The Big Book of Math Communicator Templates

The *Big Book of Math Communicator Templates* is the original book in the "Big Book" series of template books. It includes templates that can be used in every grade level from K-12. The book is best used by middle and high school teachers, and even though some templates may seem inappropriate for these grade levels, they are included so that students who need review or background for concepts developed in earlier grades can be helped.

With each of the four chapters in the *Big Book of Math Communicator Templates*, there is an overview to suggest ways in which the templates can be used, and there are also suggestions included with each sub-topic of each chapter. As you review the topics below, you will realize the wide choice of images that are available for each topic. This variety allows you to choose a template that will meet the needs of your students' current developmental understanding. As you become more and more familiar with the templates, you will think of many additional templates that could have been made or of ways to use the templates in other classes. You are encouraged to design your own templates. The Communicator® is only limited by the imaginations of all of us. The possibilities are infinite!

Big Book of Math Communicator Templates

Chapter 1: Number Sense and Place Value

Whole Numbers (Place Value)*

Whole Number Operations (Hundred Chart, Multiplication Chart)

Area Models for Decimals (Hundredth Squares, Tenth Squares)

Linear Models for Decimals (Line segments divided into tenths, line segments divided into hundredths)

Concepts of Fractions (Circles partitioned into 3^rds^, 4^ths^, etc., rectangle partitioned into 3^rds^, 4^ths^ etc)

Connecting Fractions and Decimals (Decimal fraction equivalence sheet)

Chapter 2: Measurement

Money (Various combinations of coins showing heads and tails)

Time (Various clock templates with and without hours/minutes displayed)

U.S. Customary Liquid Measure (Various sets of container showing ounces and or cups, quarts, etc.)

U.S. Customary Mass Measure (A scale with various weight gradations)

Angle Measure (degrees) (Three protractors with various markings)

U.S. Customary Linear Measure (Giant inches, 6-inch rules with gradations marked

U.S. Customary Measures and Metric Measures (Various sets of containers/rules showing metric and U.S. customary markings)

Chapter 3: Algebra and Algebraic Thinking

Integers and Number Lines (Various number lines with and without labels)

Graphs and Grids. (Various size four quadrant grids with and without labels)

Function Machines and XY Tables (Input/output tables)

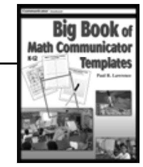
Chapter 4: Assessments, Games and Manipulatives

Discovery Sheets (Sets of related concepts arranged by characteristics so that comparisons and higher level questions can be asked.)

Answer Sheets (Various forms of bubble type answer sheets)

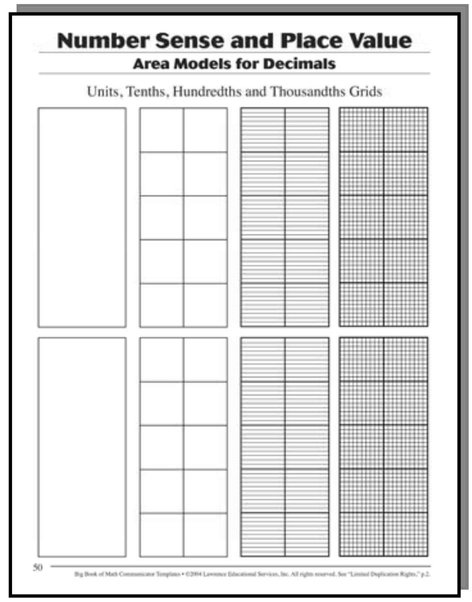
Game Sheets and Manipulatives. (Various size bingo boards, tangrams, pattern blocks, geoboard)

*Descriptions in parentheses only indicate some of the templates in a section.



Units, Tenths, Hundredths and Thousandths Grids

The four rectangles across the page are all equal in area. The one on the left represents units. The second, tenths and the third and fourth, hundredths and thousandths. This grid can be used to show decimal equivalents, expanded form of decimals, comparison of decimals and addition and subtraction of decimals.



(Reproducible template included at the end of this brochure.)

Modeling and comparing tenths, hundredths and thousandths

Have students place the Communicator® clearboard on top of template. To compare tenths, hundredths, and thousandths, have students shade three tenths on the tenths rectangle, three hundredths on the hundredths rectangle and three thousandths on the thousandths rectangle. Students should see the dramatic different among the size of tenths, hundredths and thousandths.

Have students shade 0.4 on the tenths rectangle, 0.23 on the hundredth rectangle, and 0.350 on the thousandths rectangle. Through questioning, establish that they can compare the size of the decimals by comparing the shading in each rectangle. The rectangle having the greatest area shaded is the largest decimal. The one with the smallest area shaded is the smallest decimal.

Establishing decimal equivalents

Have students place the Communicator® on top of the template. Have them shade three tenths on the tenths rectangle. Have them position the Communicator® on top of the hundredths rectangle so that the shaded tenths coincide with the rectangle. This clearly shows 0.3 – 0.30 because the shading of the three tenths also shows the shading of 0.30. Now position the Communicator® on top of the thousandths rectangle to see that 0.3 = 0.30 = 0.300.

Model thousands as expanded notation

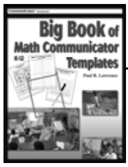
Have students shade 0.6 on the tenths rectangle, 0.03 on the hundredths rectangle and 0.008 on the thousandths rectangle. Through questioning, establish that 0.6 + 0.03 + 0.008 = 0.638. Now present students with the opposite modeling. Have them show 0.462 by showing 0.4 + 0.06 + 0.002 on the tenths, hundredths and thousandths rectangles.

