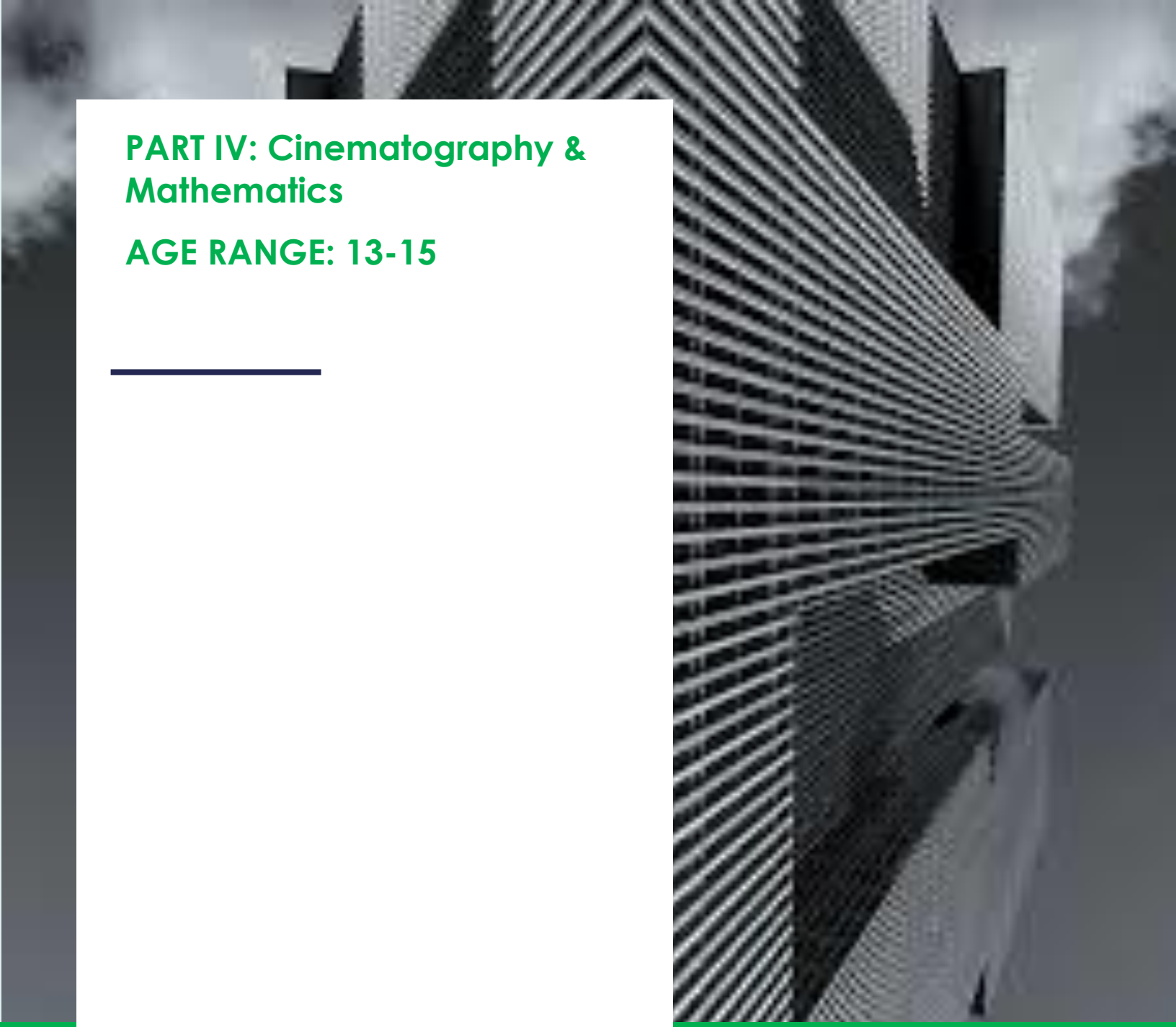

PART IV: Cinematography & Mathematics

AGE RANGE: 13-15

TOOL 45: PROBABILITY IN MIRRORED

Sandgärdskolan

TheArtOf Maths

Co-funded by the Erasmus+ Programme of the European Union

Educator's Guide

Title: Probability in Mirrored

Age Range: 13-15 years old

Duration: 2 hours

Mathematical Concepts: Probability; Binary numbers

Artistic Concepts: Crime solving series

General Objectives: The general objective in this tool is to solve a detective puzzle together with the character in the film. You will need to use knowledge of probability.
Instructions and Methodologies: Watch the film and try to solve the puzzle together with the detective.

