



VISIT MATH



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Material Creation Guide



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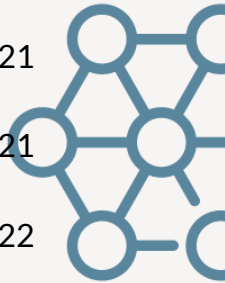


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Introduction

Mathematics, often considered a complex and intangible field, is omnipresent in our daily lives. From the geometric shapes of historic buildings to the repetitive patterns of nature, mathematical concepts shape our world. This guide aims to transform this impression into a captivating and tangible adventure.

Start creating educational math tours with this VisitMath guide. It gives you the tools to plan and develop innovative and more engaging tours for learning. The methodology used allows for combining mathematics with other disciplines such as architecture, history, or foreign languages. This opportunity to take students on a fun field trip combining puzzles to solve, anecdotes, and historical facts, all wrapped up in a story, is a great way to make learning more motivating and real.

Imagine for a moment children filled with curiosity transforming old city buildings into shape puzzles, collecting data in parks, and solving mysteries in artwork. This guide unveils the step-by-step process for embarking on this creative exploration adventure, providing practical tips and proven strategies.

This guide is structured around three main axes: preparation, design and implementation.

- Preparation: We'll guide you through selecting sites of mathematical interest and developing clear learning objectives tailored to students' different levels and needs. We'll also detail logistical considerations and the importance of careful planning. Finally, we'll address some inclusion issues.
- Design: This chapter will explore how to integrate mathematics with other disciplines, create a compelling story, and use gamification to transform challenges into real adventures. Practical tips for creating engaging learning materials will also be provided.

- Implementation: We'll provide detailed logistical recommendations, tips for collaborating with local partners, strategies for ensuring the inclusion of all learners, and tips for effectively using available resources.

Math tours aren't just learning activities. They offer an invitation to explore the world. By transforming familiar streets, monuments, and buildings into a playground for discovery, we show students how mathematics is rooted in reality.

This guide encourages you to go beyond textbooks and bring mathematics to life in an innovative and fun way. Whether you use existing tours from the VisitMath project or create your own, these experiences are a great way to make this subject more engaging and stimulating.

Preparing the mathematical visit

This chapter describes the essential steps for preparing a mathematics field trip to ensure it is as successful as possible. Proper planning will ensure a visit that is both engaging and pedagogically sound, thus maximising learning outcomes for all learners and increasing student engagement and motivation.

1. Identify interesting elements of your area

This step should be the starting point for preparation and focuses first on considering potential locations for the mathematics educational visit. Initially, the research should be quite broad, to encourage exploration beyond traditional mathematical contexts and to consider a diversity of existing elements in your region.

The localisation of potential places and elements:

- Cities/monuments/historical buildings: make a brief analysis of the advantages that these elements offer, such as architectural forms, symmetry, proportions and measurement systems. (Examples: facades of cathedrals, bridges, castles).
- Natural elements: take some time to examine patterns in nature if the location lends itself to it (spirals in shells, symmetry in leaves), the possibilities of measuring distances, angles and areas of natural formations (rivers, parks, forests).
- Urban environments: Study the characteristics of places: street patterns, traffic flow, building heights, and public art installations.

Visual examples: Create a digital or paper file with this information, also including images or sketches of the sites and potential elements to inspire you and be able to return to them later and develop them.

2. Define the educational objectives

Choose an approach that you want to prioritise

Here are the two main approaches to designing a tour:

- Theme-based approach: Start with a specific math topic you want to cover, such as geometry, trigonometry, or data analysis.

Then, look for places that offer concrete examples on this topic, such as studying angles of elevation using a tall building.

- Place-based approach: Identify a landmark or interesting local feature. Then develop math activities and problems that can be explored in and/or around that location. This approach can be more flexible, allowing for the integration of multiple math concepts. For example, a park can be used to explore geometry, measurement, and data collection.
- Comparison of the two approaches: The two approaches are complementary and can be chosen based on the objectives of the visit. The theme-based approach is ideal for focused and structured learning. It is suitable when the objective is to deepen a specific mathematical concept. The place-based approach, on the other hand, promotes versatility and contextual exploration. It is ideal for curious students or for contexts where the geographical area is a key element.

A combination of the two can enrich the educational experience.

