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Teaching Math with Everyday Manipulatives Curriculum Map

The major curriculum expectations are brought to life with these hands-on activities that involve students directly in their learning.

There is no better way to learn concepts than to experience them, and with these activities' students create their own math manipulatives with everyday items found in the classroom or at home.

Whether you use these at the start or conclusion of math lessons, or as the basis of individual or group work, you'll find them a valuable addition to your teaching strategies.

You should find many of these activities adaptable in terms of actual materials used. For example, if the activity suggests "buttons", often "pennies" can be used. Many activities suggest a game to play and implies that the games are 2 Player games, however, many activities can have more than two students and often, a single person can follow the steps alone.

Finally, most of the activities are suitable for the average Grade 4, 5, or 6 students. While some activities will be quite challenging for Grade 4 or review for Grade 6, many can be adapted to each of the grade levels.

Teachers can set the standard that they expect their students to achieve by showing examples of students who are performing the activity at the expected level. For example, save a student sample of a graph or pattern (take a picture if it was done with manipulatives) of a suitable level of work and leave it at the centre.

Students working below or above grade level should be encouraged to work to the best of their own ability. Students who achieve below grade level results should be encouraged to watch and learn from others and observe how they are getting their results.

Students working above grade level should be encouraged to model how they are working through the activity. Encourage peer teaching whenever possible.

The NCTM standards covered are included with each topic.

Teacher Notes Include:

- At a Glance – Learning Expectations Covered
- Teacher Rubric
- Student Rubric
- Teacher Suggestions

Everyday Manipulatives for:**Number Sense and Numeration**

Number sense and numeration/operations is the ability to relate numbers to the quantities they represent. Numeration/operations are the computations that students perform with numbers. Manipulatives should be used to help students use representations, develop mathematical thinking and reasoning skills and to create problem solving strategies.

Main Objectives:

- Numeration and place value
- Arithmetic functions with whole numbers, rational numbers, and integers (break down to add/subtract, multiply/divide, rationales, integers)
- Fractions, decimals, and percents

Worksheet Topics:

1. Estimation Jars
2. Place Value
3. Number Contest
4. Multiplying Mania
5. Figuring Fractions
6. Spinning In Circles
7. Multiple Arrays
8. Grid Division
9. Grid Fractions
10. Dice Fractions
11. Equality Pies
12. Lining Up Decimals
13. Dividing Dice
14. Estimating Decimals
15. Bull's Eye Estimates
16. Array Division
17. Base Ten Estimation
18. Adding Fractions with Cuisenaire Rods

Geometry

Geometry is the study of spatial patterns and learning to make sense of objects and locations in their physical environment. Manipulatives should be used to help students focus on representations, reasoning skills and to develop mathematical arguments. These activities with regular practice over time, allow students to develop stronger geometry skills.

Main Objectives:

- Two- and three-dimensional shapes
- Symmetry and translation

Worksheet Topics:

1. Three Terrific Angles
2. Triangle Classification
3. Shapes are Everywhere
4. Spin the Line
5. Secret Polygon
6. All About Solids
7. Design a Cube
8. Grid Lock
9. Battleship - Coordinates
10. Congruent Angles
11. Classifying 3D Shapes

Measurement

Measurement is assigning a numerical value to a given attribute by physically measuring it. It combines geometry and number strands. Manipulatives should be used to help students focus on choosing a unit of measure and comparing it to the object and reporting the measurement. Developing estimation strategies and understanding the relationship between various measurements are also a benefit of using manipulatives. The activities suggested in this book should, with regular practice over time, allow students to develop stronger measurement skills.

Main Objectives:

- Distance, in appropriate units
- Time, in appropriate units
- Perimeter and area
- Volume and surface area

Worksheet Topics:

1. Presenting Perimeters
2. Perfect Perimeters
3. Area and Perimeter
4. Area
5. Shopping Time
6. Dining Out
7. Measuring Mania
8. Container Capacity
9. Measuring Mass
10. Time and Time Again
11. Surface Area of 3D Shapes

Data and Probability

Data and probability are the study of information about the world by collecting data and using the information to answer questions and make judgments based on experience. Manipulatives should be used to help students collect and represent data. The activities suggested in this book should, with regular practise over time, allow students to develop stronger data and probability skills.

