

# East Providence School District K-12 Mathematics Curriculum



August 2010

# K-12 Mathematics curriculum

1. Process
2. Product
3. Implementation



# K-12 Mathematics curriculum - process

MONTH	Mathematics Task Force meetings	K-12 Mathematics Curriculum Development	TOTAL DAYS	
September	F 9/18 @ 8:00	<b>Orientation introduction, Task Force 9/18 8:00 -2:00</b> Algebra I (MS & HS) W 9/23, M 9/28, W 9/30 7:30 -2:00	3	
October	W 10/28 @ 1:30	Algebra I (MS & HS) W 10/7, 7:30 -2:00 Pre-Algebra (grades 7-8) W 10/21, W 10/28 7:30 -2:00	4	
November	No meeting	Pre-Algebra (grades 7-8) W 11/4, W 11/18, 7:30 -2:00 Geometry W 11/25 7:30-2:00	3	
December	W 12/2	Geometry W 12/2, W 12/9 7:30-2:00 Grades 5-6 W 12/16 8:00 -2:00	3	
January	W 1/13 @ 1:30	Grades 5-6 W 1/6, W 1/13, W 1/20, 8:00 -2:30 Grades 3-4 W 1/27 8:00 -2:30	4	
February	No Task Force Meeting	Grades 3-4 W 2/3, W 2/10, W 2/24 8:00 -2:30	3	
March	W 3/31 @ 1:30	Grades K-2 W 3/10, W 3/17, W 3/24, W 3/31 8:00 -2:30	4	
April	W 4/28 @ 1:30	Algebra II (Pre-Cal?) and makeup W 4/7, W 4/14, W 4/28 7:30 -2:00	3	
May	No Task Force Meeting	Algebra II (Pre-Cal?) and makeup W 5/5 7:30 -2:00 Process W 5/19, W/26	3	
June				
<b>TOTAL</b>			<b>30</b>	

# K-12 Mathematics curriculum - process

**September 2009  
June 2010**

K-12 Task Force with representation from every school that included classroom teachers, resource teachers, administrators, and department chairperson.

## **Mathematics Task Force**

Fatima Avila  
Kathleen Bickford  
Caroline Caswell  
Paula Fillion  
Sandra Forand  
Kevin Monagle  
Nicole Monte  
Linda Newman  
Beth Salzillo  
Stacy Simmons  
Patricia Usenia  
Amy Watson

# K-12 Mathematics curriculum - process

Task Force Members	Curriculum Writers	Teachers
<p><b>Meet monthly after school (Sept.- June) to:</b></p> <ul style="list-style-type: none"> <li>• Oversee entire process</li> <li>• Serve as a liaison to colleagues</li> <li>• Review research, data, and literature, standards, and GLSs/GSEs</li> <li>• Write the mission statement and philosophy</li> <li>• Align (map) current curriculum with standards, GLEs/GSEs, NEASC standards</li> <li>• Write one grade level curriculum that includes standards, GLEs/GSEs, East Providence SD benchmarks, variety of assessments, and best instructional practices</li> <li>• Work with new grade level writers</li> <li>• Facilitate the selection of resources,</li> <li>• Select glossary words</li> <li>• Review all documents</li> <li>• May volunteer to write additional grades</li> </ul>	<p><b>Meet daily (approximately 3-5 days, substitutes provided) with a grade level team to:</b></p> <ul style="list-style-type: none"> <li>• Write curriculum that includes standards, GLEs/GSEs, East Providence SD benchmarks, variety of assessments, and best instructional practices</li> <li>• Develop consistent grade level assessments (rubrics)</li> <li>• Create grade level map</li> <li>• Review and edit work</li> <li>• May volunteer to write additional grades</li> </ul>	<p><b>During the K-12 process all teachers will :</b></p> <ul style="list-style-type: none"> <li>• Review documents and provide feedback and recommendations based on research and data</li> </ul>

# **K-12 Math curriculum – process...** *connecting the dots ...of research, federal, regional, state mandates...*

## **1. NCLB – No Child Left Behind (federal)**

- Annual Yearly Progress (AYP)
- State Assessments – ALL students to proficiency

## **2. NEASC - New England Association Schools and Colleges - accreditation (regional)**

- Learner expectations
- Curriculum, instruction, and assessment (school-wide and content rubrics)

## **3. RI Comprehensive Strategy (state)**

- State Assessment Program – NECAP- GLEs/GSEs (math, ELA, science 2008)
- SALT
- Article 31
  - District and school improvement plans
  - Curriculum, instruction, and assessments

## **4. RI Diploma System (state)**

- Carnegie units
- Graduation by Proficiency (PBGR)
- Support systems

## **5. Research and Data (federal and state)**

- Scientific research based instruction
- Internal and external assessments

## **6. (Common Core Standards)**

NCLB – No Child Left Behind (federal)  
NECAP Testing Program (state)  
NEASC - New England Association Schools and  
Colleges - accreditation (regional)  
RI Diploma System (state)  
Research and Data (federal and state)  
**NEW - CORE CURRICULUM STANDARDS**

