



# **MATH-terpieces Tour**

Applying math thinking to  
artworks at the NBMAA

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Tour Preparation Packet for Teachers

**NEW BRITAIN MUSEUM OF AMERICAN ART**

56 Lexington St. | New Britain, CT | 06052 | [nbmaa.org](http://nbmaa.org)

## About this Resource

This resource has been designed to help teachers and students in grades 6-8 discover connections between art and math by viewing artworks in the NBMAA's collection.

The self-guided format allows students to move through the presentation by following questions that guide looking and discovery at their own pace.

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## How to use this Resource

- Use it to prepare students before a visit to the NBMAA.
- Use it as a virtual visit in place of a visit to the NBMAA.
- Go directly to page 5 to start the tour!
- Or review terms and concepts on pages 22-29.

## What's in this Resource Packet?

- Tour Objectives are on page 3.
- List of Artworks is on page 4.
- Tour of artworks is on pages 5-15.
- An art activity to make in classroom or at home is on page 17.
- Vocabulary, standards and key concepts are on pages 18-27.

## What are the Objectives of this Tour?

**Students will have the opportunity to:**

1. **Examine** how artists have used **problem solving, reasoning, measurement, estimation, geometry, patterns**, and other mathematical concepts to aid in the creation of this selection of artworks in the NBMAA collections.
2. **Learn** art and math vocabulary.
3. **Consider** the impact of an artistic work on themselves or others.
4. **Apply** their knowledge of mathematical principles and concepts to create their own work of art.

**In other words, students will discover connections between art and math!**



**Here are the Seven Artworks you'll explore on this tour.  
They are divided into three groups:  
Installations and Sculptures, Landscape Paintings, and Portraits.**

### **Installations and Sculpture**

- Sol LeWitt, *Scribbles*, 2005/06
- Sol LeWitt, *Complex Form #4*, 1987
- Jill Reynolds and Daniel Spitzer, *Nor'Easter*, 2015
- Dale Chihuly, *Blue and Beyond Blue*, 2000

### **Landscapes**

- Frederic Edwin Church, *West Rock*, 1849
- Kay Sage, *Unusual Thursday*, 1948

### **Portraits**

- Drew Tal, *Porcelain Promises*, 2008

**You can find more information on each artist and artwork by visiting our eMuseum Tour  
[ink.nbmaa.org/collections/46813/mathterpieces-tour](http://ink.nbmaa.org/collections/46813/mathterpieces-tour)**



