MATH IN ART
Gold Level Project

In order to be eligible for Gold Level Status using the Math in Art project, your club must follow the guidelines below. Projects must be submitted through the online Gold Level Application webform. All work on a submitted Math in Art project **must be done by club members**!

Math in Art Project: The Basics

In this project, club members will **recreate a famous painting*** using any medium (paint, colored pencils, construction paper, etc.). Your club's recreation should resemble the chosen painting/be identifiable, but it should *not* look exactly the same as the original, as **at least 2 math elements** must be incorporated into the recreation. Club members should feel free to get creative with the math elements they include! We've included some examples below to give an idea of the wide range of things we're referring to, but club members should not feel limited to these math elements:

- Your club could **represent the Fibonacci number sequence** through the diameters of circles or the sides of squares, for example, and use those shapes within their recreation.
- A **pi skyline** creates "buildings" in a skyline using each digit of pi as the heights of the buildings. For example, the first building has height 3 units (centimeters, inches, squares on graph paper, etc.), the second building has height 1 unit, the third building has height 4 units, and so on.
- The concept of **proportionality** could be incorporated in a variety of ways. For example, if an original painting depicts a forest with multiple shades of green, your club could use blue and yellow paint in differing ratios to create each shade for their recreation. Another example might be using similar shapes. If an original painting depicts a series of mountains, trees, houses, etc., your club could recreate these elements so that their sizes are all proportional in some way.
- If the chosen painting contains repetitions of the same shape, those shapes could be positioned using **transformations**, such as translations or rotations.

The painting your club selects **must be school-appropriate. No paintings depicting inappropriate themes – as determined by MATHCOUNTS staff – will be accepted. We recommend requiring your club members have their choice of famous painting approved by you, the club leader, before beginning work on the recreation.*

Required Elements of Your Math in Art Project

- A total of **3 images** must be submitted:
  1. An image of the **original painting** your club chose to recreate.
  2. A close-up image of your **club's recreation of the painting**, *without* any labels or indications of what math elements are included.
  3. A close-up image of your **club's recreation, *with* some indication of where the math elements are included** in the painting. Club members could use arrows, labels, or even simply take a photo with someone's fingers pointing to the math elements.* (This will ensure we are able to match the math elements in the visual to the math elements your club will describe in the written portion.)

- Club members must provide a **written description** of their Math in Art project. This description must include (1) the name and artist of the original painting, (2) a list of materials your club members used to make their recreation, and (3) a detailed explanation of the 2 or more math elements included in their recreation.

Your club could also digitally indicate where their math elements are included using a basic program like Microsoft Paint, for example. (They could upload a photo and circle or highlight the math elements.) However, no other digital editing or creation can be done on your club's project. The Math in Art project* ***must be completed by hand**—a digitally-created or digitally-modified Math in Art project will not be accepted.*

Project Submission Specifics

To be eligible for Gold Level Status, your club **must have earned Silver Level Status first**. The Gold Level Application webform will open on **December 1st**. We are no longer accepting offline paper applications or emailed/mailed projects for Gold Level Status. In the online webform, in addition to basic information about your club, you'll be asked to submit:

- (Optional) A **photo** to be displayed on the Silver and Gold Level Clubs recognition page of the MATHCOUNTS website, along with your club's name and state. This could be a photo of your club members, your Gold Level project, or your school's/group's logo. If you already submitted a photo in your Silver Level Application, you'll have the option to use the same photo. If you choose not to submit a photo, a National Math Club logo will be displayed for your club. To ensure the photo can display correctly on our website, please submit a photo of the size **1200 x 800 pixels**.

- Only **one file containing all elements** of your club's Gold Level project. Our Gold Level Application webform accepts several file types, so we recommend combining all elements of your club's project into whichever file type is easiest for your club to use (PowerPoint, PDF, Microsoft Word, etc.).

Math in Art Sample Project 1: Starry Night

The image on the left above is the original painting we chose, Starry Night by Vincent Van Gogh. The image on the right is our club's recreation of this painting. We used acrylic paint on a piece of cardboard for most of the recreation, but for the stars and the little buildings, we used origami paper that we glued onto the painted background.

One math element used in our recreation is a Pi Skyline. In the image below, the arrow on the left points to the first building in the Pi Skyline, which is 3 centimeters tall. The next "building" in the skyline (it's actually supposed to be a high fence) is 1 centimeter tall. The next is 4 centimeters tall and the next is 1 centimeter tall. The next (which is the first portion of the gray church) is 5 centimeters tall, and finally, the spire of the church is 9 centimeters tall. These heights represent the digits of pi, 3.14159.

Another math element used in our recreation is the Fibonacci number sequence, represented by the diameters of the circles used to create the stars. For the stars, we used origami paper in 3 different shades of yellow. Due to spacing, we decided that 1 unit = 1/2 centimeter. With the origami paper of the lightest shade of yellow, we created circles of the diameters 1, 1, 2, 3, 5 and 8 units. With the origami paper of the middle shade of yellow, we created circles of the diameters 1, 1, 2, 3 and 5 units. Finally, with the origami paper of the darkest shade of yellow, we created circles of the diameters 1, 1, 2, 3 and 5 units. In order to create the multi-shade effect of the stars, we overlapped circles of different shades of yellow in each star.

Math in Art Sample Project 2: Town among Greenery

The image on the left above is the original painting we chose, Town among Greenery by Egon Schiele. The image on the right is our club's recreation of this painting. We used origami paper to cut out each of the houses, as well as pencil to draw features onto each house. For the sky and the trees, we used acrylic paint on a piece of cardboard.

First, we used the concept of proportionality as one of our math elements. In the original painting, the houses in the town look like they are perhaps on the slope of a hill. To help create this effect in our recreation, we decided to use a constant of proportionality within each "column" of houses to determine the height of each house to cut out. In the leftmost column (labeled with arrow 1 in the image below), we started with the purple house, which was cut to be 2.75 inches tall. The constant of proportionality we chose for this column was 1.1, so the green house behind the purple house is $1.1 \times 2.75 = 3.025$ inches tall. The blue house behind that is then $1.1 \times 3.025 \approx 3.33$ inches tall, and the yellow house behind that is $1.1 \times 3.33 \approx 3.66$ inches tall. We used the same constant of proportionality for the middle column, even though it is only 3 houses (labeled with arrow 3 in the image below). For the column of houses labeled with arrow 2, we started with the brown house at the top of the column and worked our way forward, using a constant of proportionality of 0.9. Through this math element, the height of each house is proportional to the heights of the houses next to it.

Second, we used differing ratios of paint to create the 4 shades of green seen in the forest. The darkest shade is 1 part black to 2 parts "New Shamrock" green, a shade of bright green in our set of paints. We originally intended to add 1 more part of "New Shamrock" green to create each next-lightest green shade, but when we tried that (1 part black to 3 parts "New Shamrock" green), the color was too dark. So, we added 2 parts of "New Shamrock" green to create each new shade. After the darkest shade (1:2), the color ratios were 1:4, 1:6, and 1:8 (black: "New Shamrock" green).