

Equations and Inequalities



AMERICA'S
CHOICE.

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LEARNING COMPANY

Boston, Massachusetts

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Upper Saddle River, New Jersey

Online Resources

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Introduction to Math Navigator

Dear Parent/Guardian,

_____ has been selected to participate in Math Navigator! Math Navigator is one of the ways that our school is working to help all students succeed in mathematics. The program gives students the additional time and instruction they need to improve their performance in this important subject.

Your child will be participating in the *Equations and Inequalities* module. The main goal of this module is to help students create and solve equations and inequalities. Students will distinguish between expressions and equations, solve equations by rewriting given equations, write and solve word problems, examine typical errors when solving equations, display inequalities on a number line, identify the appropriate symbol for inequalities, and examine the effect of multiplication by negative numbers on inequalities. Students learn to use the addition and multiplication properties of equality and inequality, and make use of the distributive property of multiplication of addition when simplifying equations. Students will also be challenged to explain the solution processes verbally and in writing and to explain their reasoning to their peers.

There are a variety of materials students will use with this module: one of them is a set of Study Cards. These cards include mathematical ideas for students to master, game cards, and blank cards that students can customize with concepts that they need to work on. Students are encouraged to use these cards during the lessons, as well as during free time and at home. Please encourage your child to share them with you.

The more enthusiastic you can be about Math Navigator, the more it will help your child. Ask questions each day about what your child learned and how the Math Navigator class was different from your child's regular math class. It is important for you to acknowledge what your child has accomplished both on a day-to-day basis and after completing the Math Navigator module.

We are excited about using Math Navigator with students. Learn more about this special program and how it works by reading the short description that follows. If you have any questions about the program, please do not hesitate to contact us here at school.

How Math Navigator Works

Structure of a Module

Each module contains 20 days of 30- or 45-minute lessons, including a pre-test and post-test. During the 20 days, students have two or three checkpoint lessons that assess their understanding of the concepts in the module.

Frequent Skills Practice

Most lessons include a Show Me session in which students practice and reinforce skills. It is also a time for students to learn strategies and techniques that make computation easier.