# Let's begin!

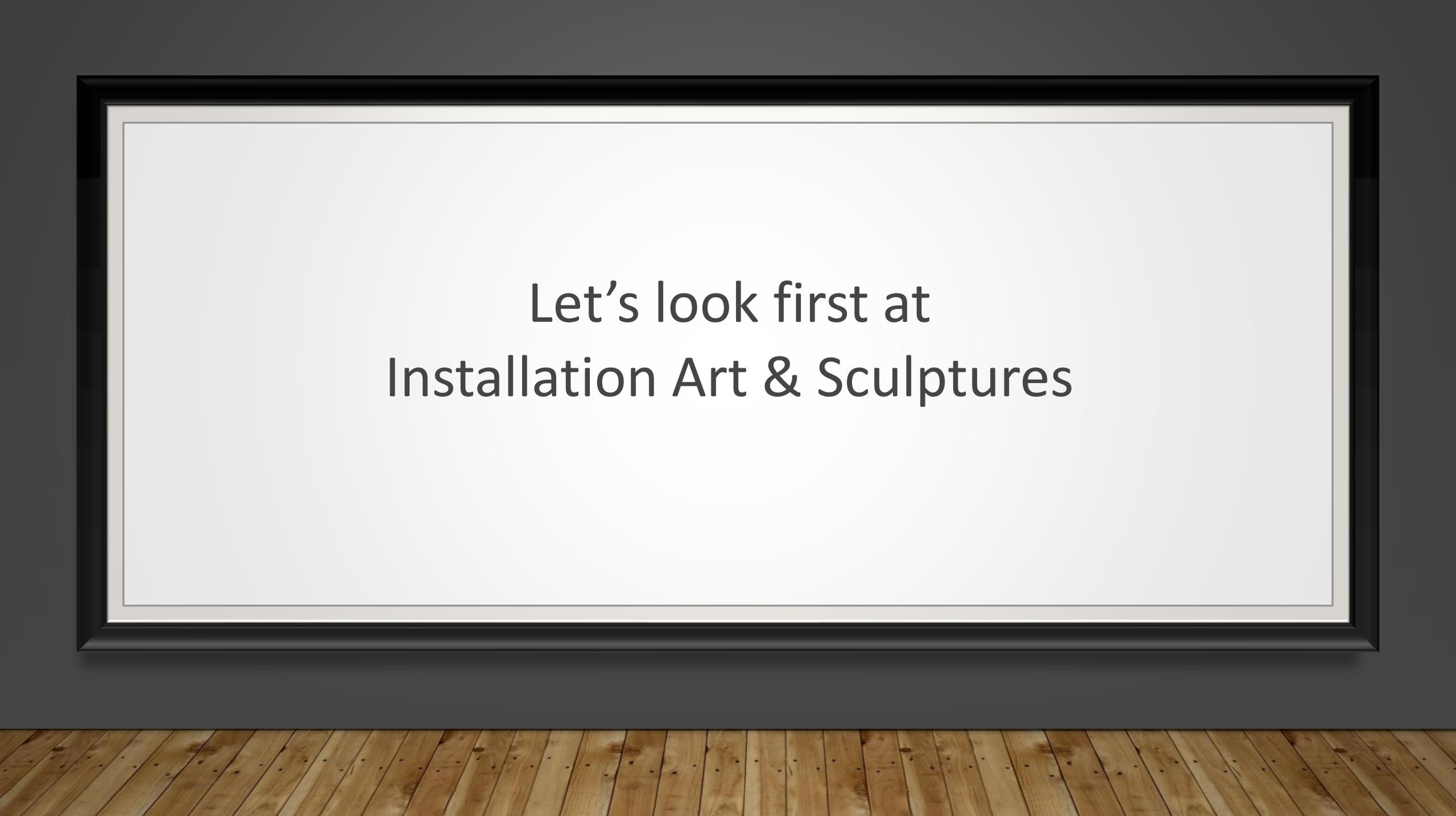
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Pretend that you are a detective.

What math concepts can you find when you look at artworks?

As you are looking, read the questions to help you find as many connections between art and math as possible.



A dark grey wall features a large whiteboard with a black frame and a white border. The whiteboard contains the text 'Let's look first at Installation Art & Sculptures'. At the bottom of the image, a wooden floor with vertical planks is visible.

Let's look first at  
Installation Art & Sculptures

## Where's the math in this drawing?

Working only with pencils and following precise instructions, six artists drew this 13 ft. 7 in. high by 27 ft. 7 in. work directly on the wall in the Museum's lobby!

Look closely at Scribbles and answer the questions on the right!



Sol LeWitt (American 1928-2007)  
*Wall drawing #1196, Scribbles*, 2005-06  
Graphite  
161" x 303"  
Gift of the Artist, 2006.1

1. How many columns can you **count**?
2. Can you describe the **pattern you see**.
3. How do you think the artist used **measurement**?
4. Can you calculate the **area** of the drawing?
5. What title would you give this artwork?

## Where's the math in this **sculpture**?

Now, let's look at another artwork by Sol LeWitt, a **sculpture**, or **structure**, named *Complex Form #4*, 1987.

This artwork was inspired by Egyptian pyramids. Some people have described this as an iceberg.

The artist used the basic geometric vocabulary of ancient architecture, including ziggurats, pyramids, and cubes to create his artwork.

