Algebra to the Core

The Hands-On Components

For each algebra lesson, it is recommended that one of the eight learning experiences be a hands-on or personal experience that lays the ground work for the upcoming concepts and skills students will study. This document provides a list of recommended hands-on activities and a brief description of each. The ability to deliver the hands-on experiences depends on the availability of certain manipulatives or materials. The hands-on experiences are a major part of the two-day professional development training that schools can choose to participate in.

Numeric Expressions

The 550 Game: Paired learners compete in a game with numbered playing cards. Each player draws five cards. On the teacher's command students have 90 seconds to create a numeric expression whose value is as close to 50 as possible. All operations are allowed. All five numbers on the five cards must be used once and only once. In this game face cards all have value 10 and aces have value 1.

Algebraic Expression

Algebra War Games: Paired learners compete in a game with numbered playing cards. Each student keeps half a deck of cards face down in his or her hand. On player A's command (GO) both players place a card face up on the table. The value of player A's card is assigned to the variable x. The value of player B's card is assigned to the variable y. The teacher defines a winning game rule by creating an algebraic expression using x and y. For example, the expression might be 2x + y. The player who is first to correctly evaluate the expression wins the two cards. The game is fast, effective, and fun.

Polynomials (Combining)

Match Maker: Twelve index cards are placed face down in three rows of four on the table. Each pair of index cards has a sum or difference of polynomials problem written on one card, and the simplified answer on the other card. When a student takes a turn, he or she turns up two cards. If the pair of cards contains a matching problem and answer, the student wins the cards. Otherwise, the student returns the cards to their face down position. Students alternate turns and are challenged to remember positions of key cards so they can turn up matching cards and win cards.

Solving Equations (1 variable)

Solve It Fast!: Game cards (8.5 x 11 card stock) have simple equations printed on them (for example: $2 \cdot \square + x = 20$. Two competing students each have half a deck of playing cards. On player A's command (GO), player A places a card face up on the rectangle next to the 2. Once the numbered card is in place, the first student who correctly solves for x wins the card. On player A's next command (GO), player B places a card face up on the rectangle next to the 2. The first player to solve the equation wins the card. The game is fast, fun, and helps students to develop an intuitive understanding of equations.

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The Hands-On Components

Understanding Functions

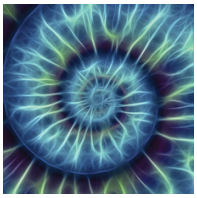
The Student Domain: This activity is a personal activity that the students can relate to. The teacher would start by drawing a large oval on the board and writing five student volunteers' names into the oval. The teacher would explain that this oval represents the domain. The teacher would draw a second oval to the right of the domain oval and label it with the word range. Next, the teacher would write a question on the board that would be applied to the students in the domain. A good question would be '*What are the names of your pets?*' Some students with multiple pets would offer more than one name. Some students who do not have a pet would not be able to offer a name. Students with only one pet would offer one name. After recording the data, the teacher would explain that some students in the domain will support the concept of function and others will not. Name by name the teacher would analyze the data and likely conclude that the data does not represent a function (some students having no answer and some having more than one). Finally, the teacher would come up with a new question than can be applied to the students in the domain, and one that would guarantee a function. The question might be '*What is the name of month in which your birthday resides?*' In this case each student would have one and only one answer. This personal activity is a great way help students understand the concept of function.

Graphing Functions

Beads and Graphs: The materials needed for this activity are coordinate planes printed on 11 x 17 paper (one sheet for each pair of students) and nine colorful beads (round but flat on two-opposite sides) for each pair of students. Students will place the nine beads below the numbers -4, -3, -2, -1, 0, 1, 2, 3, 4 that reside on the x-axis. The teacher will provide a question that students would ask relative to those x-numbers. For example, the question might be '*What is one more than twice your value?*'. As students apply the question to select numbers, they would slide each corresponding bead vertically a number of spaces equal to the answer. As beads are slid into place, the graph will start to form. Students will learn how to interpret an equation as a question. For example, the equation $y= 2x – 1$ would be interpreted as the question '*what is 1 less than twice the value of x?*'.

