



Nature-Based Learning Ideas Guide

What can I do outside today?



MATH

Preschool - Grade 2



What Can I Do Outside Today?

Introduction

This guide has been developed to help educators see the possibilities for standards-aligned nature-based and outdoor math education in preschool through second grade. The 2022 Minnesota Math standards call for Minnesota students to ‘*experience the joy, wonder and beauty of mathematics*’, a call that can be easily met in the natural world. Learning outside provides a data-rich environment with ample authentic problem-solving opportunities as students explore the curiosities and beauty of the outdoor environment. At its core, mathematics is the study of patterns and mathematicians notice and describe patterns and relationships they see in their lives and communities. Nature is made up of an abundance of patterns to explore and investigate, from the symmetry of a leaf to the growing patterns found in the forest, even the organization of trail of ants on a sidewalk. Taking math education outside is full of opportunities to not only learn important math concepts but also experience joy and wonder of the math all around us.

As children transition to kindergarten and early elementary, it is important that their needs as young and developing learners are met through developmentally appropriate and play based instruction. This includes opportunity for large motor movement, hands-on experiences, exploration, and relationship building. Lifelong learning begins with play and outdoor play is a valuable and [evidence-based teaching practice for all learners](#). Play uses exploration, imagination, and inquiry to develop cognitive and social-emotional skills and the confidence to engage in new experiences. The outdoor environment, whether concrete or forest, provides space and materials for meaningful exploration and inquiry of math concepts.

Outdoor education

Education that occurs mostly in the outdoors and is focused on engagement with the outdoor environment

Nature-based education

Nature as the central organizing feature of the curriculum and a focus is made on children forming a connection with the natural world and how the natural world supports children’s development. It can be conducted indoors or outdoors

“Sitting in the four walls of your classroom, I feel like you can only do so much. But when you get out here where there are no walls, I mean, the options there are limitless, they’re boundless.”

~ Oakridge Elementary School

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About this guide

This guide helps preschool through second grade educators bridge the gap between classroom benchmarks and the 'data-rich' environment of the outdoors. By utilizing nature as a central organizing feature, teachers can cultivate mathematical rigor through the 'three-legged stool' of conceptual understanding, procedural fluency, and real-world application. Whether students are grouping acorns in tens to build number sense, using yarn to measure tree diameters, or identifying geometric shapes in spider webs, they are engaging in **meaningful contexts** that honor the land and the mathematical traditions of the **Dakota and Anishinaabe/Ojibwe communities**. Through these outdoor experiences, learners build a vital foundation for mastery that will support them throughout their academic journey.

The 2022 Minnesota Math standards are organized around seven big ideas, or anchor standards, that serve as the lens for noticing patterns that lead to deeper sense-making and active construction of mathematical identities. While this document focuses on the ways nature-based learning can support the preschool- Grade 2 math standards and benchmarks, many of the example activities contribute to the development of more than one content area.

To learn more about the 2022 Minnesota Math Standards, please visit [2022 Minnesota Math Strands and seven Anchor Standards](#).

Find More Outdoor and Nature Learning Resources:

- [Minnesota Department of Education, Early Education Outdoor Learning](#)
- [Department of Children, Youth, and Families, Early Childhood Outdoor Learning](#)

Happy exploring!

Resources

- [2022 Math Standards Learning Progression – Strand 1 Data and Probability](#)
- [2022 Math Standards Learning Progression – Strand 2 Spatial Reasoning](#)
- [2022 Math Standards Learning Progression – Strand 3 Patterns and Relationships](#)





Data Sciences

Identify, formulate and investigate statistical questions by collecting data considering cultural perspectives, analyzing and interpreting data and communicating the results.

ACTIVITY:

Set up a simple obstacle course and have students record quantities (i.e. number of jumps, how long it took, how many steps).

ECIPS

- M12: Location, Spatial Relationships and Landmark Use
- M14: Collects, Classifies, and Organizes Information
- M15: Describes and Uses Data

GRADE ADAPTATIONS

- K:** Students use the obstacle course as a "**data-rich situation**" to notice and describe patterns, such as noticing that taller students might take fewer steps. (0.1.1.1)
- K:** Students **organize natural objects** (like rocks or sticks), draw pictures, or use **tally marks** to represent the number of jumps or steps taken by their peers. (0.1.1.2)
- 1:** With teacher guidance, students **create a statistical investigative question** for the course, such as, "How many hops does it take for most students to cross the grass?". (1.1.1.1)
- 1:** Students collect data to answer their question and represent it using **drawings, tally marks, or frequency bar graphs** to communicate their observations of the course results. (1.1.1.2)
- 2:** Students **independently formulate investigative questions** about the obstacle course and conduct the full investigation (collecting, analyzing, and communicating results). (2.1.1.2 & 2.1.1.3)
- 2:** Students **determine what counts as data** to answer their specific question (e.g., deciding if a "partial step" counts as a full step) and recognize that these data points can vary among participants. (2.1.1.2)
- 2:** After representing their obstacle course data in a **dot plot**, students **make predictions** about how a new student might perform based on the existing patterns in the visualization. (2.1.1.4)



Chance and Uncertainty

Apply and explain the concepts of probability to interpret data, generate questions, predict and make informed decisions to solve problems and communicate ideas.