1. What **shapes** do you see?
2. Can you see how LeWitt used **geometry**?
3. Do you think the artist used **measurement** to create this **structure**?
4. How would you calculate the **volume of this structure**?
5. What does this artwork remind you of?



Sol LeWitt (American, 1928 - 2007)

*Complex Form #4*, 1987

Painted aluminum (in two sections)

124 x 136 x 53 in

Sculpture

Gift of the artist and Members Purchase Fund; 1995.25

# Where's the math in this glass **sculpture**?

This sculpture is made of 257 of pieces of blown glass that are connected and suspended from a ceiling. It weighs over 600 pounds!

1. What do the **shapes** remind you of?
2. If we were to remove five pieces of glass from this **sculpture**, what would we need to consider?
3. What factors did the installers need to take into account to hang this work? (weight, height, width, supports)
4. How would you describe the **texture** of the surface of this glass if you could touch it?
5. If Dale Chihuly, the artist, joined our tour, what question would you ask him about this work?



Dale Chihuly (American, b. 1941)  
*Blue and Beyond Blue*, 2000  
Blown Glass, Steel  
107 x 82 x 77 in.  
Sculpture

## Where's the math in this **installation**?

This glass installation, called *Nor'easter*, tells stories about math, weather, and people. Approximately 256 glass pieces create the shape of an iconic nor'easter in three ways: the darker denser storm center, the surrounding lighter-colored concentric isobars of barometric pressure, and the droplets of precipitation.

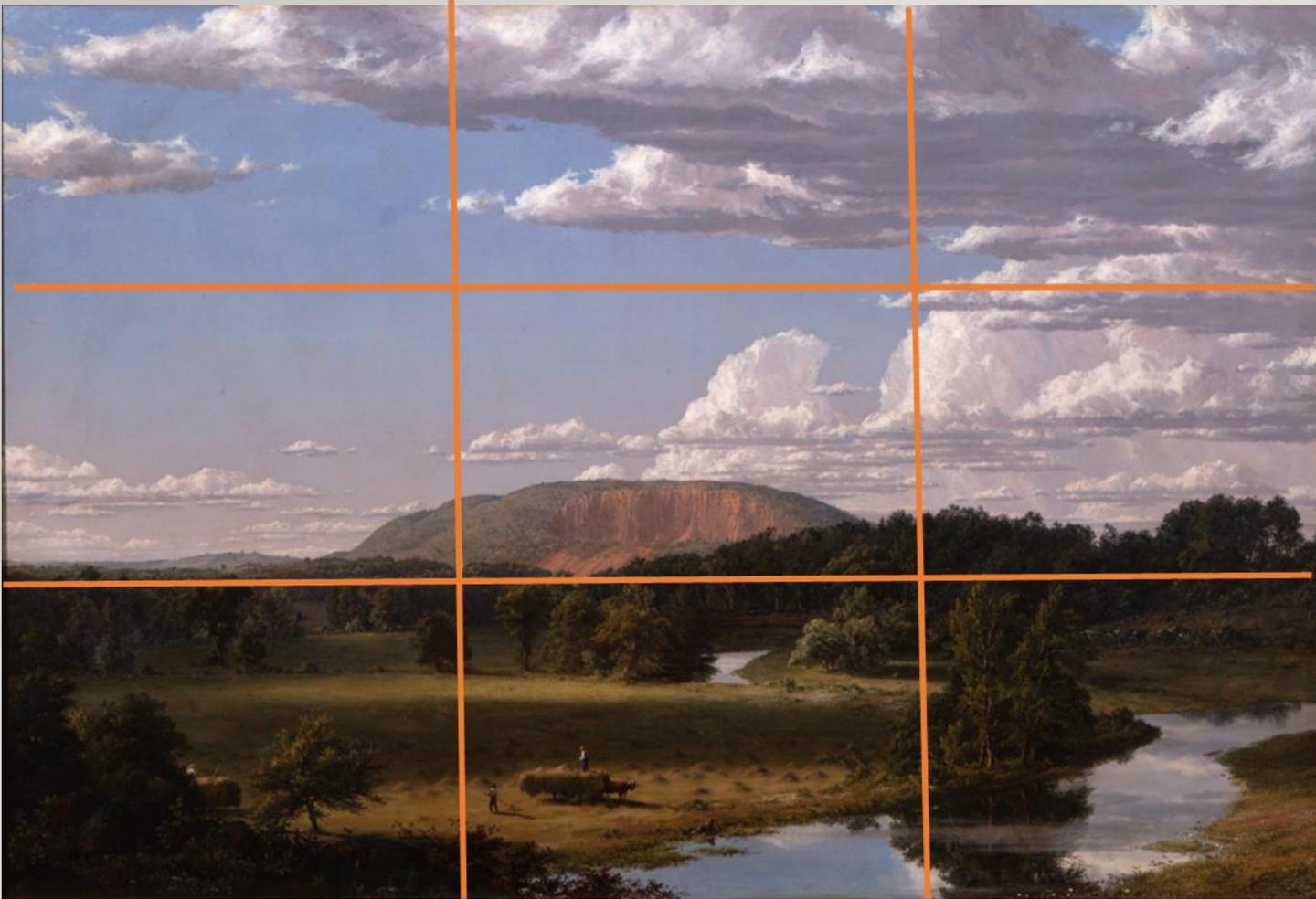
1. What is the main **color**? Why might the artists have chosen this color? (Look at the title for a clue)
2. What **shapes** do you see? Trace them with your finger. What do they make you think of?
3. The title is *Nor'Easter* – What is it like during a Nor'Easter?
4. How would you calculate the area this artwork takes up?
5. Would you want to hang this artwork in your room? Why or why not?