**East Providence Public Schools**  
**District Strategic Plan**  
**Vision, Mission, Objectives, Strategies, and Action Plans**

Systemic Standards-based Curriculum, Instruction,  
Assessment, and Professional Development

- Elementary School Improvement Plan
- Elementary School Improvement Plan
- Elementary School Improvement Plan
- Elementary School Improvement Plan
- Middle Schools School Improvement Plan
- High Schools School Improvement Plan

**High Standards for ALL Students**

# K-12 Mathematics curriculum process - research

*The world is changing!*



*Our students are different !*

- ❑ Knowledge is doubling every few months
- ❑ Shift from industrial to technological society
- ❑ The level of mathematical thinking and problem solving needed in the workplace has increased dramatically.
- ❑ Mechanics used to require 6<sup>th</sup> grade education, today a minimum of grade 13
- ❑ No longer do we have assembly line jobs for students who cannot do mathematics



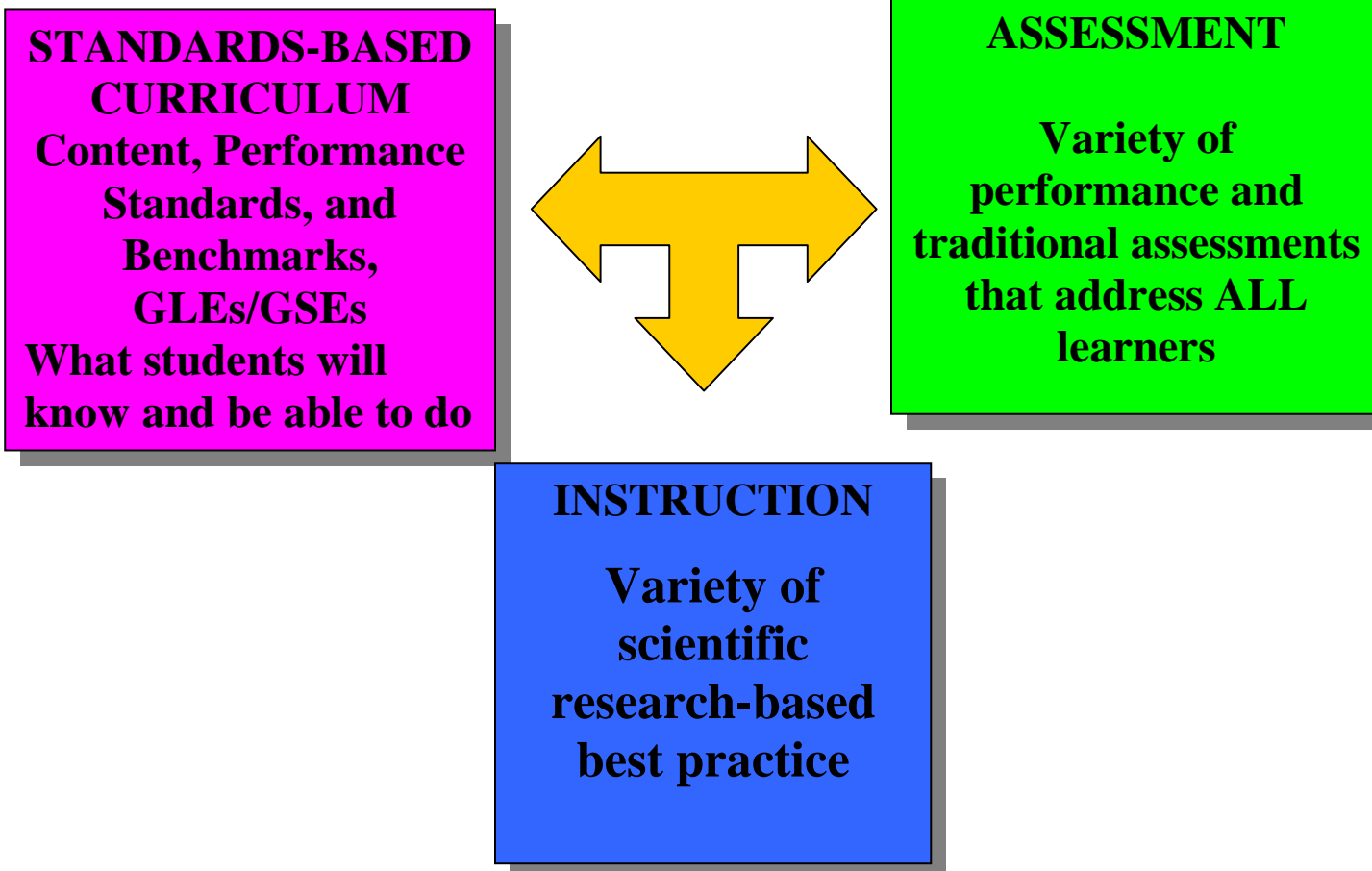
- ❑ They are comfortable with and use technology
- ❑ They are accustomed to visual stimulation and have easy access to information

*Internationally, our students are not mathematically competitive* TIMSS, Grade 8, 1995



