# Transitioning to the New 2011 Massachusetts Curriculum Frameworks in Mathematics

## MassMATE

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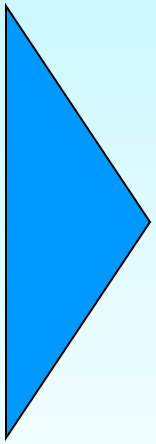
ELEMENTARY & SECONDARY
EDUCATION

# Presentation Overview

2011
Mathematics
Curriculum
Frameworks

*Incorporating the Common Core State Standards*



- Development & Adoption
- Intent and Key Features
- Implementation Timeline
- Practices Activity

# Purpose of the Standards

"These Standards are not intended to be new names for old ways of doing business. They are a call to take the next step. It is time for states to work together to build on lessons learned from two decades of standards based reforms."

-2011Massachusetts Curriculum Framework for Mathematics (page 14)

-Common Core State Standards for Mathematics (page 5)

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# Development and Adoption of the New Curriculum Frameworks Incorporating the Common Core Standards

| Spring 2009 | Summer 09-Spring 10 | July 2010 | Fall 2010 | December 2010 |
|---|---|---|---|---|
| • Governor and Commissioner sign MOU | • ESE Staff & Local Educators Provide Feedback to Drafts | • ESE & MBAE Studies | • ESE/EEC Identify Additional Standards | **BESE Adopts New Frameworks Incorporating CCSS** |
| • **Development Begins** | • Final Version of CCSS completed June 2010 | • BESE Adopts CCSS, with Option for Additions | • Public Comment Solicited on Additions | **BEEC Adopts Pre-K Standards** |

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# Evidence Base for the Standards

- Standards from high-performing countries, leading states, and nationally-regarded frameworks, such as the American Diploma Project and NCTM Math Focal Points
- National Assessment of Educational Progress (NAEP) Frameworks, international assessments (e.g., TIMSS and PISA) and longitudinal NAEP, SAT, and ACT scores
- Documents including National Mathematics Advisory Panel Report, National Academy's *Adding It Up* (see list in the framework)

# International Comparison

In what ways do the curricula of the top-achieving countries exhibit coherence?

**FIGURE 1**

*A+ Composite: Mathematics topics intended at each grade by at least two-thirds of A+ countries.*

*Note that topics are introduced and sustained in a coherent fashion, producing a clear upper-triangular structure.*

| TOPIC | GRADE: 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Whole Number Meaning | ■ | ■ | ■ | ■ | ■ | | | |
| Whole Number Operations | ■ | ■ | ■ | ■ | ■ | | | |
| Measurement Units | □ | ■ | ■ | ■ | ■ | ■ | ■ | |
| Common Fractions | | | □ | ■ | ■ | ■ | | |
| Equations & Formulas | | | □ | ■ | ■ | ■ | ■ | ■ |
| Data Representation & Analysis | | | □ | □ | ■ | ■ | | □ |
| 2-D Geometry: Basics | | | □ | ■ | ■ | ■ | ■ | ■ |
| Polygons & Circles | | | | ■ | ■ | ■ | ■ | ■ |
| Perimeter, Area & Volume | | | | ■ | ■ | ■ | ■ | □ |
| Rounding & Significant Figures | | | | ■ | ■ | | | |
| Estimating Computations | | | | ■ | ■ | ■ | | |
| Properties of Whole Number Operations | | | | □ | ■ | | | |
| Estimating Quantity & Size | | | | □ | □ | | | |
| Decimal Fractions | | | | ■ | ■ | ■ | | |
| Relationship of Common & Decimal Fractions | | | | ■ | ■ | ■ | | |
| Properties of Common & Decimal Fractions | | | | | ■ | ■ | | |
| Percentages | | | | | ■ | ■ | | |
| Proportionality Concepts | | | | | ■ | ■ | ■ | □ |
| Proportionality Problems | | | | | ■ | ■ | ■ | ■ |
| 2-D Coordinate Geometry | | | | | □ | □ | ■ | ■ |
| Geometry: Transformations | | | | | | ■ | ■ | ■ |
| Negative Numbers, Integers & Their Properties | | | | | | □ | ■ | |
| Number Theory | | | | | | | ■ | □ |
| Exponents, Roots & Radicals | | | | | | | ■ | ■ |
| Exponents & Orders of Magnitude | | | | | | | □ | □ |
| Measurement Estimation & Errors | | | | | | | □ | |
| Constructions w/ Straightedge & Compass | | | | | | | ■ | □ |
| 3-D Geometry | | | | | | | ■ | ■ |
| Congruence & Similarity | | | | | | | | ■ |
| Rational Numbers & Their Properties | | | | | | | | □ |
| Patterns, Relations & Functions | | | | | | | | □ |
| Slope & Trigonometry | | | | | | | | □ |
| Number of topics covered by at least 67% of the A+ countries | 3 | 3 | 7 | 15 | 20 | 17 | 16 | 18 |
| Number of additional topics intended by A+ countries to complete a typical curriculum at each grade level | 2 | 6 | 5 | 1 | 1 | 3 | 6 | 3 |

