

MATHEMATICS CURRICULUM FRAMEWORK

State of Illinois
MATHEMATICS GOALS 6-7-8-9

ACKNOWLEDGEMENTS

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RATIONALE FOR THE STUDY OF MATHEMATICS

Mathematics is a language used to identify, describe, and investigate the patterns and challenges of every day living.

Mathematics encompasses arithmetic, measurement, algebra, geometry, trigonometry, statistics, probability, and other fields. It deals with numbers, quantities, shapes, and data, as well as, numerical relationships and operations.

Confronting, understanding, and solving problems are at the heart of Mathematics. Mathematics is more than a collection of concepts and skills - it is a way of approaching new challenges through investigating, reasoning, visualizing, and problem solving with the goal of communicating the relationships observed and the problems solved to others.

Mathematics aids the understanding of events that have occurred; it helps to predict and prepare for events to come to more fully understand the world in which we live and to live in this world successfully.

Knowledge of mathematics and the ability to apply mathematics skills to solve problems is an empowering force for all students - both while in school and later in their lives.

All students in the schools of the Archdiocese need the opportunity to engage in learning that fosters mastery of the valued and accepted mathematics goals as outlined in the State of Illinois Mathematics Standards.

Therefore, the Office of Catholic Schools committed to create a tool to assist teachers, students, and parents as each contributes to the important work of continued learning about mathematics.

Through a contractual agreement with the *Center for Catholic School Effectiveness* at Loyola University Chicago and the assistance of elementary and high schools teachers who served as design team and responders, the Office of Catholic Schools believes that such a tool has been created.

This tool — the Mathematics Curriculum Framework — has been researched and designed to provide consistency and rigor in the content and process of the teaching of Mathematics throughout the schools of the Archdiocese.

It is expected that each school will integrate the standards and goals of the Mathematics Curriculum Framework in the delivery of math content, concepts, and skills.

EXPECTATIONS FOR MASTERY OF MATHEMATICS STANDARDS

All students will:

- Show evidence of proficiency in basic mathematics knowledge and skills.
- Recognize and investigate problems and formulate and propose solutions supported by reason and evidence.
- Think logically, critically, analytically, and ethically.
- Express and interpret ideas orally, and in writing, using correct terminology.
- Apply learning skills and techniques to real-world situations; identify and solve problems within the situation.
- Integrate learning into their everyday lives; engage in learning activities, willingly take risks, and demonstrate confidence in their skills.
- Learn and contribute productively as individuals and as members of groups.
- Utilize appropriate instruments, electronic equipment, and networks to access information, process ideas, and communicate learning.
- Recognize and apply connections of important information and ideas within and among learning disciplines.
- Demonstrate an understanding and practice of the Catholic social teachings.

All teachers will:

- Differentiate instruction to meet the diverse needs present in the student population.
- Utilize a variety of materials, resources, and assessments appropriate to student age, development, and the teaching/learning process.
- Provide varied learning situations such as flexible grouping, cooperative groups, and peer leadership.
- Use appropriate instruments, electronic equipment, and networks to support and integrate teaching and learning.
- Collaborate with colleagues at all levels to ensure the continuum of learning.
- Participate in ongoing professional development.
- Be skilled and certified in their discipline.
- Access appropriate communication venues to inform parents of the goals, objectives, and outcomes of the school's curricula in general and their child's progress in particular.

- Model and nurture Catholic values and beliefs.
- Use the published Archdiocesan curriculum framework.

All Administrators will:

- Monitor and regularly assess the written and taught curriculum.
- Monitor instruction and evaluation through regular classroom observation and the review of lesson plans.
- Provide appropriate professional and instructional resources, including technology, for all teachers.
- Design and monitor appropriate communication venues to inform parents of the goals, objectives, and outcomes of the school's curricula in general and their child's progress in particular.
- Create an environment permeated with the Gospel spirit of love and joy.
- Model and nurture Catholic values and beliefs.

All Parents/Guardians will:

- Understand and embrace their role(s) as primary educator.
- Encourage and exemplify the reality of life long learning.
- Access all opportunities for communication with school personnel appropriately and adequately.
- Partner with school personnel in a spirit of trust and collaboration.
- Be actively involved within the school community.
- Model and nurture Catholic values and beliefs.

The Office of Catholic Schools will:

- Provide the vision for curriculum.
- Initiate, develop, and publish curricular frameworks in collaboration with experts in the field, administrators, and teachers.
- Offer professional development opportunities and disseminate information regarding other available opportunities and resources for teachers and administrators.
- Encourage regular articulation between educators at all levels.
- Act as liaison with national and state departments of education regarding curricular standards and expectations for student learning.

