

Appendix K

Math Centers

Centers offer opportunities for students to practice and to extend math skills and concepts. Centers can differentiate tasks for various levels of learners and provide teachers with a wonderful opportunity to spark students' interests and connect mathematics to real situations.

Some teachers prefer to have all centers relate to the topic being studied (e.g., a variety of centers related to understanding the concept of time). In this way, students experience a variety of activities to reinforce and to extend the class lessons. Other teachers prefer to have centers on various math topics in order to provide repeated exposure to a variety of skills and concepts during the course of the year. These centers remain in the room throughout the year with ongoing changes in materials or directions to alter the activities. Whether you choose to have centers based on a unit of study or a variety of centers that remain in your classroom, the use of centers will engage students in the practice and extension of important skills.

Centers do not need to be labor-intensive for teachers. The following centers are easy to set up, and they encourage students to become engaged in the learning and application of mathematics. Changes in center activities may be as easy as posting a new direction sheet and introducing the new activity to the class. Refer to the Center Preparation Checklist at the end of this appendix for some useful guidelines.

Teachers should decide how to monitor the quality of student work while they are at centers. At times, teachers might choose to collect written tasks, while at other times, students may not be required to submit a written assignment. Teachers might have a Friday review during which center answers are shared (e.g., a discussion of estimates or a sharing of ways to solve the problem of the week). Some centers might include self-checking answer keys that are placed in envelopes at the centers. Also, some center work (e.g., art activities) can be displayed on a classroom bulletin board to promote quality work.

Some Center Ideas

The following are some easy-to-implement center ideas. There are many different ways to organize centers from general to quite specific. Rather than a Measurement Center, you might decide to have a Time Center, a Capacity Center, and/or a Temperature Center. There is not one *best* way to organize centers. The goal is to fit the activity ideas into your vision of centers for your classroom. The ideas here are intended to get you started.

Computer Center

Students might participate in computer-based math activities alone or with partners.

- Load software or locate a math website that has interactive math games for review of computation skills.
- Using a math software program, have students create a graph to display information.
- Have students use electronic manipulatives to investigate math concepts (see Appendix L for some websites that have a variety of e-manipulatives).
- Provide students with a PowerPoint template in which they can show what they have learned about a math topic (e.g., fractions, probability, polygons). Slides might include asking students to define a term, give a real-world example, or list some facts they have learned.

Estimation Center

Encourage students to practice their estimation skills at an Estimation Center. Post a weekly estimation task. The following are some possibilities.

- The height of their desk in blocks
- The amount of candy in a cup
- The number of seconds it takes to write their names 10 times
- The weight of a book in ounces
- The number of words in a paragraph from a newspaper

After estimating, have students record their estimates in a notebook or journal in the following way:

- I estimated . . . (name the item being estimated)
- My estimate is . . . (state the estimate)
- I think this is a close estimate because . . . (explain how the estimate was determined and why it makes sense)

After estimating, have students find the actual answers and compare them to their estimates, or teachers might decide to discuss all predictions on a designated day of the week and allow students to share their estimates and their strategies for finding them.

Geometry Center

Students can explore a variety of geometry skills, including identifying two-dimensional and three-dimensional shapes; understanding symmetry; and recognizing flips, slides, and turns. Here are some ideas.

- Have students sort and label various objects (e.g., buttons, blocks, plastic shapes). Ask them to draw and label a picture to show how the items were sorted.
- Put cardboard cutouts of shapes at the center and ask students to create crayon rubbings of the shapes by putting the cardboard cutouts beneath a sheet of paper and rubbing lightly across the paper with the crayon. When they have finished doing the rubbings, have them label each shape with the correct name.