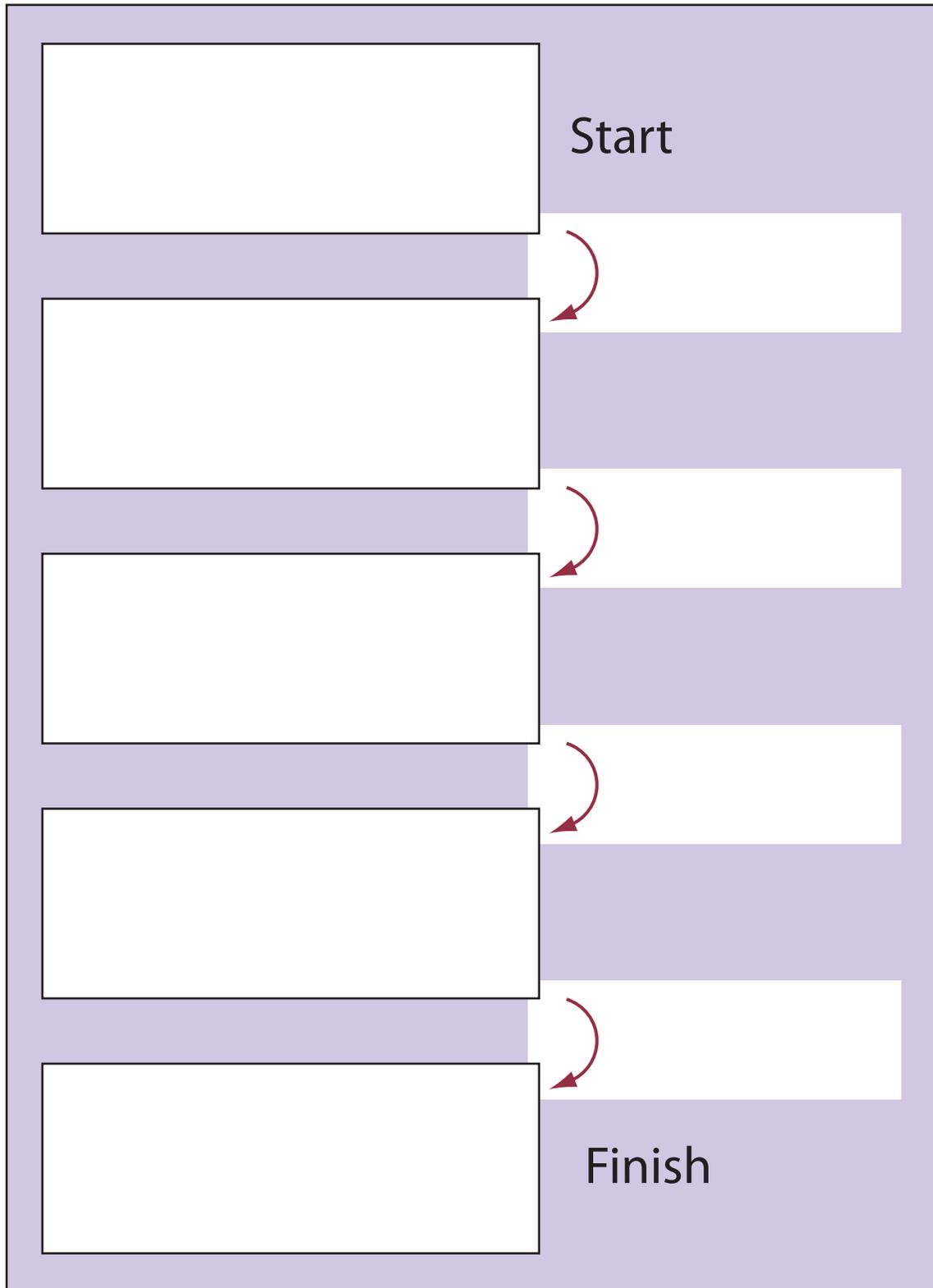
Emphasis on Understanding

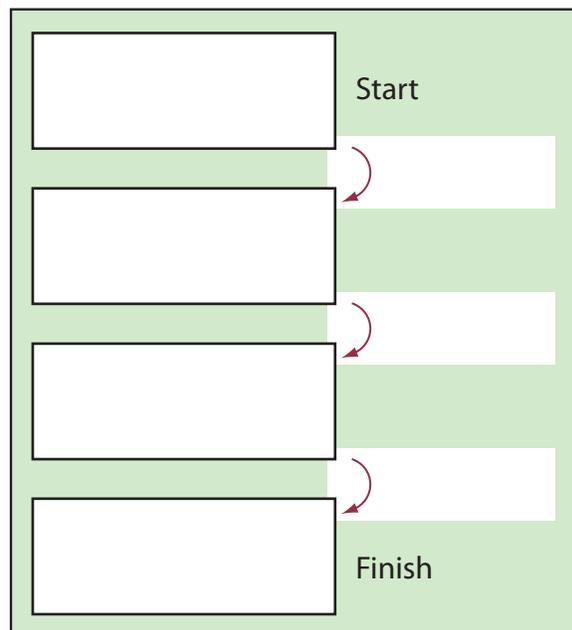
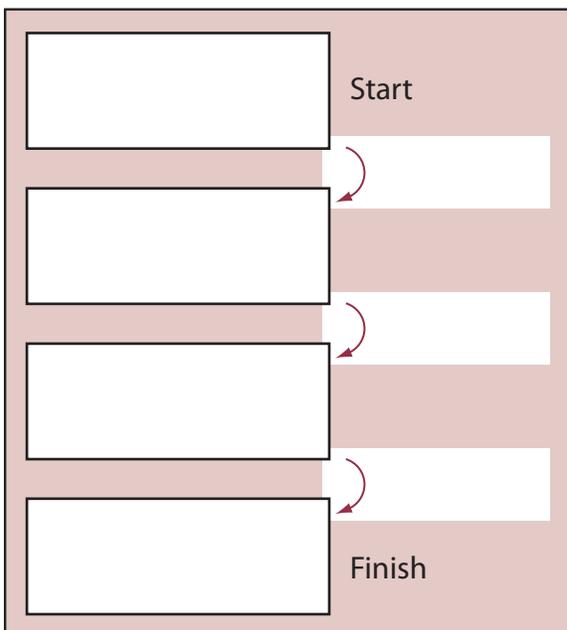
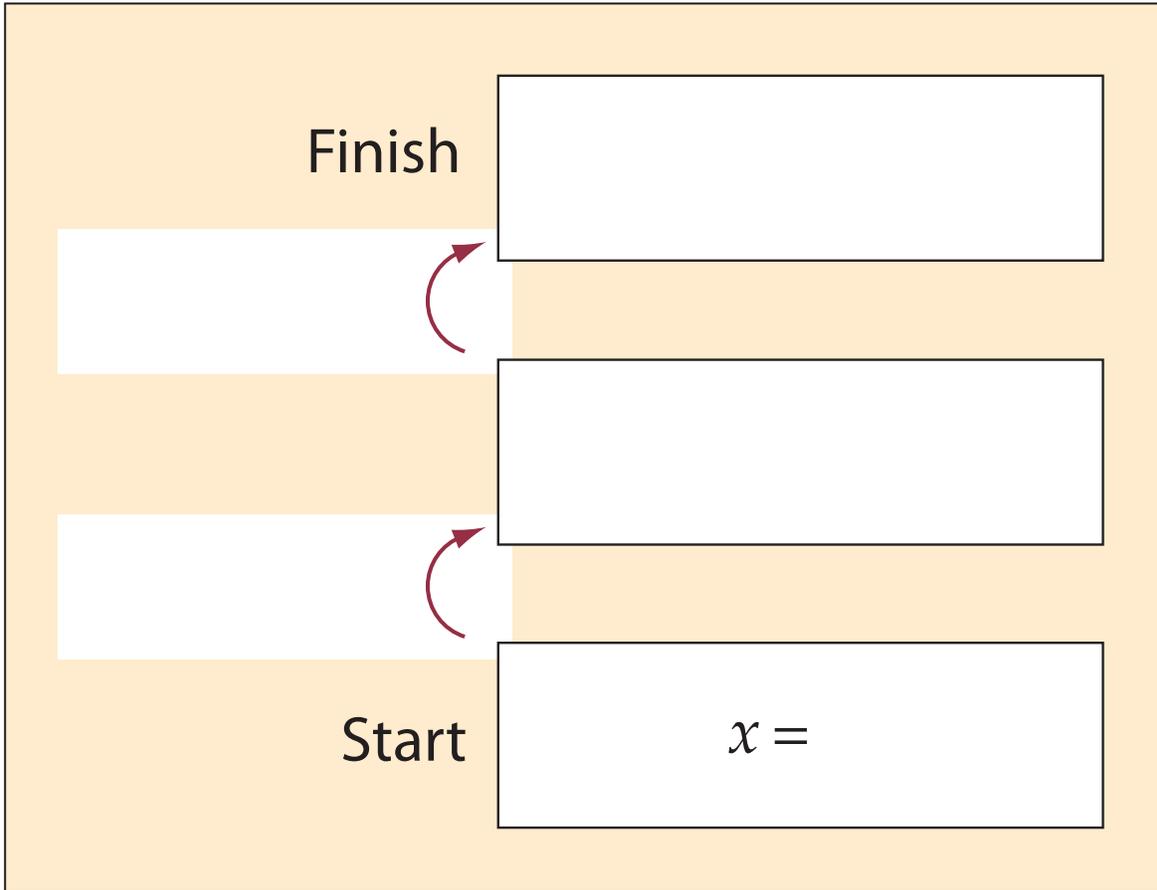
The lessons are carefully designed to uncover mistakes that result from students misunderstanding something. We call such mistakes *misconceptions*. Misconceptions need to be corrected because they can interfere with new learning. Math Navigator modules do not attempt to reteach everything that students have learned about a topic. Instead, they help students understand the mathematics of the procedures and concepts that they have already learned so that they can correct the misconceptions that are getting in the way of their progress.