Jill Reynolds and Daniel Spitzer  
*Nor'Easter*, 2015  
Blown Glass, stainless steel hardware  
160" x 40" x 7"  
Gift of Mr. Roland Vogel  
2014.87

Now let's look at two Landscape Paintings!

## Where's the math in this **landscape** painting?



FREDERIC EDWIN CHURCH (AMERICAN, 1826 - 1900)  
WEST ROCK, NEW HAVEN, 1849  
OIL ON CANVAS, 527 1/8 X 40 1/8 IN. (68.9 X 101.9 CM) FRAME DIMENSION: 40 7/8 X  
54 X 5 IN. (103.8 X 137.2 X 12.7 CM)  
JOHN BUTLER TALCOTT FUND. 1950.10

This is a painting of a well-known bluff near New Haven, CT painted in 1849. Do you see the field of freshly mown hay and men working? Notice the blue sky filled with drifting white clouds.

1. How many squares can you count on this grid?
2. What is the **proportion** of *West Rock* in the **background**, to the people in the **foreground**? (which is larger, which is smaller?)
3. What is located on the **horizon line** in bottom 1/3 of rectangle?
4. What are the shapes of the clouds?
5. Would you like to visit this place? Why or why not?

## Where's the math in this **surreal landscape**?



Kay Sage (American, 1898 - 1963)  
*Unusual Thursday*, 1951  
Oil on canvas, 31 3/4 x 38 3/4 in.  
Gift of Mrs. Naum Gabo, 1978.90

Here's what the artist said about her painting:

"I start with some sort of composition. I see it in a way in advance, but very often it changes as I go along. I do know that while I'm painting, I feel as though I were living in the place."

