represent and understand quantitative relationships.

Analyze change in various contexts.

tip, discount, mark-up, interest, and commission.

- Estimate and solve problems involving percent of increase and decrease.

EXPRESSIONS AND EQUATIONS

- Understand the opposite of a number and use it in expressions like $-x$ when $x=-2$.
- Use the properties and order of operations to simplify numeric and algebraic expressions.
- Evaluate expressions including expressions with square roots.
- Translate real life stories and verbal expressions into algebraic expressions.
- Understand the difference between an expression and an equation.
- Add and subtract monomial expressions with rational coefficients.
- Demonstrate equivalent forms of the same expression.
- Use the distributive property when simplifying expressions.
- Simplify algebraic expression by combining like terms.
- Solve multi-step problems involving rational numbers presented in various forms.

FUNCTIONAL RELATIONSHIPS

- Recognize the constant rate of change as slope.
- Solve multi-step inequalities involving rational numbers in various forms.
- Graph solutions to equations and inequities on a number line.
- Translate real life stories and verbal expressions into algebraic expressions.
- Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.
- Relate and compare different forms of representation for a relationship.
- Identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.

GEOMETRY

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and

- Find scale factor and understand the relation between scale factor and similar figures.
- Use supplementary, complementary, adjacent and vertical concepts to find missing angles including work where angle measurements are given as expressions.
- Determine perimeter and circumference.
- Calculate area of triangle, trapezoid, parallelograms and circle directly and then the area of polygons composed of these figures.
- Calculate the surface area of prisms, pyramids, and cylinders.
- Draw nets of prisms, pyramids, and cylinders.
- Identify the shapes from a cross section of a 3-D figure.

other representational systems.

Apply transformations and use symmetry to analyze mathematical situations.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

MEASUREMENT

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

- Use proportions to convert among different units of measurement.
- Apply proportionality to areas of measurement including area, volume, circumference, radius and diameter.
- Use proportions for indirect measurement in similar figures.

DATA ANALYSIS

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Develop and evaluate inferences and predictions that are based on data.

Understand and apply basic concepts of probability.

DATA INTERPRETATION

- Understand the necessity of using samples to make inferences as opposed to surveying entire populations.
- Determine if a sample is biased or unbiased.
- Use proportions to make estimates relating to a population on the basis of a sample.
- Construct data displays including box and whisker and stem and leaf plots. Analyze and interpret data from these displays to make generalizations.
- Apply percentages to make and interpret histograms and circle graphs.
- Make predictions from scatter plots using or estimating a line of best fit.
- Determine correlation shown from scatter plot.

STATISTICS

- Analyze and interpret measures of central tendency including mean, median, mode, range, and outliers, and recognize that changes in data sets can affect these measures.
- Compare the distribution of data and variability between two data sets, comparing the ranges and centers of the data.

PROBABILITY

- Understand that when all outcomes of an experiment are equally

likely, the theoretical probability of an event is the fraction of outcomes in which the event occurs.

- Use theoretical probability and proportions to make approximate predictions.
- Understand the probability of an event is a number between 0 and 1 (unlikely and likely) and a probability of $\frac{1}{2}$ is equally likely.
- Estimate the probability of an event by collecting data on the chance the event occurs.
- Create sample spaces using lists, tree diagrams, and tables.
- Compare theoretical and experimental probabilities.
- Determine if two events are independent or dependent and how that affects the outcome.
- Find the probability of compound events and create sample spaces of compound events that occur in everyday life.

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 19.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.

Grade 8 Pre-Algebra Curriculum Standards

GRADE 8 FOCAL POINTS
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS¹

Algebra: Analyzing and representing linear functions and solving linear equations and systems of linear equations

Geometry and Measurement: Analyzing two- and three- dimensional space and figures by using distance and angle

Data Analysis and Number and Operations and Algebra: Analyzing and summarizing data sets

