

# Can This Country Survive Common Core's College Readiness Level?

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## I. Purpose of Paper

This paper began as a response to the attempt by Professor Jason Zimba, a lead writer of Common Core's mathematics standards, to revise in 2013 what he said about the meaning of "college readiness" in 2010. Zimba's original comments on this topic were uttered at the March 2010 meeting of the Massachusetts Board of Elementary and Secondary Education. In the official minutes of this meeting, we find the following: "Mr. Zimba said that the concept of college readiness is minimal and focuses on non-selective colleges."<sup>1</sup> On August 2, 2013, Common Core Watch at the Thomas B. Fordham Institute posted the first of two blogs by Zimba in which he claimed that this summary statement was inaccurate. He then elaborated in each blog on what he claimed he meant by what he had said.<sup>2</sup>

What was remarkable about Zimba's claim that his definition of college readiness was not accurately or fully captured by the summary statement in the minutes of a public meeting was, first, that his complaint occurred over three years after the minutes had been approved, and, second, that there is a complete video record of the meeting. As we will show, the record does not support Zimba's claim. In fact, Zimba said much more about the limitations of Common Core's mathematics standards than is suggested by the statement in the minutes. And those comments need to be much more widely known and understood.

We are responding to Zimba's two attempts to "clarify" what he had said three years earlier because Common Core's definition of college readiness in mathematics has not been publicly discussed and approved. Yet, it has extremely serious implications for the high school mathematics and science curriculum, a range of mathematics-dependent undergraduate majors and post-baccalaureate or graduate programs, and an even wider range of post-graduate programs requiring a very high level of mathematical knowledge.

In addition, it nullifies the main reason the federal government provided over four BILLION dollars in Race to the Top (RttT) funds;<sup>3</sup> it expected these new standards to improve the critical STEM pipeline.<sup>4</sup> Zimba's explanation of college readiness together with the requirements for the RttT proposals raise a strong suspicion that many if not most states were seduced into signing on to Common Core's standards by misleading, possibly fraudulent, claims about what the standards were designed to achieve.

The purpose of this paper is to explain what the level of college readiness in Common Core's mathematics standards is and what this level means for the school curriculum, post-secondary education, and mathematics-dependent professional programs. State and national policy makers, educators, and the general public have been misinformed and are thoroughly confused because most of them do not understand enough mathematics themselves to figure out what academic level Common Core's high school mathematics standards designate and how they may affect other levels of education and this country's economy. The public, legislators, and the media

clearly do not have sufficient information to understand the import of Zimba’s discussions of college readiness in 2013.

## **II. Background information:**

***Common Core’s definition of college readiness:*** Common Core’s mathematics and English language arts standards are described as resulting from “collaboration with teachers, school administrators, and experts to provide a clear and consistent framework to prepare our children for college and the workforce.” The document claims: “These standards define the knowledge and skills students should have within their K-12 education careers so that they will graduate from high school able to succeed in entry-level, credit-bearing academic college courses and in workforce training programs.” To assure the public that Common Core’s standards reflect their definition, the National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO)—the two organizations funded by the Bill and Melinda Gates Foundation to develop Common Core’s standards—also created a Validation Committee (VC).

***Common Core’s Validation Committee:*** The VC consisted of about 29 members during 2009-2010. Some were *ex officio*, others were recommended by the governor or commissioner of education of an individual state. No more is known officially about the rationale for the individuals chosen for the VC. Milgram was the only mathematician on the VC (there were several mathematics educators, people with a doctorate in mathematics education holding an academic appointment in an education school or engaged full-time in teacher training and professional development), and Stotsky was the only expert on K-12 English language arts standards by virtue of her work in the Massachusetts Department of Education from 1999-2003 and with Achieve, Inc. on its American Diploma Project high school exit standards for English language arts in 2004 and its subsequent backmapped standards for earlier grade levels.

As a condition of membership, all VC members had to agree to 10 conditions, among which were the following:

Ownership of the Common Core State Standards, including all drafts, copies, reviews, comments, and non-final versions (collectively, Common Core State Standards), shall reside solely and exclusively with the Council of Chief State School Officers (“CCSSO”) and the National Governors Association Center for Best Practices (“NGA Center”).

I agree to maintain the deliberations, discussions, and work of the Validation Committee, including the content of any draft or final documents, on a strictly confidential basis and shall not disclose or communicate any information related to the same, including in summary form, except within the membership of the Validation Committee and to CCSSO and the NGA Center.