Modeling thousandths on the thousandths rectangle

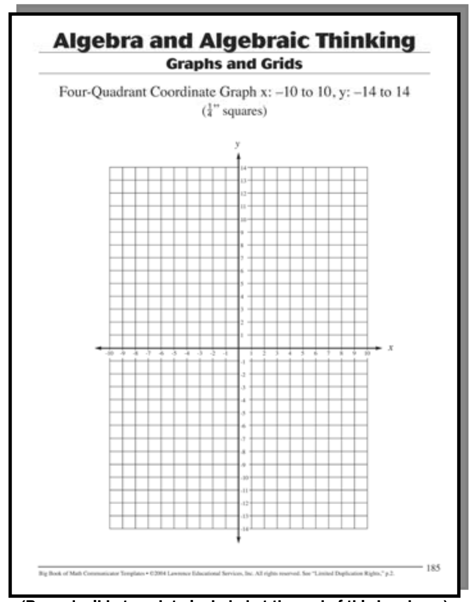
Have students show 0.346 on the thousandths rectangle. If students have difficulty with this, have them first shade 0.3 on the thousandths rectangle by shading three squares. Then have them shade 0.04 by shading an additional 4 rectangles that are not squares on the thousandths rectangle. Finally, have them shade 0.006 by adding 6 small squares to the shading already being displayed.

Comparing thousandths

To compare thousandths such as 0.456 and 0.412, have students shade the top thousandth rectangle to show 0.456 and the bottom one to show 0.412. When the size of the shadings are compared, it can be easily determined which is larger.



Four Quadrant Coordinate Grid



(Reproducible template included at the end of this brochure.)

By using the Communicator® clearboard, students will be able to create transformations, show inverse functions and the effects that changes in equations have on graphs.

Graphing the family of linear equations

Have students place the Communicator® on top of the grid. Have them graph the line $y = x$ and highlight the origin. To check understanding, have them show the graph. To check accuracy, have students remove the template from the Communicator®. Now place this Communicator® on top of the overhead, aligning the origin with a transparency you have made of the template and placed on the overhead.

Have students move the Communicator® up and down to show $y = x + 4$, or $y = x – 6$ *etc.* Also have them show $y = 2x$ and its related families of $y = 2x + 4$ *or* $y = 2x – 5$, etc..

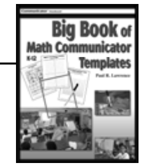
Have students use the Communicator® to graph $y = x$, and once again mark the origin. Have them turn the Communicator® over and align it with the origin. This, of course, shows the inverse graph of $y = -x$.

This same type of approach can be used to show families of parabolas, cubics etc.

Transformations

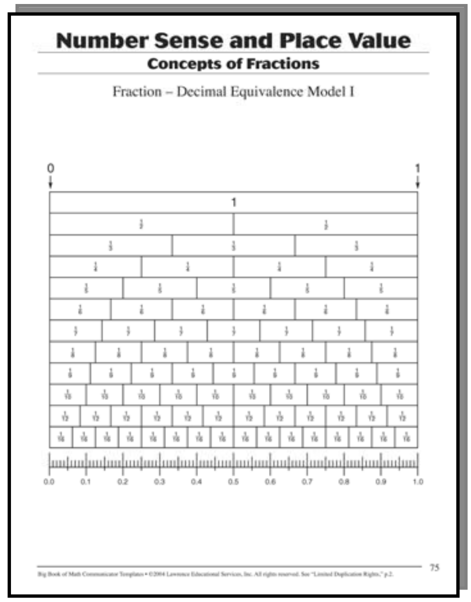
Have students place the Communicator® on top of the grid and create a polygon whose vertices are (3,4), (3, 10) and (10,4). Also have them mark the origin. To show various reflections, have students flip the Communicator® over toward them and position the origin to show the shape reflected over the *x* axis.

Reposition the Communicator® so the shape is in the original position. This time flip the Communicator® over to the left and position the origin to show a reflection over the *y* axis. Reposition the triangle and show a translation by moving the vertex at the right angle 10 units to the left and 10 units down. Reposition again and have students show rotations by rotating the Communicator® about the origin a selected number of degrees in a counterclockwise or clockwise position.



Fraction – Decimal Equivalence Model

The Fraction – Decimal Equivalence Model template can be used to compare fractions, determine fraction equivalencies, simplify fractions, add and subtract fractions with like and unlike denominators, and relate fractions to decimals.



(Reproducible template included at the end of this brochure.)

Equivalent fraction exercise: Use the halves strip to make a line segment that is half a unit in length. Use the fourths strip to make a line segment that is two fourths of the length of the fourths strip. Use the sixths strip to make a line segment that is three sixths of the length of the sixths strip. Then, continue making segments on appropriate strips that are 4/8, 5/10, 6/12, 8/16 and 50/100 in length.

Have students compare these lengths. It becomes clear that all the segments are equal in length, which means that all the fractions, regardless of their names, must be equal or represent the same thing. Write the equivalencies on the board or overhead and look for patterns to establish ways to change 1/2 to 4/8 or 1/2 to 3/6, etc.