- Provide students with the names of two-dimensional or three-dimensional shapes and ask them to draw and label pictures of real-world objects.
- Ask students to sort a variety of geometric figures into the categories of space (three-dimensional figures) or plane (two-dimensional figures). Have them record the items in two lists and explain the difference between the two groups of figures.
- Have students sort geometry vocabulary words into groups and label each group based on what the words have in common.
- Have students search through some magazines to find pictures that show symmetry. Ask them to glue the pictures on a paper and draw the lines of symmetry through each picture.
- Have students illustrate books about geometric concepts (e.g., symmetry or congruence).
- Ask students to fold a paper in fourths. Have them select a cutout shape that is available at the center (irregular shapes work well) and glue it in the top left quadrant. Have them label the other quadrants as flip, slide, and turn. Have them draw the shape as it would look after a flip, slide, or turn in each appropriate section of the paper. On the back of the page, have students define a flip, slide, and turn.
- Have students sort a variety of triangles (e.g., diagrams drawn on index cards) as to whether they are equilateral, isosceles, or scalene. Ask them to record the groupings and define each type of triangle. Or have students sort angles into the categories of acute, obtuse, or right. Have them record the groupings and define each type of angle.

Data Center

Data Centers allow students to create, interpret, and analyze a variety of graphs.

- Have students create a survey to gather data on a particular topic.
- Ask students to design a graph from a set of given data (e.g., a tally posted at the center). Or for primary students, complete a graph to show the posted data.
- Have students answer survey questions by creating a glyph to reflect their answers. (At the end of the week, after all students have had an opportunity to visit the center and create their glyph, the teacher might select a question and graph the class data on the board by asking all students to post their glyphs in the correct section of the class graph. The class graph then provides data for a class discussion.) (See O'Connell 1997.)
- Provide directions for plotting a series of points on a coordinate graph. Have students connect the points and color in the shape that is created.
- Have students write a paragraph related to a graph posted in the center, including identifying the topic of the graph, telling some facts learned from the graph, and explaining why the data might look the way it does.

Manipulative Center

A Manipulative Center can provide students with opportunities to explore with pattern blocks, tangrams, square tiles, multilink cubes, or other classroom manipulatives (see Appendix C for some templates). A basket of manipulatives should be available at the center, including directions for activities such as the following.

- Have students create patterns using colored chips or cubes. Ask them to draw pictures to show their patterns and to write a sentence to describe each one.
- Ask students to use pattern blocks to create a figure showing symmetry. Have them trace the figure and draw the line of symmetry.
- Display some tangram pictures at the center (e.g., animal shapes made with tangram pieces). Have students create the same design using their tangram pieces.

- Have students sort attribute blocks using Venn diagrams to show similarities and differences. The Venn circles might be labeled *blue* and *thin*, or *large* and *red*, or *thick* and *circles*. Ask students to write three statements about the information they observe from their completed Venn diagrams.
- Provide students with two colors of square tiles (e.g., blue and red). Have them create figures using both colors of tiles and then determine the fractional part that is blue or red. Have them use centimeter paper and crayons to record their figures and the fractions.
- Ask students to use square tiles to create 5 figures that each have an area of 12 square units. Have them draw each figure on centimeter paper. Have students calculate and record the perimeter for each figure. Ask them to write a few sentences to describe their observations about the areas and perimeters.
- Have students use blocks or cubes to create a three-dimensional figure with a volume of 36 cubic units. Ask them to determine the surface area for the figure. Have them explain in writing how they found the surface area.

Math Art Center

Notice the math skills that are needed to complete the following art projects at an Art Center.

- Ask students to draw a picture using only squares, circles, and triangles.
- Place a variety of shape cutouts in the center and ask students to create a quilt pattern.
- Select some pictures that illustrate symmetry from a magazine or from printed computer graphics. Cut the pictures in half through the line of symmetry. Have students glue the half-pictures on a sheet of white paper. Then, ask them to draw and color the other half of the shape to create a complete picture with symmetry.
- Have students create a tessellation (i.e., a tiled design in which there are no spaces between the tiles).
- Ask students to use a compass to create an abstract design with interlocking circles of 2-inch, 3-inch, and 4-inch diameters. You might provide a color code (e.g., color 2-inch circles red, 3-inch circles blue, and 4-inch circles yellow) or allow students to color the circles as they'd like.