ACTIVITY:

Nature Prediction Walk. During a walk, ask students to predict what they might see or what might happen using probability language.

ECIPS

- ST1: Observe and Question
- ST3: Experiment/Prediction

GRADE ADAPTATIONS

K: Students begin by describing outcomes of events in nature as **certain** or **impossible**. During the walk, a student might observe the bright sky and state, "It is **certain** we will see the sun today". Conversely, they might look at the school playground and note, "It is **impossible** to find a live dinosaur here today."

1: Describe outcomes of events as **impossible**, **possible**, or **certain**. Students use all three terms during their walk. For example, a student might say, "It is **possible** we will see a red bird," or "It is **certain** we will find a leaf on the ground today," recognizing that while some events are not guaranteed, they are still within the realm of possibility. (1.1.2.1)

2: Describe the difference between **possible** and **likely**. Students use comparative language to describe their observations. On the walk, a student might independently explain, "It is **possible** we see a bear, but it is **likely** we see a squirrel because squirrels live in these trees and we have seen them here before". This demonstrates an understanding that among possible events, some have a higher probability than others based on observed patterns. (2.1.2.1)



Geometry

Analyze characteristics of geometric shapes to make mathematical arguments and justifications about geometric relationships. Use visualization and geometric modeling to compare, solve problems and communicate ideas.

ACTIVITY 1:

Look for shapes in nature during an outdoor walk.

ECIPS

- M10: Knowledge and Visualization of Shapes

GRADE ADAPTATIONS

- K:** Students **describe objects in the environment using names of shapes** (e.g., "The spider web looks like a circle") and use positional terms such as **above, below, beside, in front of, behind, and next to** to explain their location. (0.2.4.4)
- K:** During the walk, students can collect natural items and **sort them by shape** or compare 2D and 3D objects using informal language to describe their similarities and differences. (0.2.4.1 & 0.2.4.2)
- 1:** Students **describe attributes of 2D and 3D objects** found outdoors, such as noting that a rectangular sign has four corners and four sides. (1.2.4.1)
- 1:** Students continue naming shapes in the environment but refine their spatial descriptions by using the terms **left and right** to describe the position of objects. (1.2.4.3)
- 1:** Students practice **identifying shapes regardless of their orientation**, recognizing a triangular leaf or a square paving stone even if it is tilted or turned. (1.2.4.4)
- 2:** Students **classify figures according to the number and shape of faces** and the number of sides, edges, and vertices (e.g., identifying a hexagonal beehive or a cylindrical tree trunk). (2.2.4.1)
- 2:** Students **describe the location of an object in relation to another object** with increasing precision (e.g., "The round stone is to the left of the triangular leaf"). (2.2.4.3)



Geometry

Analyze characteristics of geometric shapes to make mathematical arguments and justifications about geometric relationships. Use visualization and geometric modeling to compare, solve problems and communicate ideas.

ACTIVITY 2:

Draw shapes on the sidewalk or pavement with chalk.

ECIPS

- **M10: Knowledge and Visualization of Shapes**

GRADE ADAPTATIONS

- K:** Students **draw various 2D shapes** (such as squares, circles, and triangles) and use informal language to **describe their similarities and differences**, such as noting which shapes have straight lines and which are curved. (0.2.4.2)
- K:** Students can decompose a large chalk shape by drawing lines inside it to **find "hidden" simple shapes within the larger figure**. (0.2.4.3)
- K:** After drawing several shapes, students can **collect natural "loose parts"** (like rocks or sticks) and **sort them** into the corresponding chalk areas based on their characteristics. (0.2.4.1)
- K:** Students **draw shapes** and then **describe their attributes**, such as the specific number of corners or sides, using mathematical terms. (1.2.4.1)

