

**The Use of Manipulatives as an Instructional Strategy to Help Students Who are Blind or Visually Impaired Understand and Learn Math Concepts (Early Childhood through Secondary)**



WICHITA, KANSAS  
March 2, 2011

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**Presented by  
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<http://www.tsbvi.edu/math/>

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**Agenda**

- Definition of a Mathematical Manipulative
- National Council of Teachers of Mathematics (NCTM) Standards Overview
- Basics on Teaching Math to a Student with a Visual Impairment
- Accessible Math Manipulatives Including Sample Test Items
- Manipulatives Appropriate for the Kansas Mathematics Assessment

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## Mathematical Manipulatives

From Wikipedia <http://en.wikipedia.org>

- A mathematical manipulative is an object which is designed so that a student can learn some mathematical concept by manipulating it.
- Multiple experiences with manipulatives provide children with the conceptual foundation to understand mathematics at a conceptual level and are recommended by the National Council of Teachers of Mathematics (NCTM).

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## NCTM Content Standards

- Number and Operations
- Algebra
- Geometry
- Measurement
- Data Analysis and Probability

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## NCTM Standards

- Apply across all grades, prekindergarten through grade 12
- Emphasis will vary both within and between the grades
- Are richly interwoven

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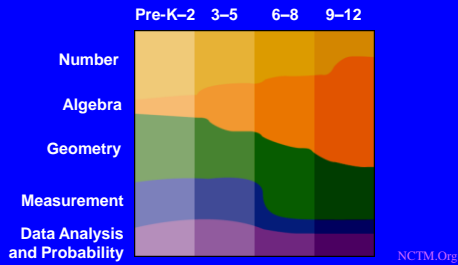
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## NCTM Emphasis Across the Grades



NCTM.Org  
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## Teaching Basic Concepts to a Visually Impaired Child



First Principle:  
Use Hands-On  
Experience with  
Concrete  
Objects to Build  
Strong Basic  
Concepts

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## Math Concepts

How do visually impaired students develop math concepts and skills?

- through experiences!!!

Visually impaired student must experience relationships with real objects in order to prepare them for understanding the same relationships with numbers.

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## Math Concepts

For students who are blind, direct teaching of mathematics concepts is essential - it must NOT be left to incidental learning. (p. 374)

Verbal descriptions alone are inadequate to convey underlying visual concepts, especially those of advanced mathematics. (p. 378)

From *Foundations of Education, Second Edition, Volume II: Instructional Strategies for Teaching Children and Youths with Visual Impairments*. AFB, 2000. <sup>10</sup>

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## Thoughts on Visual vs Tactual Perception

1. Visual impairment is not an isolated condition; it affects the whole process of information-gathering.
2. Vision enables a person to simultaneously perceive all parts of an object in its totality and in its relationship to other objects.
3. The visually impaired learner has to rely on sequential observations (only part of an object can be seen or felt at a time) and the entire image has to be "built-up" out of the components. Relationships with other objects can be lost entirely.
4. The level of cognition needed for integration of sequential information is higher than that needed for concept formation through immediate visual perception.
5. If you have vision, you can experience this way of processing information by looking at a drawing through a very small hole in a piece of card held over the drawing; I think that you will find that it's hard for you to "get the picture."

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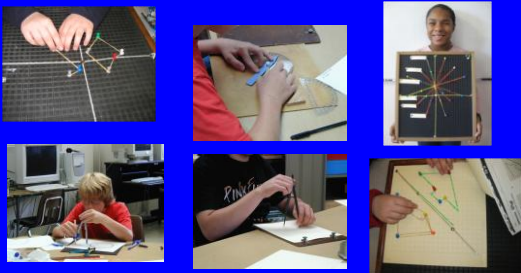
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## Accessible Math Manipulatives Including Sample Test Items



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# Number and Operations

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## Toys Count

- Problems w/ rote counting
- Importance of 1-to-1 correspondence

"Rote memorization of a set of numbers is meaningless."  
Kapperman, *Project Math Access*  
<http://s22318.tsbvi.edu/mathproject>



Braille Math Blocks from [www.lindenwoodinc.com](http://www.lindenwoodinc.com)

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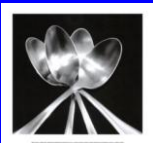
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## Counting Objects



- Real-world opportunities
- Work-Play Trays from APH with various collections of objects
- Use a highly structured method of counting
- Counting books - tactual ones, commercial or home-made



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## Numbers in the Real World