INTRODUCTION TO THE MATHEMATICS CURRICULUM FRAMEWORK

The Archdiocese of Chicago Mathematics Curriculum Framework provides Catholic schools and teachers with a blueprint or road map for student learning in mathematics from pre-school through grade 12, aligned with the Illinois Learning Standards.

BENEFITS TO SCHOOLS

This framework and supporting software helps schools:

1. Include all Illinois Learning Standards (ILS) for Mathematics in a user-friendly way for each grade level.
2. Sequence mathematics content and skills for the five Illinois State Mathematics Learning Goals without undo repetition from grade to grade.
3. Prioritize the importance of specific mathematics content and skills at each grade level, identifying what is critical for mastery at the grade, what is significant for mastery, and what is useful if time allows.
4. Use sample assessments to help teachers clarify and understand the desired learning stated in each outcome/standard.
5. Spark ideas for making connections with other subject areas, and Catholic identity and core values.
6. Support efficient and effective communication between teachers on the same grade level and from grade level to grade level in sequencing and reinforcing learning, in developing student assessments, and in working together to design and use teaching materials.
7. Collaborate with other Catholic schools in developing effective assessments and learning activities at each grade level.

UNDERSTANDING THE FRAMEWORK

The following points of information will help schools understand and use the Mathematics Curriculum Framework:

- The Mathematics Curriculum Framework (MCF) is organized by grade level (pre-school through grade 12), and by Illinois State Mathematics Goal (goals 6 through 10 in the Illinois Learning Standards).
- The framework is available to schools in three formats: 1) printed form, organized by State Goal; 2) CD, organized by grade level; 3) on the Archdiocesan Web site (www.archchicago.org/schools), ready to download either as a Word document or a PDF file, sorted by grade level or by State goal.
- For each goal at each grade level, the framework identifies the Learning Standards/Outcomes for that grade level, aligned with the ILS. The Standards/Outcomes are sorted by importance into three categories: 1) *critical for mastery* at the grade level; 2) *significant to develop*; and 3) *useful to work on*. If there are no Standards/Outcomes in one of these categories at a particular grade level, that category will not appear.
- Each Standard/Outcome has been assigned a unique identifying number for easy reference wherever the Standard/Outcome appears. The first digit in the Standard/Outcome ID represents the grade level (P, K, 1, 2, 3 and so on), followed by a period. The second digits represent the State goal (06, 07, 08, 09, 10), followed by a period. The third digits represent the number of the outcome within a particular goal at a particular grade level. For example, Standard/Outcome 1.09.03 refers to grade 1, goal 9, outcome 3. For example, Standard/Outcome 6.08.10 refers to grade 6, goal 8, outcome 10.

- The number/letter combination in parenthesis after each Standard/Outcome indicates the Benchmark Learning Standard from the ILS for that Outcome. For example, Standard/Outcome:

6.08.10 Identify and provide examples of inverse operations. (8C)

(8C) indicates that this particular outcome for grade 6 helps students meet the Illinois Learning Standard C in State Goal 8: “Solve problems using systems of numbers and their properties.” (See page x.) Teachers may ignore this reference in using the framework. It is included so that schools may demonstrate easily to accreditation review teams that the Mathematics Curriculum Framework includes all the relevant ILS on each grade level. It is also helpful for reviewing alignment with *Terra Nova* testing in relation to ILS.

- For each Standard/Outcome the framework provides a sample Assessment to clarify the teacher’s understanding of what students should do in order to demonstrate the knowledge and skills contained in the Standard/Outcome. In some instances, two Assessments are given for a single Standard/Outcome.
- The sample Assessments reflect a variety of assessment formats in keeping with best practices. For example, assessments using manipulatives, assessments using real life problems and information, assessments using technology, assessments requiring students to work in teams, assessments requiring students to write about or explain their thinking, assessments requiring multiple steps and applications.
- Within each State Goal at a grade level, the framework suggests possible Connections with other subject areas, with real life experiences, and/or with Catholic identity and core values. These Connections are by no means complete. They are intended to spark teacher creativity in planning mathematics instruction in ways that integrate learning from other subject areas and from the students’ experiences outside of school in their families and communities, emphasizing the Gospel values that are at the core of Catholic schools.