<b>HIGHER</b> 20 countries
<b>SAME</b> 14 countries
<b>LOWER</b> 7 countries

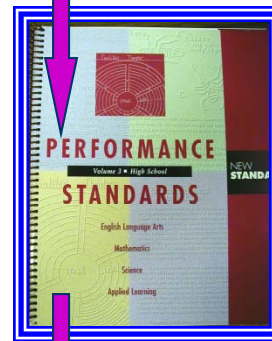
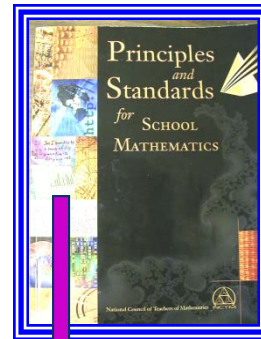
# K-12 Math curriculum - process



# K-12 Mathematics curriculum - process

1988  
1<sup>st</sup>  
Math  
Standards

Math STANDARDS	K	1	2	3	4	5	6	7	8	9	10	11	12
Numbers and Operations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Algebra	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Geometry Measurement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Data Analysis & Probability	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Problem Solving, Reasoning and Proof	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Communication Representation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



GLE's  
GSE's  
Mathematics

New Common Core Standards

- Vertical
- Horizontal
- Detailed lists of what students should know and be able to do
- Spiral K-12
- Sequential

# K-12 Mathematics curriculum - process, from standards to GLEs/GSEs

## NECAP -GLEs/GSEs Vermont, New Hampshire, Rhode Island, and Maine (recently)

- GLEs and GSEs are meant to capture the “big ideas” of reading and writing that can be assessed, without narrowing the curriculum locally.
- The GLEs and GSEs can be interpreted as describing the expectations for the end of the grade/grade span identified, or the beginning of the next grade/grade span. For example, grade 7 GLEs identify grade span expectations in writing for both the end of grade 7 and the beginning of grade 8, for large-scale assessment purposes.
- All of the concepts and skills identified at a given grade level are “fair game” for large-scale assessment purposes if “(State)” appears at the end of the GSE.

# K-12 Mathematics curriculum - process, from standards to GLEs/GSEs

- Each GLE/GSE includes three parts.
  - **A statement in bold**, called the “stem,” is at the beginning of each GLE/GSE. Each “stem” is the same or similar across the grades for a given GLE/GSE, and is meant to communicate the main curriculum and instructional focus of the GLE/GSE across the grades.
  - **The unbolded text within** a GLE/GSE indicates how the GLE/GSE is specified at a given grade level or grade span. There are often several indicators for each GLE/GSE stem. Each indicator is coded and indicated as fair game for “state” or “local” assessment.
  - **Differences between adjacent grades are underlined**. (Note: Sometimes nothing is underlined within a GLE/GSE. In these situations, differences in adjacent grades “assumes applying writing skills with increasing complexity.”)

## K-12 Mathematics curriculum - process, from standards to GLEs/GSEs

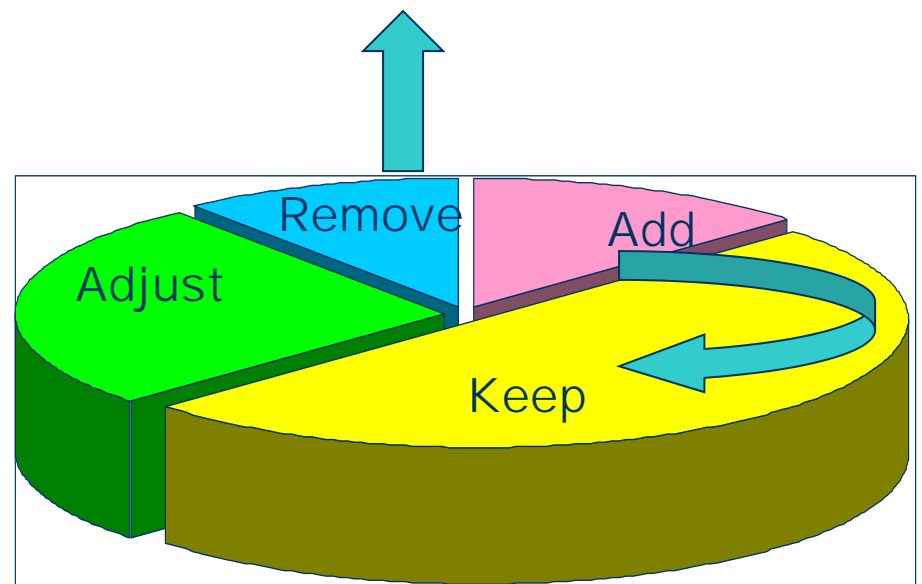
- **GLEs/GSEs – Math – Number and operations, grade 5**

**M(N&O)–5–2 Demonstrates understanding of the relative magnitude of numbers** by ordering, comparing, or identifying equivalent positive fractional numbers, decimals, or benchmark percents within number formats (fractions to fractions, decimals to decimals, or percents to percents); or integers in context using models or number lines. (state assessment)