- Age and birthday
- Phone numbers
- Child's height, weight
- Address
- Time
- Prices
- Elevator buttons
- Much more



[www.mebby.co.za/prod\\_health.html](http://www.mebby.co.za/prod_health.html)

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## Manipulatives to Enhance Number System Concepts



- Base-10 Sets
  - Digi-Blocks
- [www.digi-block.com/](http://www.digi-block.com/)

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## APH Tools to Enhance Number System Concepts

- Braille & LP "Numbers to 100" Charts
- [www.aph.org](http://www.aph.org)



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## Cranmer Abacus

[www.aph.org](http://www.aph.org)



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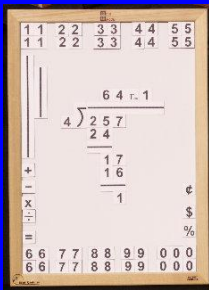
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## Hands-On Computation Tool



Math Window in Braille  
and Large Print  
[www.mathwindow.com](http://www.mathwindow.com)

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## Hands-On Nemeth Tool

TACK-TILES Braille Systems  
[www.tack-tiles.com](http://www.tack-tiles.com)



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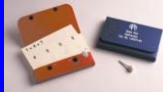
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## APH Tools to Help Increase Basic Math Skills

- Math Drill Cards
- Quick Pick: Math
- Multiplication and Division Table
- Math Flash
  - ♦ Fun self-voiced software program



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## Other Tools to Help Increase Basic Math Skills

- Twist & Shout  
Addition, Subtraction,  
Multiplication, & Division  
[www.leapfrog.com](http://www.leapfrog.com)
- Tactual Dice  
Independent Living Aids  
[www.independentliving.com](http://www.independentliving.com)



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## Identifying Money

- Coins: Tactual distinctions
- Bills: Folding System
- Coin Abacus  
[www.pcicatalog.com](http://www.pcicatalog.com)



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## Fractions

- Fraction Pies
- Fraction Tiles
- Fractions for Dessert



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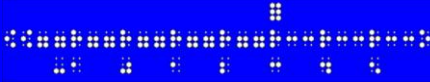
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## Student-Generated Graphics on a Number Line

- APH Number Line Device



- Student-Made Number Lines



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## 3<sup>rd</sup> Grade Numbers and Operations

16 Ben paid for a game using the money shown below.



What is the value of the money Ben used to pay for the game? Mark your answer.

- \$20.03
- \$20.63
- \$20.78
- \$21.03

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## 4th Grade Numbers and Operations

1. Each  $\square$  in the model below represents 1.  
What number is represented by the model shown below?

A 3D model of base ten blocks. It consists of 5 large cubes (hundreds), 2 medium rods (tens), and 3 small units (ones).

A 523

B 900

C 5,203

D 5,230

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## 5th Grade Number and Operations

12. What is the prime factorization of 100?
- F  $2 \times 2 \times 5 \times 5$
- G  $2 \times 5 \times 10$
- H  $2 \times 2 \times 25$
- J  $4 \times 5 \times 5$

13. A chocolate cake and a yellow cake were each cut into 8 equal slices. The shaded parts of the model below show the part of each cake that was eaten.

Chocolate      Cakes      Yellow

Which of the following addition sentences can be used to find how much more of the chocolate cake was eaten than the yellow cake?

F  $\frac{3}{8} + \frac{5}{8} = \frac{8}{8}$

G  $\frac{3}{8} - \frac{5}{8} = -\frac{2}{8}$

H  $\frac{5}{8} - \frac{3}{8} = \frac{2}{8}$

J  $\frac{3}{8} - \frac{5}{8} = -\frac{2}{8}$

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## 6th Grade Number and Operations

10. Ten pages of advertisements can be  $\frac{2}{3}$  of a page. If a page is 100 pages. The shaded parts of the model below show the fraction of a page used for two advertisements.

Which of the following operations represents the total fraction of the page used for these advertisements?

F  $\frac{1}{10} + \frac{1}{10} = \frac{2}{10}$

G  $\frac{1}{10} + \frac{1}{10} = \frac{1}{10}$

H  $\frac{1}{10} + \frac{1}{10} = \frac{1}{10}$

J  $\frac{1}{10} + \frac{1}{10} = \frac{2}{10}$

9. There were 1,230 tomato plants packed in 17 boxes. Each box had an equal number of tomato plants. How many tomato plants were in each box?
- A 67
- B 69
- C 598
- D 670

41. Nic bought 11 notebooks for \$0.70 each. What was the total cost of the notebooks before tax?
- A \$ 0.77
- B \$ 7.70
- C \$ 8.10
- D \$11.70

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## 8<sup>th</sup> Grade Number and Operations

19 Marcos buys 15 folders that cost \$0.75 each and 6 pens that cost \$1.25 each. What is the total cost in dollars and cents of the folders and pens, not including tax?

