

Mathematical Practices and Indicators

1. Make sense of problems and persevere in solving them.

Mathematically proficient students...

- explain the meaning of the problem.
- discuss the meaning of the problem with one another.
- make conjectures (inferences) and plan a solution path.
- monitor and evaluate their progress.
- "Does this make sense?"
- use a variety of strategies to solve problems.
- are flexible in choosing appropriate strategies for solving and computing a problem.

Teachers shape mathematically proficient students by ...

- providing time for students to think about and analyze the problem.
- facilitating discussion between students about the meaning of the problem.
- modeling problem solving process and appropriate strategies to solve problems.
- monitoring and evaluating student progress.
- providing descriptive feedback.
- helping students shift toward a more efficient strategy when solving and computing problems.

2. Reason abstractly and quantitatively.

Mathematically proficient students...

- have the ability to contextualize and decontextualize (navigate between the concrete and the abstract).
- manipulatives ↔ pictures ↔ symbols
- understand and can explain the computation methods they use.

Teachers shape mathematically proficient students by ...

- modeling and providing the appropriate tools.
- facilitating conversations to connect models and symbols used in mathematical concepts.

manipulatives ↔ pictures ↔ symbols

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students...

- make a mathematical statement (conjecture) and justify it.
- listen, compare, and critique conjectures and statements.
- ask useful questions.
- analyze and justify the reasoning. "Does this make sense?"
- compare the effectiveness of arguments Explain any flaws

Teachers shape mathematically proficient students by ...

- providing a safe environment that encourages discussion and risk-taking.
- listening to students and questioning for clarity of arguments.
- modeling effective questioning and appropriate ways to discuss and critique a mathematical statement.

4. Model with mathematics.

Mathematically proficient students...

- apply mathematics to solve problems that arise in everyday life.
- demonstrate understanding using a variety of appropriate tools and strategies.
- are comfortable attempting challenging problems.
- reflect on their attempt to solve problems and make revisions to improve their model as necessary.

Teachers shape mathematically proficient students by ...

- selecting problems that are challenging and reflect everyday situations.
- making connections between mathematics and everyday life.
- introducing students to models by providing opportunities for students to share.
- focusing students on the process rather than the solution.

5. Use appropriate tools strategically.

Mathematically proficient students...

- consider the available tools when solving a problem (i.e. calculator, protractor, ruler, manipulatives, software).
- make sound decisions about tool selection.
- detect possible errors when using tools by strategically using estimation and other mathematical knowledge.
- are able to use technological tools.

Teachers shape mathematically proficient students by ...

- providing a variety of tools daily during mathematics instruction.
- teaching and modeling appropriate use of tools.
- facilitating discussion regarding tool selection.
- modeling the use of technological tools to explore and deepen student understanding.

6. Attend to precision.

Mathematically proficient students...

- use clear definitions and mathematical vocabulary to communicate reasoning.
- specify labels, units, and answers within the context of the problem.
- understand and explain the meaning of mathematical symbols.

Teachers shape mathematically proficient students by ...

- providing content and academic word walls and anchor charts.
- generating anchor charts with relevant student examples.
- modeling and expecting the daily use of mathematical language and vocabulary.
- modeling specific labels, units, and answers within the context of the problem.
- providing opportunities for students to explore the mathematical symbols and their meaning

7. Look for and make use of structure.

Mathematically proficient students...

- look closely to determine possible patterns and structure (properties) within a problem.
- analyze patterns and apply them in appropriate mathematical context.
- use prior knowledge of numbers and their relationships to reason and solve mathematical problems.

Teachers shape mathematically proficient students by ...

- selecting problems that are challenging and incorporate the use of patterns.
- building number sense daily.
- facilitating the process of utilizing patterns and structure to compute and solve problems.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students...

- notice repeating calculations and look for efficient methods/representations to solve a problem.
- evaluate the reasonableness of their results throughout the problem solving process.

Teachers shape mathematically proficient students by ...

- thinking-aloud the problem solving process by teachers and/or students.
- providing students with time and opportunity to discover efficient methods for problem solving.