# K-12 Mathematics curriculum - process

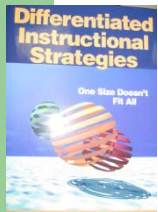
October 2009

- Developed **Algebra I** curriculum, instruction, and assessments
- Created the “exemplar”
- Shared with committee
- Recruited additional writers

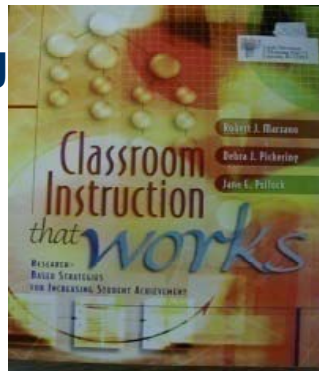


# K-12 Mathematics curriculum - process

## Methods of Instruction – district initiatives

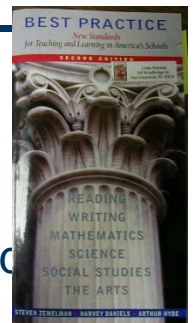


- **Differentiated instruction** (tiered assignments, jig sawing, anchoring, etc.)
- **Problem solving**



## Methods of Instruction - research

- **Best practice across all content** (e.g., student centered, authentic, collaborative, etc.)
- **Best practice for the teaching of mathematics** (e.g. using manipulatives, open-ended problems, reading, writing and discussing mathematics, using appropriate technology, etc.)
- **Exhibitions** – student work with exemplars, etc.



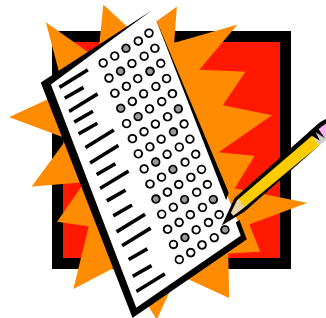
# K-12 Mathematics curriculum - process

## COMMON ASSESSMENTS

- **Formative and Summative**
  - **REQUIRED OPEN REPOSNSE and BENCHMARK PROBLEMS**
  - **COMMON TASKS**
  - MID-YEAR ASSESSMENT
  - END-OF-YEAR ASSESSMENT
  - PRE AND POST EDM UNIT TESTS
  - MID-TERM EXAM
  - FINAL EXAM

## Assessments

- **Suggested – teacher choice**
  - Interviews
  - Problem of the day
  - Written responses
  - Journals
  - Tests
  - Performance/problem-based tasks, common tasks
  - Rubrics



# K-12 Mathematics curriculum process, assessment

## Required (Benchmark) Problems

- Higher level thinking (analyze, create, synthesize)
- Variety of resources
  - NECAP, MCAS Released tests items
  - Problem solving books
  - Textbooks
- Problems that require students to **solve problem using words, symbols, and numbers**
- Problems that may require **rubrics for scoring**

# K-12 Mathematics curriculum process, assessment (rubrics)

**Rubrics** - Sets of criteria that describe levels of performance or understanding aligned to standards.  
USES THE LANGUAGE OF THE STANDARDS LOTS

- Scale of possible points, 4,5, and 6
- Descriptors
- Holistic
- Analytical
- Exemplars



# K-12 Mathematics curriculum process, assessment (rubrics)



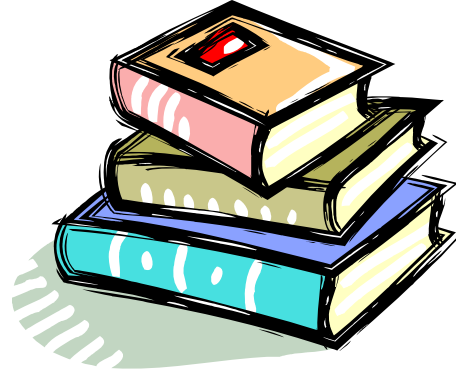
## Rubrics aligned to standards...LOTS

- Increase consistency in the rating of performances, products, and understandings.
- Provide students with “road signs” information about where they are in relation to where they need to be
- Provide students with expectations about what will be assessed as well as the standards that need to be met

# K-12 Math curriculum - process

- Resources – variety

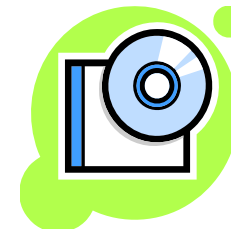
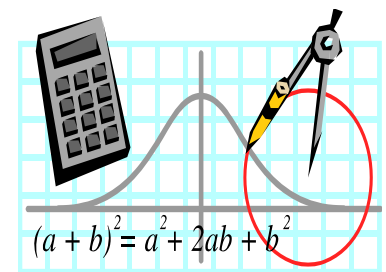
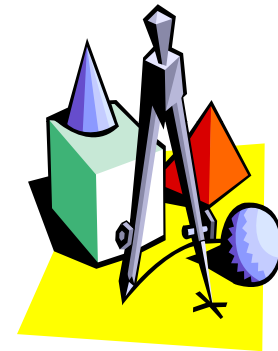
- Textbooks
- Supplementary
- Technology  
(calculators, interactive boards, computers)
- Materials
- School library
- Community