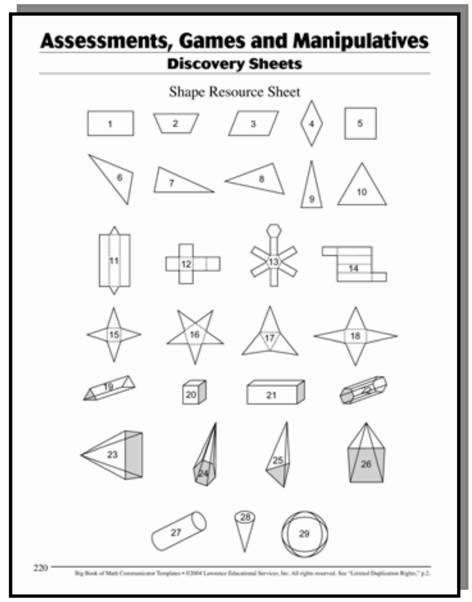
Adding fractions: Model adding 1/4 to 3/16 by having student draw a line segment on the fourths strip that is 1/4 of the unit in length. Now have them add to this line segment a length that is 3/16 of a unit in length. Since it is easier to use the sixteenths strip to model 16ths and because we want to extend the length of the original segment, it is important realize that if we move straight down on the sheet from the 1/4 to the 16ths, 1/4 becomes 4/16, and we can start to add the 3/16 to the end of the 4/16. The final length of both segments is read as 7/16. After students complete a series of these problems, it becomes obvious to them that changing the fraction to its equivalent is the best way to add fractions. Subtraction of fractions is basically the same, except the subtrahend is taken from the first fraction that is modeled.

Fraction/Decimal conversions: Using the fourths strip, have students draw a segment that is 1/4 of a unit long. Then, have them use a straight edge to mark a line straight down to the hundredths strip. Where the straight edge crosses the hundredths strip defines a segment that is 0.25 long. It will be equal to the segment that is 1/4 long. Extend their thinking by asking what the length of three-quarters would be if one-quarter is 0.25. Have students draw a segment that is 1/9 of a unit long on the ninths strip. Then take a straight edge and go straight down to the strip representing hundredths. Where it crosses will define a line segment that is APPROXIMATELY 0.11 in length. Therefore 1/9 is about 0.11. If 1/9 is about 0.11, what is the approximate value of 4/9 represented as 100ths? Once these conversions are established, use standard calculator procedures to transform fractions to decimals so students can make the connection between the answers obtained on the calculator and those they have demonstrated visually on the template.

Shape Resource Sheet

One of the many uses of the Communicator® clearboard is as a device to check for students' understanding of concepts at the end of a unit, to look for and describe patterns among sets of numbers or objects, or to compare and contrast concepts within or across strands.

After you have taught shape classification, the concept of nets and their connection to various solids, use this sheet and the set of questions provided below. At upper grade levels, this same set of questions could be used to assess student retention and understanding before a unit on shape is taught.



(Reproducible template included at the end of this brochure.)

Activities: Study the Shape Resource Sheet. Study numbers 1-10 and 19-29. Use your Communicator® clearboard to record the difference between these two sets of shapes. (Numbers 19-29 are solid, three-dimensional shapes. Numbers 1-10 are not solid; they are two-dimensional shapes.)

Study shapes 6-10. Use your Communicator® clearboard to record the name of all these shapes. (Triangles)

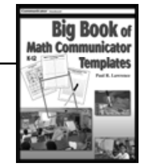
Study shapes 19-22 and 23-26. Use your Communicator® clearboard to describe the difference between these two sets of solids or three-dimensional shapes. (Shapes 19-22 are prisms, and shapes 23-26 are pyramids.) Use your Communicator® clearboard to record what the difference is between prisms and pyramids. (Prisms have two bases. Pyramids have only one.)

Study shapes 11-14. These shapes are nets, which are two-dimensional plans that when cut up and folded, will make three-dimensional objects. What kinds of shapes are in each one from 11-14? (Rectangles.) If number 11 is folded, what shape do you think it would fold into? Choose from shapes 19-26. (Nineteen; it has two triangles, one at each base, and three rectangles as the other sides/faces.)

Study shapes 11-14. What solid do you think net 14 will fold into? Record your guess on the Communicator® clearboard. (21) Why? (There are two squares and four rectangles, which also appear as faces/sides in the rectangular prism.)

Study nets 15-18. Use your Communicator® clearboard to record how 15-18 are different from nets 11-14. (There are triangles in each one of nets 15-18.) Which solid do you think net 16 will make? (25) Why? (The triangular pyramid has all triangles. The net has all triangles.)

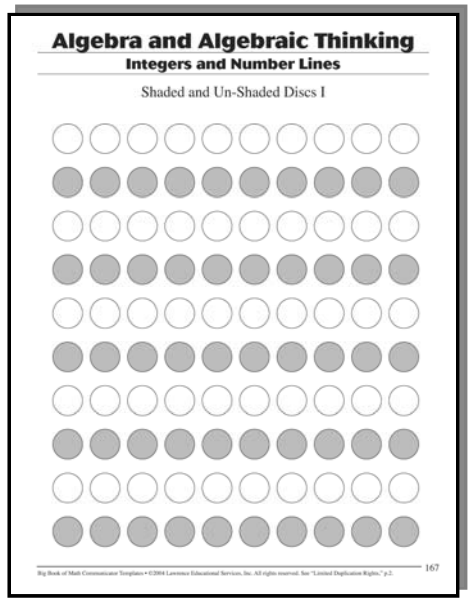
How are solids 19-26 different from solids 27-29? (27-29 have circular parts. In 19-26, there are no circular parts.)



Shaded and Un-shaded Discs

On the other side is one of the two templates that show Shaded and Un-shaded Discs (Pp. 167-168) from the Big Book of Math Communicator Templates. Carefully sequenced sets of problems from these pages can help students discover traditional rules for adding, subtracting, multiplying and dividing integers.

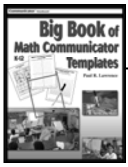
Tell students they will be asked to circle sets of shaded and un-shaded discs and then combine them together using knowledge that whenever a shaded and un-shaded disc are circled in the same problem, they count as a zero pair and can be removed from the problem.