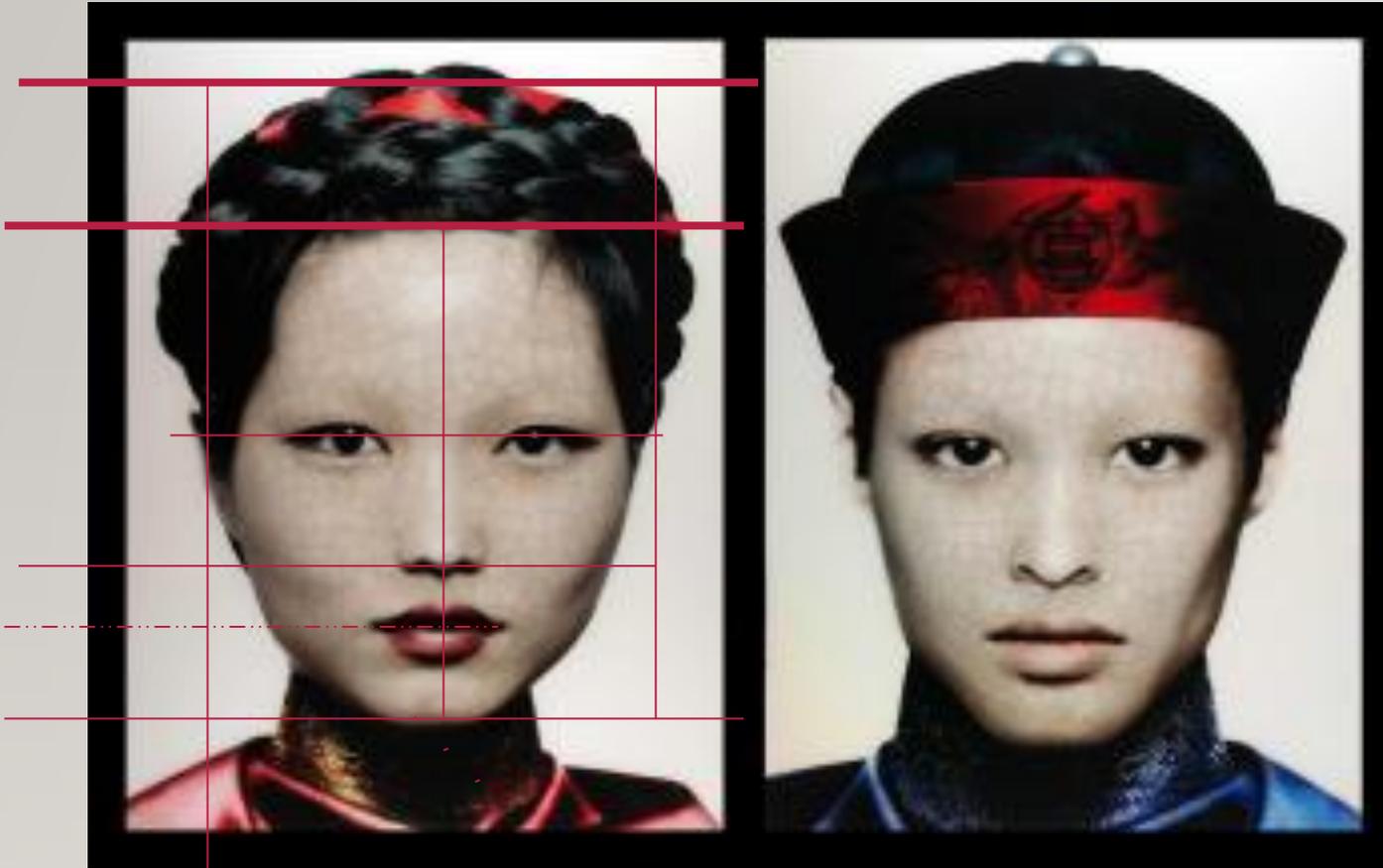
1. Would you want to live in this place? Why or why not?
2. Is this a **real** place?
3. How many **parallel** lines can you **count**?
4. Describe how the artist used symmetry.
5. Is the **horizon** line near or far?
6. What is the **story** about this place?