# K-12 Mathematics curriculum - product

## Notebooks K-5 (individual), 6-8 and 9-12 and website

- Committee
- Mission, philosophy
- Grade level/course map
- Grade level/course curriculum, instruction, and assessments
- Rubrics
- Required Problems
- Glossary



# K-12 Mathematics curriculum - product

## Mission Statement

*We are committed to providing a sequential, comprehensive, differentiated, and standards-based K-12 mathematics program*

# K-12 Mathematics curriculum - product

## Philosophy

***In East Providence Public Schools we believe the K-12 mathematics program should:***

- *Provide multiple opportunities for all students to become confident and effective communicators, problem solvers, and life-long learners*
- *Use data to drive instruction (formative and summative)*
- *Identify individual student needs and focus instruction to close the gaps*
- *Address diverse needs by effectively communicating mathematical ideas in a variety of ways*
- *Utilize technology to enhance student learning*
- *Provide all students with the opportunity to reach his/her potential and ability to achieve high standards*

# K-12 Mathematics curriculum - product

Each grade or course contains:

- Curriculum map – suggested timeline
- Curriculum, instruction, and assessments
- Required (benchmark) Problems (released NECAP, MCAS, NAEP)
- Rubrics (problem solving and math communication)
- Glossary

# K-12 Mathematics curriculum – product Curriculum Map -suggested timeline

GLEs/GSEs NCTM Standards	1 <sup>st</sup> Quarter	2 <sup>nd</sup> Quarter	3 <sup>rd</sup> Quarter	4 <sup>th</sup> Quarter
<b>1. Numbers Sense and Operations (content)</b>	<ul style="list-style-type: none"> <li>• Relative magnitude 1.2.1               <ul style="list-style-type: none"> <li>○ absolute value</li> <li>○ exponents</li> <li>○ fractions</li> <li>○ decimals</li> <li>○ percents</li> </ul> </li> <li>• Operations with integers 1.3.1, 1.3.2, 1.3.3, 1.3.4</li> <li>• Solves problems 1.4.1-1.4.2               <ul style="list-style-type: none"> <li>○ raising numbers to whole number powers</li> <li>○ operations with integers</li> </ul> </li> <li>• Mental computations 1.6.1 -1.6.2</li> <li>• Estimates 1.7</li> <li>• Properties of numbers 1.8.1 - 1.8.2               <ul style="list-style-type: none"> <li>○ field properties</li> </ul> </li> </ul> <p style="color: red; text-align: center;">Benchmark problem</p>	<ul style="list-style-type: none"> <li>• Rational numbers 1.1.1-1.1.2               <ul style="list-style-type: none"> <li>proportional reasoning</li> <li>percent</li> <li>percent of change</li> </ul> </li> <li>• Relative magnitude 1.2.1               <ul style="list-style-type: none"> <li>○ scientific notation</li> </ul> </li> <li>• Solves problems 1.4.1-1.4.2               <ul style="list-style-type: none"> <li>proportional reasoning</li> <li>percents involving discounts, tax, tips</li> <li>percent increase decrease</li> <li>interest rates</li> <li>Markups</li> </ul> </li> <li>• Mental computations 1.6.1 -1.6.2</li> <li>• Estimates 1.7</li> <li>• Properties of numbers 1.8.1 - 1.8.2               <ul style="list-style-type: none"> <li>○ divisibility</li> <li>○ prime factorization</li> <li>○ GCF/LCM</li> </ul> </li> </ul> <p style="color: red; text-align: center;">Benchmark problem</p>	<ul style="list-style-type: none"> <li>• Rational numbers 1.1.1-1.1.2               <ul style="list-style-type: none"> <li>square root of perfect squares</li> <li>cube roots</li> <li>rates</li> </ul> </li> <li>Relative magnitude 1.2.1               <ul style="list-style-type: none"> <li>○ irrational numbers</li> </ul> </li> <li>• Solves problems 1.4.1-1.4.2               <ul style="list-style-type: none"> <li>square roots of perfect or non-perfect square numbers</li> <li>rates</li> <li>dimensional analysis</li> </ul> </li> <li>• Mental computations 1.6.1 -1.6.2</li> <li>• Estimates 1.7</li> </ul> <p style="color: red; text-align: center;">Benchmark problem</p>	<ul style="list-style-type: none"> <li>• Relative magnitude 1.2.1</li> <li>• Solves problems 1.4.1-1.4.2</li> <li>• Mental computations 1.6.1 -1.6.2</li> <li>• Estimates 1.7</li> </ul> <p style="color: red; text-align: center;">Benchmark problem</p>

