

# Exploring an Ancient Artifact through High School Student Eyes

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## Abstract

This project-based study explores how engaging high school students in historical and mathematical inquiry can foster critical thinking and creative hypothesis generation. In a geometry class, students were tasked with investigating the Roman Bronze Dodecahedron—a mysterious artifact from the 2nd to 4th centuries AD—whose function remains unknown. Working in collaborative groups, students formulated original or preferred theories about the object’s purpose by analyzing its geometric features, historical context, and cultural implications. Using information curated by AI and supplemental research, students responded to three guiding questions centered on the artifact’s function, material composition, and socio-cultural significance. The project culminated in a qualitative analysis of student-generated responses to identify recurring themes and plausible hypotheses. A prevailing idea among students was that the dodecahedron may have served as a ritualistic or astrological tool, possibly linked to Hermetic or pagan cult practices. The project highlights the educational value of interdisciplinary exploration in mathematics and history, encouraging imaginative yet evidence-informed reasoning. Through this exercise, students not only developed academic skills but also contributed speculative insights that could inspire future scholarly interpretations of ancient artifacts.

## Introduction

Projects in mathematics play a crucial role in students' academic growth. In a geometry class, a teacher assigned a project asking students to express their thoughts on the possible purpose of the Roman Bronze Dodecahedron. This mysterious object, dating from the 2nd to 4th centuries AD, has long attracted researchers’ attention due to its unclear function and unique design. The students' objective was to develop an original hypothesis regarding the device’s usability, describe its structure, and consider historical or cultural circumstances that might have influenced its design and use. Working in groups of four, each student contributed with their ideas, fostering collaboration and critical thinking. As Hultenius (2024) noted, “By working together, we can build upon each other’s work and accelerate the pace of progress.”

Students’ imagination has the potential to generate unexplored and innovative ideas, possibly compelling researchers to refine, expand, or adopt theories that are more closely aligned with the true purpose of the object. As Dr. Carlson stated, “So, next time you’re facing a challenge or an issue that you need to solve, let go of some of your self-control, and re-ignite your child-like imagination” (IdeasToGo, 2025). Given that several theories exist

about the dodecahedron's function—none of which are supported by strong evidence—the goal of this project is to explore fresh ideas from a high school perspective.

## **Historical Context of the Bronze Roman Dodecahedron**

The object is dated to the late Roman Empire, from the 2nd to 4th centuries AD. It has been found in various contexts, including graves, Roman frontier zones, and settlements, often during periods marked by military conflict and cultural transition. However, no ancient texts or literature mention the object, which adds to its enduring mystery.

As of 2025, over 130 Roman bronze dodecahedra have been discovered across Europe. Notably, none have been found in Italy, the heart of the Roman Empire. These artifacts are typically made of copper alloy, and range in size from 4 to 11 cm in diameter. Each is a 12-sided, hollow object, with faces that are equilateral pentagons and feature a circular hole or aperture at the center. The holes vary in size, usually between 6 mm and 40 mm, although some specimens have uniform apertures. Technology Over Time (2024) describes several key features of the bronze Roman dodecahedron: Each one is a hollow metal shell with 12 faces, 20 vertices, and 30 edges. Because of its geometric regularity, each face is an equilateral pentagon. The apertures, centered on each face, appear to be graduated in size, possibly indicating a deliberate design, though their function remains unknown.



Figure 1. The Dodecahedron was Found Fully Intact and in Excellent Condition. Norton Disney History and Archaeology Group (Mohtasham, 2024)

Historically, the name "Roman dodecahedron" was coined following a discovery in 1739 by a local historian in Aston, Hertfordshire, England. He unearthed a curious hollow bronze object shaped as a regular dodecahedron in an area once occupied by a Roman settlement. This find is regarded as the earliest known modern discovery of

what is now commonly called a Roman—or Gallo-Roman—dodecahedron.

Since then, dodecahedra have been found across a wide area that was once part of the Roman Empire, including Germany, England, France, and the Netherlands, as well as parts of the Middle East (Vulić, n.d.). The most recent discovery was made in June 2023, when a group of amateur archaeologists in England—on the second-to-last day of their excavation—unearthed what they called the "find of a lifetime": a mysterious ancient bronze dodecahedron at a possible Roman site (Mohtasham, 2024).

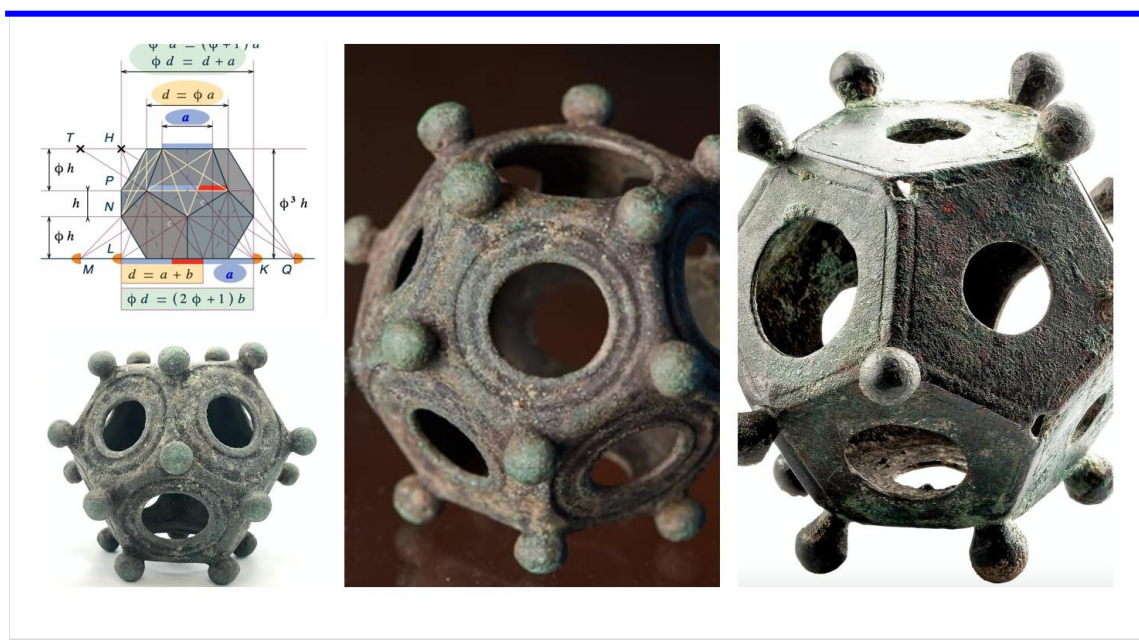


Figure 2. Modification of the Dodecahedron Figures from Different Sources (Wikimedia Commons, n. d.), (Tipper, 2024), (Wikipedia, n. d.), and (Vulic, n. d.).

## General Description of the Items

The Roman dodecahedron is a mysterious object. The Roman dodecahedra are small, hollow objects crafted during the Ancient Roman era and usually made from copper alloy and bronze (Discovery, 2024). Some of dodecahedron characteristics are as follows:

- Twelve Pentagonal Faces - Each face is five-sided
- Holes In the Center of each pentagon: Every face has a circular hole in the middle, and these holes vary in diameter.
- Spherical Knobs - Each corner (vertex) of the dodecahedron has a small knob or ball.
- Hollow Interior - Dodecahedrons are hollow inside.
- Material - Primarily made of copper alloy, often containing a significant percentage of lead.
- Different Sizes in each item - They range in size from approximately 4 to 11 centimeters.
- Decoration - Most are decorated with circles, lines, and dots, but notably, they lack any inscribed numbers or letters.

- Dating - They date from the 2nd to 4th centuries AD.

### **Initial Group Ideas**

Each group was supplied with the same information that the teacher created with AI - Gemini. The information described several theories as to why ancient Romans used the item. Those theories differed from one another, and none of them was supported by sufficient evidence. In addition, students used supplemental information from the Internet to get motivation and more ideas. Moreover, they discussed their ideas within their group and wrote three paragraphs as responses to the three research questions.

### **Research Questions**

1. "What was the item's likely function within its historical context?"
2. "What materials and manufacturing techniques were used, and what do these suggest about its purpose?"
3. "What social, economic, or cultural factors might have influenced the item's design and use?"

