



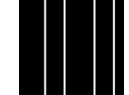







A CLOSER LOOK AT LOWER SCHOOL MATH


Lower School Math seeks to produce mathematically powerful students who are competent and confident about math. We value student-centered investigations that meet students in their zone of proximal development. By engaging in a range of problems that often require days or weeks to solve, students learn to make sense of challenging problems, persist in their search for solutions to complex tasks, have opportunities to be creative and insightful, and feel what it is to be at their mathematical edge. Our goal is to develop students who are able to work independently and collaboratively as problem posers and solvers, able to communicate and justify their thinking and ideas both orally and in writing.


What Skills Are We Learning?

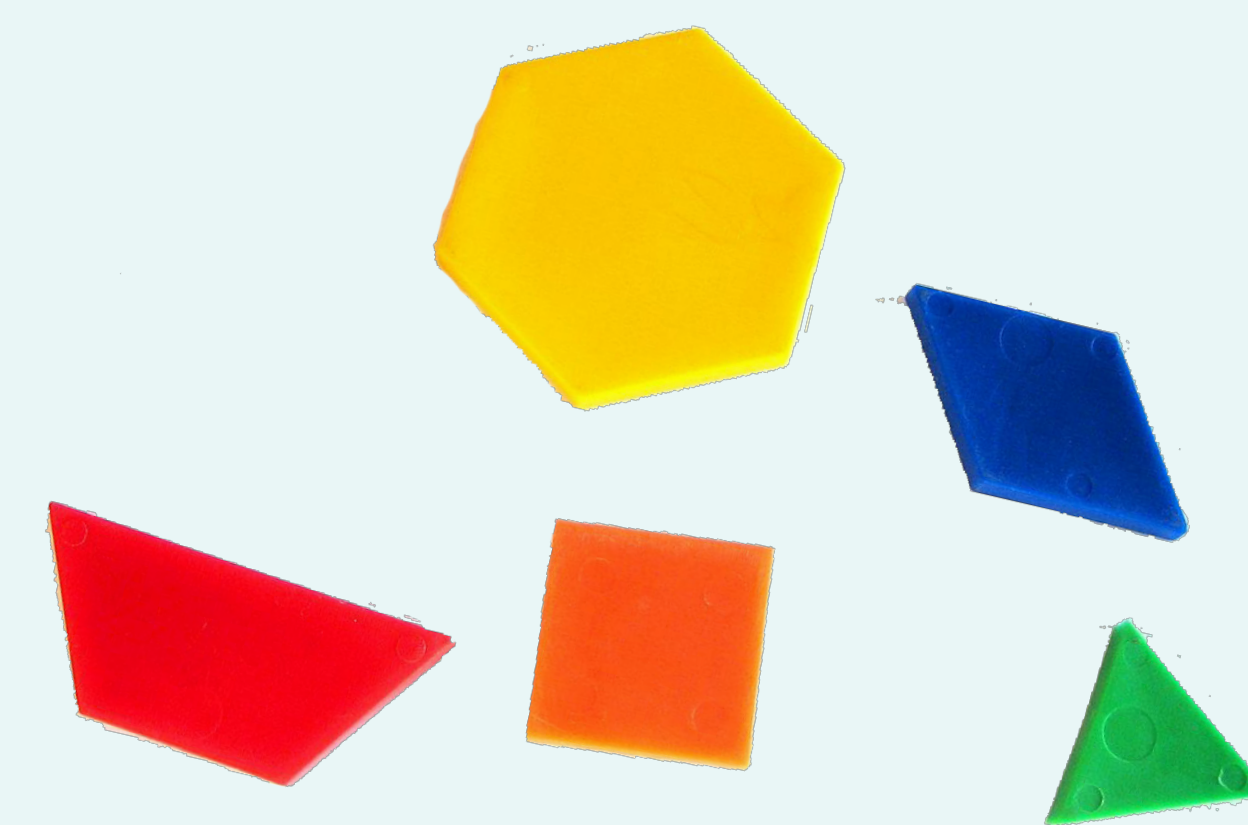
-  Data Collection and Analysis
-  Social Emotional Learning
-  Conceptual Understanding
-  Number Sense
-  Procedural Fluency
-  Problem Design
-  Making and Breaking Conjectures
-  Student Reflections
-  Teacher Prompts for Parent Involvement


 Ask your student to explain the algorithm to you. It gives him/her an opportunity for a mathematical conversation with you.

 It was really nice to experience the satisfaction that you actually finished the project in the end.

 "We want to meet students where they are and offer them experiences where they can feel successful and feel challenged."
Stephanie Englehardt
Lower School Math Specialist

 "The math culture of the Lower School is one where students enjoy doing mathematics and find the pursuit of solutions to complex problems both challenging and engaging."
Lora Saarnio
Lower School Math Specialist



 "Most of the year, the kindergarten math curriculum originates from our students' natural sense of inquiry and questions about the world. We know what they need to learn and work to weave those skills and concepts into the inquiries and conjectures students bring to the table."
Stephanie Englehardt
Lower School Math Specialist

FIRST GRADE

First grade students are currently working through a series of "micro-challenges," which provide a focus on skills and conceptual development. Throughout the year, the first-grade class dives deep in multiple-week math projects including The Farm Project, a study of area and volume, in which students create a plan for the layout of a farm. During the Rooftop Garden Project, which culminates the year's mathematical studies, students put their newfound skills in geometry, area, volume, economics, and building into practice.

