Navigating *through* Algebra in Grades 3-5

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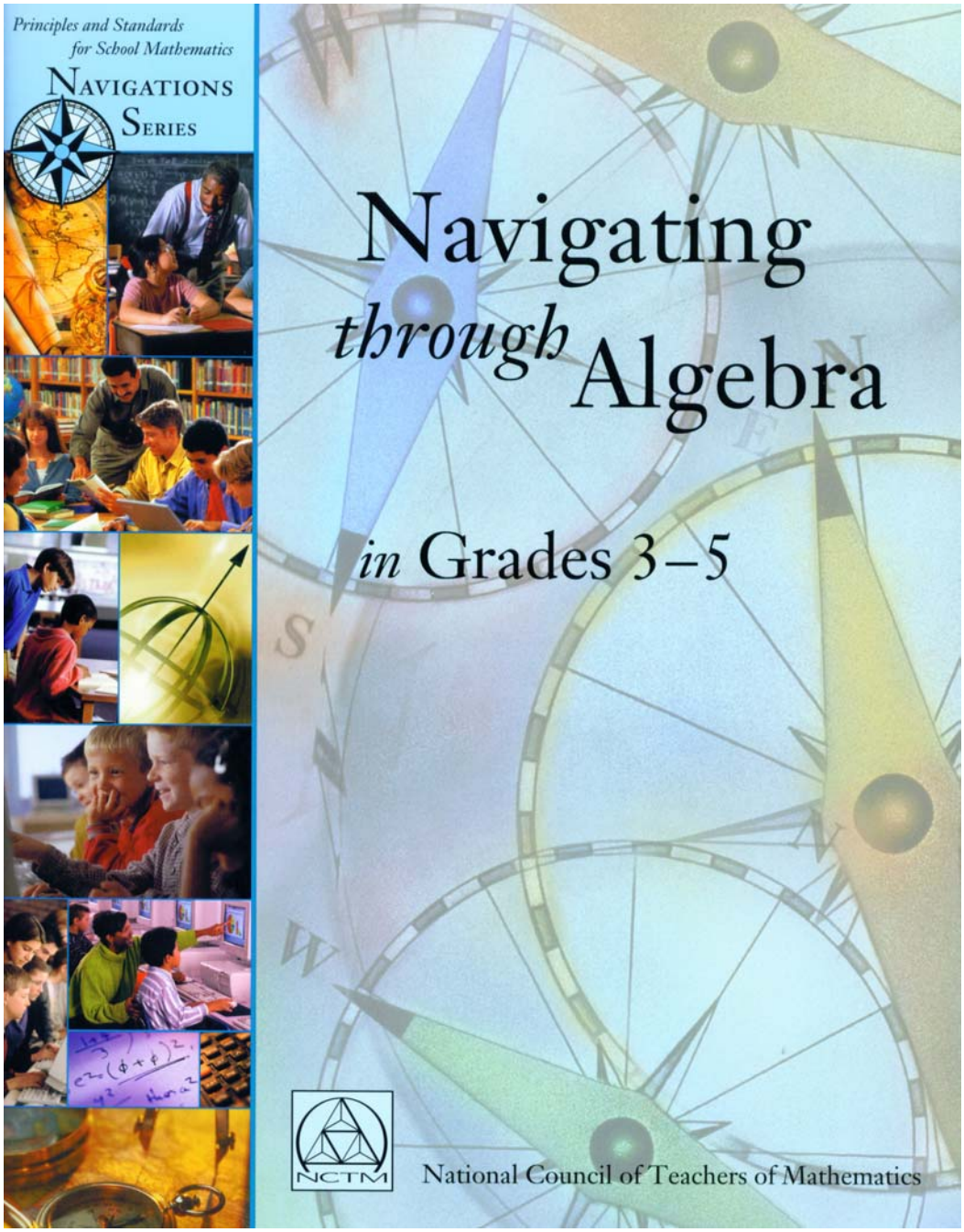

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Navigation Overview

Algebra Standard for Grades 3–5	**Expectations**
Instructional programs from prekindergarten through grade 12 should enable all students to—	**In grades 3–5 all students should—**
Understand patterns, relations, and functions	• describe, extend, and make generalizations about geometric and numeric patterns; • represent and analyze patterns and functions, using words, tables, and graphs.
Represent and analyze mathematical situations and structures using algebraic symbols	• identify such properties as commutativity, associativity, and distributivity and use them to compute with whole numbers; • represent the idea of a variable as an unknown quantity using a letter or a symbol; • express mathematical relationships using equations.
Use mathematical models to represent and understand quantitative relationships	• model problem situations with objects and use representations such as graphs, tables, and equations to draw conclusions.
Analyze change in various contexts	• investigate how a change in one variable relates to a change in a second variable; • identify and describe situations with constant or varying rates of change and compare them.

