Standards for Mathematical Practice

The eight standards for mathematical practice describe the "know-how" or habits of mind that we seek to develop in students. These practices define important methods and skills that students need to be mathematically proficient.

1. **Make sense of problems and persevere in solving them.**
   Students seek the meaning of a problem and looks for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve this?", "Does this make sense?", and "Can I solve the problem in a different way?".

2. **Reason abstractly and quantitatively.**
   Students represent a wide variety of real wold contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities.

3. **Construct viable arguments and critique the reasoning of others.**
   Students construct arguments using verbal or written explanations. They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students.

4. **Model with mathematics.**
   Students model problem situations symbolically, graphically, tabularly, and contextually. Students need many opportunities to connect and explain the connections between the different representations.

5. **Use appropriate tools strategically.**
   Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful.

6. **Attend to precision.**
   Students use clear and precise language in their mathematical discussions with others and in their own reasoning.

7. **Look for and make use of structures.**
   Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables recognizing both the additive and multiplicative properties.

8. **Look for and express regularity in repeated reasoning.**
   Students' use of repeated reasoning to understand algorithms and make generalizations about patterns.

Portland Public Schools

Great Expectations:
Standards and Practices for Advanced Algebra

What are the Common Core State Standards?

For over a decade, research studies of mathematics education in high performing countries have concluded that mathematics instruction in the United States must become more focused and coherent in order to improve mathematics achievement. Historically, math standards have varied from state to state. In June of 2009, the development of the **Common Core State Standards** (CCSS) began**.** Oregon, along with over 45 other states, has adopted the CCSS and started assessing them in the 2014-15 school year.

The CCSS provide a clear and consistent understanding of what students are expected to learn in K-12 math. Common standards will help ensure that students are receiving a high quality education consistently, from school to school, and state to state. CCSS for mathematics includes two types of standards: one for ***mathematical practices*** (how students engage, apply, and extend their understandings of mathematical concepts) and one for ***mathematical content*** (what mathematical skills and procedures students are expected to know).

This guide outlines the mathematical content and practice standards that are taught in Advanced Algebra. The math content will focus on the following critical areas: simplifying and algebraically solving simple, rational, and radical equations in one variable; sketching and performing basic transformations; graphing linear, quadratic, cubic, square root, cube root, and piecewise-defined functions; finding the inverse of a function; interpreting, modeling, and graphing exponential and logarithmic functions; proving and using the Pythagorean Trig Identity; performing arithmetic operations on polynomials; performing arithmetic operations with complex numbers; and making inferences and justifying conclusions from sample surveys, experiments, and observational notes. The eight mathematical practices define the ways that students engage with mathematics.

Advanced Algebra Learning Targets

These learning targets encompass what a student should be proficient in by the end of Advanced Algebra. Mastery of this content will ensure student success at the next level.

AA1: Creating & Solving Equations

(Example: Solve for x: $5x + 34 = -2(1 - 7x)$)

- **AA1a** - I can isolate a variable by manipulating equations with more than one variable.
- **AA1b** - I can simplify and algebraically solve simple, rational, and radical equations in one variable.

AA2: Graphs & Their Transformations

(Example: Accurately draw by hand the graph of $y = ½ (x - 5)^2 + 6$, including detail for vertex and two data points.)

- **AA2a** - I can recognize, describe, sketch, and perform basic transformations.
- **AA2b** - I can graph linear, quadratic, cubic, square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

AA3: Inverses

(Example: Given two equations, determine if they are inverses of each other and accurately graph what you find.)

- **AA3a** - I can find the inverse of a function and represent and describe the relationship using tables, graphs, equations, and domain and range.

AA4: Logarithms

(Example: Solve for x: $5^x + 8 = 37$.)

- **AA4a** - I can use the definition of logarithms to evaluate logarithms and convert between logarithmic and exponential forms.
- **AA4b** - I can interpret, model, and graph exponential and logarithmic functions, showing intercepts and end behavior.

AA5: Trigonometric Functions

(Example: Given sin(x) = ⅗, use the Pythagorean Trig Identity to find cos (x).)

- **AA5a** - I can extend the understanding of trigonometric functions using the unit circle in degrees and radians.
- **AA5b** - I can interpret, model, and graph periodic phenomena with trigonometric function.
- **AA5c** - I can prove and use the Pythagorean Trig Identity: $\cos^2(x) + \sin^2(x) = 1$.

AA6: Polynomials

(Example: Factor $4x^2 - 64$ using the difference of squares.)

- **AA6a** - I can perform arithmetic operations on polynomials.
- **AA6b** - I can understand the relationship between zeros and factors of polynomials.
- **AA6c** - I can prove polynomial identities.

AA7: Complex Numbers

(Example: Sketch the graph of $f(x) = x^2 + 4$ and solve the equation $x^2 + 4 = 0$ to find its roots.)

- **AA7a** - I can perform arithmetic operations with complex numbers.
- **AA7b** - I can solve quadratic equations with real coefficients that have complex solutions.

AA8: Statistics

(Example: The College Board scales the scores with an maximum of 800 and a minimum of 200. A) What is the corresponding range for the z-scores on the SAT's? (Assume a mean of 500 and standard deviation of 100). B) Maggie just got back her SAT results and received 800 on the verbal section. Does this imply that she did not skip any questions and answered all of the questions correctly? Explain.)

- **AA8a** - I can use the mean and the standard deviation of a data set to fit it to a normal distribution to estimate percentages and the area under the curve.
- **AA8b** - I can understand and evaluate random processes underlying statistical experiments.
- **AA8c** - I can make inferences and justify conclusions from sample surveys, experiments, and observational studies.