The research objective centers on students' perspectives regarding the Roman dodecahedron's applicability in ancient times. Students expressed their thoughts about the item in three paragraphs. The researchers' goal was to decode students' paragraphs and analyze each student's work in detail. Based on their responses, researchers aimed to find a common idea that corresponded closely to a rational one, which might be supported by significant evidence. The qualitative study utilized a great number of literature sources, such as articles, magazines, digital literature, videos, various ai platforms etc.

Hypothesis: The Roman Bronze Dodecahedron: A specific device for a particular group of pagan (astrologers) cult that served for significant rituals and for predicting the future.

### **Method**

A teacher at a technology-focused urban high school in New Jersey created a project in his geometry classes regarding the Roman dodecahedron. The mathematics teacher assigned a project to students, dividing them into groups of four (Baez et al., 2024). The teacher provided each group with information on the Roman dodecahedron from the AI platform, Gemini. He decided to create 15 groups across all three classes, with five groups in each class (Baez et al., 2025). Each group had the same access to brief information on the usability of the dodecahedron during the Roman Empire between the second and fourth century AD. Additionally, the teacher provided a physical Roman dodecahedron printed by a 3D printer. The Roman dodecahedron is described in Figure 3, and the background shows the actual classroom.

### **Group Collaboration Process**

At the NJ technology high school, a math teacher assigns projects for every math chapter to students. As the last



project (in the geometry classes), the teacher assigned Project 4C: Write three paragraphs to answer three questions that were given with some information extracted from an AI platform (Gemini). Gemini is a great tool to conduct research work. By the way, you can ask Deep Research to limit its research to certain types of sources, like peer-reviewed articles (Sylke, 2024). The teacher asked Gemini, "What was the purpose of the Roman Dodecahedron in the Roman Empire?" In a matter of seconds, Gemini provided valuable information for the teacher to use as a guide for students to complete their projects. Additionally, students may use other information to expand their exploration horizon.



Figure 3. The Roman Dodecahedron was 3D-printed at a Technology High School in New Jersey. The photo was taken in the actual classroom

Each group used the descriptive information provided by the teacher (see Table 1) and the physical dodecahedron (see Figure 3). In addition, several groups used supplemental information from Google by accessing various websites. A few groups did not use any additional information; they used just the material provided by the teacher. However, if we encounter constraints in some way, our brains naturally look for creative ways to make things work for us (Nartey, 2017).

Sometimes less information can impact greater creativity. Other groups used at least two websites on the Internet to expand their mini-research for the project. Each student read their information thoroughly, and they discussed their ideas within their groups. An important component of groups that allows for creativity is the influence of peers on cognitive and motivational processes (Paulus, Dzindolet, & Kohn, 2012). This leads to the idea that exchanging information or idea bouncing allows for innovative or creative potential, as sharing ideas with one another can lead to further thought or allow for one big creative solution created from multiple shared ideas (Backius, 2018). Student groups came up with various ideas (Table 3) on figuring out what the purpose of the Roman dodecahedron was in the Roman Empire during the II to IV Century AD.

## Process of Reviewing Literature

Several groups used Google to find the right website that supported their ideas about the Roman dodecahedron, and a few of them relied solely on the teachers' instructions and their imagination. Groups who used Google search did not delve very deeply into the research; however, all groups employed their rich imagination. With reference to Einstein's insights, we share an understanding of these important concepts here. "The use of logic permits a person to move from point A to point B; by contrast, imagination can take the mind in any direction it chooses, without restraint" (Hayes, 2007, p. 150; Class, 2022). Young minds have greater freedom to use their rich imagination. Logical reasoning failed to find a unique theory that explains the purpose of the Roman dodecahedron in the past. Therefore, imagination could envision unseen possibilities that are out of reach for logical reasoning.

Table 1. Information the Teacher gathered from the AI Platform (Gemini)

|                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Here are some of the most prominent speculative uses that have been proposed - the teacher provided students with given information from AI platform (Gemini):                                                                                                                                   |                                                                                                                                                                                                                                                    |
| 1.                                                                                                                                                                                                                                                                                               | Religious or ritual objects: Their geometric shape and the fact that many have been found at Gallo-Roman sites suggest a possible connection to religious practices or fortune-telling. Some theories link them to the zodiac or cosmic symbolism. |
| 2.                                                                                                                                                                                                                                                                                               | Measuring devices: Some researchers have proposed they could have been used for surveying, measuring distances, or even calibrating water pipes. However, the lack of standardization in size and markings makes this less likely.                 |
| 3.                                                                                                                                                                                                                                                                                               | Gaming dice: The twelve faces could have been used for games, although they don't resemble typical dice.                                                                                                                                           |
| 4.                                                                                                                                                                                                                                                                                               | Knitting aids: A more recent and intriguing theory suggests they might have been used as frames for knitting gloves, with the different-sized holes accommodating fingers.                                                                         |
| 5.                                                                                                                                                                                                                                                                                               | Candle holders: Traces of wax found in some examples have led to the suggestion they might have held candles.                                                                                                                                      |
| 6.                                                                                                                                                                                                                                                                                               | Military or surveying instruments: Some early theories suggested uses in warfare or for estimating distances, but these are largely discounted now.                                                                                                |
| 7.                                                                                                                                                                                                                                                                                               | Coin or valuable transport: The hollow nature and occasional discovery in coin hoards have led to the idea they might have been used to secure and transport valuables.                                                                            |
| <i>Note: It's important to note that none of these theories have been definitively proven, and the true function of these intriguing objects remains one of the great archaeological puzzles of the Roman Empire. Their purpose might have even varied depending on the region or the owner.</i> |                                                                                                                                                                                                                                                    |

(Source: Field Survey, 2025)

Students completed Project #4C with limited resources, primarily by visiting websites via Google (Table 2). Their attention focused mainly on the instructions provided (Table 1) and on observing the 3D-printed Roman dodecahedron. Students who used online resources did not explore the digital literature in depth. Most groups relied on two websites that offered only general information about the object.

High school students often lack experience with formal research; even many college students are unfamiliar with it. In CERP's 2017 Data Buddies Survey, 9,610 undergraduate students were asked whether they had participated in a formal research experience during their college careers; interestingly, 72 percent reported that they had not (Stout, 2018).

Table 2. Resources Used by Students (Google Websites) – On Average, they used Two Sources

The majority of groups used multiple resources on Google; two did not use any additional resources except the information that was given by the teacher.

|                                                      |                          |
|------------------------------------------------------|--------------------------|
| 1. A few groups did not use any additional resources | 8. Britanica.com         |
| 2. Wikipedia                                         | 9. Wikipedia.com         |
| 3. Google Scholar                                    | 10. New York Times       |
| 4. History.com                                       | 11. arts and culture.com |
| 5. Dailyhistory.org                                  | 12. worldhistory.com     |
| 6. roman-empire.net                                  | 13. wam.uc.uk/blog       |
| 7. atlasobscyra.com                                  | 14. youtube.com          |
|                                                      | 15. wikimedia.com        |

*Note: Students didn't use any AI platforms, except for the information given by the teacher.*

(Source: Field Survey, 2025)

Because the students did not engage in extensive independent research, their resources were limited to the teacher-provided information and their own imagination. Their ideas about the purpose of the Roman dodecahedron generally revolved around existing theories. Learning engagement is strongly influenced by prior knowledge (Dong et al., 2020). Based on the information they had, the students developed two different ideas: one group suggested that the Roman dodecahedron was used as a device to make gloves, while another believed it was a flower holder.