Algebra Vocabulary A-Z Worksheet

- Give students a copy of the "Algebra A-Z" BLM.
- Have students think of as many different algebra related words that begin with each of the letters.
- E-Glossary Websites
  - http://eduplace.com/kids/mw/g_4.html#
  - http://www.harcourtschool.com/glossary/math2/index.html
  - http://www.amathsdictionaryforkids.com/
  - http://skonline.org/support/mathonline/mathvocab.htm
  - http://hartland.k12.mi.us/curriculum/math/math.htm
  - http://www.remc11.k12.mi.us/riverval/newtroy/mathvocab.htm

Chapter 1 Patterns

- Hundred Board Wonders
  Given a rule, students will explore number patterns using the hundred board.
  - Give students a copy of the "Hundred Board" BLM and colored chips.
  - Have students create colorful patterns following different rules such as *Number with a 2 in them, Numbers whose digits have a difference of 1, Numbers that are multiples of 5,* etc.
  - Allow time for the students to discover and share patterns they have found on the number chart.

- Hundred Board Websites
  - http://standards.nctm.org/document/eexamples/chap4/4.5/index.htm
  - http://www.primaryresources.co.uk/online/numbersquare.swf

- Moyer-Packenham, Patricia S. *Using Virtual Manipulatives to Investigate Patterns and Generate Rules in Algebra*. *Teaching Children Mathematics.* April, 2005. pages 437-444.

- Graphic Stories
  The students explore relationships between variables and interpret relationships expressed in a line graph.
  - Have students choose the best graph for each situation found on the "Graphic Stories" BLM. Have students label the axis and write an explanation of why the graph is appropriate for the situation.
  - Have students write their own stories with accompanying line graphs. Have them write explanations to show how the story relates to the graph.

Chapter 2 Variables and Equations

- Catch of the Day
  Students work with variables as they determine the number of each kind of fish caught.
  - Give students a copy of the "Catch of the Day" BLM and colored chips to represent the fish.
  - Encourage students to create tables to help them explore the possible values for each "Catch of the Day."
  - Provide an opportunity for students to create their own "Catch of the Day" problems for others in the class to solve.

- Algebra Scales
  Students determine if expressions constitute an equation (balanced scale) or an inequality (unbalanced scale) and use logical thinking to find a replacement set to solve equations.
  - Give students a copy of the "Algebra Scales" BLM.
  - As students try to balance the scales, have them create a table in which they can record the replacement-set values.

- Encourage students look for patterns in the numbers used.
- Provide an opportunity for students to create their own algebra scales and require that they write statements that support the choice of values for the variables or give their reasons for identifying the expressions as either equations or inequalities.

- Pan Balance CD-ROM Applet
  Students will determine the relationships between the weights of various objects.
  - Drag the objects from their boxes to the pans. The pans will balance when the two sides have equal weight. When the pans balance, the items in each pan are recorded in the table to the right.

- Pan Balance Website http://illumtest.nctm.org/mathlets/shapebalance/index.html
  - This double pan balance provides an interesting environment in which to consider the concept of "equivalence".

- Balancing Act *from Mega-Fun Card-Game Math written by Karol L. Yeatts (2000) Scholastic Professional Books*
  This game is an introduction to the basic algebraic principle of balancing equations.
  - Players will need one shuffled deck of cards with the face cards removed and a copy of the Balancing Act game board. One player places four cards on the Balancing Act game board arranging the cards to make two addition problems. The first player selects a card from the deck and decides which card on the game board he/she will remove and substitute the newly drawn card for. If the player is able to balance the expressions, the player scores a point. If the player is unable to balance the expressions, the next player draws a card from the deck to try and balance the expressions. Players continue drawing one card at a time until the sums balance. The game ends when one player reaches ten points.

- I Spy Patterns
  The students will partition the given array into different parts to translate visual patterns into numerical patterns. Students will explore how equivalent numerical expressions represent the commutative and associative properties of operations.
  - Give students a copy of the "I Spy Patterns" BLM.
  - Explain that Investigators from "CAP" Operations (Commutative and Associative Properties) have discovered an unusual array of diamonds. They expect that the patterns in the array have some numerical codes. Your task is to find as many ways as you can to partition the array and find the numerical codes (patterns).
  - Help guide students as they translate the visual patterns into numerical patterns.