# K-12 Mathematics curriculum – product Curriculum

GLEs STANDARDS	Book Chapters	BENCHMARKS East Providence Public Schools	INSTRUCTIONAL STRATEGIES	RESOURCES	ASSESSMENT EVIDENCE
<p>1. NUMBER and OPERATIONS</p> <p>1.7 Properties of numbers</p>		<p>The student</p> <p>1.7.1 Applies properties of numbers to solve problems and to simplify computations</p> <ul style="list-style-type: none"> <li>• odd, even</li> <li>• <u>multiplicative property of zero</u></li> <li>• <u>remainders</u> M(N&amp;O)-4-8</li> <li>• <u>divisibility (D)</u> <ul style="list-style-type: none"> <li>• Applies field properties to solve problems and to simplify computations</li> </ul> </li> <li>• <u>commutative</u> <math>(6+4 = 4+6; 9 \cdot 5 = 5 \cdot 9)</math></li> <li>• <u>associative</u> <math>(2+7)+3 = 2+(7+3); (9 \cdot 4) 5 = 9(4 \cdot 5)</math></li> <li>• <u>identity</u> <math>(a \cdot 1=a \ a+0=a \ a \cdot 1=a)</math> M(N&amp;O)-4-8</li> <li>• <u>distributive</u> <math>3(3+6) = 3 \cdot 3 + 3 \cdot 6; 6(7-4) = 6(7)-6(4)</math> (D) M(N&amp;O)- 5-8</li> </ul> <p>1.7.2 Applies the conventions of order of operations where the left to right computations are modified only by the use of parentheses.</p> <p>1.7.3 Understands, uses, applies appropriate technology to solve problems.</p> <p>1.7.4 <b>REQUIRED PROBLEMS</b></p> <ul style="list-style-type: none"> <li>• Mr. Miller's Zero - Open Ended Math Assessment (24)</li> <li>• Division Story - Open Ended Math Assessment (23)</li> </ul>	<p>Teacher may model and/or facilitate the following: (also see pages 1-2)</p> <p><b>Mathematics best practice e.g.</b></p> <ul style="list-style-type: none"> <li>• using manipulatives</li> <li>• facilitating cooperative group work</li> <li>• discussing mathematics</li> <li>• questioning and making conjectures</li> <li>• justifying of thinking</li> <li>• constructing written responses</li> <li>• defending the student's mathematics</li> <li>• facilitating problem solving approach to instruction</li> <li>• integrating content with other core subjects</li> <li>• using appropriate technology</li> <li>• using frequent assessment to modify instruction</li> <li>• modeling functions of a calculator</li> </ul> <p>Differentiated instruction by varying the content, process, and product and</p>	<p>Resources, also see pages 1-2</p> <p><u>Textbook</u> <i>Everyday Mathematics Grade 4 Unit 5</i></p> <p><u>Supplementary books</u></p> <ul style="list-style-type: none"> <li>• <i>McGraw-Hill Mathematics Teacher Created Materials</i></li> <li>• <i>Comprehending Math: Adapting Reading Strategies to Teach Math, K-6, Arthur Hyde</i></li> <li>• <i>Mathematics Books by Marilyn Burns</i></li> <li>• <i>Exemplars</i></li> <li>• <i>Problem Solvers</i></li> <li>• <i>Necap Prep Grade 4</i></li> <li>• <i>Balanced Assessment Elementary Grades Pkgs. 1&amp;2</i></li> <li>• <i>Teaching Children Mathematics, NCTM Comprehensive Math Assessment, Options Pub., Inc.</i></li> <li>• <i>Open-ended Assessments in Math: A Searchable Collection of 450+ Questions, Heinemann</i></li> </ul>	<p>Assessments/evidence, also see pages 1-2</p> <p><b>REQUIRED LOCAL ASSESMENTS</b></p> <ul style="list-style-type: none"> <li>• MID-YEAR ASSESSMENT (EDM and Problem Solver)</li> <li>• END-OF-YEAR ASSESSMENT (EDM and Problem Solver)</li> <li>• PRE AND POST EDM/GLE UNIT TESTS</li> </ul> <p><b>SUGGESTED ASSESSMENTS</b></p> <p>Anecdotal record (e.g. defends student generated conjectures in class)</p> <p>Conferencing</p> <p>Journals/notebooks</p> <p>Oral presentation</p> <p>Portfolio (samples of process and products)</p> <p>Performance-based Tasks</p> <p>Rubrics</p> <p>Tests/ quizzes</p> <p>Visual representation (e.g. Power Point™)</p>

# K-12 Mathematics product – required problems

## REQUIRED PROBLEMS

- COMMON FORMATIVE AND SUMMATIVE ASSESSMENTS - Selected problems to consistently assess each standard from NECAP, MCAS, and NAEP Released Items
- Most are open ended and ask students to demonstrate knowledge in words, numbers, and/or symbols
- Include key GLE/GSE words, e.g. place value, prime factorization, absolute value
- Include key skill words, e.g. analyze, synthesize, evaluate, etc.
- Problems can be used to develop consistent district or grade level tests
- Test results can be used to change instruction

## Comparing Plain and Almond KISSES

- What different types of HERSHEY'S KISSES land on their base approximately the same percent of the time?
- Compare one plain and one almond KISS. Note the differences in the candies. Based on your examination and what you already know about the plain candies, make an estimate as to the percent of the time an almond candy will land on its base.
- Estimate + \_\_\_\_\_
- How confident are you in this estimate?
- The purpose of this activity is to help compare the percent of the time of the candies will land on their base when spilled from a cup.
- The investigation is as follows:
  - Place all 20 candies in the cup.
  - Gently shake the cup twice to help mix up the candies and spill all 20 of the candies onto the table.
  - Count the number of plain and the number of almond candies that landed on their bases. Record this information in the table below.
  - Return the candies to the cup and repeat until you have spilled the candies 10 times.
- Find the total number of each candy that landed on their bases.