(Reproducible template included at the end of this brochure.)

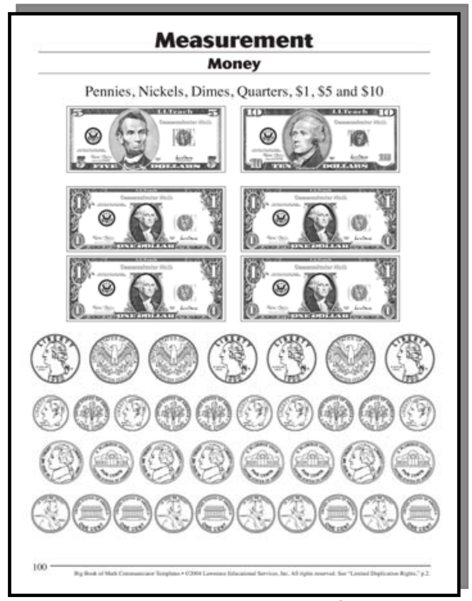
Examples:
Circle 3 shaded discs. Now circle 4 shaded discs. How many discs are circled? (7) Are they shaded or un-shaded? (shaded)
Circle 4 un-shaded discs. Now circle 5 more un-shaded discs. How many discs are circled? (9) Are they shaded or un-shaded? (un-shaded)
Circle 5 shaded discs and 4 un-shaded discs. Remove the zero pairs. How many discs are left? (1) Is it shaded or un-shaded? (shaded)
Circle 8 shaded discs and 9 un-shaded discs. Remove the zero pairs. How many discs are left? (1) Is it shaded or un-shaded? (un-shaded)

Complete 5–10 of the type of problems shown. Then have the students look for and describe the pattern when “shaded” is the answer and “un-shaded” is the answer. After the discovery, attach positive and negative signs to numbers and have students mark or visualize the discs as you complete problems.



Pennies, Nickels, Dimes, Quarters, $1, $5 and $10

This is only one of the many coin/dollar templates provided in the Big Book of Math Communicator Templates, pages 93-100. Review the templates and choose the one that is developmentally appropriate for your students. The coin/dollar templates can be used to show various amounts of money or can be used to count change of specific quantities from $1, $5 $10 or $20 bills. (Note: Having the students turn the Communicator® clearboard over after they write their answer ensures that students who are still considering the answer will not be influenced by what those around them have written.)



(Reproducible template included at the end of this brochure.)

Try some of these problems using the coin and dollar template provided.

Use your Communicator® clearboard to show how to make $0.45 with exactly 3 coins. Turn over the Communicator® clearboard. On the count of 3, show your answer. (1 quarter, 2 dimes.)

Use your Communicator® clearboard to show how to make $0.34 with exactly 8 coins. Turn over the Communicator® clearboard. On the count of 3, show your answer. (2 dimes, 2 nickels and 4 pennies.)

Use your Communicator® clearboard to record the fewest number of coins to show the change that would be given from $1.00 if the cost of the item is $0.83. Turn over the Communicator® clearboard. On the count of 3, show your answer. (2 pennies to $0.85, 1 nickel to $0.90, then one dime to a $1.00)

Use your Communicator® clearboard to record the fewest number of coins to show the change that would be given from $1.00 if the cost of the item is $0.35. Turn over the Communicator® clearboard. On the count of 3, show your answer. (1 nickel to $0.40, 1 dime to $0.50, then two quarters to a $1.00)

Use your Communicator® clearboard to record the fewest number of coins to show the change that would be given from $1.00 if the cost of the item is $0.36. Turn over the Communicator® clearboard. On the count of 3, show your answer. (4 pennies to $0.40, one dime to $0.50, and then two quarters to a $1.00)