Relate elements to mathematical concepts

From places to concepts: establish the links and provide examples of how the different places chosen can be linked to relevant mathematical concepts:

- Historical site (Example: Castle): geometry (angles, shapes, symmetry), measurement (perimeter, area, volume), history of mathematics (historical units of measurement).
- Natural feature (Example: River): measurement (length, width, flow), data analysis (water quality data), geometry (angles, slopes).
- Urban environment (Example: Town square): geometry (shapes, paving), measurement (area, perimeter), data analysis (pedestrian traffic).

Example of a preparatory table:

Location	Mathematical concepts
Cathedral facade	Symmetry, Geometry (angles, shapes), Proportions
Local square	Measurement (area, perimeter), Data collection, Statistics
Factory visit	Scaling, Reporting, Data analysis, Optimisation

Adapt activities to school levels and students with learning difficulties

Differentiation by level: Check the school curricula for different levels and don't hesitate to ask other teachers for their opinion. Then, develop examples of exercises where the same activity/concept can be adapted to different levels and test them with a few students. (For example, calculating the area of a square is simple for younger students and involves algebraic expressions for older students.)

Respond to learning difficulties (Dys):

- **Dyslexia:** Use clear and concise language, provide visual aids, and offer alternative formats for written material (example: a reading ruler, a highlighter).
- **Dyscalculia:** integrate materials for manipulations (a rope, sticks, etc.), visual representations (example: colour codes) and divide complex tasks into smaller steps.
- **Dysgraphia:** Allow other data recording forms (example: oral responses, use of technology such as a dictaphone).

Optimise the design of a visit by integrating the principles of UDL (universal design for learning):

When planning your math field trip, you can apply the principles of Universal Design for Learning (UDL). This approach involves anticipating, from the design phase, methods and activities that are accessible to all students, taking into account their diversity. The goal is to enable each student to progress to the maximum of their abilities.

That said, UDL is not a substitute for necessary adjustments to meet specific needs. Rather, it aims to reduce potential barriers from the outset, thereby providing a more inclusive and enriching learning experience for all.

3. Create a structured pathway

The essential points

Identify the key steps:

- **Introduction/context:** Briefly present the locations and the mathematical learning objectives of the visit, linking them as best as possible to the learning expected in the school curriculum.

- Exploration of places, stages and data collection.
- Detailed analysis and design of the math exercises related to each step. Include solutions.

Establish a route:

Develop the desired itinerary by describing each stage (name of the place or monument, various historical or cultural information, etc.)

Example route and visual representation:

- Analysis of the most suitable itinerary: develop the route so that the tour starts from point A and arrives at point B, or starts from point A and returns to point A at the end. Integrate the different stages and the specific activity as you go.
- Itinerary visual presentation: Include a map or sketch illustrating the planned route and the locations of the stages where the stops are to be taken. This adds visual clarity and helps readers understand the flow of the tour. Notify the cardinal points.

Transportation, time management and checklist

Be aware of transport constraints:

- Type of transport: Explore the various transportation options (public transportation, school buses, walking, etc.) and their implications in terms of cost, accessibility, and time management.
- Accessibility for all pupils: Consider each student's specific needs, any disabilities, and people with reduced mobility. Can all students access the chosen location?
- Permissions and security: Anticipate the need to obtain any necessary authorisations and learn about potential risks.

Estimate the time needed for each stage of the visit:

- **Time location:** Estimate the time needed for the tour, taking into account factors such as travel time, time needed for each stop, and any breaks. Allow a reasonable amount of time for each stop in case participants need more time to solve the enigmas.
- **Contingency planning:** Consider and anticipate possible unforeseen events such as delays or others. To do this, it is necessary to allow for a time margin.

Preparation checklist

Develop a concise checklist summarising the key steps in preparing for a math visit. This provides a practical tool to ensure you cover all the essential elements.

Designing mathematical activities and gamifying them

1. Integration with other disciplines

The concept of outdoor mathematical visits can be vast and intimidating. Where do you start when you want to begin creating this type of activity? That's a very good question, which we will answer here.

In chapter 1, we mentioned that there were many approaches to start the creation of your activity. In any approach, if you want your learners to get into your activity and retain the concepts you are going to cover, they need to have a cognitive anchor to which they can attach the abstract concepts of maths: in particular, this means using a variety of themes that are likely to be more meaningful to them.

