

Hypersphere

Requirements: Number of Players : 6 – 8 Players

Playing Time : Approximately 20 minutes

Age (12+)

Objective: This is a social deduction game revolving around the concept of classifying a 4D-rotation, to win you must not get eliminated from the game.

Learning Outcomes: To be able to classify and understand the classifications of a 4D-rotation.

Components

- 27 Function Cards – for taking actions in a player's turn.
- 16 Multiplication Cards – with a "x" on it – for determining which kind of rotation you are.
- 31 Rotation Angle Cards – with degrees symbol on it, ranging from 0, 30, 45, 60, ..., -30, -45, ... -for determining which kind of rotation you are.
- 50 Operator Cubes – for using an action card.

Setup

To set up a game:

1. Shuffle all the cards separately and put the Function Cards deck in the middle.
2. If you are playing a 6-players game, take out 1 "x0", 1 "x1" and 2 "x2" Multiplication Cards. Or if you are playing a 7-players game, take out 1 "x1" and 1 "x2" Multiplication Cards.
3. Randomly deal out 2 Rotation Angle Cards and 2 Multiplication Cards to each player faced down.
4. Each player creates two pairs of cards consisting of one Rotation Angle Card and Multiplication Card.
5. Each player then looks at each pair without changing the order.
6. Put 3 cards from the Function Cards Deck down faced up to form an open draw area.
7. Give every player 3 Operator Cubes.

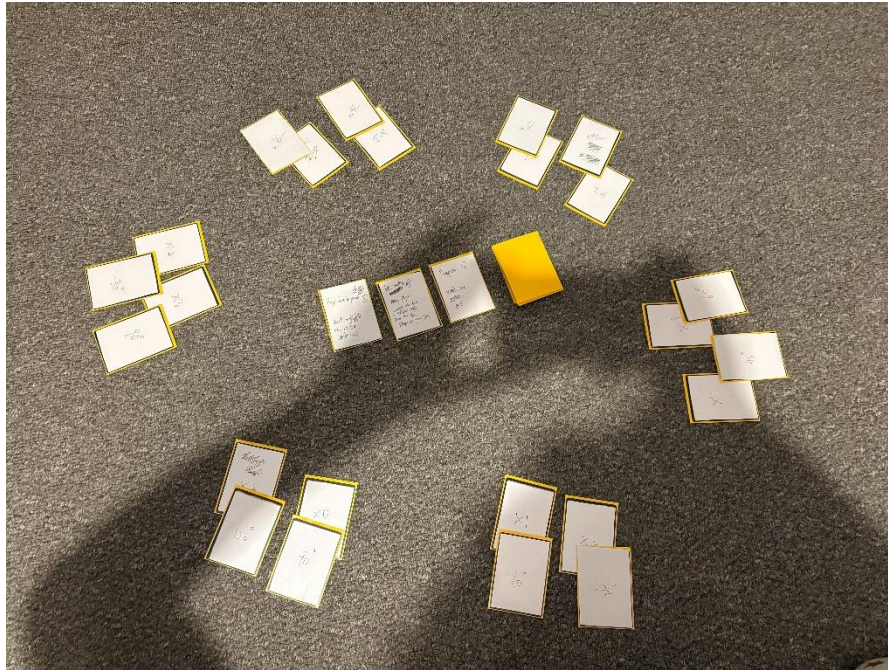


Figure 1: Example of a 6-player game with the cards faced-up

Teams

Players are classified into 4 different types of rotation: The Identity, Simple Rotation, Double Rotation and Isoclinic Rotation. To check a player's classification, we need to look at the two pairs Multiplication and Rotation Angle Cards and multiply them. (Players should not rearrange the order of the pairs once they have inspected their cards). You might need to add or subtract 360 to the resulting number to help you check your classification. For example, 360 is the same as 0, -270 is the same as 90 and 540 is the same as 180. (This is because Rotation of 360 degrees is the same as not rotating, see more in the example down below).

- The Identity: You are the Identity if the resulting angles of both pairs are 0. Your goal is to be the last person standing (you also need to eliminate other Identities Player).
- Simple Rotation: If one of the resulting angles are 0 but the other one is not, then you are a simple rotation. Your goal is to eliminate all Double Rotations Players.
- Double Rotation: If none of the resulting angles are 0, then you are a Double Rotation. Your goal is to eliminate all Simple Rotations Players
- Isoclinic Rotation: You are a special kind of Double Rotation; the difference is the two resulting angles are $\pm$ of each other. You have no means to win the game; you must change your classification in any means. If you are the last person standing, then all other players win.

How to Play

At the start of the game, randomly choose one person to be the starting player, and that player will take the first turn.

Each player must do the **ONE** of the following in each of their turn:

1. Spend Operator Cubes equal to the cost of one card in the Open Draw Area, you must then take the action that is written on the card. Then put the card faced up in a separate discard pile.
2. Spend 6 Operator Cubes to draw a card from the top of the Function Cards Deck, then you must take the action written on the card. Put the card faced up in the discard pile.
3. Gain 2 Operator Cubes
4. Spend 1 Operator Cubes to discard the whole Open Draw Area and put 3 new cards from the deck onto it.

