

ALGEBRA TIC-TAC-TIMES

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from *The Mathematics Teacher*

"Algebra tic-tac-times" combines mathematical skills with a competitive strategy. It is a highly motivational skill-review exercise that involves the problem-solving strategy of working backward.

Directions for Play

Objective

The object of the game is similar to that of tic-tac-toe; the winner is the first of two players to place four tokens in a row, either vertically, horizontally, or diagonally.

Materials

The materials necessary to play algebra tic-tac-times include a factor board and a game board (fig. 1) and forty translucent tokens of two different colors. One token of each color is used as the factor marker, and the remainder are used as game tokens. The game board should be laminated so that it can be saved from year to year. The tokens should be stored in a bag so that they don't get lost.

Method of play

Player 1 begins the game by placing a factor marker and one of player 2's factor markers on any factors on the factor board. The product of these factors determines the placement of player 1's game token. In figure 1, player 1 placed a factor marker on $x + 1$ and player 2's marker on $x - 1$. Player 1 then placed a game token on $x^2 - 1$ because $(x - 1)(x + 1) = x^2 - 1$.

Note: factor markers can be placed on the same factor, resulting in squared factors.

Player 2 can move only player 2's factor marker (player 1's marker remains in place) to another factor on the factor board, as shown in figure 2. In this example, player 2 could move a factor marker to x . The product of these new factors determines the placement of player 2's game token. In this example, player 2 would place a game token on the product of $x + 1$ (player 1's marker) and x (player 2's marker), or $x^2 + x$, on the game board.

Players must use a strategy of working backward to determine which products combined with the available factors will win the game. These same problem-solving strategies become a part of the defensive play of the game when a player wishes to block an opponent.

Penalties

A player is penalized when a product that has already been covered is used or when an incorrect response to the factors is given. A move is considered to be completed when a player's hand is removed from the factor marker in the event of a duplicate product or from the game token in the event of an incorrect response. In the event of a penalty, the opposing player has the opportunity to move both factor markers, as in the beginning of the game.

$x^2 - 7x + 12$	$x^2 - 3x + 2$	$x^2 - 16$	$x^2 + 8x + 16$	$x^2 - x$
$x^2 + 5x + 4$	$x^2 - 4x$	$x^2 + 2x - 3$	$x^2 + x$	$x^2 - \bullet$
$x^2 - 8x + 16$	$x^2 - 5x + 6$	$x^2 - 4x + 4$	$x^2 + 7x + 12$	$x^2 - 2x - 8$
$x^2 - 4$	$x^2 + 2x$	$x^2 - 6x + 9$	$x^2 - 9$	$x^2 + 3x - 4$
$x^2 - 2x + 1$	$x^2 - 2x - 3$	$x^2 - 2x$	x^2	$x^2 + 5x + 6$
$x^2 - 6x + 8$	$x^2 + 4x + 4$	$x^2 + 2x - 8$	$x^2 + 3x$	$x^2 - 4x + 3$
$x^2 + 6x + 9$	$x^2 + x - 2$	$x^2 + 4x + 3$	$x^2 - x - 2$	$x^2 - 3x$
$x^2 - 3x - 4$	$x^2 + x - 12$	$x^2 - x - 6$	$x^2 + 4x$	$x^2 + 6x + 8$
$x^2 + 3x + 2$	$x^2 + 2x + 1$	$x^2 - 5x + 4$	$x^2 - x - 12$	$x^2 + x - 6$

Game Board

$x - 4$	$x - 3$	$x - 2$	$\text{▨} 1$	x	$\bullet 1$	$x + 2$	$x + 3$	$x + 4$
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Factor Board

 Player 1's game token  Player 2's game token

Fig. 1. Player 1's first move

ALGEBRA TIC-TAC-TIMES Game Board

from *The Mathematics Teacher*

$x^2 - 7x + 12$	$x^2 - 3x + 2$	$x^2 - 16$	$x^2 + 8x + 16$	$x^2 - x$
$x^2 + 5x + 4$	$x^2 - 4x$	$x^2 + 2x - 3$	$x^2 + x$	$x^2 - 1$
$x^2 - 8x + 16$	$x^2 - 5x + 6$	$x^2 - 4x + 4$	$x^2 + 7x + 12$	$x^2 - 2x - 8$
$x^2 - 4$	$x^2 + 2x$	$x^2 - 6x + 9$	$x^2 - 9$	$x^2 + 3x - 4$
$x^2 - 2x + 1$	$x^2 - 2x - 3$	$x^2 - 2x$	x^2	$x^2 + 5x + 6$
$x^2 - 6x + 8$	$x^2 + 4x + 4$	$x^2 + 2x - 8$	$x^2 + 3x$	$x^2 - 4x + 3$
$x^2 + 6x + 9$	$x^2 + x - 2$	$x^2 + 4x + 3$	$x^2 - x - 2$	$x^2 - 3x$
$x^2 - 3x - 4$	$x^2 + x - 12$	$x^2 - x - 6$	$x^2 + 4x$	$x^2 + 6x + 8$
$x^2 + 3x + 2$	$x^2 + 2x + 1$	$x^2 - 5x + 4$	$x^2 - x - 12$	$x^2 + x - 6$

Game Board

$x - 4$	$x - 3$	$x - 2$	$x - 1$	x	$x + 1$	$x + 2$	$x + 3$	$x + 4$
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Factor Board