USING THE FRAMEWORK IN YOUR SCHOOL

The following guidelines will help teachers use the MCF in planning the mathematics instruction at their schools:

- **The Mathematics Curriculum Framework provides the starting point and the ending point for mathematics instruction at each grade level.** At a minimum, teachers should provide instruction in such a way that students can demonstrate **solid mastery of all the *critical* Standards/Outcomes** at the grade level, and can demonstrate at least a beginning mastery of all the *significant* Standards/Outcomes. The *useful* Standards/Outcomes will help students prepare for the next year’s learning and should be included whenever time permits.
- Teachers can refer to the sample assessments for each Standard/Outcome to verify their understanding of what they need to observe students doing that shows that students have mastered the Standard/Outcome. Teachers may choose to use the sample assessments given and/or they may design their own, following the model. During the instructional process, teachers will also use other assignments and assessments to see how well students are learning the knowledge and skill stated in the Standard/Outcome.
- Teachers can refer to the Connections identified at each grade level to help them plan their mathematics instruction in ways that integrate mathematics with other subjects they teach and/or with school events, service projects, and student experiences.
- As part of this framework, schools will receive an Archdiocese of Chicago Mathematics Curriculum Textbook Data Base for their school, available on a CD. The data base will help teachers make easy connections between the MCF and their mathematics textbook.

- Each year, teachers will receive a working copy of the data base for their grade level. This data base will include: 1) the unique ID for each Standard/Outcome (S/O) for their grade level, for all five State goals; 2) the exact wording of each S/O; 3) a code reference to the importance level of the S/O – C for critical, S for significant, U for useful; 4) references to the chapter(s) in their textbook where the S/O is addressed; 5) a column to check off whether the teacher has taught and tested the S/O in a particular textbook chapter; 6) a space for teacher comments to use for teaching next year.
- NOTE: CDs with textbook references identified will be provided for the several most frequently used textbooks in the Archdiocese. For lesser used textbooks, schools may enter the textbook references themselves.

As teachers plan mathematics instruction throughout the school year, they will be able to use the data base in several ways:

WHEN FOLLOWING THE ORDER OF TOPICS IN THE TEXTBOOK:

1. When teachers are ready to begin a new chapter with students, they will be able to select a “Chapter Report” which will generate a print-out for that chapter, listing all the Standards/Outcomes that are addressed in that chapter. The list will include the S/O number, the wording of the S/O, its code for level of importance, the space to check whether it is assessed, and a space for notes.
2. Teachers can use this information to plan instruction so that they focus their instruction on all the critical and significant outcomes first, and then the useful ones as time permits (or as enrichment and acceleration for more advanced students). They can use the S/O ID number to refer back to the Mathematics Curriculum Framework for sample Assessments and suggested Connections.

3. At the end of instruction for that chapter, teachers will check off those Standards/Outcomes that they assessed in ways that students showed understanding and mastery. They can also make comments for future reference. For example, a project that worked very well to teach and assess a particular S/O, a school event or holiday that they were able to tie into instruction, a suggestion to teach a particular S/O in conjunction with another S/O, a suggestion to combine teaching the S/O in this chapter with information from another chapter, and so on.
4. Finally, before moving on to the next chapter, teachers will go back to the data base on their CD and enter the information they have added to their “Chapter Report” sheet. For example, they will enter checks for the S/Os that have been assessed, and they will enter any notes they have made for future reference. They will “Save” this information on their working data base. When this is done, they can then request the “Chapter Report” for the next chapter.
5. At any point in the year, teachers can also use the CD to print a report listing all the S/Os that have not yet been assessed. Or, all the *critical* S/Os that have not been assessed, and so on.
6. Identifying the Standards/Outcomes addressed in each chapter will help teachers focus and clarify the knowledge, skills, and understandings that they need to teach and assess in order to help their students master the Archdiocesan curriculum for their grade level. Having this focus will help teachers make decisions about what to use, not use, emphasize in each chapter. Teachers will be better able to pick and choose items in the text and adjust the time spent on them in terms of the learning standards/outcomes they will assess, rather than treating each section equally. They will also be able to be confident that doing so will prepare students to meet ILS and *Terra Nova* testing.

WHEN FOLLOWING AN ORDER OF TOPICS DIFFERENT FROM THE TEXTBOOK:

Instead of following through the textbook, chapter by chapter, teachers may plan mathematics instruction around topics, pulling information and activities from multiple chapters in a single “unit.” For this kind of planning, the data base helps teachers note all the textbook chapters in which a particular S/O is addressed. Teachers can select a “Standards/Outcomes Report” which generates a printout of all the textbook references for the S/Os they select. They can then follow the process of instructional planning and recording information outlined above, 2-6.