Table 3. Student Responses to Project #4C – 12 Group Answers were Selected out of 15 Total

**Students' Ideas Shedding Light on the Usability of the Roman Bronze Dodecahedron in Ancient Rome - 12 Ideas**

| Questions                                                          | Period 2 - Group 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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| What was the item's likely function within its historical context? | The Roman Bronze Dodecahedron was probably a multifunctional object, with its exact purpose that is different by region. However, one possible theory is that it served as a religious or ritualistic item. Found primarily in Gallo-Roman territories, the dodecahedron's symmetrical design and placement at temple or sacred sites suggest it may have played a role in fortune-telling, divination, or astrological practices. The twelve faces might correspond to the zodiac signs or lunar months, reinforcing its potential use in tracking celestial or spiritual cycles. Its mysterious design hints at a symbolic rather than strictly practical purpose. |

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| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | The dodecahedrons were made from bronze, a durable workable metal in the Roman era, indicating that skilled metalworkers were involved in their creation. The object's uniform geometry and consistent hole placements suggest it required precision casting or wax techniques. These methods, combined with the inclusion of knobs on each corner and varying hole diameters, imply a deliberate design rather than mere decoration. Such craftsmanship hints at more than casual use perhaps for a specialized function, such as calibrating tools, or holding objects like yarn or candles, as proposed in the knitting and candle holder theories.                                  |
| What social, economic, or cultural factors might have influenced the item's design and use?         | During the Roman Empire, especially in its outer provinces like Gaul and Belgium, local cultures blended with Roman customs, producing hybrid religious practices and unique artisanal objects. The dodecahedron may reflect this cultural fusion serving different functions depending on local needs, whether religious, domestic, or technological. Economically the bronze was a valuable material, so producing these items suggests a purpose significant enough to justify the cost. Socially, the object's mysterious use could also indicate a specialized class of users, perhaps priests, craftsmen, or elite households adding layers of meaning to its role in Roman life. |
| <b>Questions</b>                                                                                    | <b>Period 2 - Group 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| What was the item's likely function within its historical context?                                  | The object was probably used to help with knitting. Some people think it was a tool used to make gloves because it has different-sized holes that could fit fingers. A long time ago, making clothes and things at home was really important, so having tools like this made knitting easier and helped people make better patterns. Another idea, this can help people determine the approximate distance of an object or measure angles. Furthermore, many Romans were known for their skills in building. As a result, the object could have been useful for building roads and setting up camps.                                                                                    |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | These objects were probably made out of metal, bone, or stone. People might have carved or shaped them depending on when and where they were made. The holes are different sizes, which shows they were made carefully to do something specific, like help with knitting. This means they were likely used as tools, not just for decoration.                                                                                                                                                                                                                                                                                                                                           |
| What social, economic, or cultural factors might have influenced the item's design and              | People probably made this tool because knitting was really important, especially in places where it was cold and people needed warm clothes. Women and other workers might have used it at home or to make                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



## **Students' Ideas Shedding Light on the Usability of the Roman Bronze Dodecahedron in Ancient Rome - 12 Ideas**

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| use?                                                                                                | money. Since they needed to make things faster and better, they came up with tools like this to help. It shows how everyday life and staying warm helped shape how the tool was made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Questions</b>                                                                                    | <b>Period 2 Group 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| What was the item's likely function within its historical context?                                  | One plausible hypothesis I propose is that the Roman bronze dodecahedron served as some kind of pedagogical device for astrology or geometry for the elite Romans. Greek philosophy and learning were highly influential in the Romans, and astrology was deeply entrenched in Roman society, especially among the educated classes. The twelve faces of the dodecahedron could have symbolized the twelve zodiac signs or months, and teachers could have employed visual aids while explaining celestial patterns or philosophical ideas. The geometric balance and perhaps symbolic reference could have made it ideal for application in teaching or demonstration in a temple or classroom setting. |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | The bronze dodecahedron was made of a strong and costly material so that it would not be employed once and discarded but something valuable and meant to endure. The complexity of the dodecahedron—twelve pentagonal faces, often with holes of various diameters, and little knobs at the vertices—does suggest top-grade work and expertise in advanced metalworking technologies. The care with which such a symmetrical and complex object was made suggests that it may have been used to serve a purpose that needed aesthetic and symbolic value, and not a utilitarian function alone. Such effort and detail suggest a direction of ceremonial, scholarly, or elite recreational pursuits.     |
| What social, economic, or cultural factors might have influenced the item's design and use?         | Social and cultural, the dodecahedron shape and use could have been spurred by the need of the Romans to incorporate symbolism and intellectualism into society. Within a culture that valued display of education and achievement in front of others, ownership of such an object could have been used to demonstrate education, wealth, or connection with mystical civilizations. Economically, it could be afforded by rich individuals or institutions only, and thus its use can be visualized to have been at the disposal of rich households,                                                                                                                                                    |
| <b>Questions</b>                                                                                    | <b>Period 3 - Group 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| What was the item's likely function within its historical context?                                  | The Roman bronze dodecahedron's function is still unknown, but it is likely that it could have been used as candle holders or as a storage for valuables. This is because some of the objects were found to have wax tracings, indicating that it would have held candles. This could make                                                                                                                                                                                                                                                                                                                                                                                                               |

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|                                                                                                     | <p>sense since the dodecahedron was not only found in the town of Tongeren in Belgium, but in other places across Europe as well. According to the article, "Roman Dodecahedron: The Mystery of an Ancient Artifact," it explains how the object had been found in the Netherlands, Germany, and France. This supports how the object was possibly used for simple and practical purposes like holding candles if it was widely common. It could have also functioned as a storage for valuables because it was discovered in coin hoards. Still, there is no clear answer for what the function of the dodecahedron is.</p>                                             |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | <p>The Roman dodecahedron was made from bronze which is a copper alloy. The manufacturing process is also complex due to the unique structure of the item. Given this, it suggests that the object was valuable and expensive to create. If this were true, then its purpose may be more significant than simply being a gaming object or decoration. It could have been used by more wealthy people for their own practical purposes. Or, the dodecahedron could have served as a tool for storing valuable items.</p>                                                                                                                                                  |
| What social, economic, or cultural factors might have influenced the item's design and use?         | <p>The object may have had cultural factors influencing its design and use because of the areas it was found in. For instance, it may have been influenced by Gallo-Roman culture and was used for ritualistic purposes. Fortune telling, zodiac and cosmic symbolism, and religious practices could have all been connected to the Roman dodecahedron. Other factors could have been mathematically-related, where the dodecahedron was used for measuring and surveying. Lastly, economic factors included storing wealth and valuables in the item. Overall, these are all possible reasons that contributed to the development of the Roman bronze dodecahedron.</p> |
| <b>Questions</b>                                                                                    | <b>Period 2 - Group 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| What was the item's likely function within its historical context?                                  | <p>Due to the shape of the dodecahedron, its function is probably used as a game die, like the dice used to play board games. I believe this is its function because the surfaces are quite similar to dice: they can come with six or more sides. Dice play a role as a likelihood, meaning that it represents the chances of a situation (it can be a good one or a bad one). I believe that religion also takes part since dice are also used as a toy/ game for entertainment.</p>                                                                                                                                                                                   |
| What materials and manufacturing techniques were used, and what do these suggest                    | <p>This unique polygon is made of a type of copper, usually bronze, in which is carved into multiple faces/ sides. The extraordinary proportions are likely used as an instrument for measuring. Astronomy,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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| about its purpose?                                                                                  | and the terms of math have utilized it this way since it involves a lot of calculations and statistics. Besides being used as a game, it allowed people to work with it as a companion.                                                                                                                                                                                                                                                                                                                                 |
| What social, economic, or cultural factors might have influenced the item's design and use?         | Many factors such as mathematics (specifically geometry), religious practices, and cultural exchange influenced the dodecahedron because its unique shape gave a lot of meaning to people. Mathematics played a huge role because it was carved with precision, and sharp measurements to transform into a masterpiece. Socially. It is known for its sharp look, though the real story behind this shape remains a mystery. Although we may not know its true origin, its appearance helps us make real-world anatomy. |
| <b>Questions</b>                                                                                    | <b>Period 7 - Group 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| What was the item's likely function within its historical context?                                  | The item's likely function within its historical context is a vase. The holes could be used to hold flowers together or sustain other household items. The balls on the dodecahedron could be for aesthetic purposes and for it to have a better grip on surfaces. The item is not very rusty so it must have been frequently cleaned and looked after. The holes mean that the dodecahedron cannot hold water, however it can easily store flowers for a temporary amount of time.                                     |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | The material of the dodecahedron is steel or iron suggests that it was made by a blacksmith. More so, it had to be made by request. The iron or steel had to be melted, welded, and forged. The material is strong so it means that whoever ordered it wanted it to be sturdy and able to withstand harsh conditions. Even if the dodecahedron was dropped, it would not break unlike a regular clay vase.                                                                                                              |
| What social, economic, or cultural factors might have influenced the item's design and use?         | Since there was more steel and iron availability in the olden times, it was more dispensable. It was a popular material to trade and sell. Therefore, the social and economic status of someone with a dodecahedron could be low. This is because, unlike richer members of society, these people were not available to buy vases if they were broken. They instead needed something reliable that they would not have to change.                                                                                       |
| <b>Questions</b>                                                                                    | <b>Period 7 - Group 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| What was the item's likely function within its historical context?                                  | The Roman bronze dodecahedron was used for some religious or ritual purpose. The twelve flat sides and holes of various sizes do not seem to have practical applications. It makes sense that many of these were found at Gallo-Roman sites, as they mostly would have been utilized                                                                                                                                                                                                                                    |