# K-12 Mathematics product - rubrics

## **Problem Solving and Math Communication Rubrics K-12**

- Generic rubrics can be used for any open-ended problem and communication (oral or written language)
- Generic rubrics can be personalized
- Generic rubric become a consistent tool for looking at student work and compiling “exemplar papers” of what meets the standards.

Criteria	4	3	2	1
<b>Problem solving</b> 5.1	<p><b>Skillfully and effectively</b> uses problem solving strategies appropriately, e.g.</p> <ul style="list-style-type: none"> <li>identify the problem/question/task</li> <li>make a table, chart, or graph</li> <li>solve an equation</li> <li>guess and check</li> <li>work backwards</li> <li>use logical reasoning</li> <li>simplify the problem</li> <li>make an organized list</li> <li>look for a pattern</li> <li>act out or use objects</li> <li>draw a diagram or picture</li> <li><b>Thoroughly</b> determines the reasonableness of solution</li> </ul>	<p>Uses problem solving strategies appropriately, e.g.</p> <ul style="list-style-type: none"> <li>identify the problem/question/task</li> <li>make a table, chart, or graph</li> <li>solve an equation</li> <li>guess and check</li> <li>work backwards</li> <li>use logical reasoning</li> <li>simplify the problem</li> <li>make an organized list</li> <li>look for a pattern</li> <li>act out or use objects</li> <li>draw a diagram or picture</li> <li>Determines the reasonableness of solution</li> </ul>	<p><b>Attempts to</b> use problem solving strategies appropriately, e.g.</p> <ul style="list-style-type: none"> <li>identify the problem/question/task</li> <li>make a table, chart, or graph</li> <li>solve an equation</li> <li>guess and check</li> <li>work backwards</li> <li>use logical reasoning</li> <li>simplify the problem</li> <li>make an organized list</li> <li>look for a pattern</li> <li>act out or use objects</li> <li>draw a diagram or picture</li> <li><b>Attempts to</b> determine the reasonableness of solution</li> </ul>	<p><b>Does not</b> use problem solving strategies <b>or does not use</b> appropriate problem solving strategy, e.g.</p> <ul style="list-style-type: none"> <li>identify the problem/question/task</li> <li>make a table, chart, or graph</li> <li>solve an equation</li> <li>guess and check</li> <li>work backwards</li> <li>use logical reasoning</li> <li>simplify the problem</li> <li>make an organized list</li> <li>look for a pattern</li> <li>act out or use objects</li> <li>draw a diagram or picture</li> <li><b>Neglects to</b> determine the reasonableness of solution</li> </ul>
<b>Reasoning and Proof</b> 5.2	<ul style="list-style-type: none"> <li><b>Creatively</b> uses models, known facts, and relationships to explain your thinking</li> </ul>	<ul style="list-style-type: none"> <li>Uses models, known facts, and relationships to explain your thinking</li> </ul>	<ul style="list-style-type: none"> <li><b>Attempts to</b> use models, known facts, and relationships to explain your thinking</li> </ul>	<ul style="list-style-type: none"> <li><b>Does not</b> use models, known facts, and relationships to explain your thinking</li> </ul>
<b>Communication and Representation</b> 6.1	<ul style="list-style-type: none"> <li><b>Skillfully</b> demonstrates an understanding of mathematical concepts and relationships through a variety of methods, e.g. writing, graphing, charts, diagrams, number sentences, or symbols</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates an understanding of mathematical concepts and relationships through a variety of methods, e.g. writing, graphing, charts, diagrams, number sentences, or symbols</li> </ul>	<ul style="list-style-type: none"> <li><b>Begins to</b> demonstrate <b>some</b> understanding of mathematical concepts and relationships through a variety of methods, e.g. writing, graphing, charts, diagrams, number sentences, or symbols</li> </ul>	<ul style="list-style-type: none"> <li><b>Does not</b> demonstrate understanding of mathematical concepts and relationships</li> </ul>
<b>Representations</b> 6.2	<ul style="list-style-type: none"> <li><b>Creatively</b> uses physical models or diagrams to represent important mathematical ideas.</li> </ul>	<ul style="list-style-type: none"> <li>Uses physical models or diagrams to represent important mathematical ideas.</li> </ul>	<ul style="list-style-type: none"> <li><b>Begins to</b> use physical models or diagrams to represent <b>some</b> important mathematical ideas.</li> </ul>	<ul style="list-style-type: none"> <li><b>Does not</b> use physical models or diagrams.</li> </ul>
<b>Solution</b>	<ul style="list-style-type: none"> <li>Produces and labels a correct solution <b>and reflects upon it.</b></li> </ul>	<ul style="list-style-type: none"> <li>Produces and labels a correct solution</li> </ul>	<ul style="list-style-type: none"> <li>Produces and labels a <b>partially</b> correct solution <b>which may include basic computation errors</b></li> </ul>	<ul style="list-style-type: none"> <li>Produces an incorrect solution.</li> </ul>

