

## **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.  $=$ ,  $+$ ,  $\cong$ ,  $\perp$ ,  $<$ ,  $>$ ,  $\leq$ ,  $\geq$ ,  $\pi$ ,  $\sim$ ,  $\pm$ ,  $^\circ$ ,  $\approx$ ,  $\neq$ ,  $\angle$ ,  $\sqrt{\phantom{x}}$ ,  $\cap$ ,  $\cup$ ,  $\in$ ,  $\%$ ,  $\Delta$ ? (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  $=$ ,  $+$ ,  $,$ ,  $\cong$ ,  $\perp$ ,  $<$ ,  $>$ ,  $\leq$ ,  $\geq$ ,  $\pi$ ,  $\sim$ ,  $\pm$ ,  $^\circ$ ,  $\approx$ ,  $\neq$ ,  $\angle$ ,  $\sqrt{\phantom{x}}$ ,  $\cap$ ,  $\cup$ ,  $\in$ ,  $\%$ ,  $\Delta$ ? (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?**