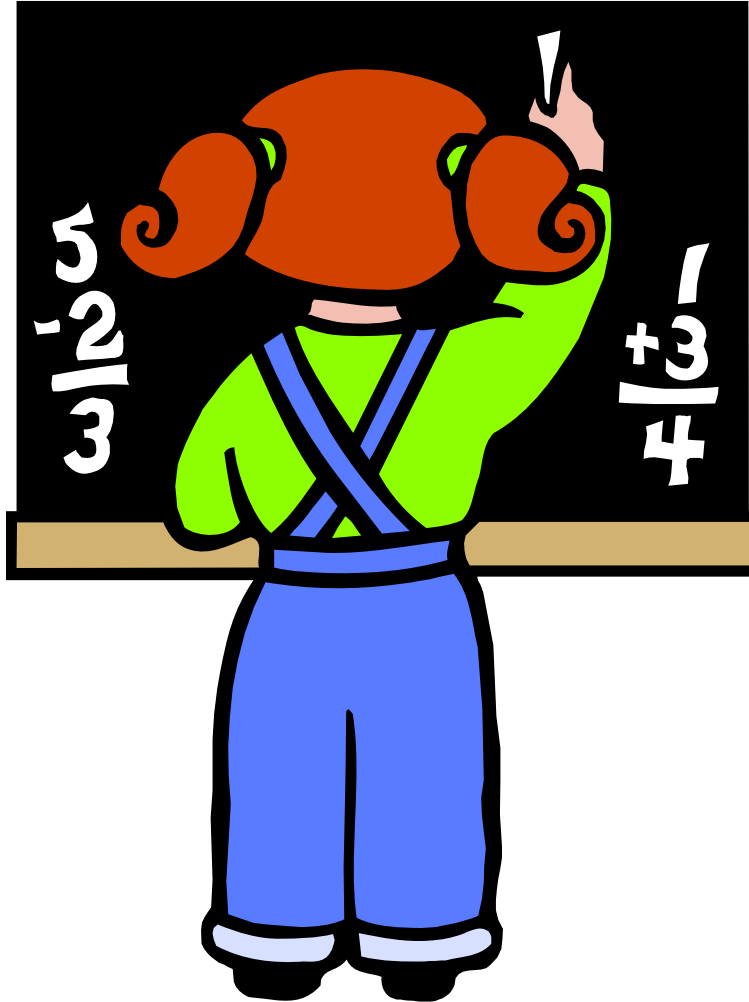


**East Hanover Mathematics Curriculum**

**Grades K – 8**



**East Hanover Township Schools  
East Hanover, New Jersey  
2008**

# East Hanover Mathematics Curriculum

## *Grades K-8*

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**MATHEMATICS**  
**Grades K – 8**

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**Written: Summer 2008**  
**Philosophy**

Mathematics is an exact science, demanding a logical progression to insure the cumulative development and mastery of basic computational procedures and an understanding of their theoretical rationale.

The mathematics curriculum is continually in the process of change. One driving force in the mathematics curriculum is the fact that to “know” mathematics is to “do” mathematics. The curriculum is evolving in the direction of having students become more involved with mathematics by gathering, discovering, creating, recording, and applying knowledge about the subject. The role of the student of mathematics is one in which he is expected to explore, investigate, validate, discuss, represent, and construct. There are fundamental concepts and procedures that should be known by all students but only to the degree that they aid one in using mathematics.

Technology is changing the way mathematics instruction is delivered. This exerts pressure to move through curriculum revision and development. Curriculum development will be accomplished with the full realization that some mathematics becomes more important because technology requires it. Some mathematics becomes less important because technology replaces it while some mathematics becomes possible because technology allows it.

The curriculum provides a logical sequential order to universal mathematics principles and gives support to the belief that the foundation for advanced study of mathematics is established at the elementary level.

Problem solving influences the curriculum throughout the grades. As mathematics curriculum is revised, greater emphasis is being placed on problem solving strategies at all grade levels.

Finally, a major initiative exerts a significant impact on the development and revision of our mathematics curriculum. These factors are the Curriculum and Evaluation Standards for School Mathematics from the National Council of Teachers of Mathematics (NCTM).