Record your answer and fill in the bubbles on your answer document. Be sure to use the correct place value.

20 The Venn diagram is used to classify counting numbers according to a set of rules.

Which one of the following numbers belongs in the region of the diagram marked by the question mark?

A 45  
B 50  
C 60  
D 65

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## Exit Level Numbers and Operations

26 Lisa wants to make a long-distance telephone call to her friend. She does not want to spend more than \$1.00 on the telephone call. If there is a \$0.50 connection fee and a charge of \$0.11 per minute, which best represents the number of minutes that Lisa can talk to her friend?

A

B

C

D

27 Which point on the number line below is farthest away from 0?

F Point Q  
G Point R  
H Point S  
J Point T

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## Publications

- Prime Factorization on the Abacus  
[www.tsbvi.edu/math/](http://www.tsbvi.edu/math/)  
[www.youtube.com/VideoTSBVI](http://www.youtube.com/VideoTSBVI)
- Osterhaus, S.A. (2003). *Susan's Math Technology Corner: Standardized Braille Number Lines*. *Division on Visual Impairments Quarterly*, 48(2), 9-11  
[www.tsbvi.edu/math](http://www.tsbvi.edu/math)

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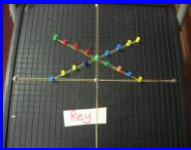
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## Algebra



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## Sorting and Ordering



- Applied use of terms of comparison
- Sort into categories
- Order by size

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## MathBuilders K-3, Unit 1: Matching, Sorting, and Patterning

[www.aph.org](http://www.aph.org)



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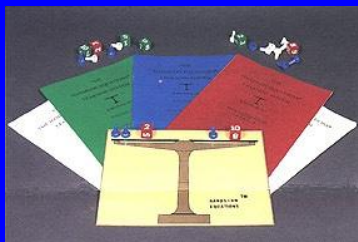
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# HANDS-ON EQUATIONS® Learning Systems [www.borenson.com](http://www.borenson.com)



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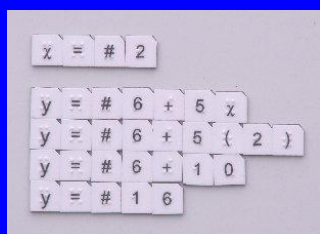
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# Math Window Algebra Add-On [www.mathwindow.com](http://www.mathwindow.com)



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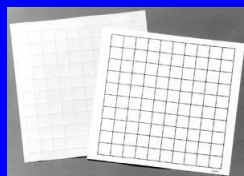
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# Graphing on the Coordinate Plane

APH Braille and LP Graph Paper  
[www.aph.org](http://www.aph.org)



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# Student-Generated Graphics on a Coordinate Plane

APH Graphic Aid for Mathematics




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# 3<sup>rd</sup> Grade Algebra

19. Keatrell is studying Native American houses. He made a model village, as shown below.

Which could be used to find the total number of houses in Keatrell's model village? Mark your answer.

$2 \times 8 =$

$8 \times 3 =$

$5 \times 6 =$

$8 \times 5 =$

20. Dakota drew the following pattern of hearts in her notebook.

If Dakota continues this pattern, which arrangement of hearts will come next? Mark your answer.

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# 4<sup>th</sup> Grade Algebra

31. Jordan used a number machine. Each number that she put into the machine changed according to a rule. Then a different number came out. Some examples are shown below.

Which equation best describes the rule for this number machine?

A. Number in  $\times 4 =$  number out

B. Number in  $\times 15 =$  number out

C. Number in  $\times 6 =$  number out

D. Number in  $\times 15 \div$  number out

30. Which pair of numbers best completes the equation below?

$\triangle \times 10 = \square$

F.  $7,700$  and  $7,800$

G.  $75$  and  $7,800$

H.  $7,700$  and  $70,000$

J.  $75$  and  $7,080$

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# 5th Grade Algebra

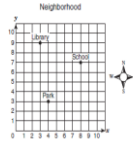
14 Look at the pattern of numbers below.

28, 84, 252, 756

Which describes the rule for determining the last 3 numbers shown in this pattern?

