The Iowa Core Curriculum and Pre-Calculus

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Goals of this session

• Identify the meaning of the (+) in separating the standards of the Iowa Core Mathematics
• Examine the (+) standards of the Iowa Core Curriculum for Mathematics
• Relate to the Pre-Calculus curriculum
Iowa Core Mathematics

• “The high school standards specify the mathematics that all students should study in order to be college and career ready. Additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics is indicated by (+).” (p. 58)

Iowa Core Mathematics

• “All standards without a (+) should be in the common mathematics curriculum for all college and career ready students. Standards with a (+) symbol may also appear in courses intended for all students.” (p. 58)
• In other words, the (+) can be presented and learned by all students, but they do not have to show mastery on these items.(Conversation with Judith Spitzli, Iowa Dept. of Ed.)
Examine the (+) items

• See handout
• Which of these items would you consider Pre-calculus content?
• Which of these items would you not consider as Pre-calculus content?
  – Where should these items be taught?

Examine the (+) items

• Would you consider any of these (+) items to be essential mathematics for all students to learn (either for college preparation or career readiness)?
Appendix A: Designing High School Mathematics Courses Based on the CCSS

• Appendix A has suggestions for where in the curriculum the various standards could be placed, given a traditional set of mathematics courses (Alg I, Geom, Alg II); integrated mathematics (Years 1 – 3); and accelerated (by putting 3 years of content into 2 years – but no “skipping”)

• Appendix A may be found as a link in the “Note on Courses and Transitions” page of Iowa Core Mathematics

Appendix A: Designing High School Mathematics Courses Based on the CCSS

• Use Complex Numbers In Polynomial Identities And Equations.
  – N-CN.8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x - 2i)$.
  – N-CN.9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
  – (to be in Algebra II)
Appendix A: Designing High School Mathematics Courses Based on the CCSS

• From Algebra

• Use Polynomial Identities To Solve Problems.
  – A-APR.5. (+) Know and apply the Binomial Theorem for the expansion of \((x + y)^n\) in powers of \(x\) and \(y\) for a positive integer \(n\), where \(x\) and \(y\) are any numbers, with coefficients determined for example by Pascal’s Triangle.¹

• Rewrite Rational Expressions.
  – A-APR.7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

• (to be in Algebra II)

Appendix A: Designing High School Mathematics Courses Based on the CCSS

• Geometry

• Understand And Apply Theorems About Circles
  – G-C.4. (+) Construct a tangent line from a point outside a given circle to the circle.

• Use The Rules Of Probability To Compute Probabilities Of Compound Events In A Uniform Probability Model
  – S-CP.8. (+) Apply the general Multiplication Rule in a uniform probability model, \(P(A \text{ and } B) = P(A)P(B \mid A) = P(B)P(A \mid B)\), and interpret the answer in terms of the model.
  – S-CP.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.
Appendix A: Designing High School Mathematics Courses Based on the CCSS

• **Use Probability To Evaluate Outcomes Of Decisions**
  – S-MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
  – S-MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

• (Geometry & Algebra II)

Should items be moved to the required 3 years?

• “The Common Core and Inverse Functions” by Kelly W. Edenfield in Mathematics Teacher, May 2012, pp. 672-678.
  – Use Complex Numbers In Polynomial Identities And Equations.
    • N-CN.8. (+) Extend polynomial identities to the complex numbers. For example, rewrite \(x^2 + 4\) as \((x + 2i)(x - 2i)\).
  – Rewrite Rational Expressions.
    • A-APR.7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
  – Connect the content standards to the Standards for Mathematical Practice, namely for these standards, “Looking for and making use of structure”
    • Students see that the structures of polynomial identities and rational numbers extend to other systems
Should items be moved to the required 3 years?

• “Integrating inverse functions throughout the first three years would increase curriculum coherence and students’ understanding of specific functions – namely, square root, cube root, and logarithmic functions.” (p. 674)
  – As they currently stand, the first three years deal only with procedural aspects of inverse functions.
  – To have a fully developed understanding of inverses, students must also study composition of functions. (doing-undoing)

Comments by Matt Miller of Cedar Rapids Washington High School

• The + items are so varied that it all depends upon the curriculum of the school prior to precalculus. Yes, some are definitely precalculus topics (that's where they'd see them in my school), but some are natural fits in earlier courses. So, it just depends upon the school.
• My guess is that most schools aren't ready to think about the + items yet because they are still working on how they are going to get all of the other items fit into their first 3 years. On top of that, I would say almost none of us are prepared to say that we ensure that ALL kids have this content knowledge before graduating. So, the + items are set on the back burner. In my honors level precalc class, we hit many of them...but that's honors level.
How are your schools handling the (+) items?

What are Your Needs?

• What do you as teachers need – and/or what do your colleagues need?
  – For the required three-years standards
  – For the (+) items

• How can we accommodate/address those needs?
  – Classes (online or face-to-face)
  – Activities (lesson plans) which highlight the content standards and taught in line with the Standards for Mathematical Practice
    • Which content standards most need to be addressed?
Illustrative Mathematics website

- http://illustrativemathematics.org/

Thank you for your participation

- If you have additional comments and/or ideas as to how we at ISU (or higher education in general) can help you, please let me know:
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