Main Objectives:

- Chance and probability
- Data collection and management
- Measurement of central tendency

Worksheet Topics:

1. Cool Cuisenaire Rods
2. Probability Practice
3. Dice Tally
4. Double Probability
5. Predicting with Data
6. Temperature Data
7. Forward or Stop
8. Probability Picks
9. Spinning Probabilities
10. Rolling for Outcomes

Algebra

Algebra is the study of the relationships between quantities, the use of symbols and the study of change. Manipulatives should be used to help students focus on looking for and making mathematical observations and resulting predictions with words, symbols and math sentences. The activities suggested in this book should, with regular practice over time, allow students to develop stronger algebra skills

Main Objectives:

- Patterns and variables
- Graphical representation

Worksheet Topics:

1. Graphing a Line Plot
2. Growth Patterns
3. Munching Numbers
4. Algebra
5. Comparing Graphs
6. Perfect Problem Solvers
7. Stem and Leaf Plots
8. Fun with Polygons
9. Slide and Switch
10. Pattern Blocks

Data & Probability



Overview:

Data and probability is the study of information about the world by collecting data and using the information to answer questions and make judgments based on experience. Manipulatives should be used to help students collect and represent data. The activities suggested in this book should, with regular practise over time, allow students to develop stronger data and probability skills.

The NCTM Standards for the Junior Grade levels suggest that students should:

- design investigations to address a question and consider how data-collection methods affect the nature of the data set;
- collect data using observations, surveys, and experiments;
- represent data using tables and graphs such as line plots, bar graphs, and line graphs;
- recognize the differences in representing categorical and numerical data;
- describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed;
- use measures of center, focusing on the median, and understand what each does and does not indicate about the data set;
- compare different representations of the same data and evaluate how well each representation shows important aspects of the data;
- propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions;
- describe events as likely or unlikely and discuss the degree of likelihood using such words as certain, equally likely, and impossible;
- predict the probability of outcomes of simple experiments and test the predictions;
- understand that the measure of the likelihood of an event can be represented by a number from 0 to 1.

Teacher Preparation Notes:

Probability Picks (page 62)

Put out (or set guidelines) that are suitable for your students' skill level. Early Junior students may do best with less objects to start with and 2 or 3 different colors/designs, etc. As students progress, they may be able to expand the total number of objects and the number of "different" items. For example, younger students may use 15 coins (10 pennies and 5 nickels) or 15 buttons (5 white, 5 black, and 5 blue). Older students may use a larger number of objects with more variations.

Cool Cuisenaire Rods



You Will Need:

- stiff paper of ten different colors (see page 80)
- scissors
- Ziplock bag with your name on it

Steps:

1. Carefully trace and cut out each of the rectangles and color them according to their label.
2. Label them all with a fraction. For example the smallest, white ones should all be labeled $1/10$.
3. Discover the relationships between the rods. For example, 10 white rods are equal to one orange rod.
4. Write 5 equivalent fractions based on what you have learned about the relationships, for example, $10/10 = 1$.

Example:



$$2/4 = 1/2$$

5. Store these in the baggie.

Probability Practice



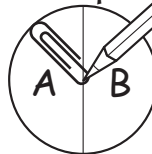
You Will Need:

- circular object, about 10 centimeters (4 inches) in diameter (lid from a jar or plastic container, small paper plate, etc.)
- blank paper
- scissors
- ruler
- paperclip

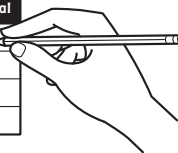
Steps:

1. Trace and cut out 4 circles.
2. Using a ruler, divide the circles into sections labeled A and B so that:
 - a) In 100 spins it will likely land on A 30 times.
 - b) In 100 spins it will likely land on A 60 times.
 - c) In 100 spins it will likely land on A 75 times.
 - d) In 100 spins it will likely land on A 90 times.
3. Now, hold the paperclip with a pencil in the middle of the circle and spin it 100 times.
4. For each circle, make a sketch of how you divided it, and record how many times the paperclip actually did land on A.

Example:



Prediction	Actual
50	53
60	
75	
90	



Circle	Sketch	Prediction – In 100 spins the paperclip will land on A:	Actual – In 100 spins the paperclip landed on A:
1.		30 times	_____ times
2.		60 times	_____ times
3.		75 times	_____ times
4.		90 times	_____ times

Extension:

1. Divide the circles into 3 or 4 sections, labeled, A, B, C and D.
2. Exchange them with a friend and have them predict how often the spinner will land on each of the letters in 100 spins.
3. Record the actual results.