Take a look at the target area with an outside eye: here are a few ideas to help you.

- **History:** Europe is full of historical events, both glorious and tragic, that have left their mark on its inhabitants. For example, there may be the remains of a battle or a famous social protest that led to concrete advances in your country's laws, etc.
- **Geography:** History is synonymous with changes in the way the land is organised. For example, the railway line that serves the town, the flow of a river that may have been modified, the construction of new housing to accommodate a demographic boom, etc.
- **Architecture:** Indirectly linked to history, architecture can be a very relevant subject for a maths activity. Of course, the aesthetic concepts involved may be more complicated and difficult to arouse the curiosity of your pupils! Nevertheless, Europe has an exceptional heritage that is still very much alive and

interesting to explore. For example, the Art Nouveau style, Gothic churches, local styles such as the 1930s houses of northern France, etc.

- **Science, technology and art:** It's sometimes interesting to take a closer look at the technological or artistic advances that have been created in your region or that have had a major impact on it. Scientists, engineers and artists may also have passed through your region. For example, the industry that gave rise to your region, elements of the life of a scientist, the workings of a local discovery...
- **Sport:** Sport is obviously a subject that can easily arise the interest of young people. For example, the performances of a local team, the construction of the town's stadium, the organisation of events, etc.

This list is not exhaustive and can be much longer depending on your region. If you are having trouble finding related topics, you can always contact your colleagues to get their opinions, or the tourist office in your town or region.

Once you have found all this information, it will be very easy to find the mathematical concepts you want to cover, and to adapt their complexity to your class level!

2. Find a story that links everything together

What is a story and what is its purpose? Another good question!

A story is a narrative element that enables smooth transitions between the various teaching elements. This is extremely important if you want your students to be fully immersed and if you want to make the most of the non-formal aspect of this activity: the risk of jumping from one element to another without a story to link them, is that your students would still have the impression of being in a traditional school activity and would be limited to their creativity and freedom to intervene.

Finding this narrative aspect serves, in particular, to identify a character who will act as a common thread for the students, and who they will be able to remember. Whether

it's a well-known character, or a "common" character of the time to whom you give an identity and a character: the possibilities are vast! Take a look at our activity library for some inspiring examples :)

If you are not sure that the use of a specific character could be protected by copyright, we suggest that you limit the use of the activity to pedagogical activity and never sell or get benefits from it.

Let's have a look at some of the possibilities for creating a story.

- **A historical fact common to all the activities you are planning:** In this case, your narrative work will be the simplest. If all the elements coincide in the same period of history, bring out a "spectre from the past" to act as a "guide" for the students in this activity.
- **Give life to a character interested in the past:** A writer who wants students to help them find inspiration for their new story, the ghost of a pirate who haunts students so that they can help him find his treasure...
- **A mascot or fictional character not set in time:** The range of possibilities is very wide here too. Historical or cultural elements can be a good reference point (as is the case with the Wrocław dwarfs, for example), but you can also broaden the spectrum to include geek culture or recent events. For example, using a fictional character from a novel, film or video game (either because the work is set in your town or because the creators are from there) can be a way of creating a link that your pupils will easily remember!

As mentioned above, this is a short and not exhaustive list of the main options we used on our tours. We recommend that you consult our tours for inspiration.

3. Integrating games into visits

Just like the stories in the chapter above, making your activities fun is important for your students' experience.

Even with the best story in the world, and activities linked to interesting topics, formal pedagogical content will detract from the experience. A simple quiz to which you apply a grade will break the immersion of the story and take students out of the informal aspect of learning.

This is why gamification is a very important facet of the activity: it will enable the pedagogy to be camouflaged behind a layer of intrinsic binding. Learning without feeling like learning is the aim here, or at least limiting the barrier and apprehension that students have with the formal framework as much as possible.

Of course, it's difficult to get rid of the formal aspect completely: as a school supervisor, you will always be wearing that "hat" and the pupils will be aware of the intention behind everything you offer them. However, with the right positioning during the briefing before the activity, open and positive supervision, and judicious play mechanisms, it is completely possible to break away from the formalism of your institutions!