As can be seen in the second condition listed above, members of the VC could never, then or in the future, discuss whether or not the VC discussed the meaning of college readiness or had any recommendations to offer on the matter. The charge to the VC spelled out in the summer of 2009, before the grade-level mathematics standards were developed, was as follows:

1. Review the process used to develop the college- and career-readiness standards and recommend improvements in that process. These recommendations will be used to inform the K-12 development process.
2. Validate the sufficiency of the evidence supporting each college- and career-readiness standard. Each member is asked to determine whether each standard has sufficient evidence to warrant its inclusion.

3. Add any standard that is not now included in the common core state standards that they feel should be included and provide the following evidence to support its inclusion: 1) evidence that the standard is essential to college and career success; and 2) evidence that the standard is internationally comparable.”

This charge was later reduced in an unclear manner by unidentified individuals to just the first two and least important of the three bullets above. Culmination of participation on the committee was reduced to signing or not signing a letter in May 2010 asserting that the standards<sup>5</sup> were:

1. Reflective of the core knowledge and skills in ELA and mathematics that students need to be college- and career-ready.
2. Appropriate in terms of their level of clarity and specificity.
3. Comparable to the expectations of other leading nations.
4. Informed by available research or evidence
5. The result of processes that reflect best practices for standards development.
6. A solid starting point for adoption of cross-state common core standards.
7. A sound basis for eventual development of standards-based assessments.

The VC members who signed the letter were listed in the brief official report on the VC (since committee work was confidential, there was little the rapporteur could report), while the five members who did not sign off were not listed as such, nor their reasons mentioned. Stotsky’s letter explaining why she could not sign off can be viewed here,<sup>6</sup> and Milgram’s letter can be viewed here.<sup>7</sup>

***March 2010 meeting of the Massachusetts Board of Elementary and Secondary Education:***

The original purpose for part of the March 2010 meeting of the Massachusetts Board of Elementary and Secondary Education was to provide a forum for higher education faculty in Massachusetts and high school mathematics and English teachers to discuss the academic meaning of Common Core’s college-readiness standards. Commissioner of Education Mitchell Chester is to be commended for inviting Zimba (and Susan Pimentel) instead. Zimba has rarely spoken to the public since his appointment as a lead writer of Common Core’s mathematics standards. Because it is rare for a person in his position to be as straightforward as he was, his comments were informative and refreshing to hear.

**III. Zimba’s Definition of College Readiness in 2010**

To verify the accuracy of the official minutes of the March 2010 meeting, the authors of this paper obtained a copy of the official recording of the meeting. Its sound quality is excellent. Zimba’s exact comment in his initial presentation was: “We have agreement to the extent that it’s a fuzzy definition, that the minimally college-ready student is a student who passed Algebra II.”

Stotsky (a member of the state board at the time) later asked him to clarify what he meant. Zimba stated: “In my original remarks, I didn’t make that point strongly enough or signal the agreement that we have on this—the definition of college readiness. I think it’s a fair critique that it’s a minimal definition of college readiness.”

Stotsky remarked at this point “for some colleges,” and Zimba responded by stating: “Well, for the colleges most kids go to, but not for the colleges most parents aspire to.”

Stotsky then asked “Not for STEM? Not for international competitiveness?” Zimba responded “Not only not for STEM, it’s also not for selective colleges. For example, for UC Berkeley, whether you are going to be an engineer or not, you’d better have precalculus to get into UC Berkeley.”

Stotsky then said: “Right, but we have to think of the engineering colleges and the scientific pathway.”

Zimba added “That's true, I think the third pathway goes a lot towards that. But your issue is broader than that.”<sup>8</sup>

Stotsky agreed saying “I'm not just thinking about selective colleges. There's a much broader question here. Zimba then added “That's right. It's both, I think, in the sense of being clear about what this college readiness does and doesn't get you, and that's the big subject.”

Stotsky then summarized her objections to this minimalist definition by explaining that a set of standards labeled as making students college-ready when the readiness level applies only to a certain type of college and to a low level of mathematical expertise wouldn't command much international respect in areas like technology, economics, and business. Zimba appeared to agree as he then said “OK. Thank you.”

#### **IV. Zimba's Explanation of College Readiness in 2010**

The above discussion does not fully explain what college readiness in mathematics *signifies*. What does Common Core mean when it says that by addressing its standards “[students] will graduate from high school able to succeed in entry-level, credit-bearing academic college courses and in workforce training programs?”<sup>9</sup> In the context of Zimba's remarks in 2010, college readiness appears to mean that students will (likely) not have to take a remedial course in mathematics or English if they seek to attend a non-selective college or a community college.