## *Statement for All Learners*

All learners benefit from differentiated instruction. Differentiated instruction is an instructional process that has excellent potential to positively impact learning by offering teachers a means to provide instruction to a range of students in today's classroom situations.

To employ differentiated instruction is to recognize students' varying background knowledge, readiness, language, preferences in learning and interests, and to react accordingly. Differentiated instruction is a process of customizing teaching and learning for students of differing abilities in the same class. The intent of differentiating instruction is to maximize each student's growth and individual success by meeting each student's academic needs where he or she is, and assisting in the learning process.

Each student learns through different approaches. There are eight different potential pathways to learning. These different pathways to learning are based on Dr. Howard Gardner's multiple intelligences. Here is the list of intelligences:

1. Linguistic intelligence (words)
2. Logical-mathematics intelligence (numbers or logic)
3. Spatial intelligence (pictures)
4. Musical intelligence (music)
5. Intrapersonal intelligence (self-reflection)
6. Body-kinesthetic intelligence (a physical experience)
7. Interpersonal intelligence (a social experience)
8. Naturalist intelligence (an experience in the natural world)

The differentiated instruction model requires teachers to be flexible in their approach to teaching and adjust the curriculum and presentation of information to learners rather than expecting students to modify themselves for the curriculum.

Created by: Mathematics Curriculum Committee

Reference: [http://www.thomasarmstrong.com/multiple\\_intelligences.htm](http://www.thomasarmstrong.com/multiple_intelligences.htm)

## **Principles for School Mathematics**

Educational decisions made by teachers, school administrators, and other professionals have important consequences for students and for society. The Principles for School Mathematics provide guidance in making these decisions.

The six principles for school mathematics address overarching themes:

- **Equity.** Excellence in mathematics education requires equity—high expectations and strong support for all students.
- **Curriculum.** A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.
- **Teaching.** Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.
- **Learning.** Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.
- **Assessment.** Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.
- **Technology.** Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.

Website: <http://standards.nctm.org/document/chapter2/index.htm>

Reference: National Council of Teachers of Mathematics (<http://www.nctm.org/>)

## The Equity Principle

*Excellence in mathematics education requires equity—high expectations and strong support for all students.*

All students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study--and support to learn--mathematics. This does not mean that every student should be treated the same. But all students need access each year they are in school to a coherent, challenging mathematics curriculum that is taught by competent and well-supported mathematics teachers.

Too many students--especially students who are poor, not native speakers of English, disabled, female, or members of minority groups--are victims of low expectations in mathematics. For example, tracking has consistently consigned disadvantaged groups of students to mathematics classes that concentrate on remediation or do not offer significant mathematical substance. The Equity Principle demands that high expectations for mathematics learning be communicated in words and deeds to all students.

Some students may need more than an ambitious curriculum and excellent teaching to meet high expectations. Students who are having difficulty may benefit from such resources as after-school programs, peer mentoring, or cross-age tutoring. Students with special learning needs in mathematics should be supported by both their classroom teachers and special education staff. Likewise, students with special interests or exceptional talent in mathematics may need enrichment programs or additional resources to keep them challenged and engaged. The talent and interest of these students must be nurtured so that they have the opportunity and guidance to excel in mathematics.

Well-documented examples demonstrate that all children can learn mathematics when they have access to high-quality mathematics instruction. Such instruction needs to become the norm rather than the exception.

Website: <http://standards.nctm.org/document/chapter2/equity.htm>

## **The Curriculum Principle**

*A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*

Mathematics is a highly interconnected and cumulative subject. The mathematics curriculum therefore needs to introduce ideas in such a way that they build on one another. Instead of seeing mathematics as a set of disconnected topics, students should perceive the relationships among important mathematical ideas. As students build connections and skills, their understanding deepens and expands.

The curriculum also must focus on important mathematics--mathematics that is worth the time and attention of students and that will prepare them for continued study and for solving problems in a variety of school, home, and work settings. The relative importance of particular mathematics topics is likely to change over time. Topics such as recursion, iteration, and the comparison of algorithms have emerged and deserve increased attention because of their relevance.

Students should have opportunities to learn increasingly more sophisticated mathematical ideas as they progress through the grades. They should not spend a significant part of their instructional time reviewing mathematics content. A well-articulated curriculum is necessary for teachers at each level to know what mathematics their students have already studied and will study in future grades.