□ – intended by 67% of the A+ countries ■ – intended by 83% of the A+ countries ■ – intended by 100% of the A+ countries

**FIGURE 2**

*State Composite: Mathematics topics intended at each grade by at least two-thirds of 21 U.S. states.*

*Note that topics are introduced and sustained in a way that produces no visible structure.*

| TOPIC | GRADE: 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Whole Number Meaning | ■ | ■ | ■ | ■ | ■ | □ | | |
| Whole Number Operations | ■ | ■ | ■ | ■ | ■ | □ | | |
| Measurement Units | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Common Fractions | □ | ■ | ■ | ■ | ■ | ■ | □ | □ |
| Equations & Formulas | □ | □ | ■ | ■ | ■ | ■ | ■ | ■ |
| Data Representation & Analysis | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 2-D Geometry: Basics | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Polygons & Circles | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Perimeter, Area & Volume | | □ | □ | □ | ■ | ■ | ■ | ■ |
| Rounding & Significant Figures | | | | | | | | |
| Estimating Computations | □ | □ | ■ | ■ | ■ | ■ | ■ | ■ |
| Properties of Whole Number Operations | □ | □ | □ | □ | | | | |
| Estimating Quantity & Size | | | □ | | | | | |
| Decimal Fractions | | | □ | ■ | ■ | ■ | □ | □ |
| Relationship of Common & Decimal Fractions | | | | □ | □ | □ | | |
| Properties of Common & Decimal Fractions | | | | | | | | |
| Percentages | | | | | □ | ■ | ■ | □ |
| Proportionality Concepts | | | | | | ■ | □ | |
| Proportionality Problems | | | | | | ■ | ■ | ■ |
| 2-D Coordinate Geometry | | | □ | ■ | □ | □ | □ | ■ |
| Geometry: Transformations | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Negative Numbers, Integers & Their Properties | | | | | | □ | ■ | □ |
| Number Theory | | | | | ■ | □ | □ | □ |
| Exponents, Roots & Radicals | | | | | | □ | □ | ■ |
| Exponents & Orders of Magnitude | | | | | | | □ | □ |
| Measurement Estimation & Errors | □ | □ | ■ | □ | ■ | ■ | ■ | □ |
| Constructions w/ Straightedge & Compass | | | | | | | | |
| 3-D Geometry | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Congruence & Similarity | | | | | □ | ■ | ■ | □ |
| Rational Numbers & Their Properties | | | | | | ■ | ■ | □ |
| Patterns, Relations & Functions | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Slope & Trigonometry | | | | | | | | |
| Number of topics covered by at least 67% of the states | 14 | 15 | 18 | 18 | 20 | 25 | 23 | 22 |
| Number of additional topics intended by states to complete a typical curriculum at each grade level | 8 | 8 | 7 | 8 | 8 | 5 | 6 | 6 |

□ – intended by 67% of the states ■ – intended by 83% of the states ■ – intended by 100% of the states