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|                                                                                                     | for spiritual or ritual use. They may have been used for divination, contact with deities, or as part of a seasonal cycle ritual. The fact that there is not even one example of a written explanation may also reflect the sacred or secret nature of their use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | The dodecahedrons were made of bronze, a strong and precious metal. Crafting an object from bronze would have been time-consuming in terms of skill and resources. The level of precision is astonishing; which small holes were used, and which points were created. Telling me that it was not just for random toys or a useful tool of some kind. If something like knitting or some games were the motivation, many wooden or clay alternatives could have been used. I believe that the workmanship of bronze suggests a validity of purpose and at least symbolic intent.                                                                                                                                                                                                                                                                               |
| What social, economic, or cultural factors might have influenced the item's design and use?         | The Roman Empire was characterized by a wide-ranging mix of cultures, especially in regions like Belgium, where Roman beliefs mingled with local beliefs. Individuals may have used the dodecahedron as part of ritual practices that sought to unite both Roman (religion) and local Celtic (tradition) beliefs. Its unusual and beautiful form is suggestive of magic or power. Additionally, bronze may have been extremely expensive, and not everyone had access to create bronze dodecahedrons. As a result, an individual possessing one of these objects may have either been wealthy or embodied some sort of elite role in society, whether this be as a priest, spiritual leader, etc. Even in the object's form, it is possible to see elements of the significance of religion, mystery, and privileged status within Roman society at the time. |
| <b>Questions</b>                                                                                    | <b>Period 7 - Group 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| What was the item's likely function within its historical context?                                  | The Roman Bronze Dodecahedron is a mysterious artifact with no solid explanation for its use. Historians said it could have been used as a candle holder. Others thought that its presence in coin hoards could have been to store and transport valuable items. Some also speculated that it could have been an important figure in religious practices. However, this artifact was most likely used in the study of Geometry, additionally an artistic approach to mathematics.                                                                                                                                                                                                                                                                                                                                                                             |
| What materials and manufacturing techniques were                                                    | Most of these artifacts were made with materials like bronze. These artifacts were made using a wax casting method. In this process, a wax                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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| used, and what do these suggest about its purpose?                                                  | model would be made and then covered in a mold. This mold would then be filled with bronze and create the final product. This type of process is usually used for mass-produced items, which would show that these artifacts were widely used throughout the ancient world.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| What social, economic, or cultural factors might have influenced the item's design and use?         | Roman Bronze Dodecahedrons are made of bronze, which is a relevant metal in Alchemy. Even though it is not one of the seven core metals, it is an alloy of copper and tin. Bronze is also symbolic because of its use during the bronze age, working as a symbol of innovation and progress. Bronze was also a valuable material in the Ancient times, since it was yellowish like gold and people thought it had a relationship to real gold. Roman Bronze Dodecahedrons were very popular back then because of its use by renowned mathematicians, valuable material, and symbolic meaning in Alchemy.                                                                                                                                                                 |
| <b>Questions</b>                                                                                    | <b>Period 3 - Group 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| What was the item's likely function within its historical context?                                  | One possible theory is that Roman bronze dodecahedra were used as teaching tools for astronomy and mathematics. The twelve faces and symmetrical geometry could represent the twelve zodiac signs or months of the year, and the different-sized holes may have been used to simulate the movement of celestial bodies or the measurement of angles. Within the historical context of the Roman Empire, which placed high value on education, engineering, and astrology, such an object could have served as a visual and interactive aid for scholars or students learning about the heavens or geometry. It may have also been used in temples or observatories to demonstrate cosmological principles, merging science with religion in a culturally meaningful way. |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | The dodecahedra were made of bronze, a durable and valuable material, which suggests they were not everyday household items. Bronze required skilled labor and a well-equipped foundry to cast and shape, indicating that the object was crafted with intention and care, likely for a specialized use. The symmetrical design and precise construction imply advanced metalworking skills, and the lack of standard sizing across examples may point to local artisans creating them for specific uses rather than a mass-produced object with a uniform function. The presence of varying hole sizes also suggests a functional use involving measurement, alignment, or symbolic representation, rather than purely decorative purposes.                              |
| What social, economic, or                                                                           | Culturally, the Roman world was a fusion of practical engineering and                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



## **Students' Ideas Shedding Light on the Usability of the Roman Bronze Dodecahedron in Ancient Rome - 12 Ideas**

| cultural factors might have influenced the item's design and use?                                   | mystical belief systems. The design and possible uses of the dodecahedron reflect this dual nature—its mathematical precision aligning with Roman innovation, and its mysterious symbolism echoing the empire's spiritual diversity. Economically, the investment in bronze suggests the object was owned by someone of means—perhaps a scholar, priest, or official—who could afford such a sophisticated tool. Socially, it may have served as a status symbol, showcasing the owner's education or esoteric knowledge. Its design could have also been influenced by the blending of Roman and local Celtic traditions, especially in frontier regions like Gaul, where several dodecahedra have been found.                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Questions</b>                                                                                    | <b>Period 2 - Group 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| What was the item's likely function within its historical context?                                  | We propose that the Roman bronze dodecahedron functioned as a multifaceted tool used in seasonal agricultural rituals, particularly those associated with planting and harvesting cycles. Each face, marked by different-sized holes, may have symbolized or corresponded to phases of the agricultural calendar or celestial events, which were essential to farming communities. Roman society placed heavy emphasis on appeasing the gods for successful crops, and the dodecahedron may have served as a ritualistic object to divine the optimal times for planting, harvesting, or performing religious ceremonies linked to agriculture. Its design allowed for interaction—possibly peering through certain holes aligned with celestial bodies or daylight—which would make it a functional part of a ritual rather than a purely decorative or mystical item. |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | The objects are typically made from bronze, an expensive and durable alloy requiring significant skill and infrastructure to produce. Crafting a dodecahedron with symmetrical faces and uniformly circular holes would have required precise casting and metalworking knowledge, implying that these were not hastily or cheaply made. This suggests that the item held value and significance—likely not for everyday use but for ceremonial or specialized purposes. The hollow construction and lack of wear in many cases indicate that they were not utilitarian tools in the conventional sense, but rather symbolic or instructional items. The level of craftsmanship suggests that their owners were likely of high status or connected to religious or administrative elites.                                                                                |
| What social, economic, or cultural factors might have                                               | The Roman Empire encompassed a vast array of local traditions, and the dodecahedra found in Gallo-Roman regions suggest a blending of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## **Students' Ideas Shedding Light on the Usability of the Roman Bronze Dodecahedron in Ancient Rome - 12 Ideas**

| influenced the item's design and use?                                                               | Roman and indigenous Celtic customs. The Celts had strong traditions tied to natural cycles and geomancy, and the Roman tolerance for localized religious practices might have led to hybrid tools like the dodecahedron. Economically, the rise of wealthy provincial elites may have supported the production of such items for use in both public and private rituals, signifying prestige and piety. Culturally, the Roman fascination with geometry, astrology, and cosmology could have inspired the object's dodecahedral shape—a geometric form historically associated with the heavens and the divine—thus giving it both symbolic and possibly divinatory significance in regional Romanized societies. |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Questions</b>                                                                                    | <b>Period 7 - Group 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| What was the item's likely function within its historical context?                                  | The Roman bronze dodecahedron might have been used to measure something, like light, distance, or angles. Since each side has a hole in it and the holes are different sizes, maybe people looked through them to line things up or figure out how far away something was. The shape is very exact, so it seems like it had a specific use instead of just being a decoration.                                                                                                                                                                                                                                                                                                                                     |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | It was made out of bronze, which is a strong metal that doesn't break easily. That tells me it was probably meant to be used more than once and maybe carried around. The way it was made looks careful and detailed, so it wasn't made quickly or cheaply. Since it's hollow and has those knobs on the corners, it might have been made by pouring melted metal into a mold and then adding details.                                                                                                                                                                                                                                                                                                             |
| What social, economic, or cultural factors might have influenced the item's design and use?         | The design could have been influenced by Roman culture, where people cared a lot about building things like roads, buildings, and cities. Maybe this object helped with those kinds of projects. Also, since it looks fancy and well-made, it might have belonged to someone important or skilled, like a builder, a soldier, or someone who used tools for their job. The dodecahedron could have been something useful that also showed the person's status.                                                                                                                                                                                                                                                     |
| <b>Questions</b>                                                                                    | <b>Period 3 - Group 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| What was the item's likely function within its historical context?                                  | The Roman bronze dodecahedron, with its twelve pentagonal faces and circular holes of varying sizes, may have served as a multi-functional tool within its historical context. One plausible theory is that it was used by Roman military engineers or surveyors for measuring distances or calibrating tools. Given the lack of written records, this theory is supported by the object's geometric precision and portable size, which                                                                                                                                                                                                                                                                            |