- F Each number is 56 more than the previous number.
- G Each number is 64 more than the previous number.
- H Each number is 3 times the previous number.
- J Each number is 4 times the previous number.

3 The grid below shows the location of 2 points in a neighborhood.



If the post office is 2 units directly north of the school, which of the following ordered pairs best represents the post office's location?

- A (6, 5)
- B (5, 6)
- C (6, 9)
- D (8, 10)

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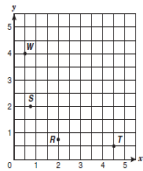
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# 6th Grade Algebra

66 Look at the grid below.



Which of the following ordered pairs best represents the location of point T?

- F  $(\frac{1}{2}, \frac{1}{2})$
- G  $(\frac{1}{2}, \frac{1}{4})$
- H  $(\frac{1}{2}, \frac{1}{8})$
- J  $(\frac{1}{2}, 1)$

79 What value for  $p$  makes the equation below true?

$$\frac{1}{3} + p = \frac{5}{12}$$

- A  $\frac{1}{12}$
- B  $\frac{4}{12}$
- C  $\frac{4}{9}$
- D  $\frac{3}{4}$

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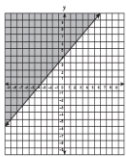
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# 8th Grade Algebra

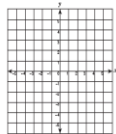
3 Mrs. Weatherman drew a line and shaded part of the coordinate plane.



Which list is made up of coordinate pairs representing points in the shaded part of the coordinate plane?

- A (2, -4), (-2, 5), and (6, -3)
- B (-4, 4), (2, 6), and (-6, -2)
- C (-4, 3), (2, 6), and (-6, -2)
- D (-4, 3), (2, 6), and (-6, 2)

69 Which ordered pair is located in Quadrant III?



- A (-2.4, 4.5)
- B  $(6, -\frac{12}{4})$
- C (-1.65, -1.55)
- D  $(\frac{1}{2}, -\frac{1}{2})$

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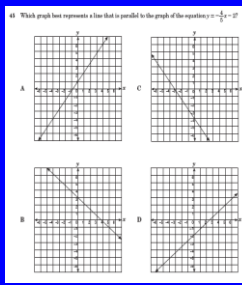
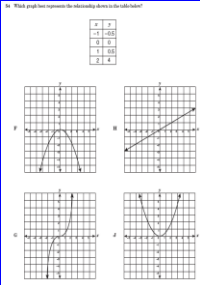
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## Exit Level Algebra




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## Publications

- Osterhaus, S.A. (2002). Susan's Math Technology Corner: Teaching A Blind Student How to Graph on a Coordinate Plane: No Tech, Low Tech, and High Tech Tools. *Division on Visual Impairments Quarterly*, 47(3), 23-26  
[www.tsbvi.edu/math](http://www.tsbvi.edu/math)  
[www.youtube.com/VideoTSBVI](http://www.youtube.com/VideoTSBVI)

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## Geometry




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## Crucial for the Blind and Visually Impaired Student

- Spatial concepts are critical for the development of academic skills, especially math skills.
  - ◆ Position in Space (top, bottom, around, beside, etc.)
    - The toy is under the table, in the sink, ...
    - Create an obstacle course and go under the slide, over the sidewalk, up the ladder, around the pole...

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## Geometric Shapes

- Talking Ship Ahoy Sorter
- Count and Learn The Shapes (now called Creativity Street Wonderfoam Puzzles)
- Talking Shapes Peg Puzzle



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## More Geometric Shapes

- Geometric Shape Sorter  
[www.exceptionalteaching.com](http://www.exceptionalteaching.com)



- Large 3D Geometric Models



[www.delta-education.com](http://www.delta-education.com)

- Tessellating Lizards



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## MathBuilders, Unit 6: Geometry K-3 [www.aph.org](http://www.aph.org)



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## Hands-on System for Learning Three-Dimensional Geometry [www.geometro.net](http://www.geometro.net)



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## Geometro Sets Now Available from APH [www.aph.org](http://www.aph.org)



GS16 Mini Kit:  
Catalog Number:  
1-03022-00  
includes 16 pieces: 8  
triangles, 6 squares,  
and 2 pentagons.



GS22 Medium Set:  
Catalog Number:  
1-03023-00  
includes 22 pieces: 12  
triangles, 6 squares, 2  
pentagons, and 2  
hexagons.