Math Literature Center

Math Literature Centers might have a variety of books related to a specific math topic (e.g., geometry) or books that relate to many different math topics (see Appendix D). Some large pillows on a carpeted floor provide a cozy reading area. After students read their books, teachers might ask them to do a follow-up task related to the math in the story.

- Ask students to draw a picture to show the math in the story.
- Have students write about how a character used math in the story.
- Ask students to create another story that uses the same type of math (e.g., dividing, measuring distance, identifying shapes).

Measurement Center

Students can practice measuring a variety of items at a Measurement Center. This center can be easily changed each week by selecting a different measurement tool (e.g., scale, measuring cups, rulers) and different items to measure. Teachers might include a recording sheet so that students can record the lengths, weights, or capacity of each item measured. For example, I measured _____; I predicted it would measure _____; it measured _____.

Other ideas for a Measurement Center include the following.

- Have students sort measurement tools (e.g., scale, ruler, measuring cup, thermometer) based on what they might measure. Have them make a list to record the way in which they sorted the tools.
- Put two or three objects at the center. Have students predict which object weighs more and then weigh the objects to check their predictions. Have students order the actual weights from least to most and record the order.
- Place a thermometer template, with a red mercury line colored to indicate a temperature (see Appendix C) in the center. Ask students to draw a picture of themselves playing outside in the temperature shown on the thermometer. Remind them to show themselves dressed appropriately and to record the temperature on the picture.
- Provide students with a stack of index cards that each have a digital time on them (e.g., 1:30). Ask students to select timecards and then show the time on a small analog clock that is placed at the center. Have students record the analog and digital times on a recording sheet that has blank clock faces (see Appendix C). Remind them to write the digital time below each clock face.
- Provide students with a stack of index cards showing a digital time on each one (e.g., 9:30 A.M., 7:15 P.M.). Ask students to select three timecards and then record the times in the correct order on a Time of Day recording sheet (see Appendix C). Students should draw the times on the clock faces, record the digital time below each clock face, and write what they do at that time of day.
- Place a newspaper weather map at the center. Have students find the city that had the lowest temperature, the city that had the highest temperature, and the city with the greatest difference in high/low temperatures for the day. Have students describe what they would bring with them (e.g. type of clothing) and what they would do (e.g., type of activities) if they were visiting those cities. Remind them to consider the temperatures when packing clothes and planning activities.
- Using a week of national or world weather data from the newspaper, have students select a city and graph the high and low temperatures for the week. Have them write a few sentences to describe the data on their graphs.
- Place a state or national road map at the center and have students plan a trip from one city to another. Have them use the map scale to determine the mileage between cities and provide them with a calculator to figure out the cost of the travel (specify a price for a gallon of gas and how many miles can be driven on a gallon). Have students explain in writing how they determined the travel cost.

Money Center

Money Centers provide a wonderful opportunity to connect math skills to real situations. Here are some ideas.

- Have students create patterns with coins (e.g., dime, penny, nickel, dime, penny, nickel or penny head, penny tail, penny head, penny tail, . . .). Have them record the patterns on a sheet of paper and describe each pattern. Younger students might do coin rubbings to show their patterns. For a coin template, see Appendix C.
- Provide students with a basket of grocery store coupons, some coins, and some crayons and paper. Ask students to select a coupon, have them glue it on a paper, and then do coin rubbings to show the amount of money on the coupon (e.g., for 25 cents, students rub 2 dimes

and 1 nickel or 1 quarter). Have them record the amount next to their crayon rubbing of the coin(s).

