

Points of Emphasis in M202

A key component of M202 is an emphasis on relationships. Whereas a typical instructional unit on complex numbers might focus on performing computations or manipulating expressions by hand disconnected from real-world contexts, in M202, students should:

- have opportunities to understand and explain why writing radical expressions in the form of rational exponents allows for easy simplification of the expressions (LP 3).
- understand and apply the properties of exponents to simplify expressions or solve problems involving radicals and rational exponents (LP 3).
- recognize that working with complex numbers is like working with polynomial expressions (LP 3).
- understand that complex numbers are useful for representing two-dimensional quantities (LP 3).
- regularly encounter real-world tasks involving polynomial equations (LP 1) that require them to make sense of multiple representations and how they relate to each other—verbal, algebraic, numerical, graphical (LP 3).
- be able to choose tasks that are organized around different scientific, social, or other topics, allowing students to have agency in their learning (LP 4).
- frequently collaborate, share their solution methods, and make their thinking visible (LP 2).
- regularly engage with tasks that focus on understanding and reasoning about different representations—verbal, algebraic, numerical, graphical. As examples, students should engage with the following:
 - Make connections between the representation of a radical expression and an expression having rational exponents (LP 3).
 - Perform operations with radical expressions (LP 3).
 - Reason about and differentiate between a real number and an imaginary number.
 - Reason about complex numbers and perform addition, subtraction, and multiplication with complex numbers (LP 3).
 - Engage with a variety of quadratic equations to reason about having complex solutions (LP 3).
- have opportunities to share their reasoning with partners or in groups, allowing for practice sharing, critiquing, and revising their arguments and including social interaction as part of the learning process (LP 2).

Students should also be given opportunities to understand and reflect on the ways that rational exponents and complex numbers can authentically involve real-world situations (LP 6). Rational exponents are useful in fields like architecture, carpentry, and masonry. Complex numbers are very useful in many interesting applications such as in physics when dealing with electromagnetism or quantum mechanics.

Often, coursework with complex numbers is focused on performing computations by hand. Instead, students should be given frequent opportunities to:

- use spreadsheets to allow for focus on understanding, rather than computation or symbolic manipulation. Students should write spreadsheet formulas that are useful in such applications as compound interest or annual rate of inflation (LP 7).