MISSISSIPPI DEPARTMENT OF EDUCATION

Ensuring a bright future for every child

Mississippi Mathematics Manipulatives Manual
Featured Activity

"It's All in the System"

8.EE.8a & 8.EE.8b

Spring 2021

Carey M. Wright, Ed.D.
STATE SUPERINTENDENT OF EDUCATION

Nathan Oakley, Ph.D.
CHIEF ACADEMIC OFFICER

Marla Davis, Ph.D.
ACADEMIC LIAISON
Office of Academic Education

Wendy Clemons
EXECUTIVE DIRECTOR
Office of Secondary Education, Dropout Prevention, & Professional Development

Tammy Crosetti
STATE DIRECTOR OF CURRICULUM AND INSTRUCTION
Office of Secondary Education

Tommisha Johnson, Ed.S.
K-12 MATHEMATICS CONTENT DIRECTOR
Office of Secondary Education

As we continue our efforts to develop high-quality instructional materials (HQIM) and resources, the Mississippi Department of Education (MDE), through the Academic Education Office, would like to showcase instructional practices and activities that foster conceptual understanding through the use of manipulatives in the mathematics classroom.

The **Mississippi Mathematics Manipulatives Manual** features activities meant to serve as short, hands-on procedures that may be implemented before, during, or after a lesson to support the teaching and learning process of the Mississippi College- and Career-Readiness Standards (MCCRS) for Mathematics. Alignment with the MCCRS Scaffolding Document has been included for additional support. Teachers may contact staff at the MDE if they would like to borrow manipulatives for classroom use.

Teachers may modify these activities to meet the needs of the students they serve and their instructional delivery model (virtual, in-person, or hybrid).

It's All in the System

MANIPULATIVE(S):
- Floor-sized coordinate grid
- Index cards
- Round dots
- String
- Tape

GRADE LEVEL OR COURSE TITLE:

CCR Mathematics Grade 8

DOMAIN AND CLUSTER HEADING:

Expressions and Equations (EE):

Analyze and solve linear equations and pairs of simultaneous linear equations

STANDARD(S):

8.EE.8: Analyze and solve pairs of simultaneous linear equations.

8.EE.8a: Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

8.EE.8b: Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*

PREREQUISITE SKILLS:

- Know a line represents the infinite number of solutions to a linear equation with two variables.
- Know linear equations graph a straight line.
- Know solutions of an equation are the values of the variables that make the equation true.
- Know a system of linear equations is two or more linear equations that represent constraints on the variables used.
- Know the point of intersection is the point where two lines intersect.
- Know how to reason abstractly and quantitatively.
- Know system of linear equations is two or more linear equations that represent constraints on the variables used.
- Know expressions in different forms can be equivalent.
- Know coordinates are ordered pairs of numbers used to locate a point on a coordinate grid.
- Know how to solve linear equations with one variable.

- Know how to look for and make use of structure.

ACTIVITY:

1. *Prior to the start of class, create a large coordinate plane on the classroom floor and have pairs of linear equations prepared for students to graph. (See Resources Section for a link to 100 Linear Equation examples and answers.)*
2. Arrange students in groups of two or three depending on class size. (***Note:*** The teacher may also want to consider students' strengths when grouping.)
3. Assign each group an equation to graph.
4. Using the string, two groups will take turns to graph their assigned linear equation on the coordinate grid.
5. Ask the class to analyze and solve the system of equations. (***Note:*** The teacher may have students use a handheld graphing calculator or Desmos for a virtual option. See link in the Resources Section.
6. Continue steps 4 and 5 until all groups have graphed their linear equations. Remember only two groups at a time.

QUESTIONS TO CONSIDER:

- (*Prior to the lesson*) How do you graph a linear equation?
- (*During the lesson*) As you observe the graph of these two equations, what does the graph tell you about the solution to the system?
- (*During/After the lesson*) How can you **prove** your solution is accurate?

RESOURCES:

- Mississippi Mathematics Scaffolding Document (Grade 8, Page 12-13)
- 2016 MCCRS for Mathematics
- Solving Linear Equations- mcckc.edu (See pages 3-4 for 100 examples and their solutions)
- Virtual Graphing Calculator – Desmos
- Learn Desmos: Graphing - Desmos

Optional: The University of Mississippi's Center for Mathematics and Science Education has an extensive inventory of math (and science and technology) tools and manipulatives that teachers may borrow for classroom use at no charge. Click the link below to access the inventory list and complete a check-out request.

- CMSE Manipulatives

BEYOND THE ACTIVITY:

- **Assessment(s)**: Provide students with real-world application word problems to illustrate the use of systems of linear equations.

- **Extension(s):**
  - Graph lines where they intersect at a fractional point, such as halfway between integers.
  - Give students different forms of equations. (*Ex: an equation written in standard form instead of slope-intercept*)