

Eight Mathematical Practices – For the Student

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

- What are you looking for? (explain meaning/restate)
- What do you know? (analyze)
- What do you need to know? (analyze)
- Is this problem similar to a problem you have solved before? (find simpler forms of the original problem)
- What are your possible plans to find the solution? (entry points to a solution)
- Can you illustrate the problem? (model using diagrams)
- How do you find it? (plan a pathway)
- Is the plan working? (monitoring and evaluating progress/PERSEVERE)
- Does this make mathematical sense? (check your answer)
- Do you need to change your plan? (change course if necessary)
- Is this the only way to solve this problem? (collaborate with other students)

2. Reason abstractly and quantitatively.

- What does the variable(s) represent/mean? (make sense of relationships)
What is the meaning of the symbols i.e. $=$, $+$, $\cong$, $\perp$, $<$, $>$, $\leq$, $\geq$, π , $\sim$, $\pm$, $^\circ$, $\approx$, $\neq$, $\angle$, $\sqrt{}$, $\cap$, $\cup$, $\in$, $\%$, Δ ? (represent symbols as if they have a life of their own)
- Can you draw a picture? (quantitative reasoning)
- Do you need units of measure? (consider the units involved)
- Are the units of measure appropriate? (attend to the meaning of the quantities)
- Can you write an equation? (represent symbolically)
- Do your drawing and equation make mathematical sense? (contextualize)
- Does your answer make mathematical sense? (contextualize)

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

- What definitions, formulas, and theorems relate to the problems?
- What leads to the next step? (logical progression)
- What supports/justifies your answer? (justify and communicate conclusions to others)
- Does this make mathematical sense? (making plausible arguments)
- Are there exceptions to your conjectures? (counterexamples, special cases)
- Ask questions to clarify other students work. (ask useful questions to clarify or improve the arguments)
- Does your answer make mathematical sense?

4. Model with mathematics.

- What prior knowledge of the subject do you have? (mathematically proficient)
- Create a model of the situation using diagrams, tables, graphs, equations, formulas, etc. (Students may need a rough draft/plan of where to begin)
- Approximate what the outcome could be.
- Does your answer make mathematical sense?
- Do you need to revise your model to make better mathematical sense?

DOES THIS MAKE MATHEMATICAL SENSE?

5. Use appropriate tools strategically.

- Which tool do you need to best solve the problem? (calculator, protractor, ruler, computer, etc)
- Create an equation. (mathematical model)
- Create a graph. (which tool would be most beneficial?)
- What conclusions/predictions can you make based on the results you have found from your equation and the tools you have used to solve the problem? (predictions)
- Does your answer make mathematical sense? / Have you used your tools correctly? (detect possible errors)

6. Attend to precision.

- Use appropriate vocabulary. (communicate precisely)
- Support your answers. (definitions)
- Label graphs, diagrams, charts, figures, etc appropriately.
- Use appropriate units of measure.
- What is the meaning of the symbols ie $=$, $+$, $,$, $\cong$, $\perp$, $<$, $>$, $\leq$, $\geq$, π , $\sim$, $\pm$, $^\circ$, $\approx$, $\neq$, $\angle$, $\sqrt{}$, $\cap$, $\cup$, $\in$, $\%$, Δ ? (state the meaning of the symbols they choose)
- Know the difference between exact and approximate when you are answering questions. (calculate accurately and efficiently)
- Does your answer make mathematical sense?

7. Look for and make use of structure.

- Look for a pattern in the problem.
- You should look for more than one way to solve the problem. (shift perspective)
- Would it help if I break the whole into parts or combine the parts into whole?
- Do I need to add anything? (a line or segment, a number to both sides, etc.)
- Does your answer make mathematical sense?

8. Look for and express regularity in repeated reasoning.

- Pay attention to detail. (maintain oversight of the process while attending to the details)
- Look for patterns. (notice if calculations are repeated)
- Recognize and apply repeated math concepts and develop a general formula for the observation. (Notice regularity in a problem)
- Look for and devise shortcuts that correctly replicate the process.
- Does your answer make mathematical sense? (evaluate the reasonableness of their intermediate results)

DOES THIS MAKE MATHEMATICAL SENSE?