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Teaching Math with Everyday Manipulatives Curriculum Map

The major curriculum expectations for junior math 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 student. 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

<u>Everyday Manipulatives for:</u>

Number Sense and Numeration

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

Geometry

- Two and three dimensional shapes
- Symmetry and translation

Measurement

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

Data and Probability

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

Algebra

- Patterns and variables
- Graphical representation

Geometry

Overview:

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. The activities suggested in this book should, with regular practice over time, allow students to develop stronger geometry skills.

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

- identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes;
- classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids;
- investigate, describe, and reason about the results of subdividing, combining, and transforming shapes;
- explore congruence and similarity;
- make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions;
- describe location and movement using common language and geometric vocabulary;
- make and use coordinate systems to specify locations and to describe paths;
- find the distance between points along horizontal and vertical lines of a coordinate system;
- predict and describe the results of sliding, flipping, and turning two-dimensional shapes;
- describe a motion or a series of motions that will show that two shapes are congruent;
- identify and describe line and rotational symmetry in two- and three-dimensional shapes and designs;
- build and draw geometric objects;
- create and describe mental images of objects, patterns, and paths;
- identify and build a three-dimensional object from two-dimensional representations of that object;
- identify and draw a two-dimensional representation of a three-dimensional object;
- use geometric models to solve problems in other areas of mathematics, such as number and measurement;
- recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life.

Geometry

Teacher Preparation Notes:

All About Solids *(page 34)*

For this activity you need 2 shape cubes. One with a different drawing on each face: rectangular prism, hexagonal prism, triangular prism, square-based pyramid, pentagonal pyramid and the other with the words: name, faces, edges, perpendicular edges, parallel faces, and parallel edges written on each face.

Battleship *(page 37)*

In advance, laminate 2 copies of the coordinate grid (from page 37). Make 2 sets of "battleships" from sturdy strips of paper that will cover the squares of the grid in the following sizes 1, 2-square, 2, 3-square, 1, 4-square. Store these in labeled zip-lock bags or envelopes.

Congruent Angles *(page 38)*

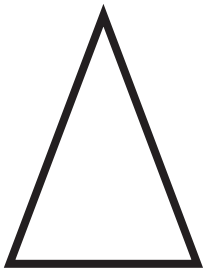
Gather items with various assorted angles and put them together in a basket or container. Since the students will be required to measure the angles, choose items that have angles that are appropriate for your students' skill level. If you keep this activity out over an extended time, simply exchange the items frequently to keep it fresh. As they improve in their speed and accuracy, you may choose to include a timer or stopwatch to further challenge them.

Classifying 3D Shapes *(page 39)*

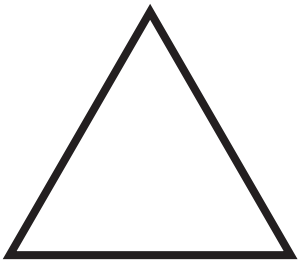
Either have the 3D shapes template available at this center, or you can do a prior lesson where all the students make their own 3D shapes.

Name: _____

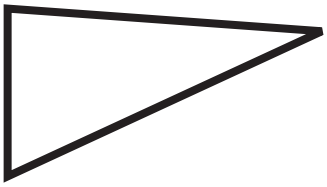
Three Terrific Triangles



isosceles
(2 equal sides)



equilateral
(3 equal sides)

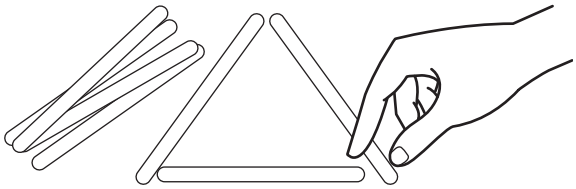


scalene
(no equal sides)

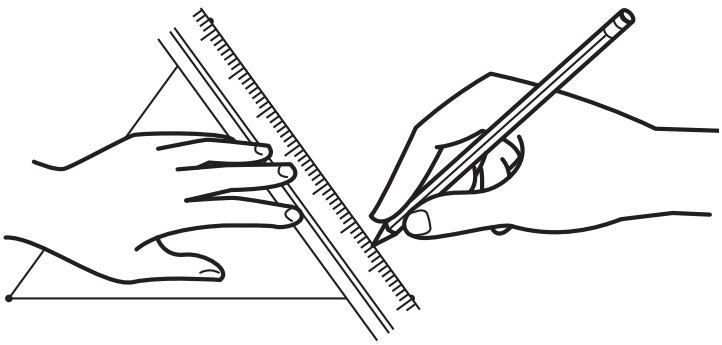
You Will Need:

- assorted lengths of popsicle sticks (or toothpicks or string or paper strips)
- ruler

Steps:

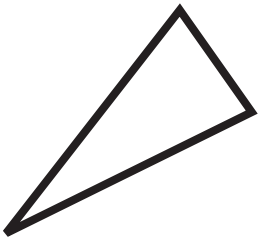


1. Make each of the three kinds of triangles.
2. Measure the sticks to find the ones with the lengths that you need.
3. On your paper, arrange the sticks to make each kind of triangle.
4. Use your pencil to mark the corners of each of the triangles.
5. Remove the sticks.
6. Use your ruler to draw the outline of the triangles, using the corner marks that you made.
7. Label your triangles.

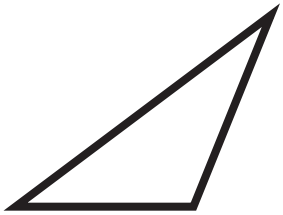


Name: _____

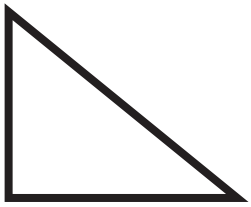
Triangle Classification



acute



obtuse



right -angle

You Will Need:

- toothpicks

Steps:

1. Create 6 different triangles. (**Tip:** Use 2, 3 or more toothpicks lined up together to create sides of different lengths.)

2. Complete the chart below for each triangle that you made.

Triangle Sketch	Kind of Triangle	Number of Acute Angles	Number of Obtuse Angles	Number of Right Angles
1.				
2.				
3.				
4.				
5.				
6.				

Name: _____

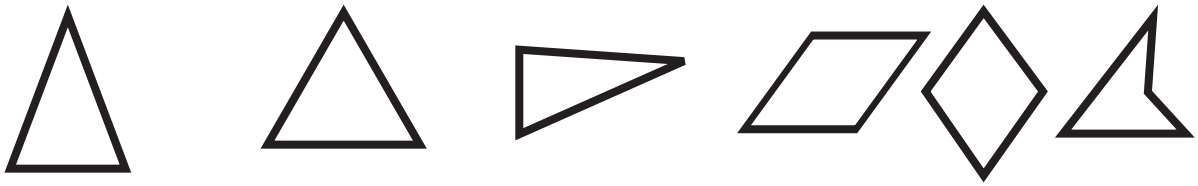
Shapes Are Everywhere!

You Will Need:

- old magazines, catalogs, flyers
- scissors and glue

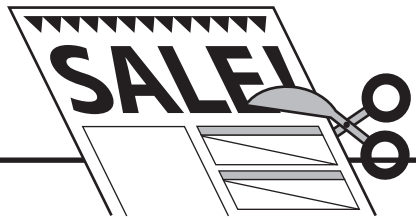
Steps:

1. Look through the magazine to find the following shapes:



isosceles triangle | **equilateral triangle** | **scalene** | **quadrilaterals**

2. Cut them out and glue them in the space below. Label them.



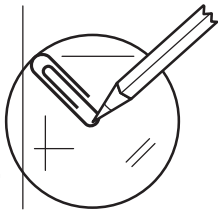
Name: _____

Spin the Line!

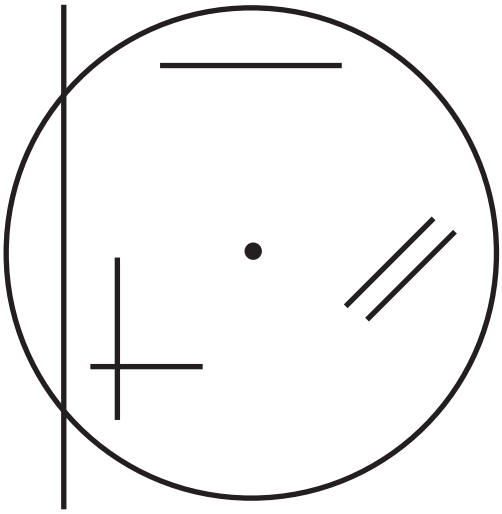
You Will Need:

- paperclip

Steps:



1. Put the paper clip in the middle of the circle (below) and hold it to the paper with your pencil.
2. Take turns spinning the paper clip around the pencil.
3. On the chart, draw an example of lines that the paper clip lands on.
4. The first person to fill in their side of the chart is the winner.



