

# DRAFT CHANGES TO SUBJECT MATTER KNOWLEDGE REQUIREMENTS FOR EDUCATOR LICENSURE

**PUBLIC COMMENT:** [WWW.SURVEYGIZMO.COM/S3/3620828/DRAFT-PUBLIC-COMMENT-SMK-UPDATES](http://WWW.SURVEYGIZMO.COM/S3/3620828/DRAFT-PUBLIC-COMMENT-SMK-UPDATES)

Subject matter knowledge requirements (SMKs) outline the minimum level of content and pedagogical skills Massachusetts educators are expected to hold. SMKs establish the content assessed in Massachusetts Tests for Educator Licensure ([MTEL](#)) and guide content-area coursework for educator preparation programs. SMKs are aligned to [Massachusetts curriculum frameworks](#).

Massachusetts regulation [603 CMR 7.06](#) requires a public comment period of at least thirty days prior to any changes to the guidelines where SMKs are published. More information on the 2017 proposed changes is available at [www.doe.mass.edu/edprep](http://WWW.DOE.MASS.EDU/EDPREP).

## MIDDLE SCHOOL: MATHEMATICS & SCIENCE

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### CURRENT SUBJECT MATTER KNOWLEDGE REQUIREMENTS 2011-2016

#### MIDDLE SCHOOL: MATHEMATICS/SCIENCE, LEVELS 5-8

##### (A) GENERAL SCIENCE.

1. Intermediate knowledge of biology, chemistry, physics, earth/space science, and related mathematics.
2. History and philosophy of science.
3. Methods of research in the sciences, including laboratory techniques and the use of computers.

##### (b) Mathematics.

1. Algebra.
2. Euclidean geometry.
3. Trigonometry.
4. Discrete/finite mathematics.
5. Introductory calculus through integration.
6. History of mathematics.

##### (c) Reading theory, research, and practice at the middle school level.

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### DRAFT CHANGES TO SUBJECT MATTER KNOWLEDGE REQUIREMENTS 2017

#### MIDDLE SCHOOL: MATHEMATICS/SCIENCE, LEVEL 5-8

THE FOLLOWING TOPICS WILL BE ADDRESSED ON A SUBJECT MATTER KNOWLEDGE TEST FOR THE 5-8 LEVEL:

##### SCIENCE

##### (a) The eight essential science and engineering practices:

1. Asking questions and defining problems
2. Developing and using models



3. Constructing explanations and designing solutions
  4. Obtaining, evaluating and communicating information
  5. Planning and carrying out investigations
  6. Analyzing and interpreting data
  7. Using mathematical and computational thinking
  8. Constructing arguments from evidence
- (b) Intermediate knowledge of Earth and Space Science
1. Understanding of Earth’s Place in the Universe
  2. Understanding of Earth’s Systems
  3. Understanding of the impact of human activity on the Earth
- (c) Intermediate knowledge of Life Science
1. Understanding of Structures and Processes of Molecules and Organisms
  2. Understanding of Ecosystems: Interactions, Energy, and Dynamics
  3. Understanding of Heredity: Inheritance and Variation of Traits
  4. Understanding of Biological Evolution: Unity and Diversity
- (d) Intermediate Knowledge of Physical Science
1. Understanding of Matter and Its Interactions: Structure of matter
  2. Understanding of Motion and Stability: Forces and Interactions
  3. Understanding of Energy
  4. Understanding of Waves and Their Applications in Technologies for Information Transfer
- (e) Intermediate knowledge of Technology/Engineering
1. Understanding of Engineering Design
  2. Understanding of Material, Tools and Manufacturing
  3. Understanding of Technological Systems

## Math

- (a) Comprehensive conceptual understanding, procedural knowledge, and problem solving application skills of the following grade PreK-8 content domains:
1. Operations and Algebraic Thinking: Understand properties of operations for computing using the operations of addition, subtraction, multiplication, and division with rational numbers and for representing numerical relationships in equivalent ways.
  2. The Number System: Understand the system of rational numbers and their placement, ordering and absolute value on a number line.
  3. Ratios and Proportional Relationships: Understand ratio and rate concepts and understand proportional reasoning and its usefulness for solving real world problems. Understand the connections between proportional relationships, lines, and linear equations.
  4. Expressions and Equations: Understand properties of operations for computing with rational numbers in algebraic expressions and equations and for representing algebraic relationships in equivalent ways.
  5. Functions: Understand the concept of function, and the correspondences between geometric transformations of graphs of functions and algebraic transformations of associated equations (including linear, quadratic, exponential, absolute value, and piecewise functions).
  6. Measurement and Data: Understand concepts of length, area, and volume and relationships between different units of measurement. Understand representations for data measurements such as line plots.
  7. Geometry: Understand properties and measurements of geometric figures and concepts of congruency and similarity and transformations in the plane.
  8. Statistics and Probability: Understand data concepts, distributions, and statistical variability in data and samples and probabilities of chance events.

(b) Knowledge in these specific topics, drawn from the grades 9-12 conceptual categories and advanced mathematics subject matter:

1. Number Systems: Understand the properties of the rational and irrational number systems and complex numbers. Understand the properties of exponents extended to rational exponents.
2. Vector and Matrix Quantities: Understand vectors can represent quantities that change over time. Understand matrices and operations on matrices.
3. Algebraic operations, expressions, equations: Understand the reasoning behind the various methods for operating with expressions and for solving equations and systems of equations.
4. Polynomial, exponential, trigonometric, logarithmic, rational Functions: Understand functions in terms of their rate of growth, periodicity, zeros, asymptotes, maximum/minimum values.
5. Geometric proofs, arc length, and triangle trigonometry: Understand proofs in terms of transformations of congruent figures and rigid motion. Understand proofs based on similarity and trigonometric ratios in terms of similar right triangles as well as radian measure of an angle defined as the ratio of arc length to radius.
6. Random samples, Independence and conditional probability: Understand random processes underlying statistical experiments.
7. Limits and derivatives: Understand how limits and derivatives approximate the slope of a curve at a point on the curve.

