

## TOMOE GOZEN

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<b>Level</b>	3 (Age group 11-14)
<b>Resources Required</b>	Pens or markers in two different colors (2 different-colored pens per pair) Game board (1 per pair)
<b>Alternate Options for the Resources</b>	To create a game board, players will draw the “Example of Game Board” in the Images/Illustrations section on a piece of paper. Each pair will need 1 piece of paper.  If two different colors of pens are not available, players can write their initials in each space the land on during the game.
<b>Strand Covered</b>	Numbers and Operations
<b>Targeted Skills</b>	Prime Factorization
<b>Inspired by</b>	<a href="#">MathPickle</a> - Gordon Hamilton
<b>Time Required</b>	20 minutes (for game) 30 minutes (setup)
<b>Previous Learning Required</b>	Multiplication of numbers 1-100
<b>Support Required</b>	Low supervision

### Rules of the Game:

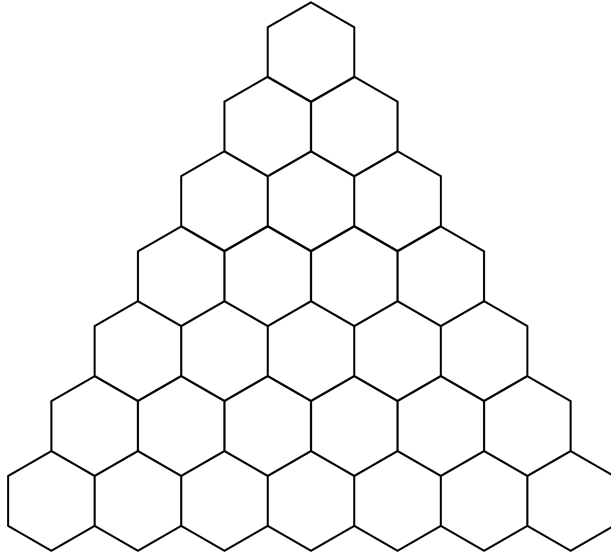
<b>Goal</b>	The last player who is able to make a legal move wins.
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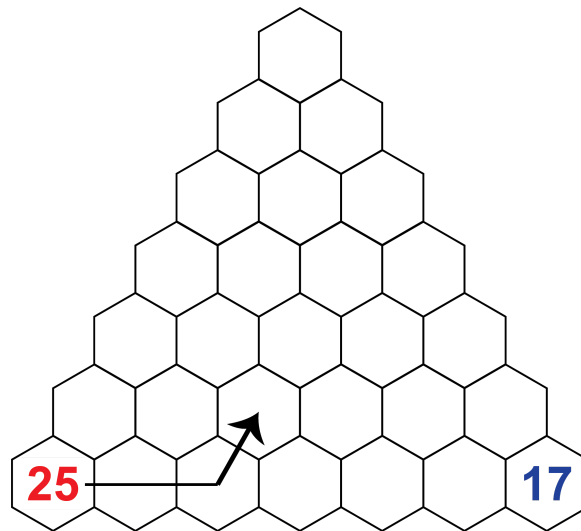
<b>Steps</b>	<p>Step 1: The teacher groups players into pairs.</p> <p>Step 2: The teacher passes out 1 piece of paper and 2 pens of different colors (we will use red and blue in these instructions) to each pair.</p> <p>Step 3: Players draw the game board (See Images/Illustrations) on their piece of paper.</p> <p>Step 4: Players choose who will be red and who will be blue.</p> <p>Step 5: The Red Player places a number from 2-100 in the lower-left corner of the game board. The Blue Player places a different number from 2-100 in the lower-right corner.</p> <p>Step 6: The Red Player goes first. The Red Player starts on a red number and moves three spaces in any direction (See Images/Illustrations for an example). On the space they end up, the Red Player writes a number from 2-100 following 2 rules:</p> <ol style="list-style-type: none"><li>1. The number written must be different from all other numbers on the game board.</li><li>2. If a straight line of empty hexagons can be made between the number written and a blue number, the blue number must <b>not</b> have a <b>greatest</b> common factor of 1 with the written number. See Images/Illustrations for an example of an illegal move.</li></ol> <p>Step 7: The Blue Player does the same as the Red Player in Step 6. The Red and Blue player alternate taking turns doing Step 6 until one player cannot find a legal move.</p> <p>Step 8: The last player who is able to play a legal move wins.</p>
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**Images or Illustrations**

