

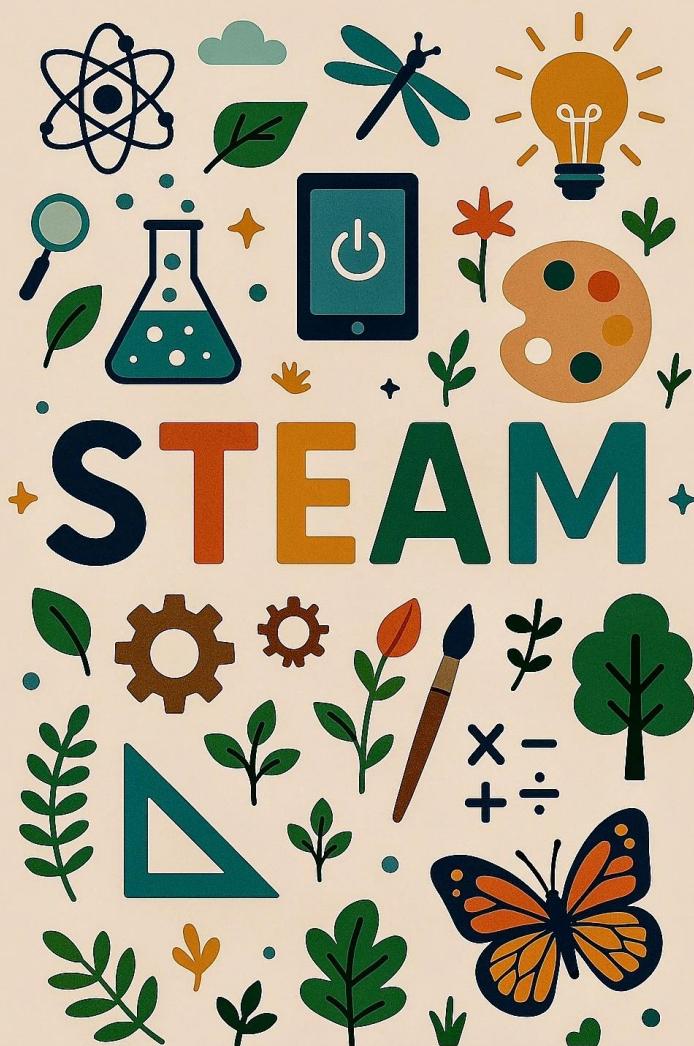


Lesson Plan

"Nature's Math Lab: Measuring, Exploring, Discovering"

STEAM Approach

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Topic: Mathematics in Nature: Measuring, Comparing & Analyzing Natural Patterns

Math: Measurement, shapes, patterns, data collection and representation, comparison

Science: Exploring natural environments, developing observation skills

Art: Visual representation of findings, using natural materials creatively

Technology: Use of measurement tools and optional digital devices

Ages: 9-12 years

Keywords: Outdoor learning, Mathematics in nature, Measurement, Data collection, Geometric shapes, Patterns in nature, STEAM education, Collaboration, Hands-on activities, Visual data representation, Nature exploration, Teamwork, Critical thinking

Duration: 90 minutes (or two 45-minute sessions)

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"STEAM - take it outside!"

Scenario

At Palade School, environmental education plays a central role, and many of the subjects taught outdoors are closely connected to nature. To make outdoor learning more diverse and not limited only to natural sciences, it's important to bring in other subjects as well.

Mathematics is a perfect example. By applying a STEAM approach, math lessons can become more exciting and multifaceted when taught outside the classroom.

Problem Statement and open discussion in classroom

We often think of mathematics as something that exists only in textbooks and classrooms. But what if math is all around us—in the shapes of leaves, the patterns in bark, or the sizes of stones? How can we explore the natural world to discover and understand mathematical ideas like measurement, shapes, and patterns?

This lesson challenges students to step outside the classroom and investigate:

Where can we find math in nature, and how can we use it to understand the world better?

Why is Math in Nature Useful in Real Life?

Math isn't just something we learn for tests—it helps us understand and solve real-life problems! When we find math in nature, we learn to observe more carefully, think more clearly, and make better decisions.