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## Geometro Sets Now Available from APH [www.aph.org](http://www.aph.org)



GS56 Large Set  
includes 56 pieces:  
24 triangles, 12  
squares, 12  
pentagons, and 8  
hexagons.

GS56 Large Set: Catalog Number: 1-03024-00

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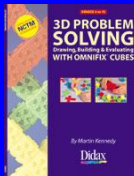
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## Omnifix Cubes [www.didax.com](http://www.didax.com)



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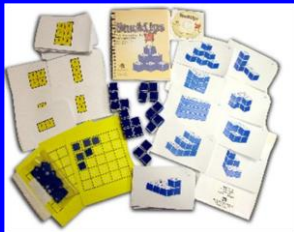
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## APH StackUps: Spatial Reasoning Using Cubes and Isometric Drawings



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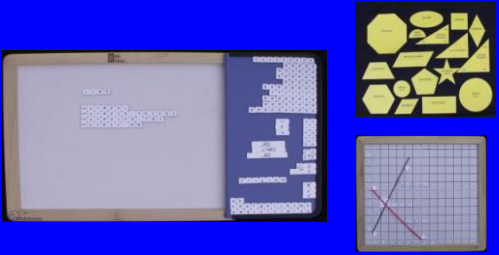
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## Math Window Geometry Kit

[www.mathwindow.com](http://www.mathwindow.com)



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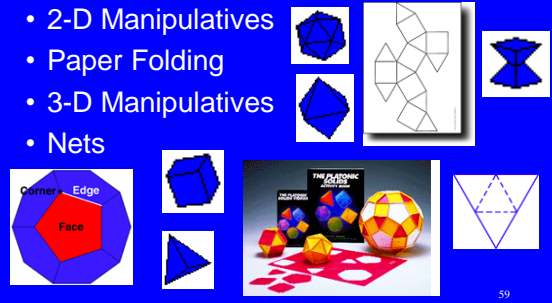
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## Geometric Manipulatives

- 2-D Manipulatives
- Paper Folding
- 3-D Manipulatives
- Nets



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## Drawing/Construction Tools

- Drawing Board
- Compass



[www.fiskars.com/](http://www.fiskars.com/)  
[www.PerkinsStore.org](http://www.PerkinsStore.org)  
[www.APH.org/](http://www.APH.org/)  
[www.staedtler.us/](http://www.staedtler.us/)

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## Drawing/Construction Tools (cont.)

- Protractor
- Straightedge
- Tracing Wheel
- Stylus and/or Pen
- Drawing Board



[www.APH.org/](http://www.APH.org/)  
[www.PerkinsStore.org](http://www.PerkinsStore.org)

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## Students at Work Drawing



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## 3<sup>rd</sup> Grade Geometry

20 Wesley's younger brother has the figures shown below.

Which of the following best describes these figures? Mark your answer.

- Circles, pyramids, and a square
- Triangles, circles, a rectangle, and a square
- Triangles, cubes, and spheres
- Prisms, spheres, pyramids, and a cube

23 Which best names the shape shown below? Mark your answer.

- Octagon
- Parallelogram
- Pentagon
- Hexagon

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## 4th Grade Geometry

65 The solid figure below was made of centimeter cubes.



Which of the following shows the top view of the figure above?



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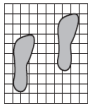
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## 5th Grade Geometry

7 Which angle transformation is shown below?



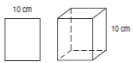
- A Reflection
- B Rotation
- C Translation
- D Not here

8 Which statement about the 3-dimensional figure below appears to be true?



- F It has no congruent faces.
- G It has 2 congruent rectangular faces.
- H It has 4 congruent faces.
- J It has 2 congruent triangular faces.

10 Look at the square and the cube shown below.



Which statement about both of these figures appears to be true?

- A The square has 4 times as many vertices as the cube.
- B The square is congruent to each face on the cube.
- C The square has 2 fewer sides than the cube has edges.
- D The square has the same number of right angles as the cube.

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## 6th Grade Geometry

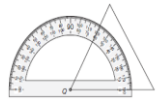
67 In the diagram below, three lines intersect to form the angles shown.



Which of the two angles below are vertical angles?

- A 1 and 6
- B 2 and 7
- C 3 and 4
- D 5 and 8

68 What is the measure of  $\angle G$  in the diagram below?



- A  $79^\circ$
- B  $117^\circ$
- C  $127^\circ$
- D  $11^\circ$

66

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# 8<sup>th</sup> Grade Geometry

7.  $APQV$  is reflected across the  $y$ -axis. Which of the following shows this transformation?