- 1: Students **compose complex composite figures** on the pavement, such as drawing a "nature house" by combining a chalk square and a triangle. (1.2.4.2)
- 1: Students practice **identifying shapes drawn by their peers** even when those shapes are oriented differently (e.g., tilted or "upside down") on the sidewalk. (1.2.4.4)
- 2: Students **label their chalk drawings with the number of sides and vertices** or draw 2D representations of 3D objects found nearby to **classify them**. (2.2.4.1)
- 2: Students demonstrate mastery by **creating accurate representations of more complex shapes**, such as trapezoids or hexagons, on the pavement. (2.2.4.2)
- 2: Students use their chalk drawings to **describe the location of an object in relation to another**, such as placing a leaf in a square and stating it is "to the left" of the chalk circle. (2.2.4.3)



Number Relationships

Describe, Interpret and use quantities, relationships between quantities, representations of quantities, and number systems. Describe operations and the relationship between operations. Use strategies and procedures accurately, efficiently and flexibly. Assess the reasonableness of the results.

ACTIVITY 1:

Match and count leaves on a blanket.

ECIPS

- M2: One-to-One Counting (also referred to as one-to-one correspondence)
- M3: Cardinality
- M4: Assigning Number Words and Numerals to Quantities

GRADE ADAPTATIONS

- K:** Students practice saying number names in standard order, **pairing one leaf with exactly one number name** to understand that the last number said represents the total quantity on the blanket. (0.3.5.1)
- K:** Students count a collection of up to 31 leaves by **organizing them into groups of tens** using ten-frames drawn on the blanket or ground. (0.3.5.2)
- 1:** Students count larger leaf collections (up to 120) by **organizing them into groups of fives or tens**. (1.3.5.1)
- 1:** Students use piles of leaves to **model place value**, recognizing that a collection of 43 leaves represents four groups of ten plus three single leaves. (1.3.5.4)
- 2:** Students count massive collections of leaves by grouping them into **tens and hundreds** to reach quantities up to 1,000. (2.3.5.1)
- 2:** After counting, students **represent their total** on a clipboard or chalkboard using numerals, expanded notation, or tally marks. (2.3.5.2)
- 2:** Once a collection is counted, the teacher can ask students to **mentally find ten more or ten less** than their current number of leaves, justifying their answer by referencing the physical piles. (2.3.5.3)





Number Relationships

Describe, Interpret and use quantities, relationships between quantities, representations of quantities, and number systems. Describe operations and the relationship between operations. Use strategies and procedures accurately, efficiently and flexibly. Assess the reasonableness of the results.

ACTIVITY 2:

Count how many clouds or birds are in the sky, ants on the ground, etc.; Count how many windows, doors, trees, flowers or buildings you pass.

ECIPS

- **M2: One-to-One Counting** (also referred to as one-to-one correspondence)
- **M3: Cardinality**
- **M4: Assigning Number Words and Numerals to Quantities**

GRADE ADAPTATIONS

- K:** While walking, students pair **one object** (like a tree or window) with **exactly one number name** in standard order, understanding that the final number said represents the total quantity they have passed. (0.3.5.1)
- K:** Students practice counting forward to at least 31. For larger sets, such as ants on the ground, they can practice **grouping items into tens** (e.g., using ten-frames drawn in the dirt) to determine the total. (0.3.5.2 & 0.3.5.4)
- K:** Teachers can prompt students to identify **"one more"** or **"one less"** than the current count of clouds or flowers they observe. (0.3.5.5)

- 1: Students count larger collections of objects (up to 120) by **organizing them into groups of fives or tens**, such as counting birds in a flock or windows on a building. (1.3.5.1)
- 1: Students practice counting **forward and backward** from any given number up to 120 during their walk (e.g., "We saw 45 trees, let's keep counting from there"). (1.3.5.3)
- 1: Before starting a walk, students **estimate** the number of buildings or trees they will pass using benchmarks of fives or tens. (1.3.5.5)
- 2: Students count very large collections in the environment by **organizing them into groups of tens and hundreds** up to 1,000, representing their total count through words, symbols, or pictures. (2.3.5.1)
- 2: Given a current count of items (like a "city" of ants), students **mentally find ten or 100 more/less** than that number, justifying their reasoning with a reference model. (2.3.5.3)
- 2: Students use their observations to **estimate sums and differences** of two-digit numbers, such as estimating the total number of combined windows and doors on a school building. (2.3.5.5)





Equivalence and Relational Thinking

Use concepts and properties of equivalence and relational thinking to represent and compare numerical expressions, proportional relationships, algebraic expressions and equations.

ACTIVITY:

The Balancing Act. Use a simple outdoor balance scale (or make one using a hanger, string, and 2 cups to put objects into) to compare the weight of different natural groups (e.g., "Do 5 pinecones equal 10 acorns?").