- Building Houses
  The students will verbalize numerical relationships and translate each relation into an algebraic equation.
  - Give students a copy of the "Building Houses" BLM and colored chips to represent the houses.
  - Explain that the students are part of a construction company that is building houses on three islands. Bridges connect the islands. The architect has written the total number of houses on the two islands that the bridge connects. She has also indicated the total number of houses to be built on the three islands. Your job is to figure out how many houses will be built on each island.

Chapter 3 Functions

- Triangle-Rule Machine
  Students will describe the rule or function that will produce the perimeter for any given arrangement of triangles.
  - Give students a copy of the "Triangle-Rule Machine" BLM and fifty equilateral triangles.
  - Have students create rows of triangles and determine the perimeter of each configuration.
  - Help students transition from pattern rules to the notion of function. Stress the idea that the perimeter of the configuration of triangles depends on the number of triangles connected.

- Function Machine CD-ROM Applet
  Students will determine the function used by the function machine.
  - Type in a value for X. Click "Enter" to see the value the function machine returns for Y. When you know what rule the function machine uses, enter it in the equation below and click "Check Formula."

- The Number Cruncher Website http://www.shodor.org/interactivate/activities/numbercruncher/index.html
  - This activity allows students to explore simple linear functions; the function is determined by looking for patterns in the outputs. The Number Cruncher records each input and output in a window. The functions available for exploration in the function machine activity have one of the following forms: $y = x \bullet \_\_$ or $y = x + \_\_$ or $y = x - \_\_$

- Additional Algebra Websites:
  - Illuminations (a partnership between NCTM and MarcoPolo): http://illuminations.nctm.org/
  - Algebra / All Grades: http://illumtest.nctm.org/swr/list.asp?Ref=2&Std=1
  - The Variable Machine: http://illuminations.nctm.org/index_d.aspx?id=291

Selected Web Resources

Algebra / Grades 3 – 5 http://illumtest.nctm.org/swr/list.asp?Ref=0&Std=1&Grd=3

Mystery Operations - This online activity allows students to explore various numerical patterns by identifying a "mystery operation" presented by the activity. - Direct to SWR

Old Stamps - Students work with costs of mailing different packages to determine how many regular and lesser-valued stamps are needed for each. - Direct to SWR

Double or Not - A challenge from NCTM's "Figure This!" Web site, this activity compares different patterns of growth, arithmetic versus geometric. - Direct to SWR

Find a Pattern with "One Grain of Rice" - This activity uses the book "One Grain of Rice" to engage students in predicting a pattern and comparing it to the story. - Direct to SWR

People Patterns - With this online activity, students try to figure out who should come next in a line of people based on observed patterns. - Direct to SWR

Traffic Jam Activity - This lesson idea presents an interesting problem for students to explore using multiple ways of representation, including role-play and a Java applet. - Direct to SWR

Grade Five Problems - This site has a set of challenging problems for students in fifth grade, along with hints and answers. - Direct to SWR

Exploring Pascal's Triangle - This activity uses Pascal's Triangle to study patterns of numbers. - Direct to SWR

Building A Brick Wall - This activity uses dominoes to help develop mathematical understanding. - Direct to SWR

Guess the Number Plus - This activity can be used to introduce students to the basic form of algebraic expressions. - Direct to SWR

Thirteen! Oh No! - Searching for patterns between dates and days can be an exciting and challenging task for students as they try to find out whether or not there is a Friday the 13th every year. - Direct to SWR

Button Beach Challenge - As buttons correspond to different numbers on a grid, students must determine the values represented by the buttons by looking at the given sums for certain columns and rows. - Direct to SWR

Maze Game - With this game, students use the Cartesian plane to avoid mines and lead the robot to safety. - Direct to SWR

Easy Fibonacci Numbers - Students are exposed the Fibonacci sequence through various patterns and challenges provided on this page. - Direct to SWR

The Function Machine - This machine processes numbers into new numbers using random or predetermined functions. Can students determine what the function is? - Direct to SWR

Number Cruncher - Function machine for the addition, subtraction, and multiplication operations. - Direct to SWR

Patterns to the Rescue - Finishing a pattern of numbers and shapes. - Direct to SWR