- Place index cards at the center with amounts and types of coins and ask students to determine the total amount of money (e.g., the card might read: 1 quarter, 3 dimes, 4 nickels, 3 pennies). Students will need to determine the total amount when the values are added. Teachers might decide to provide the answer on the back of each index card for self-checking.
- Place 2 small plastic bags labeled A and B at the center. Fill each bag with some coins. Have students total the value of each bag to determine which bag has more money in it. If there is more than one set of bags to compare, place a certain color sticker on the pair of bags so that students can compare the red bag A to the red bag B or the blue bag A to the blue bag B. Teachers might decide to place an answer card in an envelope at the center for self-checking.
- Write some different money amounts on index cards (e.g., \$0.15 or \$0.25). Ask students to record as many coin combinations as possible to show that amount of money.
- Provide students with some small plastic bags containing a variety of coins (e.g., 15 pennies, 3 nickels, 2 dimes) and a bag of additional coins for trading. Label each bag with the total amount of money in the bag. Ask students to trade the coins for larger value coins so that they have the fewest coins possible in the bag (e.g., 15 pennies might be traded for 1 dime and 1 nickel). When students think they cannot make any more trades, have them total the value of the coins to see if they still have the same total amount as the initial amount labeled on the bag. (*Tip:* In the bag, provide a list of the original coins so that students can replace their trades with the original coins for the next student who arrives at the center.)
- Cut out items from grocery ads and glue each one on a separate index card. Have students go shopping by picking an item (or several grocery items) from the stack of cards. Primary students might be asked to record the cost of the grocery item and the coins they would use to buy it. Intermediate students might be given a specified amount of money (e.g., \$20.00) before beginning their shopping, and asked to purchase food items for a party making sure that they do not overspend. Students should be asked to justify how they know they will have enough money for the items they selected using math data to support their answers.
- Display a restaurant menu and ask students to order a meal. Tell them how much money they have (e.g., \$8.00). Have them record the items they will order, how much the meal costs altogether, and how much change they will receive. Provide a calculator to assist them in determining the cost of the meal. *Variation:* Give them a larger amount of money and have them order for their family, or ask them to include a tip for the waitress.
- Place some travel brochures listing admission costs and calculators at the center. Have students figure out the cost for their family to visit the site or attraction. Ask them to explain how they determined the cost.

Numbers and Operations Center

A Numbers and Operations Center can focus on basic number skills or more advanced skills, including fractions, decimals, and percents. A Counting Center might be used in primary classrooms.

- Place some stamp pads at the center. Provide students with a paper that has numbers (e.g., 1, 2, 3, 4, 5) written down the left side. Have students stamp the correct number of designs in a row next to each number.
- Provide students with a cup of objects (e.g., blocks, plastic counting bears) and ask them to count the objects and record the number on a recording sheet (e.g., I counted ___ bears; I counted ___ red blocks; I counted ___ blue blocks).

- Create 3 stacks of index cards: one with numbers (1, 2, 3, . . .), one with sticker dots to show a model of that number, the other with number names (one, two, three, . . .). Have students match the number, name, and dot model. Have them record the number, name, and picture (model) on a sheet of paper.
- Provide students with a container of dried beans or counters. Put 4 to 5 margarine cups at the center with numbers written inside each cup with a permanent magic marker (e.g., 6, 7, 8, 9). Have students fill each container with the correct number of beans (number written in container). Then, ask students to order the containers from least to most and record the order on a sheet of paper by writing the number and making a drawing to show the counters.
- Have students create number books by writing a number on a sheet of paper and then drawing that number of objects onto their papers. Students might be asked to label their pictures or write sentences about the pictures. (Do this in installments, one number each day or week. Collect the pages and bind them into a number/counting book.)
- Ask students to spin a spinner or roll a die and get 3 numbers. Have them record the numbers, then find the largest number they can make using all 3 numbers and the smallest number they can make. Students can do this several times. *Variation:* Challenge students by asking them to figure out all of the different numbers that can be created using the 3 numbers and then order them from smallest to largest, or challenge them further by having them roll or spin 4 numbers to create larger numbers.
- Place completed 100 Charts at the center (see Appendix C). Have students find and color all of the multiples of a number (e.g., if their number is 3, they will need to find and color 3, 6, 9, 12, . . .). Students may use calculators to help them multiply the larger numbers. Patterns will appear on their 100 Charts; have students describe the patterns they see.
- Place Math Fact Memory games at a center to allow students to practice their facts (see Appendix B for some ideas).
- Have students fold a paper into 3 columns and label each column as follows: fractions, decimals, percents. Have a stack of cards at the center with some fractions, decimals, and percents on them (e.g., $\frac{1}{4}$, 50%, 0.40). Students should choose a card and record it in the correct column of their papers. Then, they must determine the equivalent of that number for the other two columns and record them. For example, if students selected 0.40, they would record that in the decimals column and then write $\frac{4}{10}$ or $\frac{2}{5}$ in the fractions column and 40% in the percents column. When done, students select another card until they have completed a specified number (to be determined by the teacher).
- Place some number cards (see Appendix B) at the center. Ask students to sort the numbers based on whether they are prime or composite. Ask them to justify their groupings by defining prime and composite.