Dice Tally

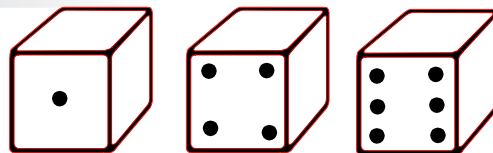


You Will Need:

- 2 or 3 die

Steps:

1. Take turns rolling the die.
2. Record (with a check mark) each time a sum is rolled. Record your results in the tally sheet below. (Sums will continue to 12 if two die are used, and 18 if three die are used).
3. The first Player to roll the same sum 10 times is the Winner.



Tally Sheet

Sum	Tally	Sum	Tally
	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓		✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
1		10	
2		11	
3		12	
4		13	
5		14	
6		15	
7		16	
8		17	
9		18	

Double Probability

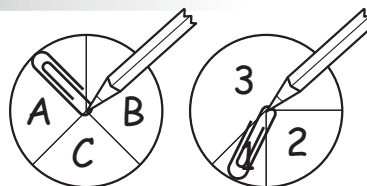


You Will Need:

- circular object, about 10 centimeters (4 inches) in diameter (lid from a jar or plastic container, small paper plate, etc.)
- blank paper
- scissors
- ruler
- paperclip

Steps:

1. Trace and cut out 2 circles.
2. Divide one circle into 3 sections (any size) labeled A, B and C. Divide the other circle into 3 sections labeled 1, 2, and 3.
3. In the chart below, list all possible combinations of outcomes if both spinners were spun (for example, A1, B1, etc.). There will be 9 combinations.
4. Based on the size of the different sections, circle the combination that you think will happen the most often. Underline the combination that you think will happen the least often.
5. Spin both spinners and keep a tally record (with check marks) of how often each combination is spun.
6. After 50 spins check to see if your predictions were correct.



Tally Sheet

Combination	Tally (✓)
A1	✓✓✓
B1	✓✓✓✓
C1	✓✓

Tally Sheet

Combination	Tally (✓)

Predicting with Data



You Will Need:

- stopwatch (or a clock or watch with a second hand)

Steps:

- Choose a simple, repetitive task such as putting pennies into a container one at a time, printing your name, jumping jacks, etc.
- Player 1 does the task while Player 2 times them.
- When Player 1 has done the task 5 times, Player 2 says, "Stop" and records, in the data chart below, how many seconds it took.
- Player 1 keeps doing the task with Player 2 recording the times. When Player 1 has done the task a total of 25 times, the Players switch roles.
- Each Player then records their data on the graph. (Add the seconds that match your time.)
- Use the graph to predict how many seconds it would take to do the task 50 times and 100 times.

# Times Task is Done (in Seconds)	5	10	15	20
50				✓
40				
30		✓		
20	✓			

John Smith
John Smith
John Smith
John Smith
John Smith



Data Chart – Task:

Task Time in Seconds	# Times Task is Done					50 (Prediction)	100 (Prediction)
	5	10	15	20	25		
100							
90							
80							
70							
60							
50							
40							
30							
20							
10							
0							

Temperature Data

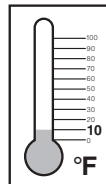


You Will Need:

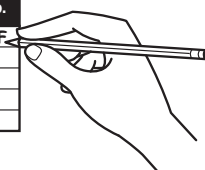
- thermometer

Steps:

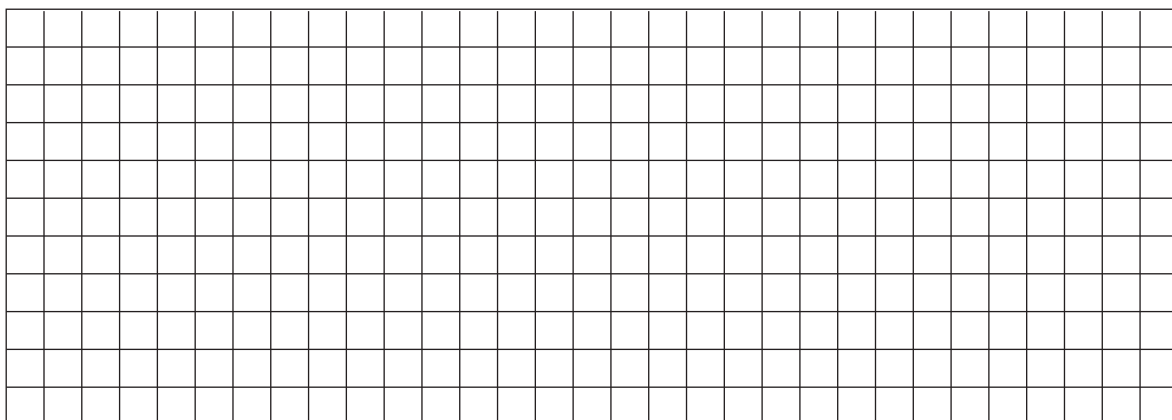
1. Measure and record the outside temperature at the same time of day, each school day for one month (30 days).
2. At the end of the month, display your data in the bar graph, line graph and pie chart below.
3. Write down 10 questions about your data. **(Examples:** Which day was the coldest? What was the mean (average) temperature? What was the median (middle) temperature? What was the mode (most common) temperature?)
4. Use your graphs to find the answers. Make a note of which graph you are using to answer each question.



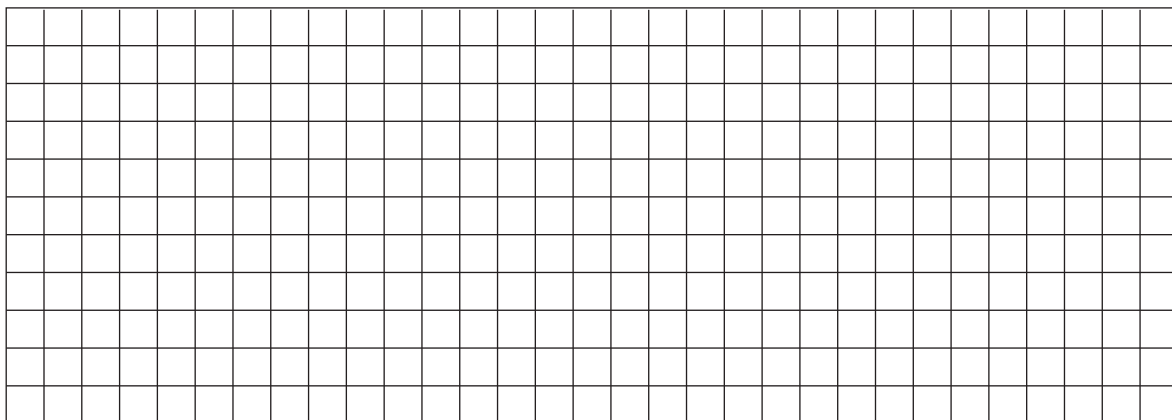
Day	Temp.
Monday	10 °F
Tuesday	
Wednesday	
Thursday	
Friday	



Bar Graph



Line Graph

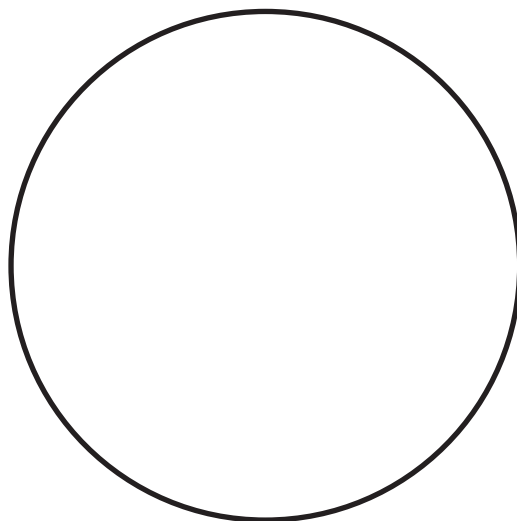


Temperature Data



Data & Probability

Pie Chart



Question	Answer	Graph Used to Solve
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Forward or Stop



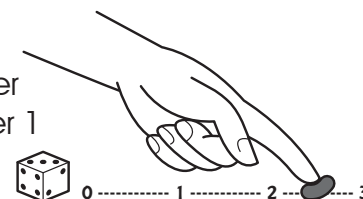
You Will Need:

- 2 counters of different colors (button, bean, tile, etc.), one for each player
- dice

0 ----- 1 ----- 2 ----- 3

Steps:

1. Both Players start at 0 on the number line above.
2. Player 1 rolls the dice. If it is even, they move their counter forward one space. If it is odd, they do not move. Player 1 rolls the dice two more times, and for each roll, moves their counter forward for even, or stops for odd.
3. After 3 rolls, Player 2 rolls the dice 3 times, and moves their counter on the number line.
4. For each roll record whether it is odd or even in the chart below, and write which number on the line you ended up on.
5. Each Player has a total of ten turns, with 3 rolls per turn.
6. Complete the chart below by putting tally marks in the proper column.