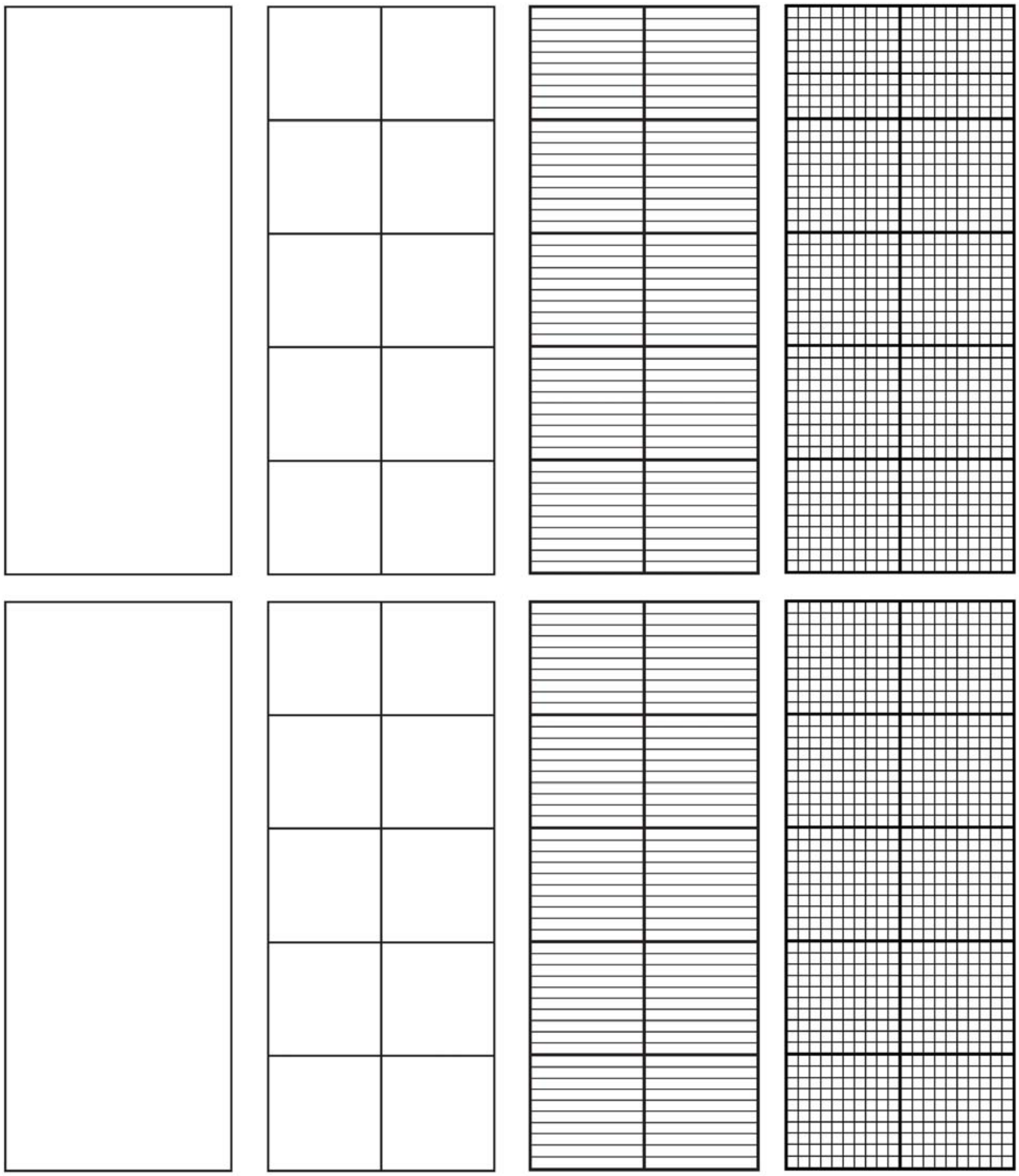
Use your Communicator® clearboard to record the fewest number of coins and bills to show the change that would be given from $5.00 if the cost of the item is $2.58. Turn over the Communicator® clearboard. On the count of 3, show your answer. (2 pennies to $2.60, 1 dime to $2.70, 1 nickel to $2.75, one quarter to $3.00 and then two $1 to $5.00)

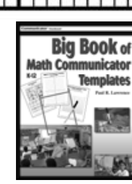
Use your Communicator® clearboard to record the fewest number of coins and bills to show the change that would be given from $10.00 if the cost of the item is $2.68. Turn over the Communicator® clearboard. On the count of 3, show your answer. (2 pennies to $2.70, 1 nickel to $2.75, one quarter to $3.00, two $1 to $5.00 and then one $5 to $10.00)