# Portraits

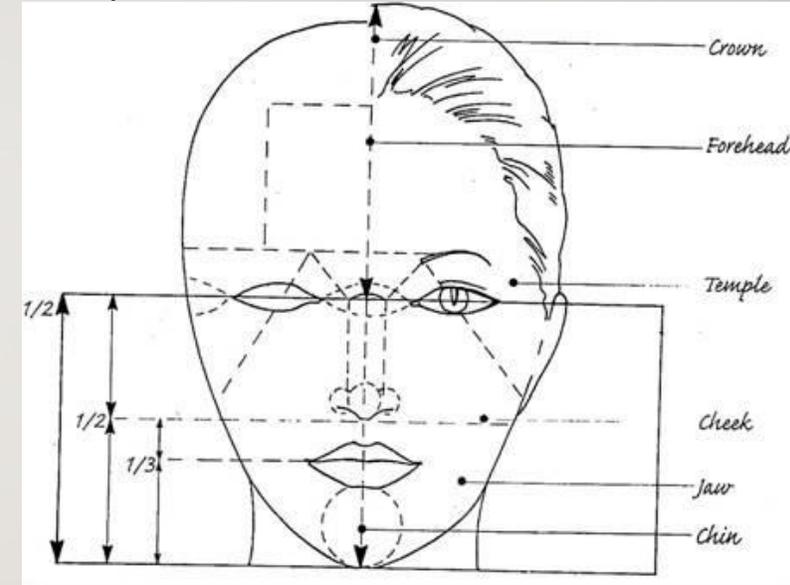
Have you ever drawn your own portrait or a portrait of a friend?

Let's see how artists use math to create portraits.

## Where's the math in this portrait?



"Porcelain Promises" is a pair of dramatic, close-up portraits featuring a young couple. In the portrait on the left, we added lines on the face to help you see the math behind the portrait.



1. Where are the eyes located on the head?
2. What is the distance between the two eyes?
3. Is the face symmetrical?

Drew Tal (b. 1957)

*Porcelain Promises*, 2008

Duraflex fine art print mounted on aluminum (Diptych)

50 × 37 1/2 in. (127 × 95.3 cm) 50 × 75 × 2 in. (127 × 190.5 × 5.1 cm)

Gift of the Emmanuel Fremin Gallery and Christopher Hyland

2011.29

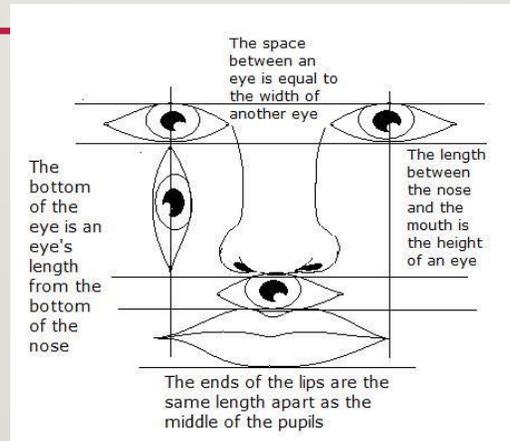
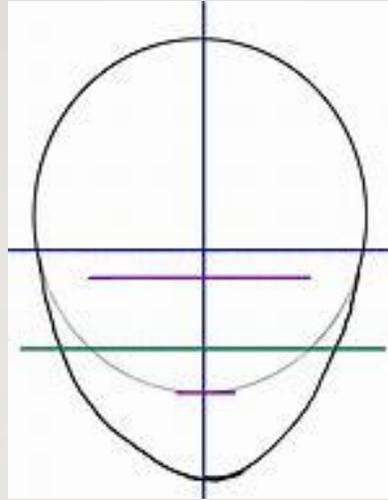
Now, it's your turn to be the artist!