### Students' Ideas Shedding Light on the Usability of the Roman Bronze Dodecahedron in Ancient Rome - 12 Ideas

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                     | would have been practical for field use. The various hole sizes could have helped estimate different measurements or alignments in construction or surveying work.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| What materials and manufacturing techniques were used, and what do these suggest about its purpose? | The dodecahedron was made from bronze, a durable and valuable metal during the Roman era. Its construction would have required skilled metalworking techniques such as casting and finishing, suggesting that it was not a mass-produced item, but one made with care and precision. The hollow interior and symmetric design may have had symbolic or practical value, hinting at its use in tasks requiring careful calibration, perhaps even in astronomy or crafting textiles. The craftsmanship involved indicates it had a purpose beyond simple decoration.                                                                  |
| What social, economic, or cultural factors might have influenced the item's design and use?         | Social and cultural factors may also have influenced the item's design and use. The Roman Empire placed high value on order, structure, and engineering, which is reflected in the geometric perfection of the dodecahedron. Economically, the use of bronze hints that the item may have been owned by someone of importance or used in official capacities. Culturally, the Romans were deeply interested in both the practical and musical qualities of geometry, so the object could have had a ritualistic or educational function as well. Overall, its mystery endures, but it remains a striking symbol of Roman ingenuity. |

(Source: Field Survey, 2025)

### Analyzing Students' Ideas

Researchers analyzed the students' ideas presented in Table 3 and categorized similar patterns (ideas) into four categories, as shown in Table 4. In the first category (Ideas related to Astrology and Religion), researchers found 9 similar patterns. In the second category (Ideas related to measuring devices), they found 3 similar patterns. In the third category (Ideas related to decorations or holders), 5 similar patterns were identified. In the fourth category (Ideas related to games), researchers also noted distinct ideas.

Intuitively, the most preferred category is the first one. However, all four categories offer valuable insights and can contribute to forming a hypothesis about the purpose of the item. Researchers created simple coding patterns for each category. An important aspect of Culture Codes is that anyone can create their own codes and adapt them to the needs of the design task and its context (Pejoska et al., 2022). Based on the four categories, we propose a hypothesis that includes the influence of all of them:

*Hypothesis:* The Roman Bronze Dodecahedron: A Multifunctional Device for Measuring and Ritualistic Practices.

However, in the discussion section, we will attempt to refine this hypothesis to suggest a single, primary purpose.

Table 4. Four General Categories of Students' Ideas – Most student ideas revolve around concepts related to astrology and religion

**Categorizing Students' Ideas of their Statements in four categories - the First Paragraph (dodecahedron Usability)**

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Ideas related to Astrology - Religion | <ol style="list-style-type: none"> <li>1. A religious or ritualistic item</li> <li>2. Astrological practice.</li> <li>3. Zodiac</li> <li>4. Pedagogical device for astrology or geometry for the elite Romans.</li> <li>5. Religious or ritual purpose.</li> <li>6. Figure in religious</li> <li>7. Teaching tools for astronomy and mathematics.</li> <li>8. Cosmological principles, merging science with religion in a culturally meaningful way</li> <li>9. Used in seasonal agricultural rituals</li> </ol> |
| 2. Ideas related to measuring devices    | <ol style="list-style-type: none"> <li>1. Coin hoards.</li> <li>2. Like light, distance, or angles.</li> <li>3. Military engineers or surveyors for measuring distances or calibrating tools.</li> </ol>                                                                                                                                                                                                                                                                                                         |
| 3. Ideas related to decorations (holder) | <ol style="list-style-type: none"> <li>1. Make gloves</li> <li>2. Been useful for building roads and setting up camps.</li> <li>3. As candle holders</li> <li>4. The holes could be used to hold flowers together or sustain other household items.</li> <li>5. A candle holder.</li> </ol>                                                                                                                                                                                                                      |
| 4. Ideas related to games                | <ol style="list-style-type: none"> <li>1. Like the dice used to play board games.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                     |

Source: (Field Survey, 2025)

## Challenges and Limitations

The reason why they used the Roman dodecahedron is challenging for every researcher is that students have limited resources and lack research experience. They did not delve deeply into the topic. Each of the three research questions was answered with only one paragraph. Their responses were based entirely on imagination. Despite these limitations, the students' answers are still valuable in contributing to the understanding of how the item may have been used in the past.

## Results

### Supporting Evidence

Students' results support a significant hypothesis: The Roman Bronze Dodecahedron as a Multifunctional Device for Measuring and Ritualistic Practices. Some findings suggest that the item may have also been used for games

or decoration. Logically speaking, a large number of decorative and gaming artifacts from the Roman Empire have survived, especially those made from durable materials like bronze.

Dice games predate Roman times by more than 5,000 years. However, in the Roman Empire, dice were typically asymmetrical, while the Roman dodecahedron is notably symmetrical. Detailed studies show that 80–90% of Roman dice are visibly asymmetrical (Schmid, 1978), compared to less than 50% of later Medieval and post-Medieval dice (Eerkens and de Voogt, 2022). Generally, dice used for games were permitted, whereas dice used for astrology and divination were condemned by Christianity.

Fortune-telling games, as opposed to gambling, often escaped full censure by the medieval Church. These were closely tied to the practice of divining “lots,” also known as *Sortes Sanctorum* (Fates of the Saints), using Bible verses and the practical application of astrology. These games frequently referenced astrology and the stars in their manuals and often instructed players to offer prayers or recite psalms before casting dice (Wolynes, 2019).

The dodecahedron dice may have been used for astrological purposes. According to numerology, the number 12 symbolizes a shielding, angelic energy. This is why the dodecahedron shape is considered protective in meditation. The number 12 also reduces to 3 ( $1 + 2 = 3$ ), which is associated with divine creativity, joy, and sharing (The Stone Spirit, 2022). Practically speaking, the bronze dodecahedron may have functioned as an astrological device to reveal life’s secrets, rather than as an ordinary game piece. This supports the theory that the object had religious and astrological significance.

Many students believe the dodecahedron served as a decorative item or candleholder. However, after examining dozens of theories developed over the past 300 years, historians assert with some certainty that these objects were not merely decorative, due to the precision with which they were cast (Pastor, 2022). In contrast, many known candleholders have been easily identified as such. Notably, Roman dodecahedra have not been found in central areas of the Roman Empire, such as Italy—despite the widespread discovery of lamps and lamp holders in those regions. Roman lamps were abundant across the Mediterranean, including in the land of Israel, reflecting the cultural prominence and craftsmanship of Roman art and manufacturing (Eliav, 2014).

Decorative elements in Roman lamps were not prohibited. They were commonly adorned with leaves, animals such as owls and birds, snakes, human figures, and even erotic imagery. Clarke (2003) notes that in the homes of ancient Roman businessmen, “every home had to have one” of these so-called “pornographic” paintings (p. 35). Lamps and candleholders ranged in material from clay to iron, bronze, and even gold—clay being typical for the poor, and metal for the wealthy. Symbolically, lamps represented human life: both physically and metaphysically, the lamp’s flame was likened to the soul (Barnes, 2014).

A smaller group of students propose that the Roman dodecahedron was used as a measuring device. Sparavigna states, “After preparing a simple specimen, my conclusion is that the hypothesis of a use for surveying is stronger than that previously proposed for these artifacts to be dice or bowls” (Sparavigna, n.d.). The object’s value lies not only in its bronze composition but also in the sophisticated craftsmanship used to achieve symmetry. If the

items were used for measurement, one would expect to find them in Italy. The lack of such findings in the core Roman area, and the absence of textual references, suggest that the object may have been taboo. It is plausible that the rise of Christianity in the 4th century led to the banning of such artifacts in Rome.