A B C D

8. The drawings below show the top, front, and right side views of a 3-dimensional figure built using identical cubes.

Top view Front view Right side view

Which 3-dimensional figure do these views best represent?

F G H J

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9. The many vertices form the polyhedron below.

F 14  
G 12  
H 10  
J 8

# Exit Level Geometry

10. How many faces, edges, and vertices does the solid above have?

F 4 faces, 10 edges, and 7 vertices  
G 4 faces, 10 edges, and 8 vertices  
H 10 faces, 14 edges, and 9 vertices  
J 4 faces, 10 edges, and 9 vertices

11. The front and right side views of a figure made of identical cubes are shown below.

Front view Right side view

Which 3-dimensional figure is best represented by the two views above?

F G H J

12. Which of the following nets forms a triangular pyramid?

F G H J

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# Publications

- Geometric Constructions  
[www.tsbvi.edu/math](http://www.tsbvi.edu/math)
- Transformations, Line Symmetry, and Tessellations  
[www.tsbvi.edu/math](http://www.tsbvi.edu/math)
- APH Braille/Print Protractor  
[www.youtube.com/TSBVIvideo](http://www.youtube.com/TSBVIvideo)

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## Types of Measurement

- Linear & Angle Measurement
- Temperature
- Volume
- Weight
- Time



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## Comparison and Ordering



- Shape Sequence Block Board

- Same - Different
- Big - Little
- More - Less
- Full - Empty
- Heavy - Light



[www.exceptionalteaching.com](http://www.exceptionalteaching.com)

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## Linear and Angle Measurement

[www.tsbvi.edu/math/mathtools.htm](http://www.tsbvi.edu/math/mathtools.htm)

- Ruler
- Yardstick and Meter Stick
- Toss-Away Rulers
- Protractor



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## Temperature



Tactile Demonstration  
Thermometer

[www.aph.org](http://www.aph.org)



SAVI Celsius  
Thermometer

[www.lawrencehallofscience.org/  
cml/saviselph/equip.html](http://www.lawrencehallofscience.org/cml/saviselph/equip.html)

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## Volume



- Measuring cups and spoons
- Tactual identification of gallons, quarts, liters, etc.



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## Weight

- Standard "kitchen scale" with braille and tactile markings
- 10 pounds!!



SAVI Balance

[www.lawrencehallofscience.org/  
cml/saviselph/equip.html](http://www.lawrencehallofscience.org/cml/saviselph/equip.html)

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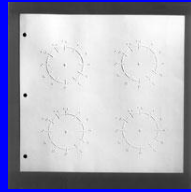
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## Measuring Time with APH Products



- Analog Clock Model  
[www.aph.org/](http://www.aph.org/)

- Clock Face Sheets in braille  
[www.aph.org/](http://www.aph.org/)



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## Other Ways to Tell Time

Exceptional Teaching Inc.

[www.exceptionalteaching.com](http://www.exceptionalteaching.com)

- Talking Clever Clock
- The Time Teacher



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## Calendars

- APH Classroom Calendar
- American Action Fund for Blind Children and Adults  
1800 Johnson Street, Suite 100  
Baltimore, MD 21230  
(410) 659-9315  
E-mail: [actionfund@nfb.org](mailto:actionfund@nfb.org)
- Tactile Vision  
[www.tactilevisioninc.com](http://www.tactilevisioninc.com)



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## Students at Work Measuring



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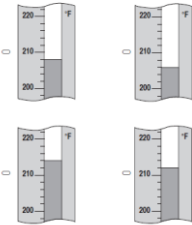
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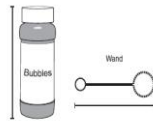
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## 3<sup>rd</sup> Grade Measurement

13. Water boils at 212°F at sea level. Which of the following thermometers shows this temperature? Mark your answer.



14. Thomas had a bottle of bubbles and a wand like the ones shown below. Use the ruler on the Mathematics Chart to measure the length of the line segments next to the bottle of bubbles and the wand to the nearest centimeter.



About how much longer is the bottle of bubbles than the wand? Mark your answer.

- 10 cm
- 7 cm
- 1 cm
- 2 cm

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## 4<sup>th</sup> Grade Measurement

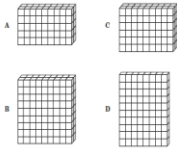
67. Jill planted flowers in the square garden pictured below.