After a player take one of those actions, they will pass the turn in clockwise order.

Every player has two life which is indicated by the amount of unrevealed Rotation Angle Cards. All Cards of a player start unrevealed, and when both Rotation Cards are revealed, that player is considered eliminated and proceed with the endgame requirements check (see below).

Each player can only have 7 operator cubes at once, players may not take Action (2) if they already have 7 operator cubes or there is no operator cubes left to take (If there is 1 left, take one).

The game will end once one of the Endgame requirements is met.

Players may not in anytime show other players one of their cards, but players are allowed to discuss and even lie about their cards.

End of the Game

Every time a player is eliminated from the game (and only when a player is eliminated), the eliminated player will check if any winning conditions are met:

The eliminated player will signal everyone to close their eyes, and they will check the following

1. Ask every player that is a Simple Rotation to raise their thumb (if you were one but not anymore don't open your eyes). If no one is a Simple Rotation, all players that are a Double Rotation but not an Isoclinic Rotation win. (including Eliminated players)
2. Ask Every player that is a Double Rotation (including Isoclinic Rotation) to raise their thumb. If no one is a Double Rotation, then all players that are a Simple Rotation win. (including Eliminated players)

If only one player is left standing, check their identity instead

1. If the player is an Identity, they are the only winner.
2. If the player is a Simple Rotation, all players that are Simple Rotation (including eliminated players) win.

3. If the player is a Double Rotation but not an Isoclinic Rotation, all players that are Double Rotation but not an Isoclinic Rotation (including eliminated players) win.
4. If the player is an Isoclinic Rotation, all other players (including eliminated players) win.

Note that it is crucial to remember that you are **no longer** the previous Rotation if you changed into another Rotation.

Function Card List:

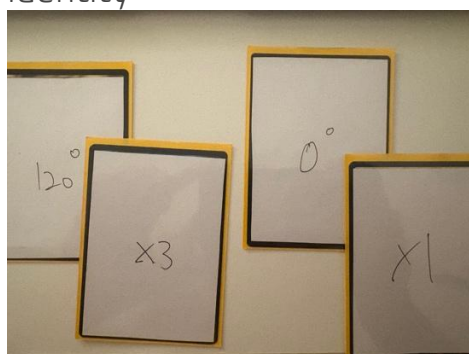
- Composition – Cost 0 – Get 3 Operator Cubes (cannot take the action if you already have 7 operator cubes or there is no operator cubes left to take. If there are only 1 or two cubes left, take all of them).
- Eigenvalue Inspection – Cost 2 – Check any one unrevealed Rotation Angle Card.
- Multiplier inspection – Cost 2 – Check any one Multiplication Card.
- Indicator – Cost 3 – Choose two players, then show one of your unrevealed Rotation Angle Card to them and then look at one of each player's Rotation Angle Cards.
- Left/Right Multiply – Cost 4 – Every player chooses and takes an unrevealed Rotation Angle Card from the player on your left/right. (Skip all eliminated players)
- Decomposition – Cost 5 – Reveals any one unrevealed Rotation Angle Cards.
- Exposure – Cost 7 – Look at every card of any one player. (Both Multiplication Cards and Rotation Angle Cards)

Teacher Tips

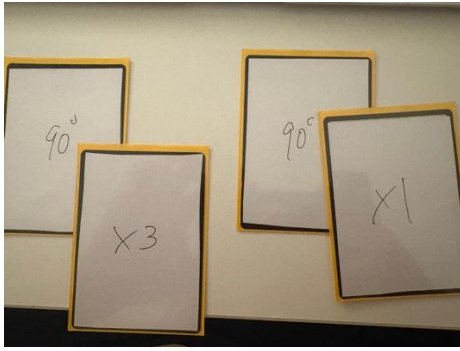
Teacher can assist the student by checking all the end of the game conditions when someone is eliminated.

Classification Examples

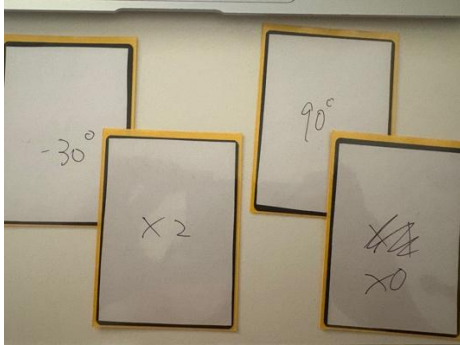
- The resulting number for the following is $0(360 = 0)$ and 0 , so the player is an Identity



- This is a harder one, the resulting number is 270 and 90 , but $270 = -90$, so this is actually an Isoclinic Rotation



- The resulting number is 60 and 0, so this is a Simple Rotation



- The resulting number is 300 ($-60 = 300$) and 270, so this is a Double Rotation.