Table 5. Descriptive Statistics of the First Paragraph of Twelve Students' Ideas completing the Project #4C

| Ideas related to<br>Astrology - Religion |      | Ideas related to<br>measuring devices |      | Ideas related to<br>decoration s (holder) |      | Ideas related to games |      |
|------------------------------------------|------|---------------------------------------|------|-------------------------------------------|------|------------------------|------|
| Mean                                     | 9    | Mean                                  | 3    | Mean                                      | 5    | Mean                   | 1    |
| Standard Error                           | 0    | Standard Error                        | 0    | Standard Error                            | 0    | Standard Error         | 0    |
| Median                                   | 9    | Median                                | 3    | Median                                    | 5    | Median                 | 1    |
| Mode                                     | #N/A | Mode                                  | #N/A | Mode                                      | #N/A | Mode                   | #N/A |
| Range                                    | 0    | Range                                 | 0    | Range                                     | 0    | Range                  | 0    |
| Minimum                                  | 9    | Minimum                               | 3    | Minimum                                   | 5    | Minimum                | 1    |
| Maximum                                  | 9    | Maximum                               | 3    | Maximum                                   | 5    | Maximum                | 1    |
| Sum                                      | 9    | Sum                                   | 3    | Sum                                       | 5    | Sum                    | 1    |
| Count                                    | 1    | Count                                 | 1    | Count                                     | 1    | Count                  | 1    |

(Source: Survey Field, 2025)

### Proposed Theories

Due to known associations between these objects and religious artifacts, some scholars have inferred their use from archaeological context. For example, a Roman dodecahedron was found near a “mounted rider god” figurine in 1989 (CNN), and several have been uncovered at temple sites (Orf, n.d.). This suggests the object may have been a pagan relic that Christianity later condemned as satanic. Astrologers and fortune-tellers who used such objects were often persecuted under Christian rule. Indeed, astrologers were expelled from Roman society, particularly as Christian emperors began legislating against astrology during the 4th and 5th centuries CE. One law, issued on February 9, 409 CE by Emperor Honorius (CT 9.16.12), stated: “All astrologers are to be expelled and exiled, unless they burn their books in the presence of a bishop and convert to Christianity” (Wisconsin Lutheran College, n.d.).

Usually, research involving hypotheses begins with an initial hypothesis and ends with a revised or refined one. When data does not align with the original hypothesis, it is essential to revise it accordingly (Research Rebels, 2024). In this case, some students' ideas do not support the evidence regarding the purpose of the Roman dodecahedron. The initial hypothesis is based on all the student ideas presented in Project #4C, which refers indirectly to the term “multifunctional device” and directly to expressions like “device for measuring” and “ritual practices.” As mentioned above, there is insufficient evidence to support this initial hypothesis; therefore, it is necessary to revise it.

The most strongly supported student idea—those related to astrology and religion—has significant potential to be accurate. According to historical accounts, in Ancient Rome, astrology was considered contrary to God’s will



under Christianity. As a result, astrology was condemned by the Church in the 4th century. In the Roman Empire, particularly in Italy, emperors increasingly aligned with Christianity and opposed paganism in various forms, including through legislation. Repeated laws issued by Theodosius and his descendants banned traditional rites, often with detailed specificity (Theodosian Code 16.10.7–9, 16.10.11–25) (Gassman, n.d.).

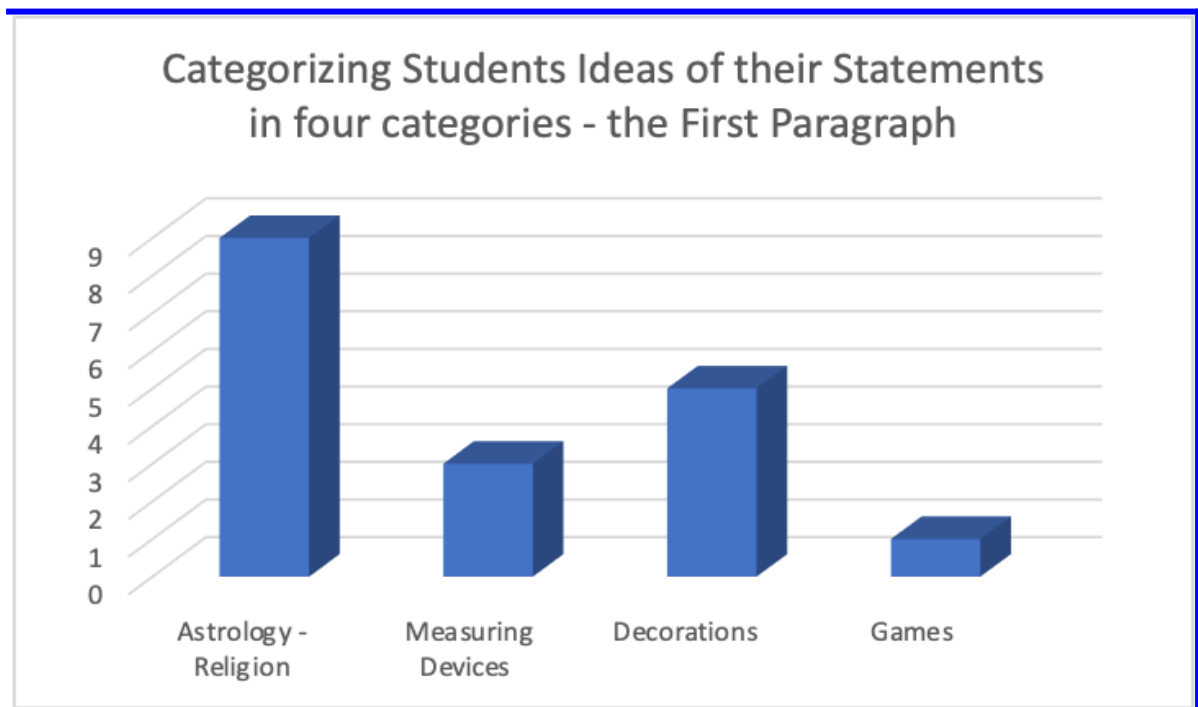


Figure 4. Visual Data of Student Groups Ideas (Table 4) about the Roman Dodecahedron Application on Project #4C

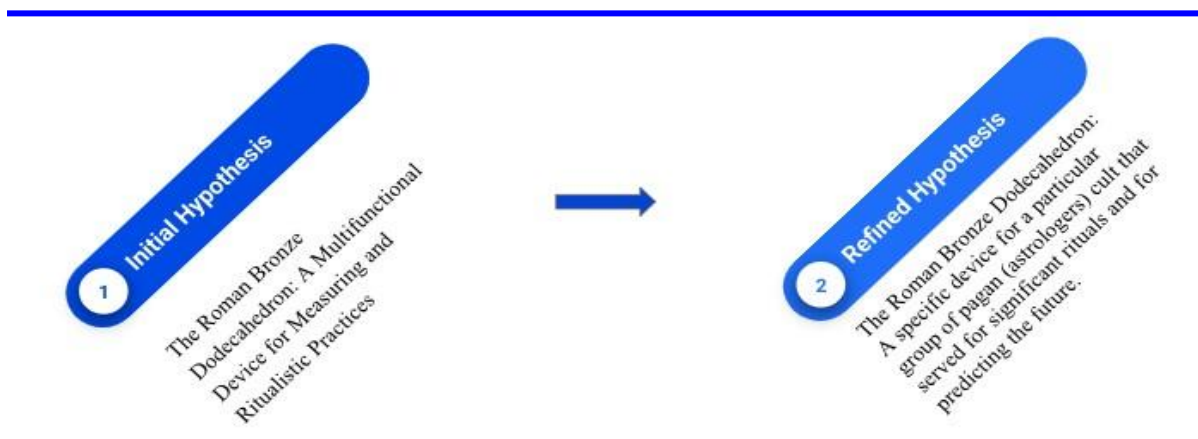


Figure 5. Generating a Refined Hypothesis by Revising the Initial Hypothesis using Significant Evidence (images created with PowerPoint).

However, the Romans were generally flexible with conquered regions. As a rule, local laws and customs were often preserved (Welch, n.d.). Pagans, forming various cults, practiced their rituals more freely outside Rome. Astrologers and fortune-tellers also moved beyond Rome's core to continue their practices.

