Introduction

The purpose of this Planning Guide is to define the scope of the Common Core State Standards for Mathematics (CCSS-M) Content Standards to be taught in the 2012-2013 school year. It has been designed by CPS teachers to be useful to CPS teachers during the three-year transition to full implementation of the CCSS-M.

In Year 1 of the transition to CCSS-M, 2012-2013, grades 6-8 mathematics teachers will be teaching:

- **To the former ILS before the ISAT in March.** The expectation is for schools and teachers to continue using their current mathematics instructional materials and to address the Illinois Assessment Frameworks from the beginning of the year until the ISAT is administered. In addition to this content, teachers will explicitly integrate the Standards for Mathematical Practice into their lessons on a regular basis.

- **To the new CCSS-M standards, per the scope described by this Planning Guide, after the ISAT,** using their instructional materials and other resources to integrate mathematical practices with rigorous mathematical tasks that support the scope of content standards. A toolset to support this instruction includes (1) samples of rigorous grade-specific tasks (including samples of formative assessment options based on MARS (Mathematics Assessment Resource Service) tasks) and (2) general tools that include a sample lesson planning template, a tool for analyzing and modifying lessons/tasks; samples of modified lessons/tasks; and a list of professional resources. These tools are available at [https://ocs.cps.k12.il.us/sites/IKMC/default.aspx](https://ocs.cps.k12.il.us/sites/IKMC/default.aspx) and on the Department of Mathematics and Science website ([http://cmsi.cps.k12.il.us](http://cmsi.cps.k12.il.us)).

Specifically, after the March ISAT, grades 6-8 mathematics teachers will focus on the *Expressions and Equations* progression, as defined in the Progressions for the *Common Core State Standards in Mathematics: 6-8, Expressions and Equations* (2011). This progression was chosen because the Grade 8 CCSS-M includes the “algebra of lines,” which was formerly taught in the first half of high school Algebra I courses (“algebra of lines” refers to equations, graphs of linear relationships, and systems of linear equations). Concentrating on this particular progression allows grades 6-8 classrooms to hone in on the vertical articulation of this very important concept, focusing on students’ cognitive development and the logical structure of the CCSS-M.

Please note: If the content standards in this Planning Guide are covered within the scope of a classroom’s instructional materials prior to ISAT, teachers should teach to these with the level of rigor expected by the CCSS-M, integrating the Standards for Mathematic Practice with the content. Post-ISAT is an opportunity to reinforce content standards already addressed, and to focus more deeply on the *Expressions and Equations* content standards that were not covered prior to ISAT.

During the first 3 quarters, teachers will explicitly integrate the Standards for Mathematical Practice (below) into their lessons on a regular basis. In the 4th quarter, instruction that integrates Standards for Mathematical Practice with targeted content standards is supported by “how to” guidance in this Planning Guide. By teaching the mathematical practices alongside the indicated content standards, students will be more likely to achieve the depth of conceptual understanding and procedural fluency expected by the CCSS-M.
The CCSS-M Standards for Mathematical Practice

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.

Following the ISAT, this Planning Guide will form the basis for instruction in Grade 8 mathematics classrooms. This year’s focus of learning, Expressions and Equations, is broken into three topics: 1) What is a Function? 2) Linear Functions and Equations and 3) Solving Linear Equations and Systems. Topic components include a targeted set of content standards, target mathematical practices (and how they apply to the specific topic), key ideas for learning, key terms, and sample instructional tasks.

The guide assumes 9 weeks for instruction, including time for formative and summative assessments. The topics are sequenced in a way that we believe best develops and connects the mathematical content of the CCSS-M. However, teachers should review the topics and decide the order and time allocation appropriate for their classrooms, given their students, instructional materials, and other considerations. The order of the standards included in a topic does not imply a sequence of the content. Some standards may be revisited several times while addressing the topic, while others may be only partially addressed, depending on the mathematical focus of the topic.