Number Sense and Place Value

Area Models for Decimals

Units, Tenths, Hundredths and Thousandths Grids



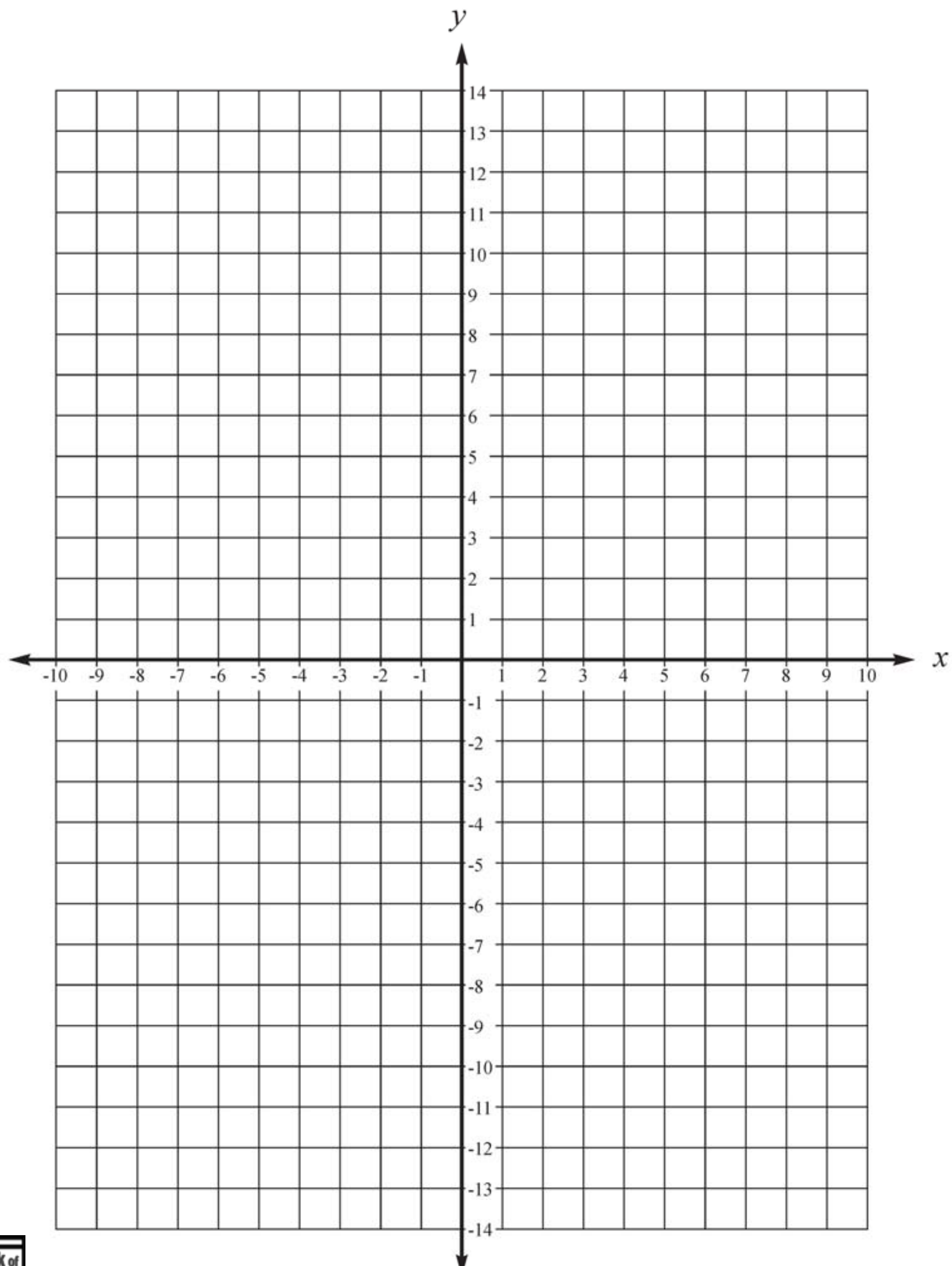


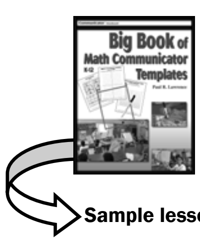
Sample lesson on Page 27.

Algebra and Algebraic Thinking

Graphs and Grids

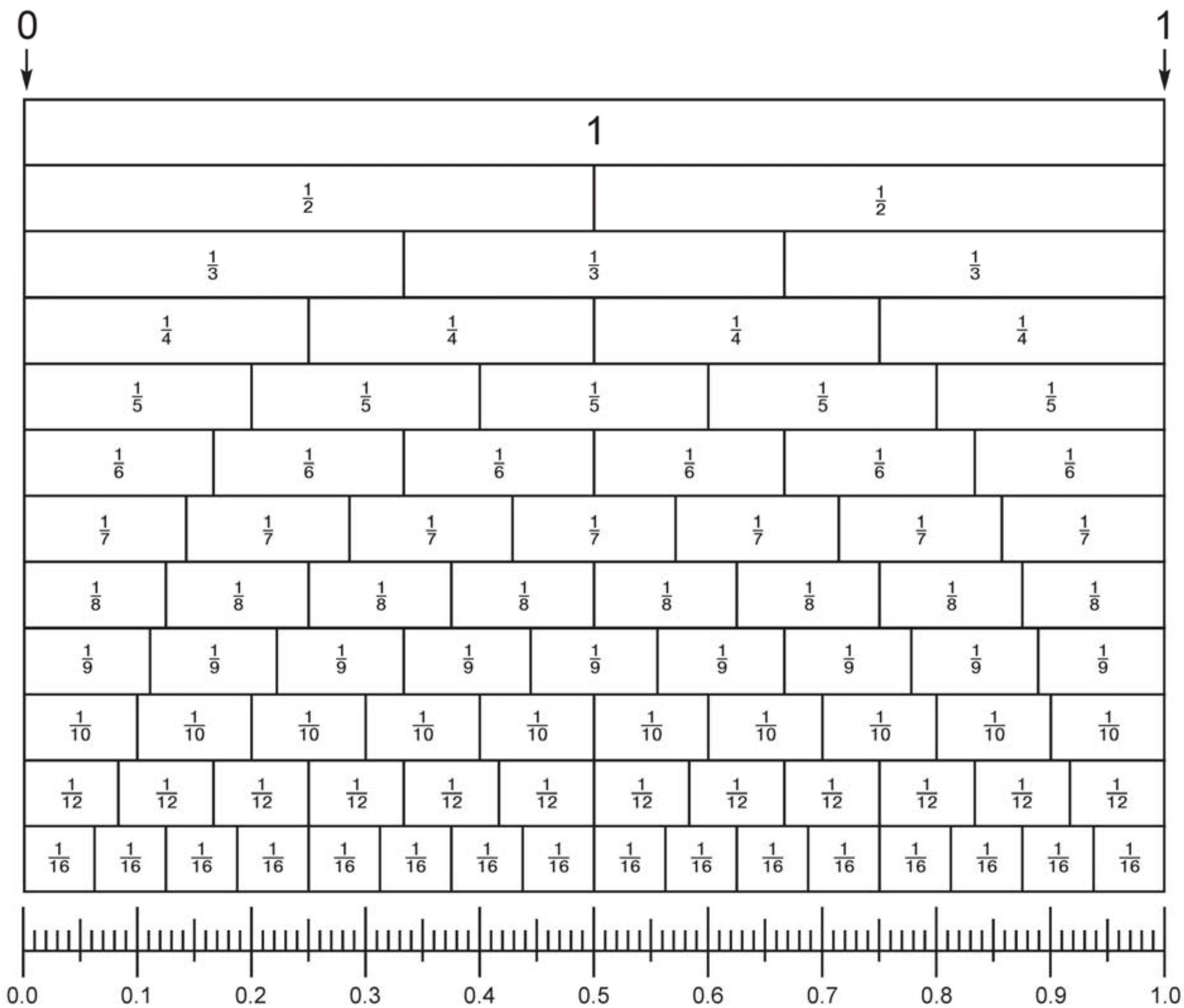
Four-Quadrant Coordinate Graph x: –10 to 10, y: –14 to 14
($\frac{1}{4}$" squares)