In many ways this definition and the dialogue above are remarkable. It is extremely rare for a lead author of a standards document to admit that a major concept (the definition of college readiness) does not apply to high school students capable of entering (or seeking to enter) a selective college or university (roughly the top 20-30 percent of a high school cohort). What the standards document is doing, so far as Zimba's 2010 comments suggest, is to specify the minimal requirements that its sponsors want the remaining, mid-level graduates (the roughly 40% of the graduates from about the 30<sup>th</sup> to the 70<sup>th</sup> percentiles in their high school classes) to meet for entry into a community college or a non-selective four-year college. While state standards for high school students typically apply to all students, Common Core's mathematics standards writer acknowledges that *its college readiness level is not for certain professions or for demanding colleges*. He implies that “all” is a euphemism for “not all” when referring to Common Core.

#### **V. Zimba's Explanation of College Readiness in 2013**

In contrast, in 2013, Zimba claimed that it's factually incorrect to say that the definition of college readiness in the Common Core is pegged to a community college level. According to him, the definition of college and career readiness in the standards document is readiness for entry-level, credit-bearing courses in mathematics at all public four-year colleges, as well as courses at two-year colleges that transfer for credit at four-year colleges.<sup>10</sup>

However, this 2013 definition not only contradicted Zimba's comments in 2010, it applied to a weaker document than the one he may have been referring to when he spoke in 2010. Zimba's comments on the recording refer to either the March 10 public comment draft or further work on the mathematics standards in the next two weeks of March. On pages 51-52 of the March 10 public comment draft, one can see the following place-markers (commonly called stubs) for standards that the writers intended to fill in later:

Limits and Continuity.....	F-LC
Differential Calculus.....	F-DC
Applications of Derivatives.....	F-AD
Integral Calculus.....	F-IC
Applications of Integration.....	F-AI
Infinite Series.....	F-IS

These topics are consistent with Zimba's March 2010 comments. They are the major topics for a full one-year calculus course. But the March draft does not indicate how the standards writers intended to reach these topics from the algebra II level, which is where the detailed standards in the March 10 draft end. The necessary material in trigonometry is only partially described by a list of nine standards, most of which are in a full Algebra II course but would be reviewed in a regular trigonometry course, and there is no precalculus material. Except for a small amount of the trigonometry material, not one of the seven stubs above or any precalculus material remains in Common Core's final mathematics standards, even as a stub. It is worth noting that a few months earlier, the other lead writer for Common Core's mathematics standards, William McCallum, was quoted as follows: "The overall standards would not be too high, certainly not in comparison [to] other nations, including East Asia, where math education excels."<sup>11</sup>

Not only were no high school topics added to the March 10 draft to strengthen the final version or to create the "third high school pathway," the final version is weaker in other respects as well. In presumably responding to the comments from the states and other interested parties, "corrections" were introduced that included many mathematical errors and weakened many lower grade standards such as:

6.RP1

Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "*For every vote candidate A received, candidate C received nearly three votes.*" [Comment: "nearly" does not correspond to ratio or rate in any way. At best it corresponds to a range of ratios but the tools for handling such objects are not covered until college and require advanced calculus.]

6.RP3(b).

Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*

[Comment: There is no indication of the size of the lawns or the amount of time it takes to mow each. Rather, the hidden assumption is that they all take the same time to mow. Suppose some were 5000 square feet and some were 8000 square feet. We do not know the amount of time it takes to mow 8000 square feet compared to 5000 or if some lawns were steeply sloped and others level.]

**VI. So what if "Common Core is better than 90% of the State Standards"**

In his blog on August 8, 2013, Zimba tried to distract from the issue of how low Common Core's college readiness level is by noting that "it is doubtless thanks in part to Professor Milgram's input during the development of the standards that they are, at least in his view, 'better than 90% of the state standards...they replace.'"

Milgram did work with the standards writers as a member of the Validation Committee. Appalled by the minimal amount of material from grade 7 on in an earlier draft, Milgram compared its algebra standards with California's algebra standards and the list of major school algebra topics in the 2008 report of the National Mathematics Advisory Panel.<sup>12</sup> The comparison showed how incomplete that draft's algebra standards were.