In our tours, you will find several approaches, depending on the creator of the tours among our partnership. Here are a few examples of approaches that could be introduced into your activities:

- **Play with the environment and hide codes:** Punctuating each activity with "true" – "false" can be very formal and break with the immersion, as mentioned above. Finding other ways for students to understand whether they got it right would be a plus. It's a bit like the experience of an escape game: the supervisor doesn't validate the puzzles themselves, the players move on when they find the code they

need to go on to the next stage. The supervisor is only there to set the mood and give clues to unlock players who are having difficulty.

- **Use the "guide" of your story:** Mixing narrative with activities turns the tour into a kind of role-playing game in which the pupils help the guide to achieve their objective. Like a strange rogue in a tavern entrusting a mission in a classic role-playing game, let your pupils experience a wonderful adventure! However, this format requires a lot of acting on your part, and will probably be more complicated to set up with a large group: but by splitting it in 2 and dividing the role of narrator between different supervisors, anything is possible.
- **Use an additional medium:** Having a medium that allows students to follow their progress in the round, or to validate their answers, is a real additional value. However, the visuals used must be of good quality and well laid out so as not to break the immersion. This could take the form of a "treasure map" or a sort of "book in which you are the hero" in which each activity represents a different chapter: in the latter, the description of a problem or a line of reasoning could enable the students to find codes corresponding to the chapter's page reference. If the code is correct, then the page they consult will ask them to go on to the next place, otherwise the page consulted with the wrong code will explain their error and invite them to try again.

Once again, this list is by no means exhaustive! You can use the same techniques as those used in our tours or in other games you have played. The parallel with the way of solving an enigma in an escape game is very relevant: we recommend that you consult the website of another European project called [SpeakER](#), in which numerous ways of creating enigmas are detailed.

To have support on the animation, you probably have colleagues who are used to this type of informal activity: indeed, sports teachers have a great expertise in taking charge groups of pupils during outdoor activities, while maintaining their interest. Don't hesitate to ask them!

4. Create the material

If you have read this guide so far, you're probably interested in trying to create your own tour on maths and integrating the gamification aspect, which is excellent! Now let's get down to the practical side and see how creating some gamified elements that are a bit different from what you're used to.

We will start with the main difficulty you may be facing: the feeling that you're getting into a huge project on your own. However, depending on the size of your organisation and its specialities, you may not be the only person who wants to try this adventure. Asking for help is necessary for several reasons:

- **Testing your story and your games:** From an educational point of view, you probably have all the expertise you need to create pedagogical maze with specific answers. However, the way a story unfolds, the way a character's commentary makes you feel or the difficulty of a puzzle is subject to much more subtlety. It's vital to test your story and mini-games with colleagues or small samples of students to make sure you have got your trick right.
- **Creative synergy:** "You work better alone, but with others you can go further"- a well-known saying in the world of entrepreneurship - is also true for the creation of this kind of experience. Staying on your own locks you into your own point of view, whereas doing workshops with your peers allows you to formulate your problems and hesitations, and to find solutions together.
- **Creating materials:** If your organisation has design workshops, 3D printers, laminators, large-format or high-quality printers, etc., you could use this equipment and the skills of your colleagues to create physical items for your learners: for example, booklets, cards, tokens or statuettes that can be used during one of the activities.
- **Creating visual assets:** With the advent of artificial intelligence, we need to talk about the importance of creating visual assets for your media. Of course, if you don't have access to the artistic skills needed to create original elements, you can

use image generation tools: but it is advisable to check the rights of use beforehand and to mention the source of these assets. But if you have access to the artistic skills required, we strongly recommend that you create original assets for your experience supporting materials: using AI for educational purposes will also tend to standardise the use of AI for your students. Also, although the quality of the images generated is often recognised as "aesthetically beautiful", it has also become standardised and sanitised: the external view of the experience you have created could be negatively impacted by an extensive use of AI.

Once you have defined the media you need and the skills you have at your disposal, it's time to look at the tools available to create them. There are many different tools available to help you create different types of media.

For our tours, we mainly used **Canva**: its ease of use meant that the members of our consortium, whatever their profile, were able to use it. The free version already allows you to integrate many of the available assets, as well as those you have created on your own, and to export the support in several different formats. One of the special features of Canva is that it can also be used to create videos: this could allow you, for example, to create a quick presentation sequence of the places you visit for your students. It can also be used as a support for the animation and relieve you of the burden of providing it at the time.