Turn	Position at End of Turn									
	Roll 1		Roll 2		Roll 3		Number Line Total			
	Odd	Even	Odd	Even	Odd	Even	0	1	2	3
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

7. Answer the following questions:

Which number did you land on the most? _____

Which number did you land on the least? _____

What is the probability of landing on: 0? _____ 1? _____ 2? _____ 3? _____

What is the probability of landing on a number higher than 1? _____

If you rolled the dice 3 times each turn, for 100 turns, what is the probability of ending up on: 0? _____ 1? _____ 2? _____ 3? _____

Probability Picks



You Will Need:

- objects
- container

Steps:

1. Put some objects into a container. Record below how many objects there are in total, and how many of each different object there are. (For example, "There are 30 buttons. 10 are purple; 15 are silver; 5 are yellow.")
2. Guess the probability of choosing 2 certain objects in 6 tries. (For example, "I think there is a 75% chance of choosing 2 silver buttons" or "I think there is a 25% chance of choosing a yellow and purple button".)
3. Then, reach into the container (without looking) and pick 2 objects. Record the results in the chart, and repeat for a total of 6 times.



How many objects are there in total? _____

How many of each is there? _____

Turn	Guess	Objects Pulled from Jar
1		
2		
3		
4		
5		
6		

4. Answer the following questions.

Why did you make the prediction that you did? _____

Was your guess close? Why or why not? _____

Did you get more accurate at guessing? _____

Do you think it would have made a difference if you had picked 100 times instead of 6? Why? _____

Spinning Probabilities



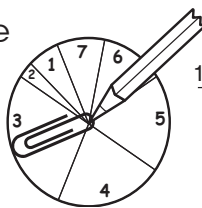
You Will Need:

- circle or small paper plate
- paperclip (to use as a spinner)

Steps:

1. Write 4 criteria for your spinner using "more likely" or "less likely" in each.

Examples: I will more likely spin a 3 than a 4. I will less likely spin a 1 or 2 than 3 or higher.



1. I will more likely spin a 3 than a 4

2. Create a spinner that fits all your criteria.
3. When your spinner is complete, spin the paperclip around a pencil tip 20 times and record the results. Include a sketch of your spinner.

My Criteria:

1. _____
2. _____
3. _____
4. _____

Sketch	Spin	Result	Spin	Result
	1		6	
	2		7	
	3		8	
	4		9	
	5		10	

Did the results of the spinning match your criteria? _____

Rolling for Outcomes



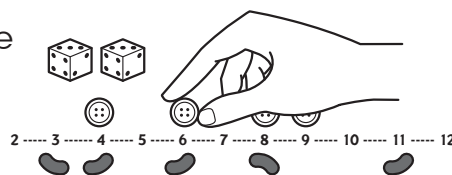
You Will Need:

- 10 counters (buttons, coins, etc.) for each Player (a different color or kind for each player)
- 2 die

2-----3-----4-----5-----6-----7-----8-----9-----10-----11-----12

Steps:

1. Each Player places their counters next to any of the numbers on the number line above. One Player should place their counters above the number and the other Player should place their's below the number.
2. Player 1 rolls both die and adds the two numbers together. If you have a counter at that number, remove it. (If you have more than one counter at that number, just remove one.) Record the result in the chart.
3. Player 2 rolls and removes a counter, if possible, and records the result.
4. The play continues until one Player has removed all their counters.



Turn	Sum of Dice	Action	Turn	Sum of Dice	Action
1			9		
2			10		
3			11		
4			12		
5			13		
6			14		
7			15		
8			16		

Extension:

1. Discuss how you chose to place your counters.
2. What would you do differently next time to improve your chances of removing all your counters first?

Cuisenaire Rods



white

1 cm



red

2 cm



light green

3 cm



purple

4 cm



yellow

5 cm



orange

10 cm



blue

9 cm



brown

8 cm



black

7 cm



dark green

6 cm