Resources: This tool provides links to videos for you to use in your classroom.

Tips for the educator: Even though there is much hands-on activities involved, remember to be exact about the mathematics.

Desirable Outcomes and Competences: At the end of this tool, the student will be able to:

- Understand probability and binary numbers in an improved way.
- Understand crime series in a more distinguished way

Debriefing and Evaluation:

Write 3 aspects you liked about this activity:	1. 2. 3.
Write 2 aspects that you have learned	1. 2.
Write 1 aspect for improvement	1.

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Introduction

Li finds a mysterious mirror in her grandmother's summer cottage and suddenly receives strange messages on her cellphone. She contacts her friends Greger and Amina and together they try to figure out what the messages can mean. At the same time, Li's grandmother, who is the manager of a large research facility, is starting a final experiment before midsummer evening.

Watch the first section of Mirrored. In this section they are going through binary numbers and probability.

 https://urskola.se/Produkter/193912-Spegelvand-Spegeln?cmpid=del:cl:20190218:urskola

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The laboratories MAX IV and CERN

The MAX IV-laboratory is a Swedish national laboratory for accelerator physics and science, with the help of synchrotron light. The laboratory is located in the south of Sweden in the University city Lund. It will be fully built in 2026 and is calculated to have around 3000 users per year, from all over the world, working in a lot of different fields such as Physics, Biology, Chemistry, Medicine and material science. The MAX-lab was opened 1986.

Picture 1 Brunnshög in northeastern Scania, Sweden Max IV–flygbild 06 september 2014-2.jpg

CERN is seen as the leading laboratory in the world when it comes to high energy physics and the world's largest laboratory for particle physics. About 2500 people

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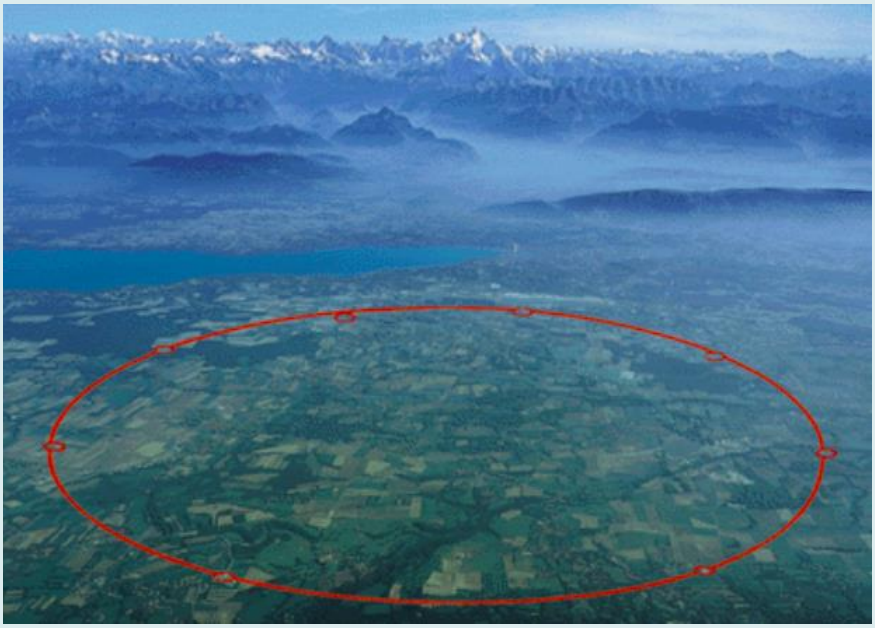
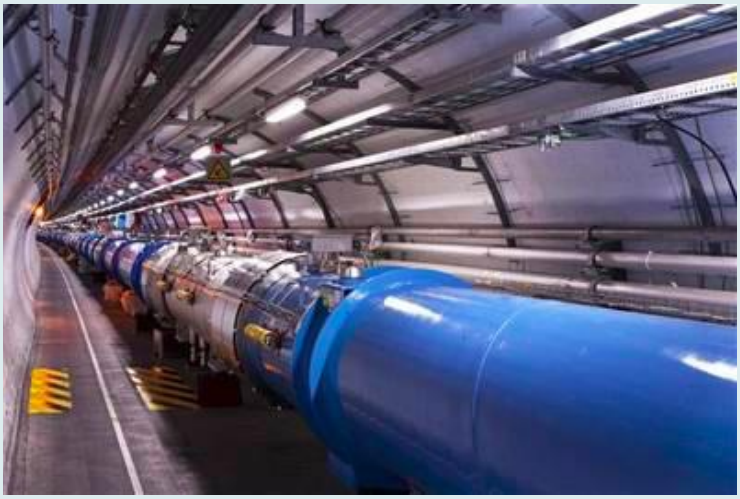
work here and more then 10000 guest scientists from 113 countries participate in the science work at CERN.