# Draw a head and face in 9 Steps!

**Materials:** Any size paper, a pencil and eraser  
(You can print this page and draw in the frame!)

## Instructions:

1. Draw a large egg shape wider at the top and thinner at the bottom. The top is the forehead and the bottom is the chin.
2. Draw a light line vertically down the center of the face or egg. This is the "Y" axis.
3. Then draw a light horizontal line through the face at the eye line. This is the "X" axis and where you will draw the eyes. Each eye should be drawn equal in distance from the Y axis. The ears will also be opposite this line outside of the head.
4. Next draw the nose line, a light line 1/2 way between the horizontal line and the chin (the nose should be drawn where the X and Y axis intersects).
5. Draw the mouth line, a light line between the nose line and the chin. The mouth is drawn on this line where the X and Y axis intersects. The corners of the mouth line up with the middle of the eyes.
6. The neck starts under the ears as just two lines.
7. A shirt curves around the neck and down to the end of the paper.
8. The hair is put in on and above the forehead - above the eyes.
9. First erase all the grid lines then color It, If you'd like.



# Concepts, Terms, and Definitions

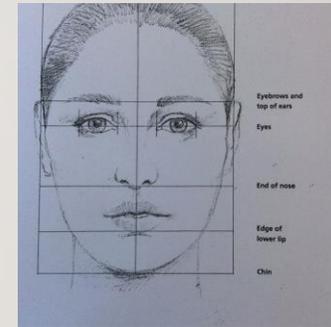
# WHAT IS ART?



The expression of human creative skill and imagination producing works to be appreciated primarily for their beauty or emotional power.



The various branches of creative activity, such as painting, music, literature, and dance.



A skill at doing a specified thing, typically one acquired through practice.

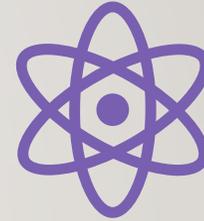
# WHAT IS MATH?



Math is all around us, in everything we do.



It is the building block for everything in our daily lives, including mobile devices, **architecture**, **art**, money, **engineering**, and even sports.



Mathematics is the science that deals with the logic of shape, quantity and arrangement.

## What are some ways that artists use math?

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Artists use mathematics when they:

- buy materials to make art
- calculate the size of the artwork
- use shapes and lines
- divide a composition
- use perspective
- measure size and proportions
- create preliminary sketches
- use symmetry
- create balance
- work to scale

## What are some ways that we can describe art using math?

We can use mathematics to:

- describe shapes and lines
- describe use of perspective
- describe size and proportions
- describe symmetry
- discuss balance
- calculate the area of an artwork



Many **art** terms are also **math** terms!

**Art terms used on this Tour**

Installation	Sculpture	Blown Glass
Landscape	Seascape	Cityscape
Surreal	Portrait	Perspective
Foreground	Middle-ground	Background

**Math terms used on this Tour**

Counting	Patterns	Shapes	Geometry
Balance	Measurement	Volume	Area
	Grid	Plotting	

# The Elements of Art

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## 7 Elements of Art

7 Elements of Art	Definition
Line	A line is a recognizable path created by a point moving in space. It is one-dimensional and can vary in thickness, direction, and length.
Shape	Shapes have two-dimensions, length and width, and they can be geometric or organic.
Value	Value describes the brightness or darkness of color. A gradient is a series of values from lightest to darkest. Tint- White added to a color will make it lighter. Shade - Black added to color will make it darker.
Form	Forms exist in three dimensions, with length, width, and height. Shape and form define objects in space.
Space	Space in a work of art refers to a feeling of three dimensions. It can also refer to the artist's use of the area within the picture. Positive space is described as the areas in a work of art that are the subjects, or areas of interest. Negative space is area around the subjects, or the areas of interest.
Texture	The surface quality of an object. Actual texture: you can feel it. Implied texture: no actual texture.
Color	Reflected light. Organized on a color wheel with 3 primary colors, 3 secondary colors and 6 intermediate colors. Intensity refers to the brightness in color. Dull colors are muted.

# Definitions of Art Terms

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**Installation Art** - installation art is an artistic genre of three-dimensional works that are often site-specific and designed to transform the perception of a space. Generally, the term is applied to interior spaces.

**Landscape** - generalization for any artist's depiction of natural scenery. Figures and other objects are of secondary importance to the composition and incidental to the content.