Example of Game Board:

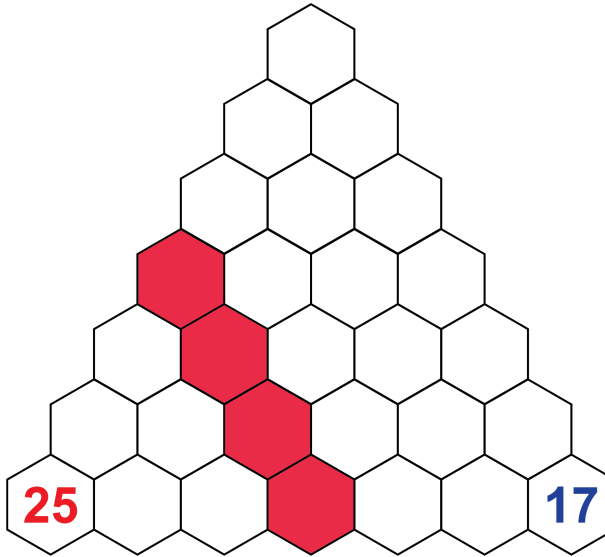


Example of Moving 3 Spaces:



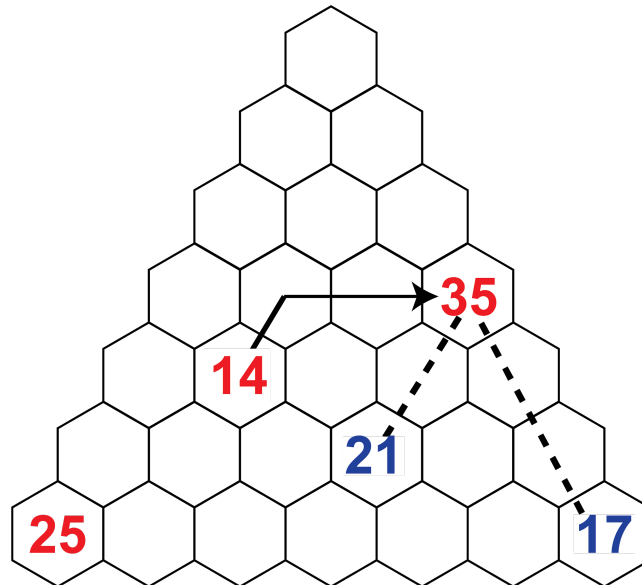
Here is one possible space that the Red Player can move to starting from the 25.

Example of Moving 3 Spaces in Any Direction:



The red spaces are **all possible spaces** that the Red Player can get to starting from the 25. Notice that it takes 3 moves to get from the 25 to any of the red spaces.

Example of an **Illegal** Move:



The Red Player decides to move 3 spaces from the 14 and write a 35 in the space shown above. This is an **illegal move**, or in other words, the Red Player is not allowed to do this. This is because the 35 can “see” two blue numbers: the 21 and the 17. 35 and 21 have a greatest common factor of 7, which is ok according to the rules. However, 35 and 17 have a greatest common factor of 1, which is



	<p><b>not ok</b> according to the rules. The Red Player must move to a different space, or must choose to write in a number other than 35. For example, if the Red Player chose to write in the number 51 instead of 35, this would be a legal move, because the greatest common factor of 51 and 21 is 3, and the greatest common factor of 51 and 17 is 17.</p>
<b>Enrichment</b>	<ul style="list-style-type: none"><li>• Have players choose numbers from 2-200 or larger.</li><li>• Have players play on a larger board. The board included has 7 rows of hexagons. Players can instead play on boards with 10 or more rows of hexagons.</li></ul>
<b>Simplification</b>	<ul style="list-style-type: none"><li>• Have players choose numbers between 2-50.</li><li>• Have players use a smaller board. The board included has 7 rows of hexagons. Players can instead play on boards with 5 or fewer rows of hexagons. If a smaller board is used, players should write in numbers in empty hexagons that are adjacent (shares a side with) to another hexagon that already has a number of their color written in it.</li></ul>