## **The Teaching Principle**

*Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*

Students learn mathematics through the experiences that teachers provide. Teachers must know and understand deeply the mathematics they are teaching and understand and be committed to their students as learners of mathematics and as human beings. There is no one "right way" to teach. Nevertheless, much is known about effective mathematics teaching. Selecting and using suitable curricular materials, using appropriate instructional tools and techniques to support learning, and pursuing continuous self-improvement are actions good teachers take every day.

The teacher is responsible for creating an intellectual environment in the classroom where serious engagement in mathematical thinking is the norm. Effective teaching requires deciding what aspects of a task to highlight, how to organize and orchestrate the work of students, what questions to ask students having varied levels of expertise, and how to support students without taking over the process of thinking for them.

Effective teaching requires continuing efforts to learn and improve. Teachers need to increase their knowledge about mathematics and pedagogy, learn from their students and colleagues, and engage in professional development and self-reflection. Collaborating with others--pairing an experienced teacher with a new teacher or forming a community of teachers--to observe, analyze, and discuss teaching and students' thinking is a powerful, yet neglected, form of professional development.

Teachers need ample opportunities to engage in this kind of continual learning. The working lives of teachers must be structured to allow and support different models of professional development that benefit them and their students.

Website: <http://standards.nctm.org/document/chapter2/teach.htm>

## **The Learning Principle**

*Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*

Research has solidly established the importance of conceptual understanding in becoming proficient in a subject. When students understand mathematics, they are able to use their knowledge flexibly. They combine factual knowledge, procedural facility, and conceptual understanding in powerful ways.

Learning the "basics" is important; however, students who memorize facts or procedures without understanding often are not sure when or how to use what they know. In contrast, conceptual understanding enables students to deal with novel problems and settings. They can solve problems that they have not encountered before.

Learning with understanding also helps students become autonomous learners. Students learn more and better when they take control of their own learning. When challenged with appropriately chosen tasks, students can become confident in their ability to tackle difficult problems, eager to figure things out on their own, flexible in exploring mathematical ideas, and willing to persevere when tasks are challenging.

Students of all ages bring to mathematics class a considerable knowledge base on which to build. School experiences should not inhibit students' natural inclination to understand by suggesting that mathematics is a body of knowledge that can be mastered only by a few.

Website: <http://standards.nctm.org/document/chapter2/learn.htm>

## **The Assessment Principle**

*Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*

Assessment should be more than merely a test at the end of instruction to gauge learning. It should be an integral part of instruction that guides teachers and enhances students' learning. Teachers should be continually gathering information about their students through questions, interviews, writing tasks, and other means. They can then make appropriate decisions about such matters as reviewing material, reteaching a difficult concept, or providing something more or different for students who are struggling or need enrichment.

To be consistent with the Learning Principle, assessments should focus on understanding as well as procedural skills. Because different students show what they know and can do in different ways, assessments should also be done in multiple ways, and teachers should look for a convergence of evidence from different sources.

Teachers must ensure that all students are given an opportunity to demonstrate their mathematics learning. For example, teachers should use communication-enhancing and bilingual techniques to support students who are learning English.

Website: <http://standards.nctm.org/document/chapter2/assess.htm>

## **The Technology Principle**

*Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Calculators and computers are reshaping the mathematical landscape, and school mathematics should reflect those changes. Students can learn more mathematics more deeply with the appropriate and responsible use of technology. They can make and test conjectures. They can work at higher levels of generalization or abstraction. In the mathematics classrooms envisioned in *Principles and Standards*, every student has access to technology to facilitate his or her mathematics learning.

Technology also offers options for students with special needs. Some students may benefit from the more constrained and engaging task situations possible with computers. Students with physical challenges can become much more engaged in mathematics using special technologies. Technology cannot replace the mathematics teacher, nor can it be used as a replacement for basic understandings and intuitions. The teacher must make prudent decisions about when and how to use technology and should ensure that the technology is enhancing students' mathematical thinking.