For example:

- **Measuring** the height of a tree or the size of a garden helps us plan how to take care of it.
 - **Patterns** in plants or animal tracks help scientists study how living things grow and move.
 - **Shapes** in nature inspire builders, artists, and designers when they create new homes, bridges, or artworks.
 - **Comparing** sizes of leaves or distances between trees helps us collect data and learn more about our environment.
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By using math in nature, we become better problem-solvers, thinkers, and explorers. It helps us connect what we learn in school with the real world around us!



Guidance for Supporting Students with Special Educational Needs (SEN)

This outdoor STEAM lesson can be flexibly adapted to ensure all learners, including those with special educational needs, are supported and engaged. Here are some inclusive strategies:

1. Differentiated Tasks

- Offer **simplified measurement tasks** (e.g. only measuring length, not width).
 - Provide **pre-drawn shape templates or visuals** to support shape recognition.
 - Allow students to focus on **one part of the activity**, such as collecting or observing, rather than all steps.
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2. Visual and Tactile Aids

- Use **visual instructions** and task cards with icons and step-by-step images.
 - Provide **hands-on tools** (e.g. string for measuring, colored pencils for sorting).
 - Encourage the use of **real objects** to explore patterns and shapes.
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3. Peer Support and Group Work

- Pair SEN students with supportive peers in mixed-ability groups.
 - Assign roles (e.g. recorder, measurer, photographer) so each student has a clear and manageable responsibility.
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4. Additional Time and Flexible Pacing

- Allow **extra time** for completing measurements or recording data.
 - Provide **break options** or quiet areas if needed during the outdoor exploration.
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5. Communication Support

- Use **clear, simple language** and repeat instructions when necessary.
 - Offer **verbal scaffolding** or sentence starters for reflection and group discussions.
 - For students with communication difficulties, allow **drawing or pointing** instead of verbal responses.
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6. Emotional and Sensory Support

- Prepare students ahead of time with a **visual schedule** or **social story** about going outdoors.
 - Ensure access to **sensory-friendly materials** and consider noise levels or weather sensitivities.
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- Allow students to **opt out of overwhelming parts** and participate in a modified version.
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7. Assessment Adjustments

- Focus on **individual progress** rather than group comparison.
 - Use **portfolio-based assessment** (drawings, photos, simple recordings) instead of written reports.
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Celebrate small successes and provide positive feedback frequently!

Learning Outcomes

- ✓ By the end of the lesson, students will be able to:
 - ✓ Measure objects in nature and convert between units (cm to m, mm to cm).
 - ✓ Identify and describe 2D shapes, symmetry, and repeating patterns in natural forms.
 - ✓ Record and represent data using tables and simple bar or pie charts.
 - ✓ Explain how math is used in science, nature observation, and environmental awareness.
 - ✓ Work collaboratively and communicate findings clearly.
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Final Learning Products

- Measurement tables and data sheets
 - Simple charts (bar graph, pie chart, or table)
 - Photos or drawings of natural shapes and patterns
 - Short group presentation or poster on “Where We Found Math in Nature”
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Lesson Objectives

- Students will be able to measure natural objects (e.g., leaves, sticks, stones) accurately using standard and non-standard units.
 - Students will identify and describe geometric shapes and patterns found in nature.
 - Students will collect, organise, and represent simple data related to natural objects.
 - Students will understand the relevance and application of mathematics in natural environments.
 - Students will develop teamwork and problem-solving skills through collaborative activities.
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Goals

This lesson plan has its very own goals. Some of them are going to be cognitive, while some others are going to be social and emotional. Learning itself is not enough, as well as getting information is not enough either. That is why our students will be working in groups. Regarding this, our goals are mentioned below:

In terms of cognitive goals, students will be able to:

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- Develop critical thinking and observational skills by identifying patterns and shapes in nature.
 - Enhance mathematical reasoning through measurement, data collection, unit conversion, and analysis.
 - Foster problem-solving by engaging in hands-on activities and real-world application of math concepts.
 - Improve ability to interpret and represent data visually (charts, tables, graphs).
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Regarding the socio-emotional support, we would like students to be able to:

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- Promote collaboration and communication as students work in small groups to complete tasks.
 - Encourage sharing of ideas and respectful discussion during group presentations and class reflections.
 - Build cooperative skills and collective responsibility through joint data collection and analysis.
 - Cultivate curiosity and a sense of wonder about the natural world and its mathematical properties.
 - Increase motivation and engagement by connecting classroom learning with outdoor experiences.
 - Develop confidence in using mathematical tools and expressing findings through drawings, notes, and presentations.
 - Foster a sense of environmental stewardship by highlighting the importance of nature and its preservation.
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Pedagogical Approach and Learning Modes

Approach:

The lesson uses a constructivist, inquiry-based, and experiential learning approach. Learning is grounded in real-world exploration, encouraging students to actively construct mathematical understanding through observation, measurement, discussion, and reflection. The approach is rooted in the STEAM framework, integrating science, technology, engineering, art, and mathematics in a meaningful, nature-based context.