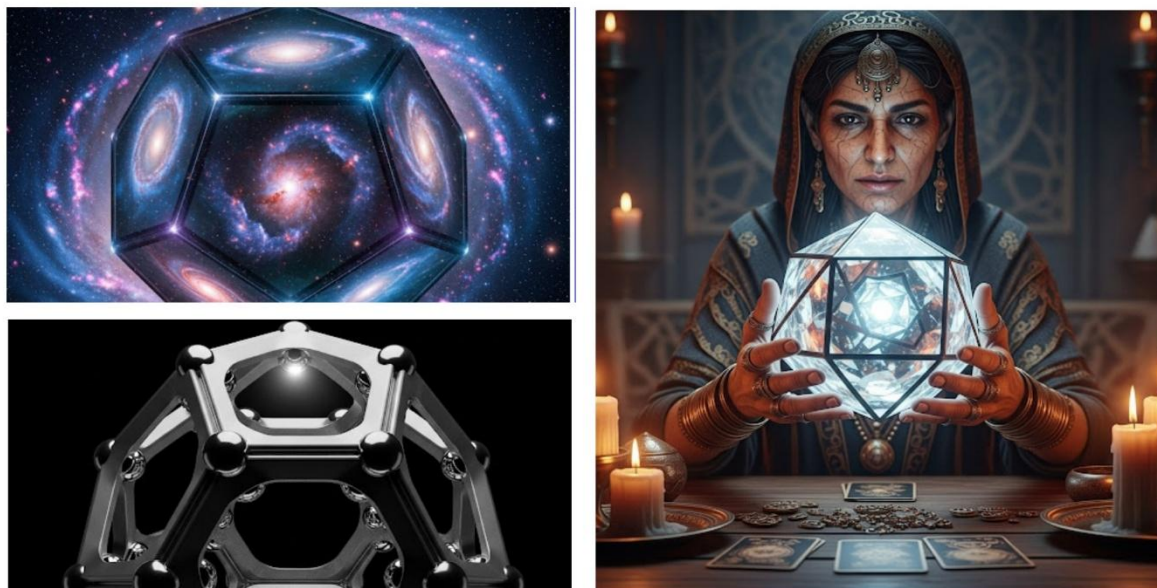


Figure 6. The Images were created using the AI Platform Gemini, depicting the Roman Dodecahedron as Aether (the fifth element) and as Part of a Fortune-telling Device

The fact that Roman dodecahedrons have recently been found outside Italy suggests these objects may have been part of such cult practices—possibly used by astrologers or fortune tellers to predict the future. Christianity came to dominate the cultural landscape of Ancient Rome. According to Campion (2019), from the early 4th century, classical culture—including astrology—entered a period of decline as Christianity gained dominance, especially in Western Europe. The spread of Roman dodecahedrons to different parts of Europe, where they were found buried underground, may indicate their use by astrology or pagan cults that continued outside Italy.

In summary, the students' ideas in Project #4C converges on a single conclusion: the Roman dodecahedron served as a tool for astrologers, specifically within pagan cults for religious purposes. Pagan cults, including astrologers, used various objects believed to have miraculous powers. These included both man-made items—such as burial sites and boundary stones—and mysterious artifacts like Neolithic tools (possibly including meteorites) or bronze shields, often thought to have originated from more advanced cultures (Grant, n.d.). The closest association of the Roman dodecahedron is with astrologers, as astrology is rooted in pseudoscience. The Stoics viewed this pseudoscience as evidence of the Platonic unity of the universe (Grant, n.d.). Since the dodecahedron is a Platonic solid and was used by astrologers, it stood in opposition to Christianity. Beginning in 391 A.D., Emperor Theodosius issued a series of decrees banning pagan worship and ordering the destruction of temples and altars (Karoglou, 2013). This provides strong evidence for why the Roman dodecahedron eventually disappeared in Italy.

## Discussion

### Interpretation of Results

Results were derived from twelve student groups in geometry classes who read instructional material (Table #1),

examined a physical figure (see Figure 3), and reviewed selected articles via Google. These results were categorized in (see Table 4). The first category dominated with nine preferences, the second with five, the third with three, and the last with one. A visual presentation is shown in (see Figure 5). The idea that the Roman dodecahedron was used as a decorative object or candle holder does not hold up under scrutiny.

There is no evidence to suggest that the Roman Empire prohibited the use of candle holders or decorative items. On the contrary, both were prevalent and culturally significant aspects of Roman life. Roman women, for instance, developed a taste for elaborate jewelry adorned with colorful, exotic stones (Lightfoot, 2009). The Romans embraced decoration in various forms, using it to enhance living spaces, public buildings, and religious sites.

The theory that the dodecahedron was used to measure angles, distances, or weight is also unsupported, as there is no evidence that any tools were prohibited in ancient Rome. On the contrary, tools were valuable items essential for creating architecture, irrigation systems, walls, art, and sculpture. Ancient Roman sculptors, for example, used a range of specialized tools to complete their work (Lijingwen, 2024). The Roman dodecahedron is a valuable item in part because it was made of precious metals such as bronze. Its absence from the heart of Rome may be due to it being a prohibited object associated with pagan religion or astrology, such as its use by fortune tellers.

The most plausible theory regarding the use of the dodecahedron is its association with pagan religion or astrologers. Both were banned in ancient Rome through official decrees. The persecution of pagans in the late Roman Empire began during the reign of Constantine the Great (r. 306–337), who, for example, destroyed a pagan temple in Aelia Capitolina (Jerusalem) to build a Christian church in its place (Wikipedia, n.d.). As astrologers and pagan cults were banned from the Roman Empire, they migrated with their possessions to regions where they were safer. This explains why Roman dodecahedrons have been found outside the core of the Empire, in territories conquered by Rome.

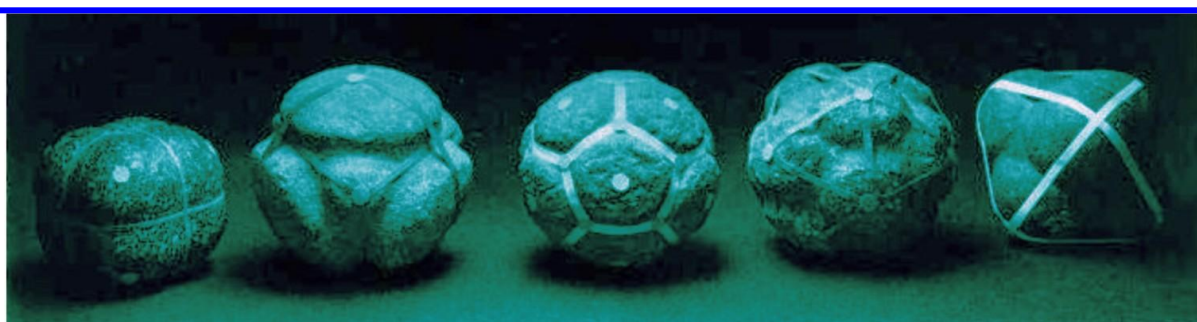


Figure 7. Five Platonic Solids Carved in Stone 5,000 Years Ago; Figure modified from Ancient-Wisdom (n.d.).

Narrowing the interpretation of the item's purpose in the Roman Empire to a single, well-supported theory encourages further scholarly investigation. It allows other researchers to either support or refute this idea with their own evidence. In doing so, researchers avoid the risk of biased selection from earlier studies and ensure a more trustworthy synthesis of existing literature (Lund et al., 2021). Additionally, this approach may bring greater clarity in uncovering the true purpose of the Roman dodecahedron.

## Historical Contextualization

Carved stones resembling the Platonic Solids found in Scotland are estimated to be around 5,000 years old. This suggests that the concept of the five geometric figures—known as the Platonic Solids—existed approximately 1,500 years before Plato wrote about them in *Timaeus*. The Greeks believed that these five solids represented the fundamental patterns of physical creation (Ancient-Wisdom, n.d.).

The five Platonic Solids are:

- Tetrahedron (four faces)
- Hexahedron or Cube (six faces)
- Octahedron (eight faces)
- Dodecahedron (twelve faces)
- Icosahedron (twenty faces)

Although Neolithic people had limited mathematical knowledge—being able to count to at most 200—they managed to trace all five Platonic Solids within a sphere with remarkable proportional accuracy. Their craftsmanship reflects an ability to generate spherical objects with maximum symmetry (Ancient-Wisdom, n.d.). The challenge for Neolithic people was not only creating these geometric figures accurately, but also developing specialized tools capable of carving such shapes into hard materials like stone.