Finally, this document reflects our current thinking about the transition to the CCSS-M. We welcome feedback about your experience with the document. Please share your thoughts with your network staff who will forward to the Department of Mathematics and Science.
# Grade 8 Mathematics Planning Guide – SY12-13

## Big Idea: Expressions and Equations

### Big Idea Assessment: Expressions and Equations

See the 8th Grade Toolset**: MARS task: Sorting Functions, Summative for this Big Idea

### Topic: What is a Function?

**CCSS-M Content Standards**

- **8.F.1** Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

- **8.EE.5** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

- **8.F.2** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

- **8.F.5** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

### Connections to Standards for Mathematical Practice

<table>
<thead>
<tr>
<th>Standards for Mathematical Practice</th>
<th>How it applies...</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP7 - Look for and make use of structure.</td>
<td>How different components of an equation affect or are represented in the graph of the equation; how components of the graph can lead to developing an equation.</td>
</tr>
<tr>
<td>MP8 - Look for and express regularity in repeated reasoning.</td>
<td>Through drawing the graphs of various equations, students will recognize the effect of different portions of the equation on the graphs; through repeating calculations, students express the generalized set of operations and create an equation.</td>
</tr>
</tbody>
</table>

### Key Ideas and Terms for “What is a Function?”

**Key Ideas**
- Definition and characteristics of different types of functions
- Relationship between graph and equation
- Development and consistent use of the language of functions

**Key Terms**
- Function, input, output, independent variable, dependent variable, rate of change, Cartesian plane, slope, intercept, proportional

Terms should be deeply understood within the context of their use. Not to be considered standalone vocabulary exercises.

### Prior Knowledge

- Use of letters as variables rather than boxes, etc. as in earlier grades
- Familiarity with graphing in all four quadrants of the Cartesian plane
- Understanding of the meaning of operations, particularly with integers

### Students will be able to:

- Move between tables of value and function rules to represent functions.
- Graph functions using input-output values as ordered pairs and identify type of function through the shape of the graph.
- Match corresponding tables, graphs, equations.
- Draw a graph given verbal descriptions.
- Identify shapes of graphs of parent functions (linear, quadratic, cubic, exponential, etc.) and the effect of different components of the equation (leading coefficient, constant term, etc.).
- Graph proportional relationships.
- Compare different proportional relationships represented in different forms.

### Possible task(s)*

CME Algebra 1 text, Chapter 3, for shapes of graphs of parent functions

*The Grade 8 mathematics toolset includes this and other resources and can be found online at [https://ocs.cps.k12.il.us/sites/IKMC/default.aspx](https://ocs.cps.k12.il.us/sites/IKMC/default.aspx) and on the Department of Mathematics and Science website ([cmisi.cps.k12.il.us](http://cmisi.cps.k12.il.us)).
## Grade 8 Mathematics Planning Guide – SY12-13

**Big Idea: Expressions and Equations**

### Topic: Linear Functions and Equations

**CCSS-M Content Standards**

8.EE.6 Use similar triangles to explain why the slope $m$ is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at $b$.

8.F.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two $(x, y)$ values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

### Connections to Standards for Mathematical Practice

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<tr>
<td>MP2 - Reasoning abstractly and quantitatively.</td>
<td>Decontextualizing is working strictly with the equation and the graph; contextualizing is interpreting the slope as the rate of change and the $y$-intercept as the initial value of the context or situation. This also involves understanding when a graph should be continuous or when it will not continue from the first quadrant to the second, third, or fourth.</td>
</tr>
<tr>
<td>MP7 - Look for and make use of structure.</td>
<td>How different components of an equation affect or are represented in the graph of the equation or arise from context</td>
</tr>
<tr>
<td>MP8 - Look for and express regularity in repeated reasoning.</td>
<td>Repeated calculation of slope leads to an equation for the graph of a line or a linear context.</td>
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</table>

