



MATHEMAGIC

- THE RACETRACK -



Educational Goals

- ❖ Develop logic
- ❖ Understand probabilities with a concrete example and estimate the chance of a successful trick.

Key Features of the Targeted Competencies

- ❖ To decode the elements that can be processed mathematically
- ❖ To work out a mathematical solution
- ❖ To form and apply networks of mathematical concepts and processes
- ❖ To establish conjectures

Concept Used

- ❖ Probability

Materials

- ❖ Magic trick video
- ❖ 1 deck of playing cards per team
- ❖ 1 die per team
- ❖ Paper
- ❖ Pencils

Targeted Academic Levels
Grades 7 to 11

Mathematical Field Concerned



Suggested Teaching Method



Time Required
Approximately 40 minutes



SUGGESTED PROCESS



Step 1: Introduction (5 minutes)

Play the magic trick video once (www.amazingmaths.ulaval.ca).

If you prefer to do the magic trick instead of playing the video, refer to *The Racetrack's* Explanation Sheet available online.

Step 2: Finding out how the trick works (20 minutes)

Place the students in teams of 6.

Here is a suggestion to let the students find out how the trick works:

Each team must create a racetrack with the 24 cards. Afterwards, explain that they will have to find a way to try all the possibilities of the route that the spectator can take.

You may give them the following hints:

- Which accessory should the spectator use to determine the card on which he should start?
- How many faces does this accessory have?
- What are the possibilities of starting points?

As there are six possible starting points, each person can try a different possibility and observe on which card, after the finish line, each person finishes.

Once each of the possibilities is completed, you can ask the following questions:

- What do you notice about the final card on which you all landed on?
- How do you think the magician managed to find the spectator's final card?

Once they understand that in any case we arrive on the same final card you can question them on the reason of this fact.

- Where did the routes intersect? Suggest observing each route to understand how the trick works.

Inform the students that the magician is looking at the first card and making the route in his head while the spectator positions the cards to maximize his chances of meeting.

Step 4: Estimate the probability of the trick's success (20 minutes)

Play the end of the video again during the final question:



Does this trick work every time?



SUGGESTED PROCESS (CONTINUED)

As the answer is no, the rest of the activity will be aimed at approximating the probability of the trick's success.

To make as many different routes as possible, ask each team to create a different track.

Note: The cards' suits (spades, hearts, diamonds, clubs) are not important for the trick. Only **the value of the cards** matters. Thus, 2 routes are similar when the cards from the starting card to the finishing card all have the same value.

For each route, students can try a different start option. Since a die has the numbers 1, 2, 3, 4, 5 and 6, they can start on the 1st, 2nd, 3rd, 4th, 5th, or 6th card from the beginning. They must look at which card they finish on at the end of the route. They can then compare this card to the card obtained by the magician, that is the card obtained when completing the route starting from the 1st card from the beginning.

- If they finish on the same card as the magician, the attempt counts as a success.
- If they finish on a different card, the attempt is scored as a failure.

The whole class tries **different routes**. Each time a route is tried, we note whether it corresponds to a success or a failure.

At the end, we count the number of successes obtained. By dividing it by the total number of attempts, the students will then have estimated the probability of success of the trick and they will see that this number is close to 1. This shows that the trick is likely to work, but is not perfect!