Probability Center

Probability Centers can provide opportunities for students to conduct and analyze probability investigations or to explore probability ideas.

- Have students fold a paper into 4 parts and label each section: certain, impossible, likely, unlikely. Then, ask students to list real examples in each section; for example: “It is likely that I will drink some milk today.” “It is impossible that I will fly through the classroom today.”
- Place a variety of spinners (see Appendix C) in the center and have students sort them based on whether they are fair or not. Have them draw the spinners in two columns on a recording sheet (fair and not fair) and then justify their sorting. Ask students to design 2 fair spinners and 2 spinners that are not fair.

- Place a variety of unfair spinners at the center (i.e., having sections of different sizes). Have students look at each spinner and predict which section will be the winner (i.e., most frequently spun). Have them write their prediction on a paper. Have them spin 30 times and record the results. Ask them to check to see if their prediction was correct. (Students should gather data during center time; the teacher can discuss the “whys” with the class at a later time.)
- Provide students with some dice probability investigations; for example: “Which sum will result most often if you roll 2 dice and add the numbers to find the sum?” Have students conduct the investigation, record their results, and explain their findings.
- Place a bag of colored chips or colored blocks at the center. Put blocks of 2 or 3 colors in the bag (use a paper bag so that students cannot see through it). Tell students the total number of cubes in the bag and the colors of the cubes; for example, “There are 12 cubes in the bag and they are blue and green.” Ask students to predict how many of each color are in the bag by conducting an investigation. Students should pick a cube and then replace it; they can pick 20 times. Then, they should use their data to predict and justify their predictions. After recording their predictions, they can check the contents of the bag.

Problem of the Week Center

Problem of the Week (POW) Centers provide stimulating problems for students to ponder throughout the week (see Appendix A for some ideas) and should include discussions in which students share their methods.

- Post a POW and have students solve the problem and write an explanation of how they solved it. Ask students to put their answers in the answer jar by a specified time (e.g., Friday at noon). All students with the correct answer get their names posted as “POWerful Problem Solvers” for the following week. At the Friday class discussion, the solution and various methods are shared. *Variation:* Students record their answers in a journal. On Friday, students share their answers through a class discussion of the problem.

Center Preparation Checklist

- _____ Are center locations appropriate?
- Adequate room for students to complete center activities
 - Located in spots where they will not be distracting to other students in the classroom
 - Materials placed in folders or baskets that can be taken from a central area to students' seats
- _____ Are all centers labeled?
- _____ Are specific directions for the activities displayed at the centers, including sample activities when appropriate? (For primary students, pictures can be used to show center directions.)
- _____ Are all necessary materials located in the center areas?
- _____ Do centers represent various levels of activities to meet the needs of learners with different skills?
- _____ Is there a system to let students know when they can use the center (e.g., weekly rotations, assignments posted on the board), and how long they can stay at it (e.g., duration of an activity, a specified time limit)?
- _____ Should center participation be individual, with partners, or in groups?
- _____ Has each center been introduced to the class, including a discussion of the procedures for using it and cleaning up after use?
- _____ Will work be collected? Have reporting sheets been prepared or has paper been placed at the center for students to record their work?
- _____ Is there a consequence for the misuse of centers, and are students aware of the consequence?