Julia Robinson Mathematics Festival

التعليم فوق الجميع | education above all

Dots & Algebra

Level	3 (Age group 8-10)
Resources Required	Pen or pencil Paper (1 per pair) Whiteboard or blackboard (optional)
Strand Covered	Algebra
Targeted Skills	Simplify algebraic expressions involving one, two, or three variables
Inspired by	Dots & Boxes - Édouard Lucas, MathPickle - Gordon Hamilton
Time Required	45 minutes (for game) 15 minutes (setup)
Previous Learning Required	Addition, subtraction, multiplication of numbers 1-10 Knowledge of variables
Support Required	Low supervision

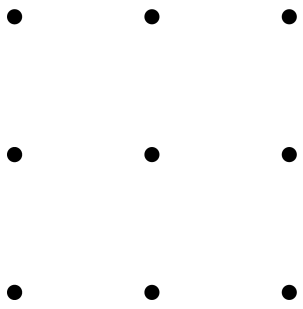
Rules of the Game:

Goal	The player with the most points wins. If there is a tie, the player who went second wins.

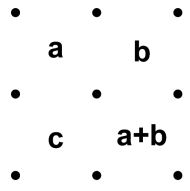
Steps	Step 1: The teacher groups players into pairs. Step 2: The teacher gives each pair a piece of paper. Step 3: The teacher chooses and draws 4 game boards on a whiteboard or blackboard that all players can see. If the teacher does not have access to a whiteboard or blackboard, the teacher can make the game sheets for players ahead of time. Step 4: Players draw 9 dots in a 3x3 grid (see Images/Illustrations). Step 5: Players choose one of the 4 game boards that the teacher drew on the board. Players replicate the chosen game board on their own piece of paper. Step 6: Starting with the youngest player, players take turns drawing horizontal or vertical lines that connect two dots. See Images/Illustrations for an example. Step 7: When a player completes one of the 4 small squares on the game board, that player writes their initials in that square. This player takes another turn and draws another horizontal or vertical line. Step 8: Repeat Steps 6-7 until the entire board is complete (See Images/Illustrations). Step 9: Players compute their points by evaluating the algebraic expressions in the squares with their initials. Step 10: The player with the most total points wins. If there is a tie, the player who went second wins. Step 11: If there is time left over, pairs can start a new game by following Steps 4-10.

Images or Illustrations

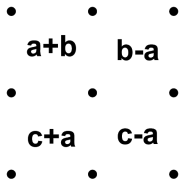
Example of Empty Game Board:



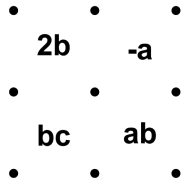
Example of 4 Game Boards:



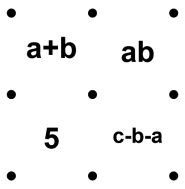
a = 2
b = 3
c = 4



a = -1
b = 0
c = 1

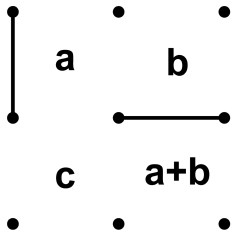


a = -2
b = 1
c = 4



a = -1
b = 3
c = 4

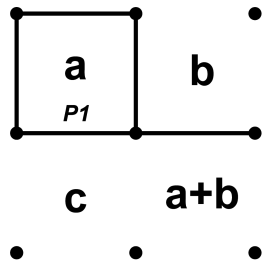
Example of a Game After 2 Moves:



a = 2
b = 3
c = 4

On the first move, Player 1 drew a vertical line to the left of “a.” On the second move, Player 2 drew a horizontal line under “b.”

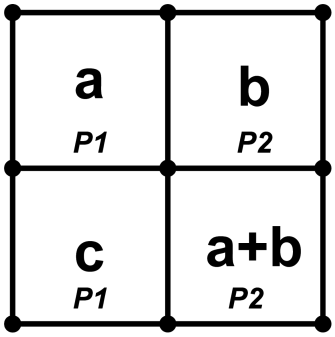
Example of Completing a Square:



a = 2
b = 3
c = 4

Player 1 completed the upper-left small square and wrote their initials (P1) in the completed square.

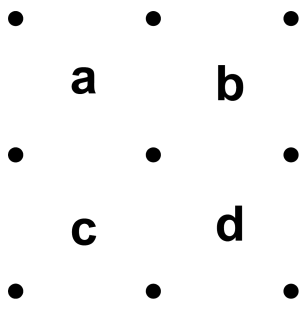
Example of a Completed Game:



a = 2
b = 3
c = 4

Every horizontal and vertical line has been drawn, so the game is over. Player 1 won the “a” and “c” boxes; Player 2 won the “b” and “a+b” boxes. Since a = 2 and c = 4, Player 1 receives 2 + 4 = 6 points. Since a = 2 and b = 3, Player 2 receives 3 + (2 + 3) = 8 points. Player 2 wins.

Example of a Simplified Game:



a = 2
b = 3
c = 4
d = 5

Enrichment	• Have players make their own boards. • Use larger numbers. • Use other operations, like exponents. • Have players make 4x4 or 5x5 boards
Simplification	• Use boards that do not use addition, subtraction, or multiplication (See Simplified Board in Images/Illustrations).