Graphing Linear Equations

Why m for Slope?: In the equation $y= mx + b$, the letter m is used for slope because it is the constant multiplier applied to the numbers on the x-axis. Students can learn how the constant multiplier dictates the slope by repeating the Beads and Graphs activity described above, with a slight change. The teacher would ask the student to place their beads under the numbers 0, 1, 2, 3, 4, and 5. Next, the teacher would ask the students to multiply those numbers by .5 and slide the beads vertically according to the answers. Once a linear pattern is formed by the beads, the teacher would ask the students if a hill, with the same degree of steepness, would be difficult to ride a bike up. After students express their answers, the teacher would ask the students to repeat the exercise with the multiplier m=1. Again, students would slide the beads into place. This linear pattern will be steeper than the previous. Again, students will provide opinions as to whether it would be easy or difficult to ride their bikes up a similar hill. The experiment will be repeated for m= 2 and 3. Students will gain a very good understanding of how and why m controls the slope or steepness of the line.



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Polynomials (Part 2)

The Algebra Floor Plan Activity: Students make a sketch of their home's floor plan. The sketch should include major rooms (living room, dining room, main hallway, bedrooms, kitchen, and bathrooms), but not closets. Students should measure the dimensions of rooms and record the measures (to the nearest whole number) on their floor plans. This floor plan will be called the numeric floor plan. Next, the students will create an algebraic floor plan as follows. Each student will assign the variable x to the smaller measure of his or her bedroom. For example, if the measures of the student's bedroom are 10 feet by 12 feet, x would equal 10. Next, the student would create a second floor plan, this time writing all the measures in terms of x. For example, a measure of 8 feet would be $x - 2$. A measure of 21 feet would be $2x + 1$, and so on. The new floor plan would be the algebraic floor plan. The students will be challenged to calculate the areas of all the rooms on both floor plans. The room areas on the numeric floor plan will be whole numbers. The room areas on the algebraic floor plan will be binomials or trinomials. The students will find the total square footage of the house two ways: first by adding the numeric room areas and second, by adding the polynomial room measures. In the end, the numeric total area might be 1500 square feet. The correctness of the polynomial total area can be verified by substituting 10 for x and evaluating the final polynomial. This is a great activity that the students will enjoy. Along the way, they will learn how to add, multiply, and evaluate polynomials.

Solving Linear Inequalities

What's My Line?: Provide each pair of students with two number lines, 10 two-sided counters, and a deck of playing cards. Students will also be given ten index cards. A printed inequality statement will be on each index card. For example, $x + 2 \geq 5$. Each student will draw an index card and study their inequality. Students will take turns drawing a playing card. Red cards will represent negative values and black cards will represent positive values. On each draw, students will determine if their card represents a solution to the inequality or not. If yes, the student will place a red counter on the number line at the number's position. If no, the student will place a yellow counter on the number line at the number's position. After five card draws each, the student with the most red counters on their number line wins the hand. Repeat this game with different inequalities.

Note: This game can be extended by printing inequalities with two variables on the index cards. Instead of a number line, students would use a coordinate plane. Students can use a spaghetti noodle to represent the defining line on the plane. In this game, each student would draw two cards (x and y) and place red counters on the plane when a solution occurs, and yellow counters on the plane when a non-solution occurs.

Irrational Numbers

Match Maker: Twelve index cards are placed face down in three rows of four on the table. Each pair of index cards has an irrational expression (not in simplest form) written on one card, and the simplified expression on the other card. When a student takes a turn, he or she turns up two cards. If the pair of cards contain a matching problem and answer, the student wins the cards. Otherwise, the student returns the cards to their face down position. Students alternate turns and are challenged to remember positions of key cards so they can turn up matching cards and win cards.