NCTM STANDARDS ²	OBJECTIVES
<p>NUMBERS AND OPERATIONS</p> <p>Understand numbers, ways of representing numbers, relationships among numbers, and number systems.</p> <p>Understand meanings of operations and how they relate to one another.</p> <p>Compute fluently and make reasonable estimates.</p>	<ul style="list-style-type: none"> ➤ Apply rational approximations/estimations of irrational numbers. ➤ Order and compare rational and irrational numbers from a list and on a number line. ➤ Find and estimate square roots and classify numbers as rational or irrational. ➤ Find cube roots and solve cube root equations. ➤ Represent large and small rational numbers using scientific and exponential notation. ➤ Write numbers in standard form and scientific notation. ➤ Relate the four basic operations to the properties of real numbers. ➤ Divide and compare numbers written in scientific notation. ➤ Multiply and divide powers with the same base. ➤ Multiply numbers written in scientific notation, choosing appropriate units of measure.
<p>ALGEBRA</p> <p>Understand patterns, relations, and functions.</p> <p>Represent and analyze mathematical situations and structures using algebraic</p>	<ul style="list-style-type: none"> ➤ Determine whether a number is rational or irrational. ➤ Relate the four basic operations to the properties of integer exponents. ➤ Simplify powers with negative exponents. ➤ Multiply numbers written in scientific notation, choosing appropriate units of measure. ➤ Combine like terms. ➤ Simplify algebraic equations using the distributive properties. ➤ Translate a verbal description into an equation.

symbols.

Use mathematical models to represent and understand quantitative relationships.

Analyze change in various contexts.

- Solve one-step, two-step, multi-step and variables on both sides of the equal sign equations that contain integers, fractions and decimals.
- Identify whether a linear equation with one variable has one, infinitely many, or no solutions.
- Apply and understand the different uses of variables.
- Determine whether a relationship is a function or not.
- Define a function using tables and graphs.
- Evaluate functions and complete input-output tables.
- Compare properties of two functions represented in different ways.
- Interpret and translate functions between verbal descriptions, tables, equations and graphs.
- Recognize linear functions and use tables and equations ($y = mx + b$) to graph them.
- Identify nonlinear functions.
- Write function rules from words, tables and graphs.
- Find the slope of a line from a graph or table.
- Interpret and sketch graphs that represent real-world situations.
- Use similar triangles to prove that the slope is the same between any two distinct points on a non-vertical line on the coordinate plane.
- Determine whether a linear relationship is proportional.
- Determine the missing measures of a two-dimensional figure using your equation and formula skills.

GEOMETRY

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Apply transformations and use symmetry to analyze mathematical situations.

Use visualization, spatial reasoning, and geometric modeling to solve problems.

- Prove congruence or similarity of figures using a series of transformations.
- Graph and describe translations of a line and angle in a coordinate plane.
- Graph reflections of lines, parallel lines and angles in a coordinate plane and identify lines of symmetry.
- Describe a sequence of transformations that map one figure onto another, to determine whether two figures are congruent by using a sequence of transformations.
- Graph rotations and identify rotational symmetry.
- Graph dilations and determine the scale factor of a dilation.
- Identify parallel lines and the angles formed by parallel lines and transversals.
- Determine measures of the angles of triangles and use them to help prove that triangles are similar.
- Find the angle measures of polygon.
- Solve problems using the Pythagorean Theorem and its converse.
- Use the Pythagorean Theorem to find the length of the hypotenuse of a right triangle.
- Use the Pythagorean Theorem to find the missing measurements of triangles.
- Use the Pythagorean Theorem to solve real world problems.
- Graph points and apply the Pythagorean Theorem to find distances in the coordinate plane.
- Solve rational expressions using π .

MEASUREMENT

Understand measurable attributes of objects and the units, systems, and processes of measurement.

Apply appropriate techniques, tools, and formulas to determine measurements.

- Apply perimeter, area, surface area and volume skills/formulas in real world situations.
- Identify solids, parts of solids, and skew line segments.
- Find the volume of prisms, cylinders, pyramids, cones and spheres.
- Apply the Pythagorean Theorem and the slant height of a cone and pyramid to determine the figure's height.
- Apply solving volume of prisms, cylinders, pyramids, cones and sphere in real world situations.

DATA ANALYSIS

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Develop and evaluate inferences and predictions that are based on data.

Understand and apply basic concepts of probability.

- Interpret and create scatter plots of bivariate data.
- Describe patterns in scatter plots, such as clustering, outliers, positive or negative correlation and linear or nonlinear correlation.
- Assess the fit of a trend line on a scatter plot.
- Apply trend lines to estimate and make predictions.
- Create and apply an equation in the form of $y = mx + b$ of the trend line and explain/label the parts of the equation.
- Create and understand how to use two-way frequency tables and two-way relative frequency tables.

¹ National Council of Teachers of Mathematics. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. Reston, VA.: National Council of Teachers of Mathematics, 2006. 20.

² National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA.: National Council of Teachers of Mathematics, 2000. 392-401.