	Player 1: _____	Player 2: _____
Horizontal		
Vertical		
Parallel		
Intersecting		
Perpendicular		

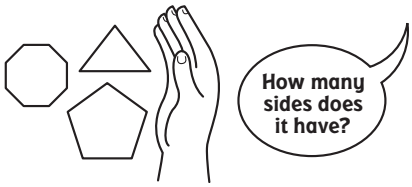
Name: _____

Secret Polygon

You Will Need:

- ruler
- coloring pencil

Steps:



1. Using a ruler and pencil, each Player draws 6 different polygons.
2. Player 1 secretly thinks about one of the polygons on their paper.
3. Player 2 asks questions about the secret polygon. (**Example:** How many sides does it have? How many right angles does it have?) Each question asked is worth 1 point for the Player who chose the secret polygon.
4. When Player 2 thinks they know the secret polygon, point it out. Each incorrect guess gives the other Player two points, so be quite sure about your guess!
5. Players switch roles. The Player with the most points after three guesses per Player is the winner!

My Polygons

Score Card	Total
Points for Questions Asked *(1 point each)*	
Points for Incorrect Guesses *(2 points each)*	
Total Score	
Points for Questions Asked *(1 point each)*	
Points for Incorrect Guesses *(2 points each)*	
Total Score	
Points for Questions Asked *(1 point each)*	
Points for Incorrect Guesses *(2 points each)*	
Total Score	

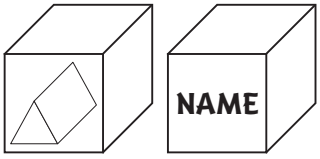
Name: _____

All About Solids

You Will Need:

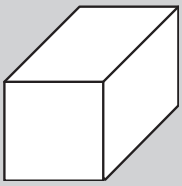
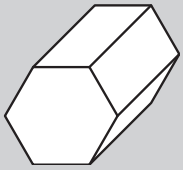
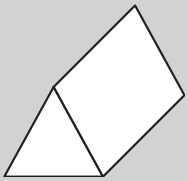
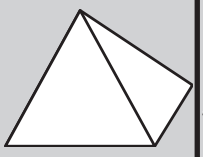
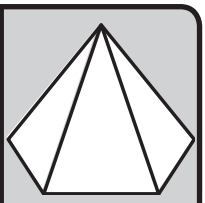
- 2 shape cubes (see instructions page 28)

Steps:



triangular prism

1. Player 1 rolls both dice.
2. On the chart, Player 1 fills in the answer of the second dice, about the solid rolled on the first dice. (If you roll a combination that you have already filled in, you miss your turn.)
3. Player 2 rolls both dice and fills in his or her chart.
4. Repeat steps 1 to 3. The first person to correctly fill in everything about all shapes is the winner.

Type of Solid					
Name					
Number of Faces					
Number of Edges					
Number of Perpendicular Edges					
Number of Parallel Faces					
Number of Parallel Edges					

Name: _____

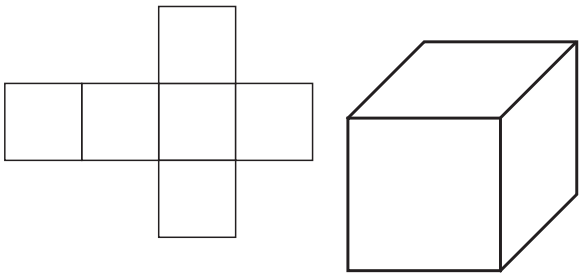
Design a Cube

You Will Need:

- scissors
- tape

Steps:

1. Use the template to make a hexomino (6 joined squares) that will fold into a cube.
2. Cut it out and fold it into a cube.
3. Now, design your own hexomino that is different from the one you just made. If it does not work, try another design.



4. How many different hexominos can you fold into cubes? _____

Hexomino Template

Extension:

Fold pentominos (5 joined squares) into a topless box.

