Painting By Numbers

Key Learning Content

This film describes the use of perspective in Renaissance art to give 2-dimensional images the illusion of 3-dimensional depth. The rules of perspective are illustrated on screen. Lines parallel to the horizon remain parallel, while lines perpendicular to the horizon converge to a vanishing point. Implications for the scale of objects near and far away are demonstrated, with larger objects appearing nearer to the viewer. The film can also be used as an introduction to the principles of mathematical enlargement, with the vanishing point serving as the centre of enlargement.

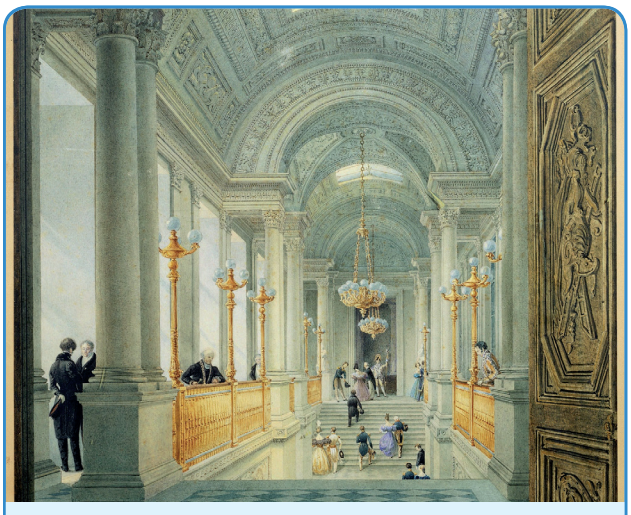
Core Outcomes

Learning Points

- Be able to understand that enlargements are specified by a centre and a scale factor (positive scale factor only).
- Be able to use and interpret maps and scale drawings.
- Be able to solve problems using scale drawings.

Suggested Activities

- Enlarge a given object using a centre of enlargement and lines through the centre.
- Find the centre and scale factor of enlargement given object and image.



The art world first embraced perspective during the Renaissance period, giving art a new dimension.

Extension Outcomes

Learning Points

- Be able to give informal reasons, where required, when arriving at numerical solutions to geometrical problems based on lines, triangles or polygons.
- Be able to use angle properties of intersecting lines, parallel lines and angles on a straight line, e.g. angles at a point, vertically opposite angles, alternate angles and corresponding angles.

Suggested Activities

- Construct a scale drawing of a chess board drawn using perspective and identify similar shapes within the drawing.
- Calculate the areas of congruent shapes drawn under perspective.

Related Films

To use before the lesson plan:

Modelling the Spitfire	This film explores the mathematics of making a 1:72 scale model of a Spitfire airplane.

To use after the lesson plan:

Perspective: Parallax	This film shows how perspective and the parallax effect are used to measure distances to the most distant stars.
The History of the Golden Ratio	This film explains that mathematics has affected art and design from the ancient Egyptians to the Renaissance.
Maths and the Mona Lisa	This film presents a mathematical analysis of Leonardo da Vinci's famous painting.
Proportion: The Vitruvian Man	This film demonstrates the importance of proportion in drawing the human figure.
Topology	This film contains examples which deceive the eye with tricks of perspective.

Guide Lesson Plan

Introduction

Show pictures drawn with 'false' perspective to confuse the eye (e.g. Escher's endless staircase). Ask students to interpret them and explain how they think the effects were obtained.

Show Film

Painting By Numbers

Main Activity

Foundation

Begin by explaining the principles of mathematical enlargement with a scale factor and centre of enlargement. Then tell students to enlarge a given shape, e.g. a picture of the Taj Mahal. Repeat for fractional enlargements. Explore what happens to area under these enlargements.

Main Activity cont...

Advanced

Tell students to draw a chess board using perspective, i.e. start with a horizontal line across the bottom of the page divided into eight equal segments. Place the vanishing point above the line and perpendicular to its centre. Draw the complete chess board (hint: consider diagonal lines on the chess board which remain straight in the perspective drawing). What determines the distance between the first pair of horizontal lines drawn?

Extension Activity

Foundation

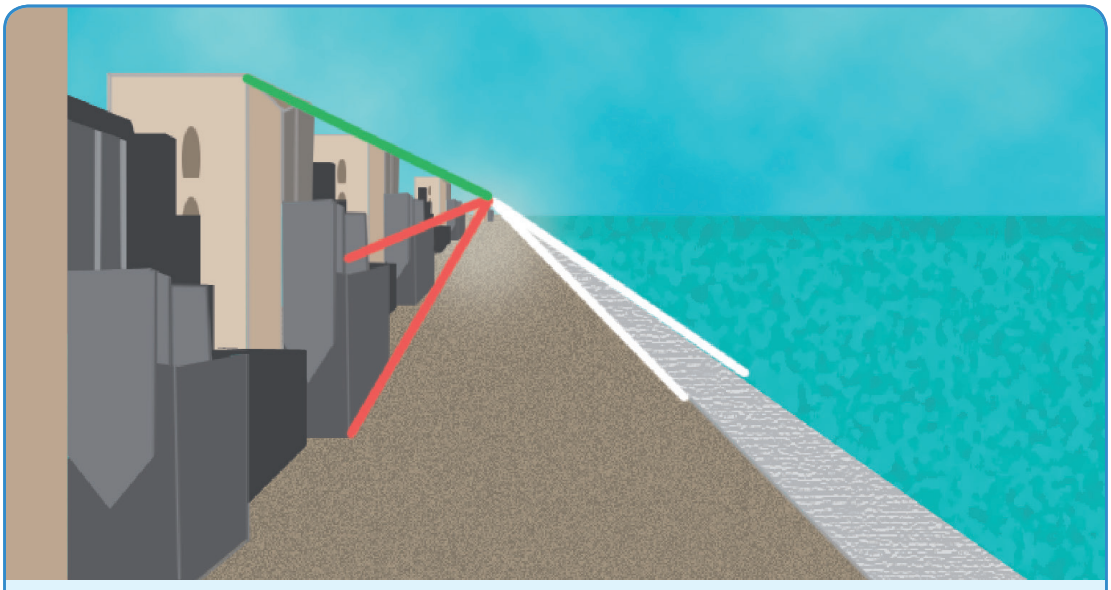
Extend theory to cover negative enlargements. Explore what happens to the orientation (clockwise/anticlockwise) under negative enlargement.

Advanced

Consider the chess board drawn with perspective. Take the middle two columns of squares on the board. Calculate the ratio between the areas of successive squares on the board as you move into the distance.

Optional Extra

Using perspective drawing, create your own optical illusion. Students may wish to take an existing optical illusion drawing, analyse how it has been created using perspective, and then reproduce the method in another setting.



Brunelleschi's rules of perspective state:
1) The horizon should appear as a line.
2) The lines running perpendicular or parallel to the horizon should remain parallel in order to give depth.
3) The rest of the sets of parallel lines need to converge at a point.