USING LEARNING-CENTERED CURRICULUM DECISION-MAKING: “BACKWARDS DESIGN”

The MCF supports instructional planning in the “Backwards Design” model. In this model, teachers plan instruction by repeatedly asking and answering three questions, **in this order:**

1. What is the intended learning?

(**Outcome/objective:** What should students know, understand and be able to do, stated as observable behavior –use an active verb)

2. What will count as evidence that students can do it?

(**Assessment:** What will students do to show me that they have acquired and can use the knowledge, skill and understanding in the outcome.)

3. What will I do to help them be ready to show me the evidence of their learning?

(**Strategies:** What teaching and learning activities, resources, field trips, etc. will help me teach the knowledge, skill, and understanding in the outcome so that students will be able to give the evidence of learning asked for in the assessment(s) I have designed.)

The MCF provides the *starting and ending answers* for questions 1 and 2. Teachers will develop intermediate mastery objectives and matching assessments as they teach specific knowledge and skills through the year. The S/Os will make it much easier for teachers to develop the intermediate objectives, and the S/Os will provide a final checkpoint to make sure that teachers have included everything that is important on the grade level.

The sample Assessments and Connections in the MCF offer suggestions and cues about useful and appropriate strategies (3)

ILLINOIS LEARNING STANDARDS

MATHEMATICS STATE GOALS 6-10

- State Goal 6:** Demonstrate and apply a knowledge and sense of numbers, including numeration and operations (addition, subtraction, multiplication, division), patterns, ratios and proportions.
- State Goal 7:** Estimate, make and use measurements of objects, quantities and relationships and determine acceptable levels of accuracy.
- State Goal 8:** Use algebraic and analytical methods to identify and describe patterns and relationships in data, solve problems and predict results.
- State Goal 9:** Use geometric methods to analyze, categorize and draw conclusions about points, lines, planes and space.
- State Goal 10:** Collect, organize and analyze data using statistical methods; predict results; and interpret uncertainty using concepts of probability.

ILLINOIS LEARNING STANDARDS

MATHEMATICS

STATE GOALS AND DEFINING STANDARDS

- STATE GOAL 6:** Demonstrate and apply a knowledge and sense of numbers, including numeration and operations (addition, subtraction, multiplication, division), patterns, ratios and proportions.
- Learning Standard A:** Demonstrate knowledge and use of numbers and their representations in a broad range of theoretical and practical settings (6A)
- Learning Standard B:** Investigate, represent and solve problems using number facts, operations (addition, subtraction, multiplication, division) and their properties, algorithms and relationships. (6B)
- Learning Standard C:** Compute and estimate using mental mathematics, paper-and-pencil methods, calculators and computers. (6C)
- Learning Standard D:** Solve problems using comparison of quantities, ratios, proportions and percents. (6D)
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- STATE GOAL 7:** Estimate, make and use measurements of objects, quantities and relationships and determine acceptable levels of accuracy.
- Learning Standard A:** Measure and compare quantities using appropriate units, instrument and methods. (7A)
- Learning Standard B:** Estimate measurements and determine acceptable levels of accuracy. (7B)
- Learning Standard C:** Select and use appropriate technology, instruments and formulas to solve problems, interpret results and communicate findings. (7C)

STATE GOAL 8: Use algebraic and analytical methods to identify and describe patterns and relationships in data, solve problems and predict results.

Learning Standard A: Describe numerical relationships using variables and patterns. (8A)

Learning Standard B: Interpret and describe numerical relationships using tables, graphs and symbols. (8B)

Learning Standard C: Solve problems using systems of numbers and their properties. (8C)

Learning Standard D: Use algebraic concepts and procedures to represent and solve problems. (8D)

STATE GOAL 9: Use geometric methods to analyze, categorize and draw conclusions about points, lines, planes and space.

Learning Standard A: Demonstrate and apply geometric concepts involving points, lines, planes and space. (9A)

Learning Standard B: Identify, describe, classify and compare relationships using points, lines, planes and solids. (9B)

Learning Standard C: Construct convincing arguments and proofs to solve problems. (9C)

Learning Standard D: Use trigonometric ratios and circular functions to solve problems. (9D)

STATE GOAL 10: Collect, organize and analyze data using statistical methods; predict results; and interpret uncertainty using concepts of probability.

Learning Standard A: Organize, describe and make predictions from existing data. (10A)

Learning Standard B: Formulate questions, design data collection methods, gather and analyze data and communicate findings. (10B)

Learning Standard C: Determine, describe and apply the probabilities of events. (10C)