

Ghost Leg

Grade Levels

This activity is intended for grades 6th-8th.

Objectives and Topics

Through this activity, students investigate permutation groups through visualization of “Ghost Legs”. This will be an introductory activity into a different level of mathematics where the students can define operations in numerous ways.

Materials and Resources

- [Ghost Leg Presentation](#)
- [Ghost Leg Handout](#)
- [Ghost Leg Worksheet](#)

Introduction and Outline

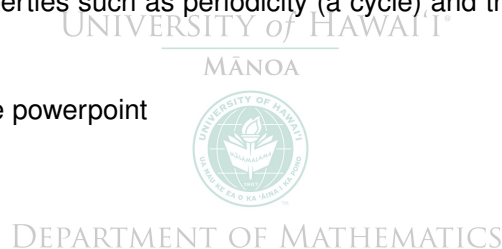
[Ghost Leg](#) is a method of randomly assigning pairs between two sets of items. There are four basic rules:

1. Starting from the top, one follows the ladder down
2. If you reach a horizontal “leg”, you must follow the path
3. Once on another vertical line, continue down the ladder
4. Repeat this process until you’ve reached the bottom of the ladder

Mathematically, this game is very interesting for two reasons. First, Ghost Leg randomly pairs the two sets (on the top and bottom) in a one-to-one fashion, dissimilar to other games involving random pairings. Second, the game displays mathematical properties such as periodicity (a cycle) and the mathematical concept of permutations.

Here’s how one works through the powerpoint

- Slides 1-9



- Introduce students to the game through an example
- Slides 10
 - The students (while we still are learning the game) are presented with the challenge of finding all the Ghost Legs with only two vertical lines
 - At this point, students can work on Ghost Leg Handout
 - As they add more and more horizontal lines, a pattern will emerge
 - This illustrates the idea of a permutation
 - Introduce the students to “set notation”, as this will make things easier later
 - In the two vertical line example, we have two sets of two numbers, $\{1, 2\}$ on top and $\{1, 2\}$ on the bottom
 - Using the Ghost Leg, we can either map the top to the bottom as such:
 - * $\{1, 2\} \longrightarrow \{1, 2\}$, or
 - * $\{1, 2\} \longrightarrow \{2, 1\}$
 - It is very clear that the order of the numbers in the brackets is significant
- Slides 11
 - Expands from a set of two items to a set of three elements
- Slides 12
 - Discuss the concept of a permutation and how it relates to the game
- Slides 13-14
 - Students now must compose Ghost Legs
 - This relates to the defining operations (functions) mathematically
- Slides 15-18
 - Provides an example of a composition of two Ghost Legs
 - At this point, students can work on Ghost Leg Worksheet

The handout and worksheet are provided below

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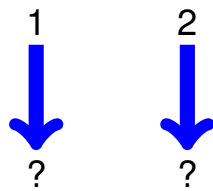
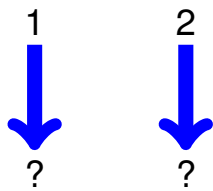
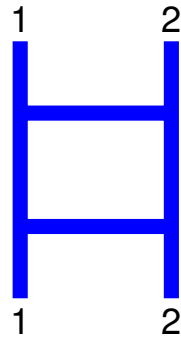
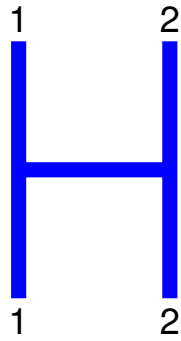
DEPARTMENT OF MATHEMATICS

Ghost Leg: Two Vertical lines

Find as many Ghost Legs with only two vertical lines that you can.

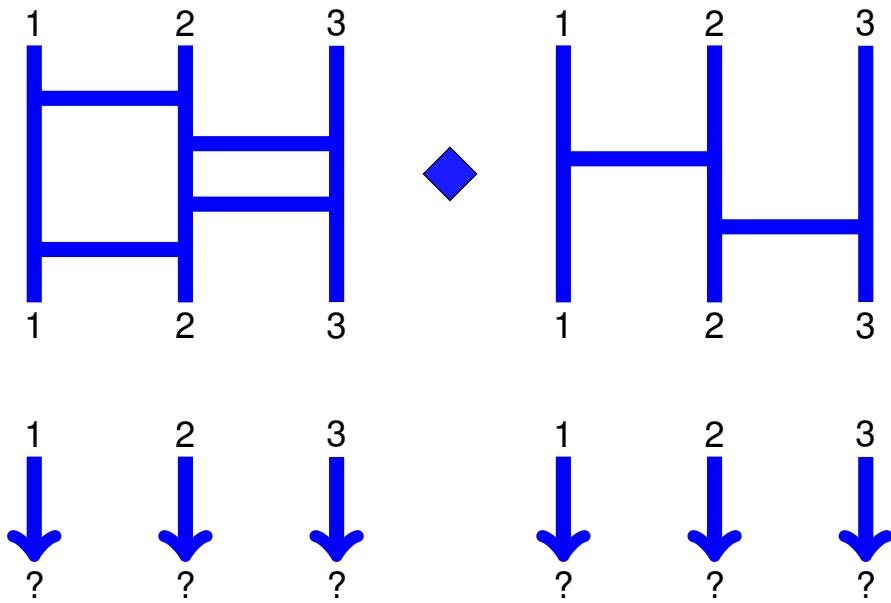
Where do the first two Ghost Legs take 1 and 2?

Do you notice a pattern developing as you add more horizontal legs?



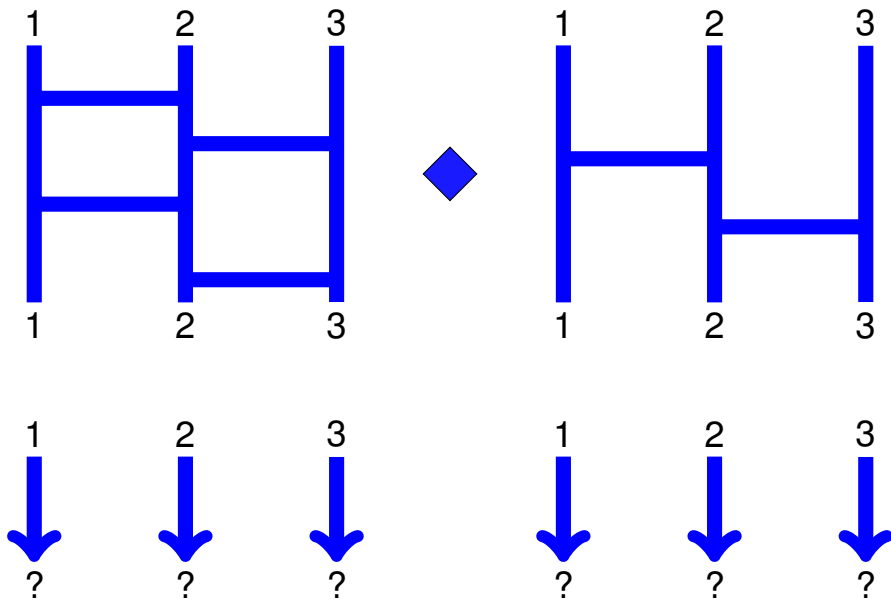
Ghost Leg: Composition of Ghost Legs

Example 1: Find the composition of the two Ghost Legs by drawing the Ghost Leg



Ghost Leg: Composition of Ghost Legs

Example 2: Find the composition of the two Ghost Legs by drawing the Ghost Leg



Ghost Leg: Composition of Ghost Legs

Example 3: Find the composition of the two Ghost Legs by drawing the Ghost Leg