Learning to Think Mathematically

Lessons are structured to teach students to think like mathematicians. Students will learn how to ask themselves questions before beginning a problem; to use diagrams, tables, and other methods of representing problems; and to estimate as a way of determining whether their answers are reasonable. Most importantly, they will come to see that mistakes are opportunities for learning, rather than something to hide.

| | |
|--------|-------|
| Finish | |
| | |
| | |
| | |
| | |
| | |
| Start | $x =$ |





Mr. Stevens' class is holding a dance to raise money.

The price of each ticket = \$ *a*

The number of tickets sold = *b*

The cost of renting music equipment = \$ *c*

The profit made = \$ *d*



Misconceptions and Errors

| | |
|-------------|--|
| A16 | Does not understand conventions for writing expressions |
| E8 | Does not understand the equals sign; for example, reads the equals sign as “makes” without considering what is on the other side of the equation |
| E9 | Misapplies the properties of equality |
| E11 | Does not understand adding like terms |
| E12 | Does not know how to simplify an expression |
| E19 | Thinks a variable represents an object rather than a number |
| E20 | Thinks that different variables must stand for different numbers |
| NN8 | Does not correctly relate adding negatives with subtracting or subtracting a negative as a positive |
| NN9 | Does not understand how negative numbers affect inequalities; misapplies properties of inequality |
| NN14 | Misapplies the rule “two negatives make a positive” when adding or subtracting |
| NN18 | Does not understand how to read inequalities in one variable and graph them |
| O24 | Does not recognize or misapplies the distributive property of multiplication |

A16 Does not understand conventions for writing expressions

Not using parentheses when they are necessary to interpret the expression

example $5 + x \cdot 5$ rather than $5(x + 5)$

E8 Does not understand the equals sign; for example, reads the equals sign as “makes” without considering what is on the other side of the equation

example $9 + 10 = x + 9$
 $9 + 10 = 19; x = 19$

E9 Misapplies the properties of equality

Confusing negative signs when adding and subtracting terms

example $2x + 12 = x$
 $x = 12$
 $2x + 3 = x + 4$
 $x = 7$

E11 Does not understand adding like terms

Adding a constant to a variable term

example

$$10 + 2x = 12x$$

$$10x^2 + 2x = 12x^2$$

E12 Does not know how to simplify an expression

When simplifying expressions, writing like terms next to each other, but not adding

example

$$4 + 2x + 6 + x = 10 + 2x + x$$

E19 Thinks a variable represents an object rather than a number

Thinking that a variable can only stand for one particular number

example

If there are d days in w weeks,
then $w = 7d$ because a week equals seven days.