Figure 8. The Image was Created using the AI Platform Gemini. It depicts the five Platonic solids and their roles in space

## Five Platonic Solids Building Blocks of the Physical Universe

Plato paid a great deal of attention to shapes, especially the five solids he believed were the building blocks of the physical universe. Platonic Solids are the five unique three-dimensional shapes in which each face is identical,



and every angle is the same (GeoFossils, 2024). Each Platonic Solid represents a fundamental element of existence. Dodecahedron signifies aether or universe. Aether has two definitions—one from early medieval alchemists and another from 1887 AD. In early physics and alchemical chemistry, aether was considered the fifth element. It was the name given to the substance believed to fill the universe beyond the terrestrial sphere (Helmenstine, 2019). This is one reason why the dodecahedron is said to represent the universe in some sources. Plato's perspective on the five solids led to the idea that these geometric figures are the fundamental building blocks of the universe and life. Neolithic people who carved the five solids into stone left no written records explaining why they did so or what the shapes meant to them. However, one thing is clear: the Platonic solids held significant importance for Neolithic people—otherwise, they would not have invested so much time in creating something that lacked meaning for them.

The most common form of the Flower of Life is a hexagonal pattern, in which the center of each circle lies on the circumference of six surrounding circles of the same diameter. This design is composed of 19 complete circles and 36 partial circular arcs, all enclosed within a larger circle (Creation Arts, 2015). A version of the Flower of Life believed to contain the 'secrets of life' consists of 13 complete circles.

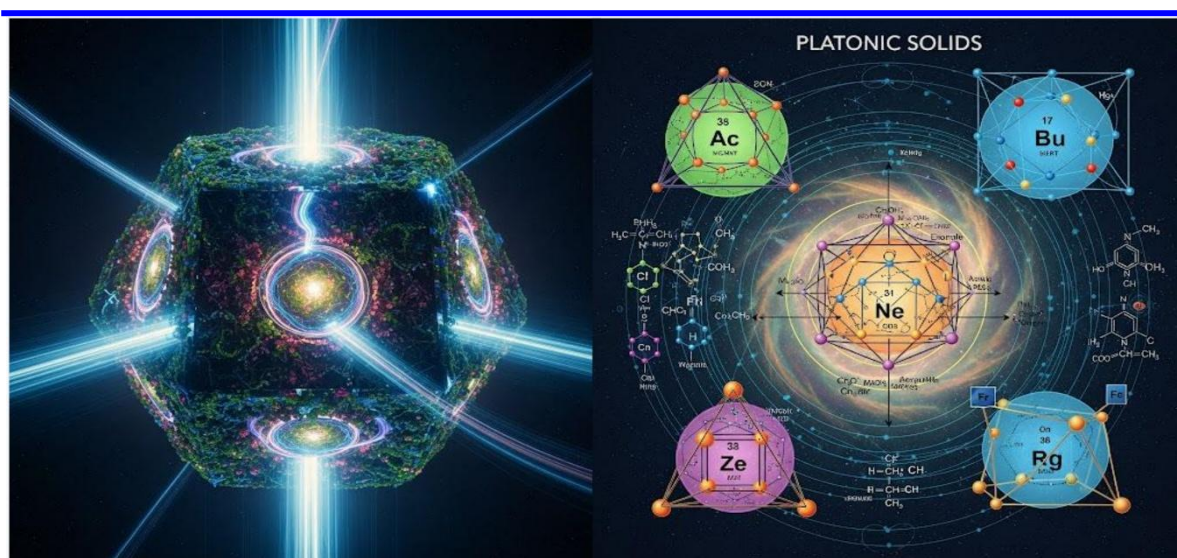


Figure 9. Dodecahedron as a Source of Life, and the Appearance of Platonic Solids in the Bounding Structures of Atoms (chemical elements). The figure was created using the AI platform Gemini

Atomic compounds composed of chemical atoms can take the form of the five Platonic solids. Roccatano (2018) describes a boron compound: “composed of 12 boron atoms bonded to 12 hydrogen atoms with the formula . This stable compound is called the dodecaborane anion, and it has the geometry of a regular icosahedron.” Many chemical elements form structures based on the Platonic solids because these shapes fit perfectly into a sphere. Other examples can be seen in Figure 9.

### Significance of the Number Twelve

The Platonic solids consist of 12 faces, each with a hollow, and each face is five-sided. Burkhard Heim attempted

to find a connection between the seen and the unseen in the space through his theory centered on the number 12. His theory of 12 dimensions proposes a framework that transcends the conventional four-dimensional continuum of space and time, inviting us into realms of speculative physics where the line between science and philosophy blurs (Leong, 2024).

The number 12 holds multiple meanings: it represents the hours on a clock, the signs of the zodiac, the 12 months of the year, the 12 dimensions of the universe, and has special significance in various religions. There are numerous repetitions of the number 12 in the Bible, as well as in other organized religions and world mythologies—for example, the 12 Adityas in Hindu mythology, the 12 Olympian gods in the Greek pantheon, the 12 Great Gods of Egypt, and the 12 Knights of the Round Table in the legends of King Arthur (Oldale, 2024).

The number 12 is a special number, considered a key to understanding the fabric of the universe. It appears to hold particular significance to God, often representing perfection and authority (Crier, 2014). God always works with perfect precision. By now, it should be clear that the structure of cosmic space and time is fundamentally based on the Platonic, Archimedean, and Catalan solids (Cosmic Core, n.d.). The power of the number 12, as embodied in the Platonic solid dodecahedron, preserves or reveals the secrets of the universe.

### **Astrology and Mystery Cults**

Astrology in ancient Rome blended seamlessly with mystery cults such as Mithraism—associated with zodiac imagery and the concept of cosmic ascent after death—and Hermeticism, which regarded astrology as a pathway to enlightenment and divine knowledge. The Greeks and Romans considered Mithras a sun god (Merkelbach, 2025). Hermeticism, on the other hand, sought divine knowledge and enlightenment through astrological practice. According to The New World Encyclopedia, Hermeticism is a set of philosophical and religious beliefs primarily based on the writings attributed to Hermes Trismegistus, a syncretic fusion of the Greek god Hermes and the Egyptian god Thoth (The New World Encyclopedia, n.d.; Kesinger, 2003).

These cults aimed to practice their religions based on their own interpretations and to validate their beliefs through astrological experiences. At the time, science as we know it today had not yet developed, but they made use of available tools, such as the Roman dodecahedron and other devices. From our modern perspective, astrology is considered a pseudoscience, but in the ancient Roman era, it was regarded as a mainstream science.

Astrologers' predictions—especially those concerning the emperor's death, rise, fall, or revelations—did not always align with imperial interests. As a result, astrologers were sometimes banished from Rome or even executed. Whenever the state perceived astrology as a threat, emperors acted against it. In 11 CE, Augustus attempted to further restrict astrologers by making it illegal to consult them privately or to ask questions about the timing of a person's death (King, 2023).

By the end of the 4th century, growing Christian opposition to astrology contributed to its decline in popularity in ancient Rome. As astrology lost its status as a key aspect of Roman society, artifacts like the Roman dodecahedron



also faded from use and disappeared from historical records.

### **Challenges of Interpreting Historical Artifacts**

There is no historical record of the Roman dodecahedron, making it difficult to determine with certainty its original purpose. Based on the logical premises described in this paper, it is highly possible that the fate of the Roman dodecahedron was linked to the decline of astrology. Nevertheless, there is limited evidence to support any definitive conclusion about its exact function.

### **Conclusion**

There are several theories about the function of the Roman dodecahedron in ancient Rome, including its use as a candle holder, a measuring tool, a decorative piece, or an object in religious practices. These mysterious items require a thoughtful approach blended with critical thinking. As Nietzsche once claimed, “Mystical explanations are thought to be deep; the truth is that they are not even shallow.” The truth often resides in the simplest explanation. We often fail to solve a mystery because we ignore the simple answers and instead seek complex ones.

To explore the question of the Roman dodecahedron's purpose, we asked the same question to high school students. They received some background information, as outlined in the introduction and methods sections. As supplementary material, students used Google and shared their ideas collaboratively within their groups. The majority of students favored the theory that the objects were used in religious practices, which is a plausible interpretation. Historical literature also suggests that pagan cults—particularly astrology—were banned in ancient Rome. Since the Roman dodecahedron resonates with similar themes (e.g., the universe), it, too, was likely banned.

The 4C project in geometry classes served as an excellent example to show students that mathematics is not just about numbers—it is also about thinking critically. Geometric figures are not merely abstract concepts. They hold keys to understanding various patterns, including those found in the physical universe.

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