# Key Features
# New Mathematics Framework

The new standards support improved curriculum and instruction due to increased:

- **FOCUS**, via critical areas at each grade level
- **COHERENCE**, through carefully developed connections within and across grades
- **CLARITY**, with precisely worded standards that cannot be treated as a checklist
- **RIGOR**, including a focus on College and Career Readiness and Standards for Mathematical Practice throughout Pre-K-12

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| Focus | Coherence | Clarity | Rigor |
|---|---|---|---|

# Adding MA Standards to the K-12 Common Core State Standards

MA added preKindergarten standards

- About 4% additional standards in K-12:
  - 13 K-8 additions
    - No additions in Kindergarten, grade 3 or grade 8
    - One addition in grade 4 and grade 5
    - Two additions in grade 1, grade 2, and grade 7
    - Five additions in grade 6
  - 9 high school additional standards
    - Included in conceptual categories: Number and Quantity, Algebra, Functions, and Geometry

# Tour the 2011 Mathematics Curriculum Framework

# 2011 MA Curriculum Framework for Mathematics Organization

- Introduction (pg.7)
- Guiding Principles for Mathematics Programs (pg.9)
- Standards for Mathematical Practice (pg.15)
- Pre-K to 8 Grade-level standards (pg.18-65)
  - Grade-level Introduction highlighting critical areas
  - Grade-level Overview of the domains and clusters
- High School Standards: Conceptual Categories (pg.66-93)
- High School Model Pathways and Courses (pg.94-151)
- Appendices (pg.152-155)
- Sample of work consulted (pg.156-159)
- Glossary (pg.160-167)
- Tables (pg.168-171)

# (8) K-12 Standards for Mathematical Practice

"Expertise" for students at all grade levels:

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

# Organized by Domains Rather than Strands

| PK-8 Domains Progression | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Domains** | **PK** | **K** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Counting and Cardinality** | MA | | | | | | | | | |
| **Operations and Algebraic Thinking** | MA | | | | | | | | | |
| **Number and Operations in Base Ten** | | | | | | | | | | |
| **Number and Operations - Fractions** | | | | | | | | | | |
| **Ratios and Proportional Relationships** | | | | | | | | | | |
| **The Number System** | | | | | | | MA | | | |
| **Expressions and Equations** | | | | | | | | | | |
| **Functions** | | | | | | | | | | |
| **Measurement and Data** | MA | | | | | | | | | |
| **Geometry** | MA | | | | | | | | | |
| **Statistics and Probability** | | | | | | | | | | |

# High School Standards

- Conceptual Categories
  - Cross course boundaries
  - Span high school years
- Standards
  - "Core" for common mathematics curriculum for **all** students to be College and Career Ready
    - "College Ready" for entry level credit bearing course
    - "Career Ready" to qualify for post-secondary training in one's chosen field
  - (+) Additional mathematics that students should learn in order to take courses such as calculus, discrete mathematics, or advanced statistics.

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| Focus | Coherence | Clarity | **Rigor** |
|---|---|---|---|

# High School Organization: Conceptual Categories

- Number and Quantity (N)
- Algebra (A)
- Functions (F)
- Geometry (G)
- Modeling (★)
- Statistics and Probability (S)