E20 Thinks that different variables must stand for different numbers

example

Does this equation have one solution, multiple solutions, or no solution? $x + 9 = y + 9$

No solution

NN8 Does not correctly relate adding negatives with subtracting, or subtracting a negative as a positive

Confusing negative signs when adding and subtracting terms

example

Solve: $2x + 12 = x$
 $x = 12$ rather than $x = -12$

NN9 Does not understand how negative numbers affect inequalities; misapplies properties of inequality

example

Solve: $4 - 3g > -11$
 $-3g > -15$
 $g > 5$

NN14 Misapplies the rule “two negatives make a positive” when adding or subtracting

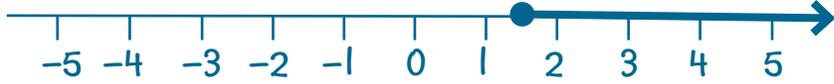
example

$(-7) + (-4) = 11$
 $(-6) - 4 = 10$

NN18 Does not understand how to read inequalities in one variable and graph them

Confuses the representations of inequalities on the number line

example Represent $x < 1.5$ on a number line.



O24 Does not recognize or misapplies the distributive property of multiplication

Not distributing multiplication to all terms in the parentheses

example $2(x + 6) = 2x + 6$

Distributes multiplication by a negative term (or subtraction) to only the first term in an expression

example $x - 2(x + 6) = x - 2x + 12 = -x + 12$

Class Profile Instructions

About the Class Profile

Completing an analysis of student work gives you a clear picture of the strategies an individual student is applying to a particular problem or topic in mathematics. Such an analysis is even more powerful when it is applied to the Math Navigator class as a whole.

The Class Profile gives you both. By reading the Class Profile across a row, you can see where each student stands at any point in time. Reading down the columns allows you to see the strengths and needs of the entire class at a glance. By reviewing the Class Profile, you will be able to make decisions that target appropriate instruction to individuals, small groups, and the whole Math Navigator class.

The first pages of the Class Profile provide assessment items related to the content of the module. The last page is based on the mathematical practices from the Common Core State Standards for Mathematics.¹ On this page, record evidence of students using these practices.

Recording Data on the Class Profile

When you see—either through discussion, analysis of student work, or direct observation—that a student understands a concept, still has a misconception, or engages in a mathematical practice, make a note on your Class Profile. As the student’s understanding increases, update the Class Profile.

Using the Class Profile

Review the Class Profile periodically during the lesson to help you decide which topics would be most beneficial for your students to focus on during the class discussion. Address topics that most of the students in the Math Navigator group need to learn during the show me, work time, or probing for understanding parts of the lesson. Address topics that only some students are struggling with during partner work or in conferences. If only one or two students need help with a topic, address the topic in an individual conference.

Give a copy of the completed Class Profile to each student’s classroom teacher at the end of the module.

¹Common Core State Standards Initiative. 2010. “Common Core State Standards for Mathematics”: 6–8. Accessed July 1, 2011. http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf.

CLASS PROFILE (1 OF 3)

| Concepts | | | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Student Name | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
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| | | | | | | | | | |
| Observed Errors | | | | | | | | | |

CLASS PROFILE (3 OF 3)

| Mathematical Practice Standards | |
|--|--|
| <p>MP1: Make sense of problems and persevere in solving them.</p> <p>MP2: Reason abstractly and quantitatively.</p> <p>MP3: Construct viable arguments and critique the reasoning of others.</p> <p>MP4: Model with mathematics.</p> | <p>MP5: Use appropriate tools strategically.</p> <p>MP6: Attend to precision.</p> <p>MP7: Look for and make use of structure.</p> <p>MP8: Look for and express regularity in repeated reasoning.</p> |
| Student Name | Observations |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |



A Complete Solution to a Word Problem

includes all of the following ...



A written estimate



All work that you do



An equation (even if you solved it using column form)



A diagram, number line, table, or other representation



The answer to the question in a complete sentence



What to Do If You Get Stuck



Look at past work times



Look at the charts that are posted



Model the problem using counters or other materials



Sketch a diagram or other representation



Change the numbers to make the problem simpler



Write what you do know



Write down questions to ask later



Check other resources

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