The Beauty Formula

Key Learning Content

This film argues that attractiveness in the human face is determined by two key factors: reflective symmetry and proportion. These factors are known as the Golden Ratio. Appeals are made to genetics to support the argument. Examples of Golden Ratio proportions in facial features are illustrated on screen. The film requires little prior mathematical knowledge, although familiarity with the Golden Ratio would be desirable. The film gives an opportunity for advanced students to cover reflections and rotations using matrices.

Core Outcomes

Learning Points

- Be able to use ratio notation, including reduction to its simplest form and its various links to fraction notation, expressing it in the form $1:n$.
- Be able to identify lines of symmetry in a given two-dimensional figure.

Suggested Activities

- Identify lines of reflective symmetry in nature, buildings and art.
- Carry out a survey of body lengths within the class to see how the Golden Ratio works in practice.

Extension Outcomes

Learning Points

- Be able to use matrices to reflect an image about a mirror line.
- Be able to use matrices to rotate an image about a fixed point.

Suggested Activities

- Transfer images to an x-y grid and rotate and reflect these using matrices.
- Explore how other transformations can be captured using matrices.

The Golden Ratio is visible in many parts of human anatomy, including the face.

Related Films

To use before the lesson plan:

Variables: Dating By Numbers	This film shows how one mathematician is trying to use mathematics to model human attraction.
Maths and the Mona Lisa	This film demonstrates that the Golden Ratio principle underpins the enigmatic beauty of the Mona Lisa.

To use after the lesson plan:

Proportion: The Vitruvian Man	This film shows how Leonardo da Vinci used precise proportions to construct his idea of a perfect body shape.
The Mirror Lines of the Taj Mahal	This film analyses the many lines of reflective symmetry found within the design of this famous building.

Guide Lesson Plan

Introduction

Using photo editing software, select a publicly available image of a well-known celebrity, crop the image in half with a vertical cut, and reflect the remaining half-face to create a perfectly symmetrical image. Show both the original and transformed images to the students and discuss which is most attractive.

Show Film

The Beauty Formula

Main Activity

Foundation

Ask the students to carry out a survey of their key body lengths, for example:
underarm to fingertips : elbow to fingertips;
length of head : width of head;
hairline to chin : hairline to bottom of nose;
height : floor to navel.
Calculate the ratios of these lengths and compare with the Golden Ratio.

Advanced

Explain how to use 2-by-2 matrices to rotate and reflect points about the origin and the y-axis. Ask the students to transfer the outline of an image onto an x-y grid and read perimeter coordinates from the grid. Multiply coordinate vectors by matrices to generate image points. Explain that this is how computer graphics software works.

Extension Activity

Foundation

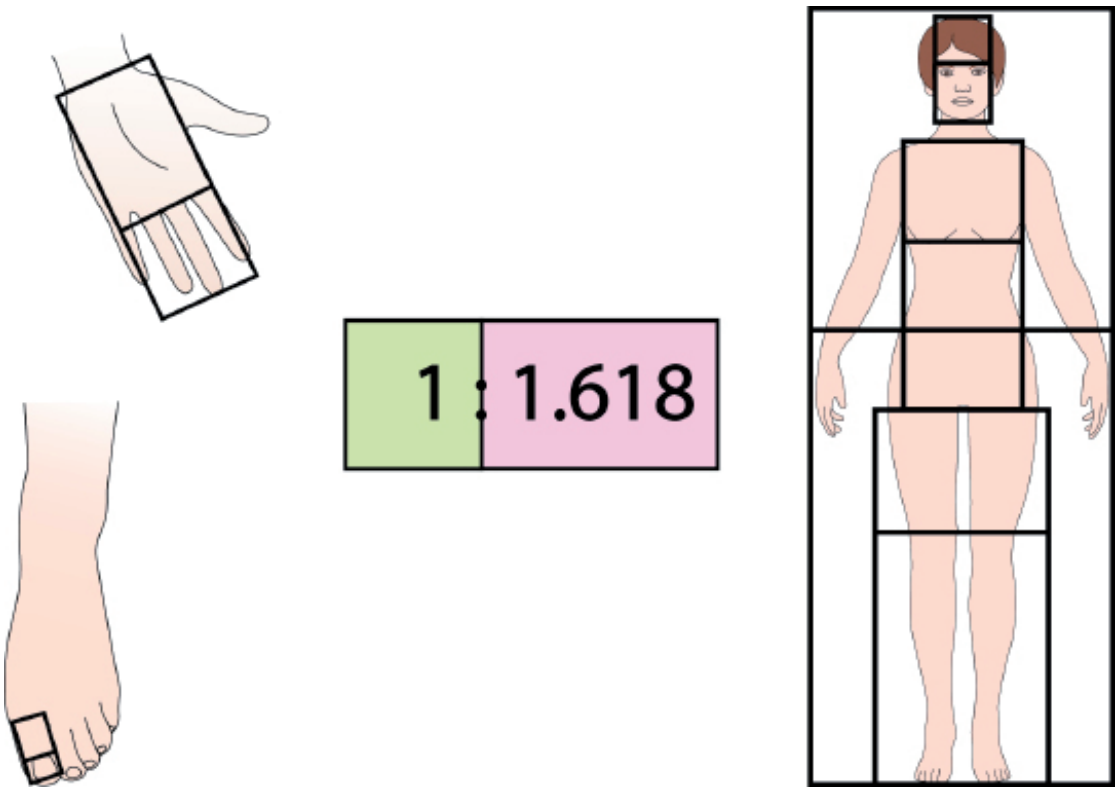
Suggest that students to carry out a survey with family members in order to find out if there are any common family traits in body ratios.

Advanced

Ask the students to automate the matrix multiplication using a spreadsheet, and use the software to plot object and image.

Optional Extra

Ask students to transform images of themselves and their family members using photo editing software at home. Does reflective symmetry in facial features really make a difference to attractiveness?



Scientists have revealed that the Golden Ratio, 1:1.618, is central to our perception of beauty. It is visible in many parts of human anatomy, from our toes, to our hands and torso.