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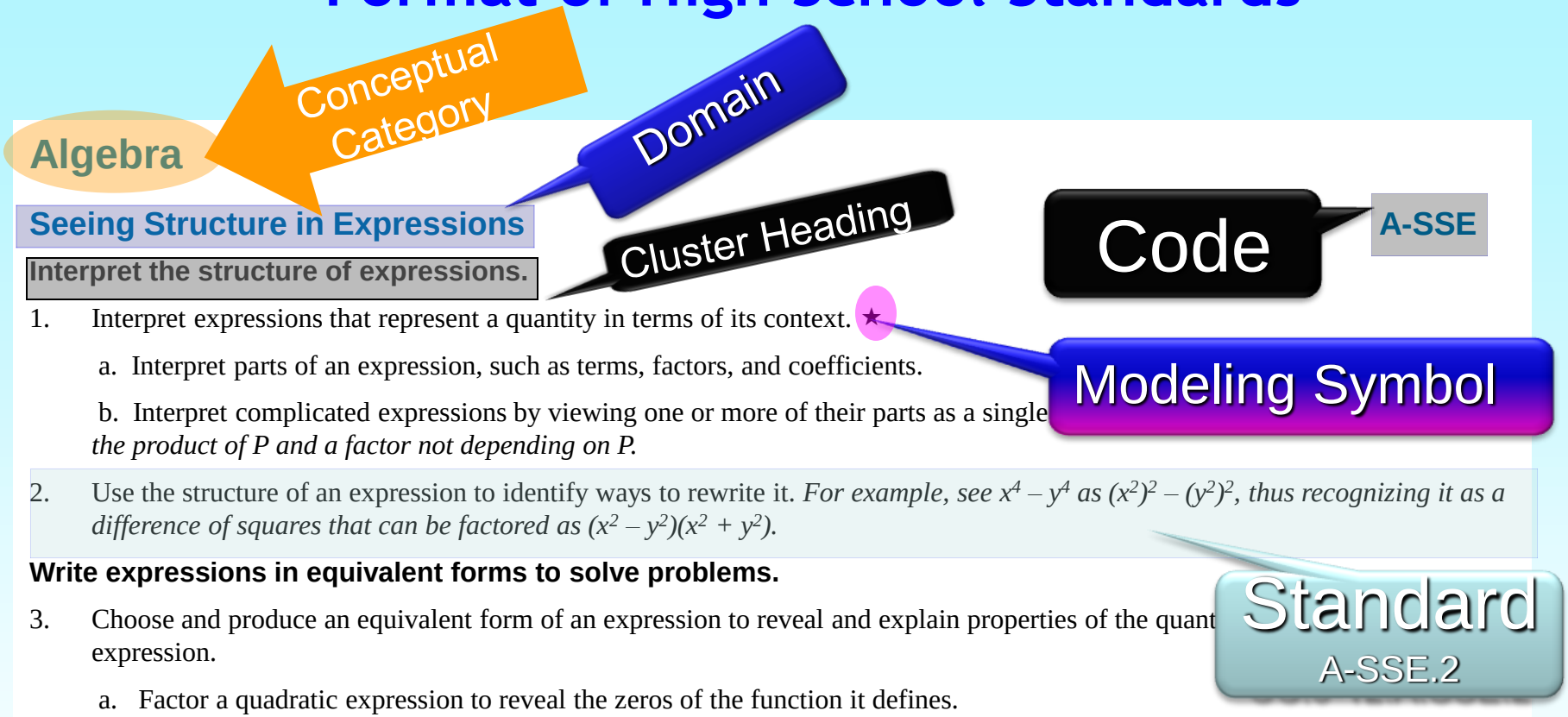
| Focus | Coherence | Clarity | Rigor |
|---|---|---|---|

# Format

- Introduction
  - PK-8 outlines critical areas for each grade
  - Conceptual Category narrative of that category
  - Model course outlines the critical areas for each model course
- Overview
  - All Overviews include the domains and clusters for the grade, conceptual category or model course
- Standards
  - Presented by Domain and Cluster

# Format of High School Standards



# Model High School Pathways

Two model course pathways

- Traditional:
  - ✓Algebra I, Geometry, Algebra II
- Integrated:
  - ✓Mathematics I, Mathematics II, Mathematics III

- Additional courses:
  - ✓Precalculus, Advanced Quantitative Reasoning

# Standards for Mathematical Practice bring Rigor to the New Standards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| Focus | Coherence | Clarity | **Rigor** |
|---|---|---|---|

# Applying the Standards for Mathematical Practice

- Open the Massachusetts Curriculum Framework for Mathematics to the Standards for Mathematical Practice (page 15)
- Read Standard 7 and underline key words and phrases that help to explain the standard
- Turn and talk
- While you watch the video clip, use the transcript to note when you see evidence of standard 7 (www.insidemathematics.com: Quadratic Functions: Problem 1, Part D)
- Turn and talk

# General Discussion

- Do you see these Standards for Mathematical Practice as having an impact on your teaching?
- How can you see them being applied from preKindergarten through grade 12?