What is the area of the garden?  
(Area = length x width)

- A 10 square feet
- B 20 square feet
- C 25 square feet
- D 55 square feet

88. The models below are made with 1-unit cubes. Which model has a volume of 108 cubic units?



81

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## 5<sup>th</sup> Grade Measurement

17. A clock will show a time of 1:50 in all the ways that the hands could be drawn. Which clock shows the time or which of the clocks has the hands drawn?



18. The drawing below represents a parking lot at the mall.



Scale  
1 cm = 10 m

Use the ruler on the Mathematics Chart to measure the dimensions of the parking lot to the nearest tenth of a centimeter. Which is closest to the perimeter of the actual parking lot in meters?

- F 440 m
- G 330 m
- H 225 m
- J 220 m

82

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## 6<sup>th</sup> Grade Measurement

61. Sarah has a box that measures 1 foot on each side. How many 1-inch cubes will fill the box?

- A 36
- B 144
- C 432
- D 1,728

The picture below is a scale drawing of a rectangular bulletin board. Use the ruler on the Mathematics Chart to measure the dimensions of the scale drawing to the nearest inch.



Scale  
1 inch = 2 feet

Which of the following is closest to the perimeter in feet of the actual bulletin board?

- F 28 ft
- G 16 ft
- H 36 ft
- J 48 ft

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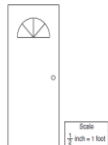
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## 8<sup>th</sup> Grade Measurement

11. The scale drawing below shows a door. Use the ruler on the Mathematics Chart to measure the dimensions of this door to the nearest  $\frac{1}{2}$  inch.



Which of the following dimensions are closest to those of the actual door?

- A  $2\frac{1}{2}$  feet wide and  $7\frac{1}{2}$  feet high
- B  $2\frac{1}{2}$  feet wide and 7 feet high
- C 2 feet wide and  $7\frac{1}{2}$  feet high
- D 2 feet wide and 7 feet high

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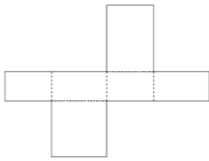
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## Exit Level Measurement

28 The drawing below shows the net of a rectangular prism. Use the ruler on the Mathematics Chart to measure the dimensions of the net to the nearest tenth of a centimeter.



If the net is folded to form the rectangular prism, which of the following is closest to the prism's volume?

- F 17.2 cm<sup>3</sup>
- G 5.8 cm<sup>3</sup>
- H 4.8 cm<sup>3</sup>
- J 10.8 cm<sup>3</sup>

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## Publication

- Linear Measure, Perimeter, Area

[www.tsbvi.edu/math](http://www.tsbvi.edu/math)

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## Data Analysis and Probability

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## Graphs & Predictions

Place stickers in columns on a piece of braille graph paper to make a chart of how many bananas were consumed during the week.

- How many bananas do we need to buy at the grocery store this week?

| I like carrots. | I don't like carrots. |
|-----------------|-----------------------|
| Mom             | Dad                   |
| Amanda          | Carlos                |
| Kim             |                       |
| Joe             |                       |

- Should we have carrots for dinner?
- How many servings?

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## MathBuilders, Unit 8 Kit: Data Collection, Graphing, and Probability and Statistics K-3 [www.aph.org](http://www.aph.org)



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## Student- or Teacher-Generated Braillewriter Pictograph



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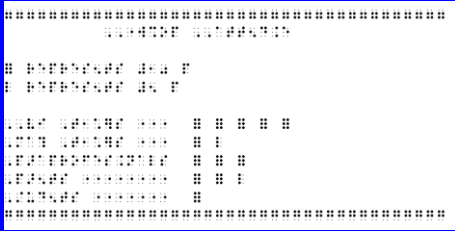
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## Student- or Teacher-Generated Braillewriter Pictograph



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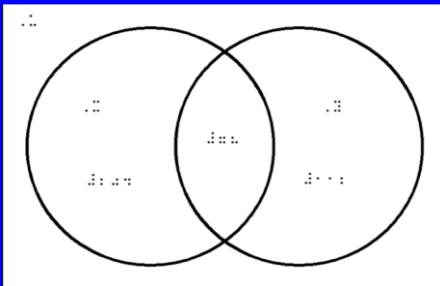
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## Student- or Teacher-Generated Venn Diagram



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## 3rd Grade Data Analysis & Probability

1. Juwita and Carl did a survey to find the number of different pets owned by students at their school. The results are shown in the pictograph below.