### Key Ideas and Terms for “Linear Functions and Equations”

<table>
<thead>
<tr>
<th>Key Ideas</th>
<th>Key Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equations and graphs of lines</td>
<td>Slope, intercepts, slope-intercept form, proportional</td>
</tr>
<tr>
<td>Building linear equations from a context</td>
<td>Terms should be deeply understood within the context of their use. Not to be considered standalone vocabulary exercises.</td>
</tr>
</tbody>
</table>

### Prior Knowledge

- Fluency with arithmetic operations and the connections to real world contexts
- Exposure to proportional relationships and reasoning
- Understanding that a graph is a picture of the set of coordinate pairs that satisfy an equation

### Students will be able to:

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<table>
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<tbody>
<tr>
<td>Translate from English to algebraic expressions/equations.</td>
<td>Determine rate of change in linear relationships.</td>
</tr>
<tr>
<td>Use similar triangles to determine why slope is same between collinear points.</td>
<td>Move fluently between a table, a graph and an equation.</td>
</tr>
<tr>
<td>Derive a linear equation from a context and transform it into $y=mx$ or $y=mx+b$ and interpret the meaning of each component of the equation.</td>
<td>Describe the relationship between two variables.</td>
</tr>
<tr>
<td>Recognize non-linear equations.</td>
<td>Interpret meaning of slope and $y$-intercept in contexts.</td>
</tr>
</tbody>
</table>

### Possible task(s)*

- Triangle Task (NYC EE Unit); CME lesson 4.1; Aussie Fir Trees (NYC EE unit); Square Patterns (MARS); EZ Coasters (NYC EE Unit)

*The Grade 8 mathematics toolset includes this and other resources and can be found online at [https://ocs.cps.k12.il.us/sites/IKMC/default.aspx](https://ocs.cps.k12.il.us/sites/IKMC/default.aspx) and on the Department of Mathematics and Science website ([cmsi.cps.k12.il.us](https://cmsi.cps.k12.il.us)).
**Topic: Solving Linear Equations and Systems**

**CCSS-M Content Standards**

8.EE.7 Solve linear equations in one variable.

a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form \( x = a \), \( a = a \), or \( a = b \) results (where \( a \) and \( b \) are different numbers).

b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

8.EE.8 Analyze and solve pairs of simultaneous linear equations.

a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.

c. Solve real-world and mathematical problems leading to two linear equations in two variables.

<table>
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<tr>
<th>Connections to Standards for Mathematical Practice</th>
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<th>How it applies...</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP4 - Model with mathematics.</td>
<td>Creating an equation that represents the situation and captures the generalized situation of the context.</td>
<td></td>
</tr>
<tr>
<td>MP7 - Look for and make use of structure.</td>
<td>How different components of an equation affect or are represented in the graph of the equation or arise from context and use various representations of linear relationships and identify benefits to using each form.</td>
<td></td>
</tr>
</tbody>
</table>

**Key Ideas and Terms for “Solving Linear Equations and Systems”**

<table>
<thead>
<tr>
<th>Key Ideas</th>
<th>Key Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Solving linear equations</td>
<td>Break-even point, intersection point, substitution, elimination, like terms, equivalence, distributive property, solution</td>
</tr>
<tr>
<td>• Solving systems of linear equations</td>
<td>Terms should be deeply understood within the context of their use. Not to be considered standalone vocabulary exercises.</td>
</tr>
</tbody>
</table>

**Prior Knowledge**

| • Substituting values for variables to evaluate expressions (value of \( 3x + 4 \) if \( x = 8 \)) | • Understand equivalent expressions |
| • Apply the distributive property | • Combining like terms |

**Students will be able to:**

| • Solve linear equations in one variable. | • Find the solution to a system of equations from a graph. |
| • Identify linear equations with one, infinitely many, or no solution. | • Solve systems algebraically using substitution and elimination/combination. |
| • Transform an expression or equation into alternate forms. | • Understand the solution of a system of equations in the context of the problem and write as an ordered pair. |

**Possible task(s)**

CME lessons 4.10, 4.12; Carnegie car rentals from two companies; Cell Phone Plans

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