Name: _____

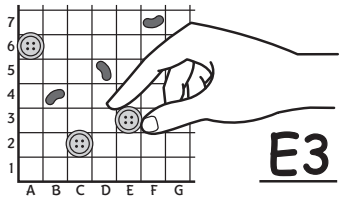
Grid Lock

You Will Need:

- 5 each of two different small objects (**Example:** 5 beans and 5 pennies, or 5 red buttons and 5 yellow buttons)

Steps:

1. Place 10 objects on the coordinate grid provided below.
2. Write down the coordinates of each of the 10 objects.



Coordinate Grid

	A	B	C	D	E	F	G	H	I	J	K	L
10												
9												
8												
7												
6												
5												
4												
3												
2												
1												

My Coordinates

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

5. _____ 6. _____ 7. _____ 8. _____

9. _____ 10. _____

Name: _____

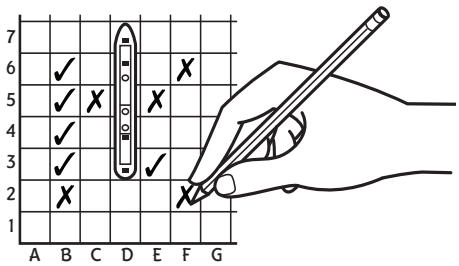
Battleship

You Will Need:

- copy of the coordinate grid below for each player
- 2 sets of "battleships" (see instructions page 28)

Steps:

1. Each Player secretly places their "ships" on their own grid.
2. Take turns guessing a coordinate where you think the other player may have hidden a ship.
3. Keep track by putting a check mark on your grid when you guess correctly and an X if there is nothing there.
4. The first player to find all 4 of the other Players ships wins.



Coordinate Grid

	A	B	C	D	E	F	G	H	I	J	K	L
10												
9												
8												
7												
6												
5												
4												
3												
2												
1												

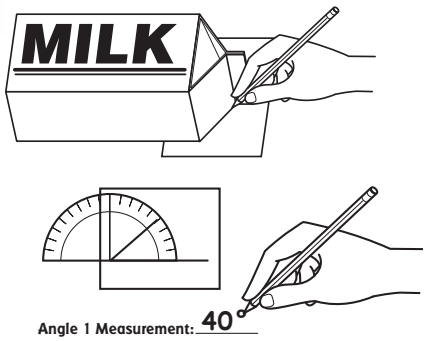
Name: _____

Congruent Angles

You Will Need:

- items with different angles
- protractor

Steps:



1. Choose an item and trace one angle on a sheet of paper.
2. Measure the angle with a protractor and record the measurement below.
3. Find another object with a congruent (same) angle and trace the angle.
4. Measure and record the second angle below.
5. Repeat steps 1 to 5 until you have traced 6 sets of congruent angles. Make sure that you do not trace the same angle that you have done before. For example, if your first angle is 90°, then you cannot choose another an angle with 90°.
6. How quickly did you trace 6 sets of congruent angles? _____

1. Angle 1 measurement: _____ Angle 2 measurement: _____
Are these angles congruent? _____

2. Angle 1 measurement: _____ Angle 2 measurement: _____
Are these angles congruent? _____

3. Angle 1 measurement: _____ Angle 2 measurement: _____
Are these angles congruent? _____

4. Angle 1 measurement: _____ Angle 2 measurement: _____
Are these angles congruent? _____

5. Angle 1 measurement: _____ Angle 2 measurement: _____
Are these angles congruent? _____

6. Angle 1 measurement: _____ Angle 2 measurement: _____
Are these angles congruent? _____

Name: _____

Classifying 3D Shapes

You Will Need:

- assorted small 3D objects
- Venn diagram (page 80)

Steps:

1. Think of a secret sorting rule and then sort the 3D shapes into the Venn diagram. (**Note:** some shapes may not fit the rule and can be left out.)
2. Sketch the objects below as you have sorted them. Write the sorting rule next to your sketch.
3. Repeat these steps using a new sorting rule until you have sketched and recorded 4 different sorting rules.
4. Recreate your sorting sketches for a friend, and see if he or she can guess each rule. You will need to cover the written rules with a piece of paper.

Sketch **Rule:** _____ _____	**Sketch** **Rule:** _____ _____
Sketch **Rule:** _____ _____	**Sketch** **Rule:** _____ _____