Milgram then had a number of conversations with the people at Achieve overseeing the project, as well as with the standards writers themselves. As a possible result of these efforts, the March 2010 public comment draft was considerably stronger than the earlier 2009 draft. It also contained the calculus stubs listed above.<sup>13</sup> However, the details in the March draft did not go beyond a relatively weak algebra II course, with both logarithms and the standard algebraic analysis of conic sections missing.<sup>14</sup>

Since the calculus stubs were not in the final version, and a small number of the advanced (+) standards in trigonometry remain as the only indication of anything between an algebra II course and a calculus course, Common Core's standards clearly cannot help to prepare students for STEM areas.<sup>15</sup> Thus, Milgram's remark that Common Core's standards are better than 90% of the state standards should not be construed as a compliment to Common Core but as an indictment of most state standards. Milgram is saying that as weak as Common Core's standards are, about 45 states had even weaker standards. This situation requires something other (and much more) than the weak Common Core's standards to correct.

### **VII. Academic Implications of Race to the Top (RttT) Agreements**

We are surprised that there has been no public discussion of the academic implications of the Race to the Top (RttT) criteria for judging state applications for a RttT award. At least, we know of no discussion by a state board of higher education or by trustees (or regents) of a public university system when a governor, commissioner of education, and/or state board of education decided to apply for a RttT award. The criteria in the Federal Register should have occasioned some concern, if not some very serious questions.

The federal government published the conditions for RttT awards in the Federal Register on Friday, April 9, 2010 (vol. 75, no. 68, pages 18172-18185). The introduction notes:

We intend to promote collaboration and better alignment between public elementary, secondary, and postsecondary education systems by establishing a competitive preference priority for applications that include commitments from public IHEs<sup>16</sup> or IHE systems to participate in the design and development of the consortiums final high school summative assessments and to implement *policies that exempt from remedial courses and place into credit-bearing college courses students who meet the consortium-adopted achievement standard (as defined in this notice) for those assessments....*

Eligible applicants addressing this priority must provide, for each IHE or IHE system, a letter of intent that: (a) commits the IHE or IHE system to participate with the consortium in the design and development of the consortium's final high school summative assessments in mathematics and English language arts in order to ensure that the assessments measure college readiness; (b) commits the IHE or IHE system to implement policies, once the final high school summative assessments are implemented, that exempt from remedial courses and place into credit-bearing college courses any student who meets the consortium-adopted achievement standard (as defined in this notice) for each assessment and any other placement requirement established by the IHE or IHE system; and (c) is signed by the State's higher education executive officer (if the State has one) and the president or head of each participating IHE or IHE system.

Although the IHEs clearly have a role in designing the assessments, the two consortia in charge of the tests—Partnership for Assessment of Readiness in College and Career (PARCC) and Smarter Balanced Assessment Consortium (SBAC)—cannot address the mathematics requirements of selective public or private colleges or universities because, as we have already noted, major topics in trigonometry and precalculus are not in Common Core's standards and the

tests cannot address topics that are not in the standards. Nevertheless, the language in the RttT agreement indicates that states must place new students admitted by their major public colleges and universities into credit-bearing mathematics (and English) courses if these students have passed a Common Core-based “college readiness” test.

One might criticize the generality of the statement above by pointing out that these students don’t have to be admitted or that colleges can admit students who haven’t passed such a test. However, in many states including California the top 30 percent of students graduating from high school are guaranteed admission to an IHE or IHE system. Moreover, only the chief administrative officer of an IHE has to sign on to this policy, not the relevant faculty. For the most part, this faculty knows nothing about the changes that Common Core will bring.

We find these requirements for Common Core states astounding because they apply to all public institutions of higher education, not just to those for which Common Core’s mathematics standards were intended, according to the lead mathematics standards writer, Jason Zimba. And even if these requirements are intended only for non-selective postsecondary institutions, they are problematic because non-selective schools have often had to place newly admitted students into intermediate algebra (a course lower than “college algebra”) that was remedial at these institutions. To make matters worse, the first for-credit courses at non-selective institutions are often regarded as remedial at other colleges and universities, yet “articulation agreements” between two- and four-year public colleges seem to require that transfer credit be given. All that the PARCC and SBAC tests can verify is whether freshmen have to start with intermediate algebra if they do not pass, or could start with “pre-calculus trigonometry” or “pre-calculus algebra,” as the first two for-credit courses at a community college are usually described.

### **VIII. Educational Significance of Common Core’s College Readiness Standards in Mathematics**

Two major academic consequences loom in these federal conditions for a RttT award. First, they will likely lower the level of introductory mathematics courses at selective public colleges and universities. How so? Students who are otherwise eligible for a selective institution (i.e., there is no other placement requirement) and are admitted subject to fulfilling the missing admission requirements would, under this agreement, be able to take a credit-bearing mathematics course if they had passed the PARCC or SBAC Algebra II test. Because such students would probably fail a regular precalculus course (never mind a calculus course), public colleges and universities would likely feel compelled to provide lower-level (but credit-bearing) introductory mathematics courses for them in order to avoid too high a failure rate.