**Portrait** - a work of art that represents a specific person, a group of people, or an animal. Portraits usually show what a person looks like as well as revealing something about the subject's personality. Portraits can be two-dimensional or three-dimensional.

**Rule of thirds** – The rule of thirds is a guideline which applies to the process of composing visual images such as designs, films, paintings, and photographs. The guideline proposes that an image should be imagined as divided into nine equal parts by two equally spaced horizontal lines and two equally spaced vertical lines, and that important compositional elements should be placed along these lines or their intersections. Aligning a subject with these points creates more tension, energy and interest in the composition

**Sculpture** - a three-dimensional piece of art that can be viewed from all angles. It may be made of bronze, clay, stone, metal or other materials. It can be carved, chiseled or assembled.

# Definitions of Math Terms

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<b>Area: n.</b>	The extent or measurement of a surface or piece of land.
<b>Balance: n.</b>	An even distribution of weight enabling someone or something to remain upright and steady.
<b>Density: n.</b>	How much space an object or substance takes up (its volume) in relation to the amount of matter in that object or substance (its mass).
<b>Equation: n</b>	A statement that the values of two mathematical expressions are equal.
<b>Estimation: n.</b>	A rough calculation of the value, number, quantity, or extent of something.
<b>Geometry: n.</b>	The branch of mathematics concerned with the properties and relations of points, lines, surfaces, solids, and higher dimensional analogs.
<b>Grid: n.</b>	A network of lines that cross each other to form a series of squares or rectangles
<b>Linear: adj.</b>	Arranged in or extending along a straight or nearly straight line.
<b>Measurement: n.</b>	The size, length, or amount of something, as established by measuring.
<b>Nor'easter: n.</b>	A storm along the East Coast of North America, so called because the winds over the coastal area are typically from the northeast. These storms may occur at any time of year but are most frequent and most violent between September and April.
<b>Parallel: adj.</b>	(Of lines, planes, surfaces, or objects) side by side and having the same distance continuously between them.
<b>Patterns: n.</b>	An arrangement or sequence regularly found in comparable objects.
<b>Perspective: n</b>	The art of drawing solid objects on a two-dimensional surface so as to give the right impression of their height, width, depth, and position in relation to each other when viewed from a particular point.

# Definitions of Math Terms

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<b>Plane: n.</b>	A flat 2-dimensional surface, meaning it has length and width but no depth. A plane also extends infinitely in all directions.
<b>Plotting points: v.</b>	To mark on a plan, map, or chart
<b>Problem solving: v.</b>	The process of finding solutions to difficult or complex issues
<b>Proportion: n.</b>	A part, share, or number considered in comparative relation to a whole.
<b>Quantity: n.</b>	The amount or number of a material or immaterial thing not usually estimated by spatial measurement.
<b>Ratio: n.</b>	The quantitative relation between two amounts showing the number of times one value contains or is contained within the other.
<b>Reasoning: n.</b>	The action of thinking about something in a logical, sensible way.
<b>Shapes: n.</b>	the quality of a distinct object or body in having an external surface or outline of specific form or figure.
<b>Surface: n.</b>	The outside part or uppermost layer of something (often used when describing its texture, form, or extent).
<b>Symmetry: n.</b>	The quality of being made up of exactly similar parts facing each other or around an axis
<b>Volume: n.</b>	The amount of space, measured in cubic units, that an object or substance occupies.

# APPLICABLE COMMON CORE STANDARDS EMBEDDED IN THE TOUR AND ART ACTIVITIES FOR GRADES 6, 7 & 8

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## Ratios and Proportional Relationships

- Understand ratio concepts and use ratio reasoning to solve problems
- Analyze proportional relationships and use them to solve real-world and mathematical problems.

## Geometry

- Solve real-world and mathematical problems involving area, surface area, and volume.
- Draw, construct, and describe geometrical figures and describe the relationships between them.
- Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
- Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