ECIPS

- **M5: Comparing Numbers and Quantities:** The child uses organizing strategies to know how many objects they have.
- **M8: Measurement:** Child recognizes and makes comparisons of measurable attributes (e.g., length, height, width, area, volume, physical distance, time duration).

GRADE ADAPTATIONS

- K:** Students use the balance scale to **identify whether the number of objects in one group is greater than, less than, or equal to** the number in another group. (0.3.6.1)
- K:** As students achieve a level balance, the teacher can introduce the **equal sign (=)** as a symbol representing that two different expressions (like 5 pinecones and 10 acorns) have an equal value in weight. (0.3.6.2)

- 1: Students can set up physical "equations" on the scale to **determine if they are true or false**. For example, they might test if a group of 4 stones plus 2 sticks is truly equal to 6 acorns. (1.3.6.2)
- 1: Students solve for an **unknown whole number** by finding out how many more items must be added to one side of the scale to make it balance perfectly with the other side. (1.3.6.3)
- 1: When using larger groups of small items (like pebbles), students **compare two-digit numbers** by organizing them into tens and ones to predict which side of the scale will be heavier. (1.3.6.1)
- 2: Students **make conjectures and justifications** about equality by predicting if a specific combination of natural items will balance the scale and then explaining their reasoning based on previous observations. (2.3.6.3)
- 2: Students write **number sentences involving unknowns** to represent the state of their balance scale, such as "8 pinecones + ? = 15 acorns," and use the scale to find the value that makes the sentence true. (2.3.6.2)
- 2: Students practice comparing **two- and three-digit numbers** of items (like a large collection of seeds), using their understanding of place value to reason about the relationship of the groups before weighing them. (2.3.6.1)



Patterns and Relationships

Represent and connect mathematical patterns and relationships using verbal descriptions, generalizations, tables and graphs. Use representations to generate questions, make predictions and solve mathematical problems.

ACTIVITY 1:

Make patterns with natural items; Look for patterns in nature; Have materials out on a blanket or table to sort create patterns

ECIPS

- M9: Repeating Patterns
- M13: Sorting

GRADE ADAPTATIONS

- K:** Students **recognize, create, and extend simple patterns** using natural materials sorted by shape, color, or size, including repeating and growing patterns (e.g., "rock, leaf, rock, leaf"). (0.3.7.1)
- K:** During an outdoor walk, students **recognize patterns in counting** by skip-counting by tens up to 100. (0.3.7.2)
- 1:** Students use nature "loose parts" to **create patterns and identify rules** to complete or extend them, recognizing if a pattern is repeating, growing, or shrinking. (1.3.7.1)
- 1:** Students observe things like the branching of a tree or the growth of a plant to **describe what is changing and what is staying the same** in a visual growing pattern. (1.3.7.3)
- 1:** While moving along a trail or sidewalk, students **recognize patterns in counting** by skip-counting by twos and fives up to 120. (1.3.7.2)
- 2:** Students **identify and describe number patterns** outdoors, such as using repeated addition or arrays of natural objects (e.g., a 2x5 grid of acorns) to represent a situation. (2.3.7.1)
- 2:** Students practice **skip-counting by twos and fives from any given number** up to 120 while navigating an outdoor space. (2.3.7.3)





Patterns and Relationships

Represent and connect mathematical patterns and relationships using verbal descriptions, generalizations, tables and graphs. Use representations to generate questions, make predictions and solve mathematical problems.

ACTIVITY 2:

Nature Pattern Makers. Create repeating patterns with natural items (leaf, stick, leaf, stick). Look for existing patterns in the forest, like the branching of trees or symmetry in leaves.

ECIPS

- **M8: Measurement**
- **M11: Transformations and Symmetry**

GRADE ADAPTATIONS

- K:** Students **recognize, create, and extend simple patterns** using natural materials (leaves, sticks, stones) based on attributes like shape, color, or size. For example, a student might create a repeating "AB" pattern of "red leaf, yellow leaf" or a sound pattern like "tap stick, clap hands". (0.3.7.1)
- 1:** Students **use nature "loose parts" to identify possible rules to complete or extend patterns**, recognizing if a sequence is repeating, growing, or shrinking. (1.3.7.1)
- 1:** When looking at the forest, students **describe what is changing and what is staying the same** in a visual growing pattern, such as the way a tree's branches split or how a plant adds new leaves over time. (1.3.7.3)
- 2:** Students **identify and describe number patterns** outdoors, such as using arrays of natural objects (e.g., a 3x3 grid of acorns) or repeated addition to represent a situation found in nature. (2.3.7.1)
- 2:** Students **use numeric expressions to describe a visual growing pattern** they observe, such as documenting the increasing number of petals or seeds in different stages of a flower's growth. (2.3.7.3)