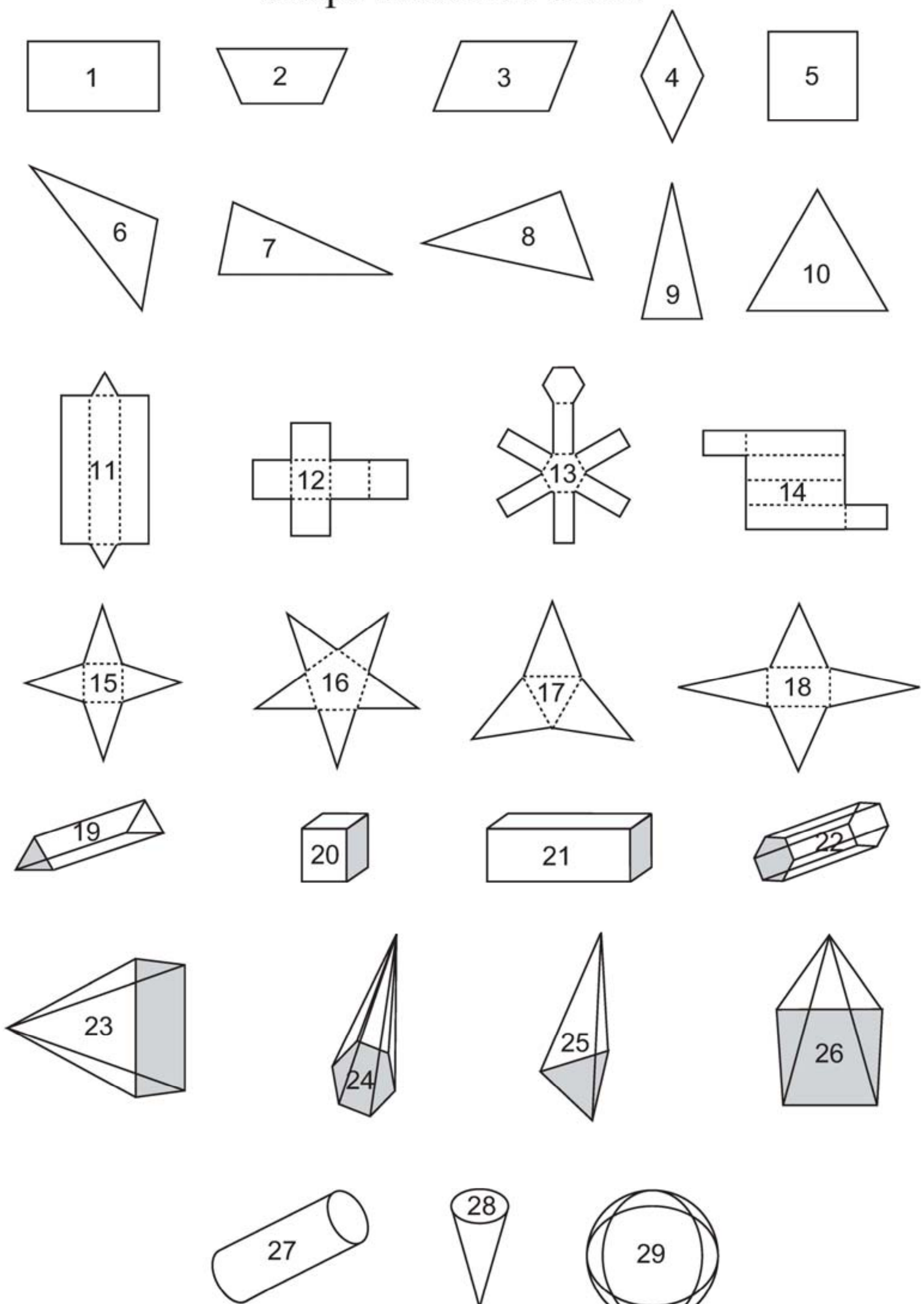
Sample lesson on Page 28.

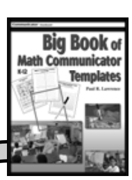
Fraction – Decimal Equivalence Model I



Sample lesson on Page 29.