The convention to establish CERN was signed in September 1954 by 12 countries. CERN is situated near Geneva in Switzerland



Picture 2 CERN Aerial view https://commons.wikimedia.org/wiki/File:CERN_Aerial_View.jpg



Picture 3 CERN tunnel https://www.flickr.com/photos/miniprince/10007299826/

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Glossary

Antimatter: is the opposite to ordinary matter, which our galaxy and the rest of our visible universe consists of.

Particle accelerator: a device where charged particles, mainly elementary particles like electrons, positrons and protons, accelerate to high speed end high energy in electric fields.

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The Math behind Mirrored

Binary Numbers: is based on the number bases 2 and only use two digits. Just as in the decimal number system, the digit to the right is the biggest. To write numbers in the binary number system you only use the digits 0 and 1. The position of the digit is important. See the chart below.

Decimal	Binary
0	0
1	1
2	10
3	11
4	100
5	101
6	110

 Still confused? Watch this video:
https://youtu.be/LpuPe81bc2w

Number line: The number line is one way of illustrating real numbers (all numbers) value in related to each other. See example below.

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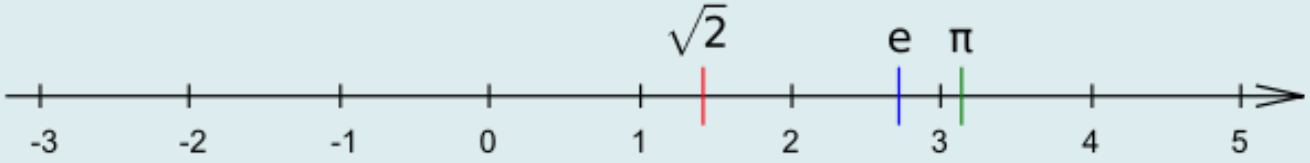

Probability: is a technique for how likely a specific incident would happen. When you describe probability you use percent, fractions or decimals.

Picture 4 Dice Red Two Game https://pixabay.com/vectors/dice-red-two-game-rolling-chance-25637/

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TASK

Probability

1. Throw two dice 50 times. Note your results and compile them in charts. Note how many results you get of number 1-6. Then calculate how many percent of the number 1-6 you got. You have now calculated a probability.
2. If you want one specific digit when you hit a dice how much probability is it then that you just get that digit.
3. If you have two dice, how many combinations is it possible to get when you throw.
4. How high is the probability that you get a one when you throw a dice? How high is the probability that you get a one when you throw three dice? How high is the probability that you get three ones when you throw three dice?

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