

#1 Make sense of problems and persevere in solving them

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the meaning of a solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider similar problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Mathematically proficient students can draw diagrams of important features and relationships and search for patterns, and they continually ask themselves, “Does this make sense?” They can understand the approach that others take to solving complex problems.

#2 Reason abstractly and quantitatively

Mathematically proficient students make sense of numbers and their relationships in problem situations. They are able to represent a situation symbolically (variable) and manipulate the symbols. Reasoning requires habits of creating a logical representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

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

Mathematically proficient students use rules, definitions and established results to make statements. They can explain the logic and reasoning behind these statements. These students are able to critique other students’ ideas and ask useful clarifying questions. They can also justify their arguments with proof and counterexamples.

#4 Model with mathematics

Mathematically proficient students can solve real world math problems. For example, they may use proportional reasoning to plan a school event or use geometry to solve a design problem. They can use diagrams, tables, graphs, flow charts and formulas to show relationships or patterns. They can analyze these mathematical relationships to solve problems and make conclusions. They interpret their results and determine if the results make sense based on their models, improving their models if necessary.

#5 Use appropriate tools strategically

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools may include, but are not limited to the following:

- Paper and Pencil
- Calculator
- Ruler
- Protractor
- Concrete Models

Students should also be able to use technological tools to explore and deepen their understanding of concepts.

#6 Attend to Precision

Mathematically proficient students try to communicate precisely to others. They can be precise by doing the following:

- Discuss clear definitions with others
- State meanings of symbols they choose to use
- Specify units of measure
- Use the equal sign appropriately and consistently
- Label axes so that they correspond with quantities in a problem
- Calculate and express numerical answers accurately and efficiently

Students should also be able to give carefully formulated explanations to each other when solving a problem.

#7 Look for and make use of structure.

Mathematically proficient students look closely to find a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later students will see 7×8 equals $7 \times 5 + 7 \times 3$, when learning about distributive property.

#8 Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. As they work to solve a problem, mathematically proficient students pay attention to the overall process while attending to the details. They continually evaluate the reasonableness of their answers.