# Exploration Activities Posted

- Explore **FOCUS** by Examining the Critical Areas in Mathematics:
  - Participants organize standards by Critical Areas and discuss connections in order to understand how the new standards provide greater focus at each grade level. (PK-12)
- Explore **COHERENCE** by Tracing Domain and Cluster Progressions:
  - Participants explore domains and clusters to see how the new standards connect concepts within and across grades as the basis of a coherent curriculum. (PK-8)
- Explore **CLARITY** by Comparing the New and Former MA Mathematics Standards:
  - Participants use the crosswalk documents to compare the standards in the former and new Framework and consider how the increased clarity of the new standards may impact teaching and learning. (PK-12)
- Explore **RIGOR** by Connecting the Standards for Mathematical Practice to the Content Standards:
  - Participants examine content standards to see how they connect with the Standards for Mathematical Practice and how in tandem they form the basis of a rigorous curriculum. (PK-12)

# Some National Projects Underway….

- PARCC Model Content Framework project
  - Scope and Sequence for each grade
  - Narratives to help unwrap the standards
- National Council for Supervisors of Mathematics
  - Illustrating the standards for mathematical practice PD materials
- Gates Foundation, (http://illustrativemathematics.org/) led by the original standards writers
  - Illustrative Mathematics Project will produce a complete set of sample problems and tasks illustrating the standards.
- CCSSO, Bill Bush
  - Tool for analyzing instructional materials

# Transitioning Curriculum and Instruction to the New Frameworks

# Timeline for Preschools, Districts, Colleges and Universities

| 2010-2011<br><br>Initial Planning | 2011-2012<br><br>Partial Implementation | 2012-2013<br><br>Near Full Implementation |
|---|---|---|
| Build awareness and identify what needs to change and how it will be changed | Continue planning and make changes in targeted grades, subjects, and courses | Implement balance of changes |

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# ESE and Readiness Center Help

| 2010-2011<br>Initial Planning | 2011-2012<br>Partial Implementation | 2012-2013<br>Near Full Implementation |
|---|---|---|
| • Orientations<br>• Crosswalks<br>• Modules<br>• RTTT $$$<br>• Targeted support | • Model Curriculum<br>• PD courses<br>• RTTT $$$<br>• Targeted support | • Model Curriculum<br>• Formative Assessment System<br>• PD courses<br>• RTTT $$$<br>• Targeted support |

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# Transitioning Grades 3-8* MCAS

Objectives: (1) Fairness (2) Maintain Trendline

| **2010-2011** Initial Planning | **2011-2012** Partial Implementation | **2012-2013** Near Full Implementation |
|---|---|---|
| **MCAS**<br>No changes - based on *former* Frameworks | **MCAS**<br>Focus on standards *common* to *former* and *new* Frameworks<br><br>Will also assess selected standards from the *former* Frameworks not included in the *new* Frameworks** | **MCAS**<br>Focus on standards *common* to *former* and *new* Frameworks<br><br>Will also assess selected standards from *new* Frameworks not included in *former* Frameworks** |

* The transition plan for grade 10 is being determined.

** www.doe.mass.edu/MCAS/transition

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# Looking Ahead

- Preschools, districts and educator preparation programs should have curriculum and instruction *fully* aligned to the new frameworks by the beginning of the 2013-2014 school year
- MCAS in grades 3-8 will be based exclusively on the new frameworks in spring 2014
- Pending its successful development, Massachusetts will transition to PARCC for ELA and math in 2014-2015
- Similar standards development process for science and engineering, with standards expected in mid-2012 and a transition period to follow
- Standards for English Language Learners, Comprehensive Health, History and Social Science, the Arts, and Foreign Languages will be added to the revision cycle

# Continuing Updates

- The 2011 Frameworks and crosswalks are available at http://www.doe.mass.edu/candi/commoncore

- Please check this site regularly for additional resources and updates on professional development.

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