- Uses problem solving strategies appropriately, e.g.
  - identify the problem/question/task (**underline or highlight**)
  - make a table, chart, or graph
  - solve an equation
  - guess and check
  - work backwards
  - use logical reasoning
  - simplify the problem
  - make an organized list
  - look for a pattern
  - act out or use objects
  - draw a diagram or picture
- Determines the reasonableness of solution. **Does your answer make sense?**
- Uses models, known facts, and relationships (**e.g.  $9=3+3+3$  or  $4+2=3+3$** ) to explain your thinking.
- Demonstrates an understanding of mathematical concepts and relationships through a variety of methods, e.g. writing, graphing, charts, diagrams, number sentences, or symbols.
- Uses physical models or diagrams to represent important mathematical ideas.
- Produces and labels a correct solution.

# K-12 Mathematics curriculum - product

## Glossary - Consistent vocabulary for:

- Mathematics
- GSEs/GLEs
- Curriculum
- Best practice instruction
- Assessments

- two intersecting directed straight lines, usually perpendicular to each other, and usually called the x-axis and y-axis. Every point in a coordinate plane can be described uniquely by an ordered pair of numbers, the *coordinates* of the point with respect to the coordinate axes.
- **Counting number** A number used in counting objects, i.e., a number from the set 1, 2, 3, 4, 5,.....
- **Counting technique** -methods to determine the number of possible outcomes of an event. Some of the methods are tree diagram, list, rules for multiplication, combinations, and permutations.
- **Curve fitting** - the sketching of a line or curve to best describe a relationship between two variables on a scatter plot.
- **Decimal number** Any real number expressed in base 10 notation, such as 2.673.
- **Deductive reasoning** A type of reasoning wherein the conclusion about particulars follows necessarily from general or universal premises. (W)
- **Diagonal** - for a polygon in the plane, any line segment joining non-adjacent vertices. For a polyhedron. In space, a line segment joining two vertices not in the same face.
- **Differentiated instruction** – the teacher plans and carries out varied approaches to content, process, and product in anticipation of and response to student differences in readiness, interest, and learning needs (Tomlinson, 1995).
  - **Compacting** - a three step process that: assesses what a student knows about material to be studied and what the student still needs to master
    - Plans for learning what is not known and excuses student from what is known
    - Plans for freed-up time to be spent in enriched or accelerated study (Tomlinson)
  - **Cubing** – technique that can help student think at different levels of the taxonomy . Cubing is a technique from considering a subject from six points of view, e.g., describe it, compare it, analyze it, etc. Cubes can also be constructed with multiple intelligences such a verbal, bodily- kinesthetic, visual, etc. (Gregory, Chapman)

# K-12 Mathematics curriculum - implementation

## **Professional Development**

- Training in best practices of instruction, e.g. workshop model, DI, using graphic organizers (Algebra 1)
- Training for teachers in using GLEs/GSEs/Curriculum (grade 6, Task Force)

## **Materials**

- Student white boards and markers (Algebra 1)
- Supplementary resources (grade 6)
- Flips, slides and turn materials for grade 3 (tested no materials)
- Tangrams
- Vocabulary references for elementary

## **Technology**

- Overhead graphing calculator (Algebra 1 High School)
- Graphing calculators (Algebra 1)
- Geo Sketch Pad training (MS)

## **Roll out**

- September 14, 3 hours, a.m., writers to roll out, compensation

## **Staffing**

- Math teachers responsible for math GLEs/GSEs, other areas support

# K-12 Mathematics curriculum

## References

- *Achieve, Inc.*
- *Best Practice Today's Standards for Teaching and Learning in American Schools* , Zemelman,S
- *Classroom Instruction That Works*, Marzano
- *Common Core Standards for Mathematics*
- *Comprehending Math: Adapting Strategies to Teach Math*, Arthur Hyde
- *Curriculum Focal Points for Pre-kindergarten through Grade 8 Mathematics*, NCTM
- *Differentiated Instructional Strategies, One Size Doesn't Fit All*, Gregory
- *Everyday Mathematics K-6*
- *Exemplars*
- *Literacy Strategies for Improving Mathematics Instruction*, Kenney
- *Mathematics Books*, Marilyn Burns
- *Mathematics GLE Resource Materials, Definitions and Examples for Grades K-8*
- *New England Compact Assessment Program – Release Items*, [NECompact.org](http://NECompact.org)
- *Performance Tasks and Rubrics, Elementary, Middle, and High School*, Charlotte Danielson
- *Principles and Standards for School Mathematics*, NCTM
- *New Standards*
- *Teaching Children Mathematics*, NCTM
- *Priorities and Practices, The Essentials of Mathematics K-6*, Checkley