It emphasises:

- Student-centered learning
 - Hands-on, outdoor activities
 - Collaborative problem-solving
 - Cross-curricular integration
 - Environmental awareness and curiosity
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Learning Modes:

This lesson supports multiple learning modes to address diverse learner needs:

- Kinesthetic learning: Students physically interact with their environment through measuring, sorting, and manipulating natural objects.
 - Visual learning: Shapes, patterns, and data are recorded through sketches, charts, and photos.
 - Auditory learning: Group discussions and teacher guidance support verbal reasoning and sharing ideas.
 - Social learning: Cooperative group work promotes peer-to-peer learning and shared discovery.
 - Reflective learning: Students analyze their findings, draw conclusions, and reflect on their learning through discussions and simple presentations.
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Materials & Resources

- **Natural materials:** Leaves, sticks, stones, cones, seeds
 - **Measuring tools:** Tape measures, rulers, string
 - **Drawing tools:** Pencils, worksheets, clipboards
 - **Optional:** Cameras or tablets for photo documentation
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Teacher Guide

- Choose an outdoor location with access to varied natural materials.
 - Prepare materials in advance and set clear safety rules.
 - Encourage curiosity and observation—not every answer has to be exact.
 - Scaffold mathematical language (e.g. perimeter, average, compare, symmetry).
 - Allow students to use technology if available, but not required.
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Learning Activities

1. Introduction (15 minutes): "Math Around Us"

The teacher starts with a class discussion: "Where have you seen or used math outside school?"

Introduce the day's theme and challenge: Can we find math in nature?

Explain that the class will go outside to explore math in the environment.

2. Outdoor Exploration (45 minutes): "Discover Math in Nature!"

Students are divided into small groups (3–4 students).

Each group receives tools: measuring tape, string, worksheets, and pencils.

Tasks:

Measure leaves (length and width), compare them, find similarities.

Sort and measure sticks of various lengths.

Identify shapes in stones, leaves, tree bark.

Observe patterns in leaf arrangements or bark textures.

Measure tree circumferences using string and compare.



Teacher facilitates, supports observation, and ensures focus on mathematical thinking. Students take notes, draw, or take photos.

3. Data Sharing and Discussion (20 minutes): Based on the completed worksheets "**What Did We Discover?**" **An option:** the schedule may be adjusted to the following lesson if students have finished the homework designed to reinforce their new knowledge

Groups return to the classroom and present their findings.

Class discussion led by the teacher:

- What math skills did you use?
 - What shapes and patterns did you find?
 - Were there any surprises?
 - How else could we present this data? (e.g., charts, graphs)
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4. Wrap-Up and Reflection (10 minutes): "**Math is Everywhere!**"

The teacher summarises the lesson, emphasising maths's presence in everyday life and nature.

Class reflects on other places where math may exist in nature (e.g., insect legs, flower petals, river paths).

Homework: Observe and draw or describe an example of math in nature at home or school surroundings.

Possible Supporting Materials for Teachers to Foster Critical Thinking During the Lesson

These prompts help students observe, analyze, hypothesize, and explain.

To encourage deeper thinking, reasoning, and problem-solving, the following materials and tools can be included in the lesson:

1. Open-ended Guiding Questions

Provide students with prompt cards or posters that include questions such as:

"What patterns do you notice in these leaves or tree bark?"

"Why do you think some trees are thicker than others?"

"How could you estimate the height of a tree?"



“What could these shapes tell us about the plant’s growth?”

2. Reflection Sheets or Journals

Students can use simple worksheets or personal notebooks to:

Record their measurements and compare them

Reflect on what they noticed or what surprised them

Ask their own questions about the natural environment

This encourages metacognition and helps students track their thinking process.