In their weekly Beautiful Math class, students study varied topics, such as abstract games/game analysis, mathematical puzzles, mathematical art, and computer science.

KINDERGARTEN

A recent measurement unit began while students were building a structure out of Magna-Tiles. When asked how tall the structure was, one student shouted out, "90 Magna-Tiles tall!"

The students soon came to the conclusion that measuring in Magna-Tiles might not be the most reliable way to measure the world around them. On their own, they discussed alternative ways to measure height; they became fascinated by comparing their own heights.

As they collected data on each student's height, the teachers overheard two students say, "Of course, we are the same height, we were born on the same day!"

This created the perfect opportunity for a new and authentic mathematical investigation: Does your birthday determine your height? Through their authentic questions, our kindergarteners are building an authentic and indelible sense of two-digit numbers.



PREK

The idea of making ten is a big concept, one we are putting focus on in preK this year.

We believe that once children understand the idea that putting together makes more, what follows is an understanding of the number bonds for making ten.

With multiple exposure through game play, it was as if our students "just knew" how to make ten. When they were unsure, our preK students could look at their fingers and see the answers.

Once children understand ten, they can begin building larger numbers with base ten blocks. Their understanding of ten catapulted them forward to bigger and bigger numbers.

As we have moved into looking at money, the children are better able to navigate larger coin values as well because of this understanding of place value.

SECOND GRADE

In second grade, we seek to integrate writing and mathematics as much as possible in order to provide students with the opportunity to explain their thinking about how they solve problems and support their claims with evidence.

Much of the first half of the year focused on a comparative number study. We examined our own Base 10 system, which utilizes Hindu and Arabic numerals.

By examining the Mayan system, which was Base 20, the Babylonian system, which was Base 60, time which is Base 12, and the language of computing, which is Base 2, students gained a deep and authentic understanding of place value.

Second-grade students spend considerable time developing their pattern recognition skills in numbered data sets and writing mathematical functions to describe how these observed patterns grow – the root of algebraic thinking.



THIRD GRADE

Third grade students explore how the dimensions of a rectangular pool table affect the journey of a ball across it through a segment called Pool Hall Math. In this exercise, the ball starts in the bottom-left corner, traveling at a 45° angle. Each time it hits a wall, it bounces at a 90° angle from the wall. It finally exits when it reaches a corner.

After testing the path through various sized boxes, students began to observe recurring patterns in how the balls traveled – straight lines, a triangular "pyramid" shape, single and multiple "fish" shapes, and "plaid" patterns that criss-crossed every square.

Students then began to recognize the connections between the dimensions of the rectangle and the recurrence of similar patterns. Students learned about ratios and found they could create the same pattern by scaling rectangles.

Using the information gathered from the numbers of bounces or billiard ball exits,



students then began to create tables in Excel. Using titles, labels, colors, a key, and other elements, students made discoveries and conjectures about rules that could help them make predictions about where the ball would go next.

Finally, students were asked to share the knowledge they gained during Pool Hall Math in a newspaper article using Piktochart.

FOURTH GRADE

One tradition in fourth grade math is the creation of Digit Symbol Puzzles. Students designed equation investigations built on the numbers 0-9. The goal was to solve the equations, thereby finding which symbol represents a particular digit.


In an effort to look more carefully at data trends and make predictions about future data outcomes, students created collages of graphs, charts, data analysis, and new questions to investigate.

Earlier in the year, students participated in an ancient Greek Quarry Simulation, which mimics the transportation of stone drums from the quarry to the building site. Students were given two 20-pound patio stones (the stone drum), two pieces of wood (the sledge), 10 thick dowels (the logs), and rope.


Fourth graders were challenged to transport the stones from one end of the hallway to the other, and then up a ramp to the faux building site. Groups could assemble and tie the rope any way they chose, but could not touch anything besides the logs and rope to pull the stone along the course.


We heard some great pull-ups and assertive language during this challenging task, as students practiced coming to consensus before making group decisions.




 "We want to help students be mathematically powerful and trust that this is a safe space for risk-taking...it is okay to make mistakes!"
Lori Mustille
Fourth-Grade Teacher

"We want to highlight and celebrate moments of understanding for every student throughout the year."

 You can challenge your own student to see if they can explain how each of their illustrations of "cafe tables" relates to its corresponding function!

 I really liked when I got an answer to one, or I figured out there could be multiple patterns. It was just really exciting!



 "Skills and competencies in Lower School Math spiral over time. For example, students have experiences with data collection and analysis in kindergarten through third grade, but by fourth grade, students independently develop and pursue a data question of interest because they are ready for a more sophisticated exploration involving the visualization of data and the application of mean, median, and mode."
Lora Saarnio
Lower School Math Specialist