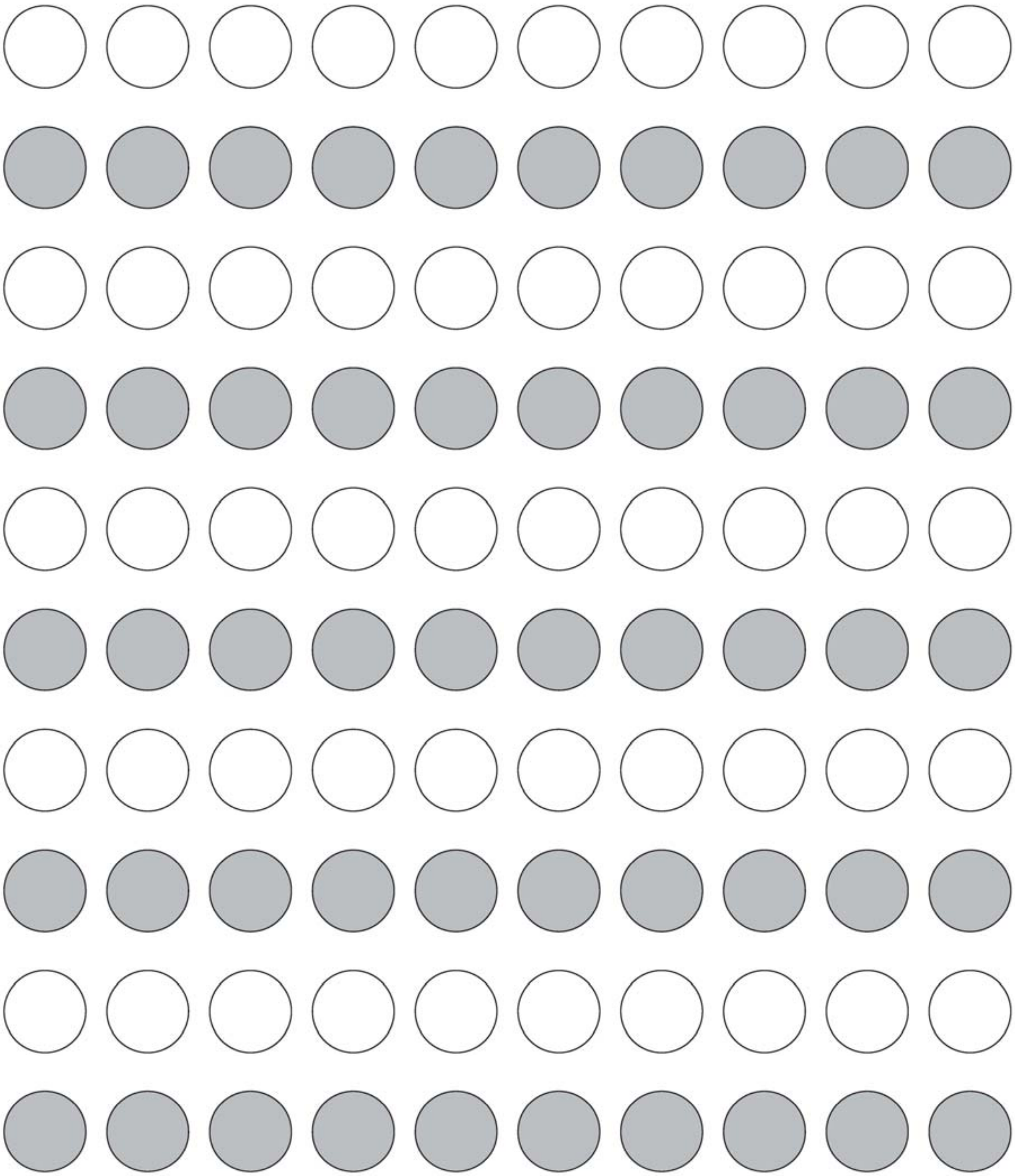
Shape Resource Sheet





Sample lesson on Page 30.

Shaded and Un-Shaded Discs I

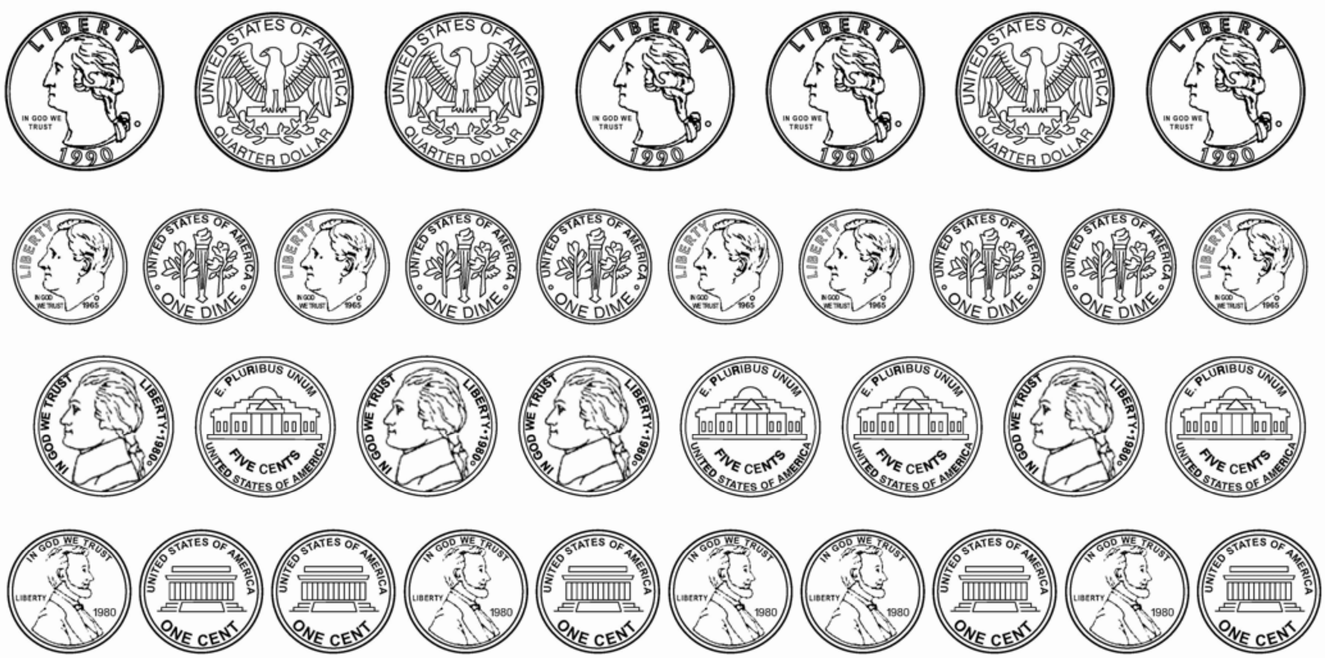


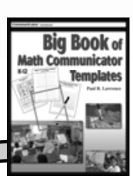
Sample lesson on Page 31.

Measurement

Money

Pennies, Nickels, Dimes, Quarters, $1, $5 and $10





Sample lesson on Page 32.