Genially and **PowerPoint** are also relevant alternatives: dynamic transitions can be useful, as can the ability to move from one window to another via "actions" integrated into buttons. This makes it possible to create **interactive books** that can be used on tablets or with page numbers to make a printed "book where you are the hero" .

If you have the technical skills, there are a number of other tools available, but they have additional constraints in terms of complexity and pricing. The two main tools are **Adobe In Design** and **PubCoder**.

Practical Recommendations

1. Logistical organisation

Planning a mathematics tour requires great care to ensure that teachers and students enjoy an enriching experience. These important logistical considerations should help you plan a great visit.

Planning the tour:

A well-organised mathematical visit starts with a clear itinerary that balances practical logistics and pedagogical objectives. Here's how to approach it:

- Set realistic group sizes: For easier management and engagement, split your class into smaller students groups.
- Think of public transportation: If you use public transports, make sure to collect the money to pay for the tickets in advance.
- Meeting point: Set up a meeting place in case someone gets separated from the group.

Indoor alternative:

While exploring outdoors is ideal for practical mathematical involvement, unpredictable weather can disrupt plans. It's essential to have a backup strategy:

- Identify indoor alternatives: Select museums, libraries or cultural centres along the route that could welcome the group.
- Adapt activities for indoor settings: Transform location-based tasks into paper-based or digital exercises.

- Prepare digital resources: Use digital resources such as QR codes or virtual tours (e.g., Google Earth) to allow students to explore locations remotely if needed.

Other logistical considerations:

In needed, make sure each student has the necessary mathematical tools for the tour (such as rulers, protractors, clipboards, etc.). If the trip includes digital tools, check that students have access to smartphones or tablets with an internet connection—or provide printed alternatives. In addition, set clear safety guidelines to guarantee students follow road safety rules and stick to designated meeting points.

By addressing these logistical elements, your mathematical tour will not only run smoothly but also provide an engaging and interactive learning experience for students.

2. External contributors

Cooperating with external professionals can greatly improve the quality of a mathematical tour, as it provides students with expert insights, historical context, and hands-on learning opportunities. Local partnerships can also help maintain and involve broader community involvement in educational activities.

If you want to add depth and authenticity to the experience, consider collaborating with local experts, institutions, and cultural organisations.

- Contact local museums or cultural centres that can provide information about the historical significance of a specific place. Some organisations may offer guided explanations or have archives that could be used for the mathematical tour.

- Schools and universities with mathematics, architecture, or urban planning departments may have professors or students who can contribute as guest facilitators.
- Local tourism offices may also provide maps, interactive materials, or logistical support for self-guided mathematical tours.

Students' learning process will be much more immersive if they use local expertise to see personally how mathematics is connected to history, architecture, and daily life.

3. Inclusion

Making a mathematical tour a relevant experience for every student—including those with specific learning disorders (SLDs), disabilities, or other specific needs—is dependent on ensuring accessibility and inclusivity in the tour. While maintaining everyone's involvement and participation, a well-designed tour should accommodate diverse talents, backgrounds, and learning styles.

Make sure that all students—regardless of physical, cognitive, or sensory challenges—can participate in the mathematical activities. Consider the following adaptations:

Format variations:

- Provide large-print materials for students with visual impairments.
- Offer both printed and digital versions that are compatible with screen readers.
- Choosing inclusive fonts (sans-serif), adequate colour contrast, clear headings, and structured layouts to support students with dyslexia or visual difficulties.

Simplified and clear instructions:

- Make sure all tasks use clear and concise language.
- Provide step-by-step guidance with visual aids, such as icons or illustrations.

Adapt the experience for all mobility needs:

- The tour should be physically accessible so that students with mobility challenges can fully participate.
- If a site is inaccessible, provide alternative activities that can be completed at a nearby location.
- If possible, choose paths that are flat, well-maintained, and wheelchair-friendly.
- Avoid narrow walkways, steep inclines, or cobblestone paths where possible.

Encourage collaboration:

- Allow students to work in pairs or small groups to accommodate different strengths.
- Use peer support systems, where students explain concepts to one another.

Allow choice and flexibility:

- Let students decide how they complete an activity—whether through writing, drawing or discussion.

Using inclusive approaches helps make the mathematical tour a very interesting and relevant experience for every student, supporting the belief that everyone can study mathematics regardless of ability or learning style.