**Pet Survey**

|       |    |    |    |    |    |    |    |    |    |    |
|-------|----|----|----|----|----|----|----|----|----|----|
| Dogs  | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Cats  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  |
| Birds | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  |
| Fish  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  | 2  |
| Other | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

Each means 5 pets.

What is the total number of dogs owned by the students at Juwita and Carl's school? Mark your answer.

4

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45

4. The pictograph below shows the number of miles each of four people traveled by canoe.

**Miles Traveled by Canoe**

|          |    |    |    |    |    |    |    |
|----------|----|----|----|----|----|----|----|
| Samuel   | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Amanda   | 5  | 5  | 5  | 5  | 5  | 5  | 5  |
| Brittany | 3  | 3  | 3  | 3  | 3  | 3  | 3  |
| Carlson  | 2  | 2  | 2  | 2  | 2  | 2  | 2  |

Each means 4 miles.

How many more miles did Brittany travel by canoe than Amanda? Mark your answer.

12 miles

8 miles

4 miles

36 miles

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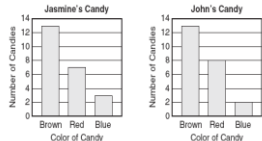
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## 4<sup>th</sup> Grade Data Analysis & Probability

59 John and Jasmine each recorded the color of the candies in their bag. The results are graphed below.



Based on the data in the graphs, which is true?

- A Jasmine had more red candies than John.
- B Jasmine and John had the same number of blue candies.
- C John had more brown candies than Jasmine.
- D John and Jasmine had the same number of brown candies.

13 The diagram below shows the types of meals and salads available at a restaurant buffet.



How many combinations of 1 meat and 1 salad are possible?

- A 7
- B 9
- C 12
- D 16

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## 5<sup>th</sup> Grade Data Analysis & Probability

55 The chart below shows the amount of time Erin and Amanda each spent on the phone each day last week.

| Time Spent on the Phone |                |                  |
|-------------------------|----------------|------------------|
| Day                     | Erin's Minutes | Amanda's Minutes |
| Monday                  | 8              | 15               |
| Tuesday                 | 10             | 0                |
| Wednesday               | 30             | 45               |
| Thursday                | 12             | 5                |
| Friday                  | 25             | 30               |
| Saturday                | 30             | 20               |
| Sunday                  | 5              | 25               |

How many more minutes did Amanda spend on the phone last week than Erin?

- A 10
- B 15
- C 20
- D 260

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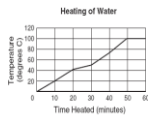
## 6<sup>th</sup> Grade Data Analysis & Probability

57 The data below show a set of Angela's golf scores. What is the mean of the scores listed?

- A 73
- B 82
- C 84
- D 88

84 88 88 77 73

33 During science class students were heating water and keeping track of the change in temperature by graphing the temperature as shown below.



According to the graph, what is true about the temperature of the water?

- A The temperature stopped changing between 20 and 30 minutes of heating.
- B The temperature changed a total of 120 degrees in the 60 minutes it was heated.
- C The temperature stayed the same for 10 minutes out of the 60 minutes it was heated.
- D The temperature changed about 60 degrees between 40 and 60 minutes of heating.

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## Examples of Manipulatives Appropriate for the Kansas Math Assessment

2010 - 2011 Kansas Accommodations Manual  
<http://www.ksde.org/Default.aspx?tabid=2372>

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• Base 10 blocks</li><li>• Chips, two-color counters, two-sided counters</li><li>• Clock or clock face</li><li>• Color tiles (squares)</li><li>• Cubes: multilink, connecting, color, wooden, unifix, multilink cubes</li><li>• Cuisenaire rods</li><li>• Geoboards</li><li>• Geometric solids</li><li>• Graph paper</li></ul> | <ul style="list-style-type: none"><li>• Hundreds chart</li><li>• Integer number line</li><li>• Money</li><li>• Number cubes</li><li>• Pattern blocks</li><li>• Rulers*, meter sticks*, protractors*, compass*</li><li>• Snap blocks</li><li>• Spinners</li><li>• Transparent mirror or mira</li></ul> |
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## Other Math Resources

- Delta [www.delta-education.com](http://www.delta-education.com)
- Didax [www.didax.com](http://www.didax.com)
- ETA/Cuisenaire [www.eta-cuisenaire.com](http://www.eta-cuisenaire.com)
- Math Forum [www.mathforum.org](http://www.mathforum.org)
- Online Math Tutorial Videos  
[www.youtube.com/VideoTSBVI](http://www.youtube.com/VideoTSBVI)

101

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