Website: <http://standards.nctm.org/document/chapter2/techn.htm>

## **Problem Based Learning Projects**

(Created by: Mathematics Curriculum Committee)

### **NEW JERSEY ROAD TRIP**

This project directs students to choose various destinations of interest within the state of New Jersey. Students will be asked to plan a trip for a family of four. While learning what the state of New Jersey has to offer, they will be required to calculate the distance, the length of trip, as well as the cost. Students will need to add up expenses related to the trip which may include food, gas, lodging, entrance fees, and spending money. Social studies, language arts, decision-making skills, and life skills are all integrated throughout this project. The students will be required to apply their knowledge of numerical operations, money and decimals, map reading, estimation, and budgeting in order to understand how math integrates with travel.

### **FITNESS PROJECT**

This project has students utilizing their math skills while increasing their levels of physical fitness. Students will be required to select and participate in specific activities to improve their endurance, stamina, and strength. Some suggested activities would include increasing the number of sit-ups completed, decreasing the time needed to walk/run a mile, and increasing the number of push-ups completed. They will have to design graphs each week to chart their progress throughout the year. Examining the data as a class will enable students to understand how graphs can show results over time. A healthy lifestyle will be reinforced while working on math skills such as increasing/decreasing numbers, graphing, data analysis, measures of central tendency, decimals, elapsed time, estimation, probability, making predictions.

### **READING PROJECT**

This project encourages reading with the emphasis of meeting a class goal. Children will select appropriate books from multiple genres. The class will chart preferred genres, as well as number of pages, chapters, or books read. A monthly log of personal total, classroom total, as well as the amount required to meet the goal will be recorded. The average number of books will be calculated each month to see if the total will be reached. Class surveys, graphing, and measures of central tendencies will be emphasized throughout this project.

### **GOING GREEN**

This project will incorporate math skills while increasing environmental awareness for students. Activities can include reducing, reusing, and recycling materials. Students can classify the shapes of these materials, and transform them into other shapes. They will be given the opportunity to create usable objects out of recyclable materials. Students will use measurement, geometry, and volume. The goal of this project is to use mathematical skills to gain insight on environmental issues.

### **BUDGET PROJECT**

This project has the students going on a journey through the world of adulthood to see how math applies to everyday living. Students will become real adults and discover what their financial responsibilities are. Along the way, they will complete a number of tasks that will help them put together their final project, which is to develop a yearly budget plan that fits the lifestyle they are living. Students will be required to apply their knowledge of basic mathematical operations, money, decimals, percentages, and algebraic equations to successfully complete this project. They will not only be reinforcing their math, social studies, and language arts skills throughout the process but also learn important life skills, which they can apply in the future. The goal of this project is for students to gain a better understanding of and appreciation for the use of mathematics in real-life situations and develop good budgeting habits.

### **SCHOOL STORE PROJECT**

This project provides the students with the skills necessary to operate a school store. Students will participate in a number of activities such as interviewing for a job, greeting and assisting customers, making change, using a cash register, calculating percentages, keeping inventory, ordering and displaying merchandise, creating slogans and advertisements, managing a budget, using time cards, analyzing sales data, and working as a team. They will not only be reinforcing their mathematical, historical, literary, and artistic skills throughout the process but also learn important life skills, which they can apply in the future. The goal is for the students to gain the experience of working together and successfully maintaining a school store.

### **QUILT PROJECT**

This project provides the students with the historical background of quilt-making while reinforcing their coordinate graphing skills. Students will measure and lay out various quilt patterns on a coordinate plane, color the pattern symmetrically, design their own quilt block, and research and read about memory quilts. They will not only be reinforcing their mathematical, historical, literary, and artistic skills throughout the process but also gain an appreciation for the arts. The goal is for the students to gain an understanding of how mathematics is involved in quilt-making.

### **SCALE MODEL PROJECT**

This project has the students creating a scale model of their dream house or dream room by applying appropriate math skills and utilizing resources such as teachers, parents, and the construction industry. Students will research historical architecture, plan and draw a blueprint of their idea, gather the materials for construction, and create a three-dimensional model of their architectural design. They will be required to apply their knowledge of measurement, perimeter and area, geometric shapes and angles, and scale modeling. They will not only be reinforcing their mathematical, historical, and artistic skills throughout the project but also gain an appreciation for the process of architectural design and construction. The goal is for the students to gain an understanding of how mathematics applies to and is used in various disciplines.