If you want more detailed guidance on inclusive practices, check the [VisitMath guides](#). "How Our Cities Can Help Teach Mathematics" (p. 29) covers strategies for accessible learning, and the "Pedagogical Guide" (p. 18) provides practical tips on adapting field trips for all learners.

4. Material

Well-prepared resources are essential to ensure that the mathematical tour runs smoothly and engages students effectively. Testing materials in advance helps identify potential issues and allows educators to refine the experience.

Think about the following to help to prevent issues throughout the tour:

Print and organise materials:

- Make sure all printed worksheets, maps and instructions are clear.
- Prepare extra copies in case of loss or damage.

Digital and interactive tools:

- If your tour includes digital tools (e.g., QR codes, online quizzes, or mobile apps), test them on different devices and check for stable internet access at tour locations.
- Ensure that students can easily scan QR codes and that the linked content is functional and accessible.
- As a backup in case of technical problems, have a printed or offline copy.

Testing the tour:

- To make sure activities are clear and realistic given the allocated time, do a test trip with colleagues or a small number of students.
- Verify locations for accessibility, safety, and visibility and change location if needed.
- Time each activity to ensure a balanced schedule without rushing students.
- Test all materials' readability and comprehension; if necessary, change wording or formatting for clarity.

5. Additional resources

This Creation Guide explains how to create your mathematical tour, but if you're looking for ready-made materials, we have 18 pedagogical tours already available on our [website](#). These tours integrate mathematics with cultural exploration, using real locations to engage students in learning math through their surroundings.

Beyond these tours, we also provide a variety of other useful and engaging resources to support educators:

- E-Books: 15 interactive stories with mathematical challenges based on real-world locations, making learning engaging and memorable.
- Map of Europe: Featuring 60 locations of architectural relevance, each linked to educational activities and resources.
- Pedagogical Sequences: Classroom-ready lesson plans that complement the tours and provide structured, engaging frameworks for teachers.
- How Our Cities Can Help Teach Mathematics: A guide on interdisciplinary teaching and gamification, with practical examples.
- Pedagogical Guide for Math Field Tours: A comprehensive guide with practical advice on organising successful mathematical tours.

All resources are free and tested by educators to ensure they are practical, engaging, and adaptable. For more details, visit [VisitMath resources](#).



Conclusion

Mathematical tours are not just a learning experience: they offer a chance to observe the world through numbers, patterns, and solutions. Students can discover and learn mathematics by stepping out of the classroom, making it more interesting and pertinent. Such field trips make ordinary streets, landmarks, and buildings discovery opportunities, showing students that mathematics rules the world around them.

From the tallest skyscrapers to the smallest tiles on a city square, math is everywhere. A simple walk around town is a chance to measure angles, find symmetry, or analyse proportions in ancient monuments, modern buildings, or even nature. But these school trips are not just about numbers and equations. In fact, they help students better appreciate their own local heritage. By discovering the mathematical precision in old buildings and urban planning, students learn to appreciate their surroundings differently and understand how they have evolved over the years. The association of mathematics with culture and history enhances the learning process and encourages students to feel proud of their local heritage.

Although many students find math abstract and complex, these tours bring mathematics to life in a practical and engaging way. Instead of solving problems in a textbook, students actively explore patterns, solve puzzles, and apply mathematical thinking to real-world situations. The gamification aspect adds another level—converting challenges into quests and learning into adventures. This reduces math anxiety, enhances critical thinking, and enables students to develop problem-solving skills that they will remember long after graduating.

Mathematical tours have an impact on cooperation as much as they do on personal learning. Students work together, exchange ideas, and support each other to overcome mathematical challenges. This teamwork builds confidence, encourages diverse ways of thinking, and creates a positive, inclusive learning environment where every student has a role to play.



And what if students weren't just participants but creators? Teachers can involve students in developing their own mathematical visits. Imagine a project where a group—or even an entire class—researches their local area, selects locations, designs math challenges, and tests their tour before presenting it to other students. This kind of student-led project encourages critical thinking and teamwork in a way that is both empowering and engaging.

Whether you use existing [VisitMath tours](#) or create your own, these experiences are a great approach way to make math feel real, relevant, and exciting. The world is full of mathematical wonders—it just takes the right perspective to see them. So why not start today? Step outside, explore, and let mathematics lead the way!



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