3. Visual Thinking Tools

Venn diagrams for comparing different natural objects

T-charts to organize data (e.g. round vs. angular shapes)

Concept maps to connect ideas (e.g. shape → function → habitat)

4. Photo Documentation

Students can take photos of findings (with teacher guidance), then later analyze and discuss them in groups. Questions such as “What does this image show mathematically?” promote observation-based reasoning.

5. Estimation Challenges

Include small tasks like:

“Estimate the number of pinecones in this area. How did you arrive at your answer?”

“Guess the tree's height based on its shadow. Can you prove it?”

These support creative reasoning and approximation skills.

6. Mini Problem Cards

Give groups cards with small real-world challenges:

“How can we measure the area of a leaf without a ruler?”

“You found 7 different rock shapes — how would you sort and classify them?”

7. Simple Graphing Tools

Printable graph templates or access to spreadsheets (Google Sheets or Excel) help students turn collected data into visual arguments — a powerful way to support evidence-based conclusions.



Reflection Prompts for Students: open discussion

- How else could you use math in nature?
- Were you surprised by how much math you found outside? Why?

Possible Assessment Versions

Criteria	Method
Participation	Teacher observation during outdoor work and discussions
Measurement	Skills Accuracy and completeness of collected data
Data Representation	Use of charts, tables, or visual summaries
Creativity	Observations and sketches of shapes and patterns
Collaboration & Communication	Group work and final presentation
Reflection	Quality of insights during discussion or written reflection



Adaptation of the Lesson Plan to Suit Grade 5-6 Students

Content Enrichment:

Precise Measurements: Use measuring tapes with millimetre accuracy; teach how to avoid common measuring errors.

Unit Conversions: Students can practice converting units (e.g. cm → m, mm → cm).

Finding Averages: Calculate average lengths of leaves or compare the circumferences of different trees.

Basic Data Analysis: Create frequency tables and bar charts based on collected measurement data.

Percentages and Comparisons: Ask questions like: “What percentage of the leaves were longer than 10 cm?” or “How many of the items found were circular in shape?”

New Goals and Learning Outcomes for Older Students:

Students will:

- Collect, organize, and analyze measurement data gathered from nature.
- Create clear visual representations of data (e.g. tables, bar or pie charts).
- Identify and describe mathematical relationships found in natural phenomena (e.g. growth patterns, symmetry, proportions).
- Reflect on how math can help us understand and protect nature (e.g. measuring environmental change, sorting waste, etc.).

Additional Activities for Grade 5-6:

Visualizing Data in tools like Excel or Google Sheets.

Challenge Activity: “How can you measure the height of a tree without climbing it?” – Use simple geometric strategies (e.g. shadow length).

Group Discussion Prompt: “How can scientists use measurements in nature to help protect the environment?”

Extended Project or Mini-Exhibition: Create a class display called “Mathematics Around Us in Nature” including measurements, sketches, photographs, graphs, and conclusions.



Student Worksheet: Math in Nature – Discover and Measure!

Name: _____

Date: _____

Group: _____



Task 1: Measure the Leaves!

Find three different leaves.

Measure their length (tip to stem) and width (widest point). Use a measuring tape or string + ruler.

Leaf	Length (cm)	Width (cm)
Leaf 1		
Leaf 2		
Leaf 3		

Which leaf is the longest? _____

Which is the shortest? _____

What's the difference in length? _____ cm



Student Worksheet: Math in Nature – Discover and Measure!



Task 2: Investigate the Sticks!

Find three sticks of different lengths. Order them from shortest to longest and measure each one.

Stick	Length (cm)
Shortest	
Medium	
Longest	

How much longer is the longest stick than the shortest? _____ cm



Student Worksheet: Math in Nature – Discover and Measure!



Task 3: Geometry in Nature!

Look for natural shapes.

Draw or describe them and say where you found them (e.g., "round rock", "triangle leaf tip").

Circle: _____

Triangle: _____

Square/Rectangle: _____

Other shapes (describe): _____



Student Worksheet: Math in Nature – Discover and Measure!



Task 4: Patterns Around You!

Look closely at bark, leaves, or plant arrangements. Can you find a repeating pattern?

I noticed a pattern: _____

The pattern looked like this: (draw if needed)



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