Second, the federal conditions for an RttT award in effect give a state board and a state department of elementary and secondary education control of the content of entry courses in all Common Core state colleges and universities. For years, there has been a growing gap between the entry level expectations of our colleges and universities and the typical academic strength of our high school graduates. This has created considerable tension between K-12 and the colleges. High schools insist that college expectations are too high and that current high school preparation is all students really need, while colleges insist on maintaining their existing standards. Applying for an RttT grant in effect requires states to cede control of college entry expectations for ELA and mathematics to state boards of education, departments of education, and education schools—institutions whose policies and practices determine K-12 outcomes.

This is the context for understanding PARCC’s definition of college readiness:<sup>17</sup>

Students who earn a college- and career-ready determination in mathematics will have demonstrated the academic knowledge, skills and practices necessary to enter directly into, and succeed in, entry-level, credit-bearing courses in college algebra, introductory college statistics, or technical courses requiring an equivalent level of mathematics

Over 46 state boards and departments of elementary and secondary education have adopted Common Core's college- and career-ready standards, regardless of whether a few minor changes have been made to the Common Core document or its standards as in Pennsylvania or Alaska, or whether up to 15 percent more standards material was added. All did so without asking for and receiving an analysis of Common Core's definition of college readiness by the faculty who *teach* mathematics to college freshmen in the state's own institutions of higher education. *Not one* state board or department of education is on record as having sought (and obtained) the opinion of their own state's higher education *teaching* faculty in mathematics, science, and engineering (never mind English or the humanities). These state boards and departments of education seem to lack a full understanding of the intellectual purposes of mathematics coursework in higher education.

The government data for STEM are compelling and make our case better than we can. It is extremely rare for students who begin their undergraduate years with coursework in precalculus or an even lower level of mathematical knowledge to achieve a bachelor's degree in a STEM area.<sup>18</sup> In addition, the National Center for Education Statistics (NCES) publication *STEM in Postsecondary Education* shows that only 2.1 percent of STEM intending students who had to take pre-college mathematics coursework in their freshman year graduated with a STEM degree (see Table 7).<sup>19</sup>

### **IX. Significance of Common Core's Standards in Mathematics for High School Science**

The traditional 19<sup>th</sup> and 20<sup>th</sup> century high school science curriculum consisted of biology (actually just taxonomy), chemistry, and physics. The mathematical requirements for these courses involve only part of the material in Algebra I, Geometry, and Algebra II. Consequently, there should not be many problems with the articulation between the mathematics indicated in Common Core's standards and traditional science courses.

However, there have been many attempts to introduce courses more relevant to today's needs into the high school curriculum, in particular, basic engineering, computer science, and robotics. The major difficulty is that mathematical requirements for these courses are significantly more than for the traditional science curriculum. As an example, basic engineering requires some linear algebra, familiarity with partial fraction decompositions of rational functions, and quite a bit more trigonometry than was previously required. Similarly, it is extremely important in robotics that students can work with polynomials where the variables are the basic elementary trigonometry functions  $\sin(t)$  and  $\cos(t)$ .

Likewise, if high schools want to offer a biology course more in line with current developments, then some molecular biology should be included. Such a course requires significant amounts of statistics and probability, as well as discrete mathematics. Clearly, if this country is seriously interested in 21<sup>st</sup> century mathematics and science, then there is even more reason to question Common Core's mathematics standards.

### **X. Conclusions**

In a September 2013, a Hechinger Institute writer reported Zimba acknowledging that students who do not go beyond Common Core's high school standards could be precluded from attending selective colleges and that these standards are not aligned with expectations at the college level.<sup>20</sup>

Zimba is quoted as saying: “If you want to take calculus your freshman year in college, you will need to take more mathematics than is in the Common Core.”

There are several major questions at this point.

First, why is this situation not indicated in the Common Core document? Or by the advocates of Common Core’s standards? Or by their many endorsing organizations?

Second, why didn’t those individuals and organizations capable of recognizing the crippling limitations of Common Core’s mathematics standards suggest an additional set of mathematics (and possibly English) standards that *would* prepare students for the freshman mathematics course that most majors in science, mathematics, engineering, finance, and economics (and, increasingly, in other areas) must take and pass successfully?

Third, given the limited mathematical literacy of most citizens and education policy makers, where did responsibility lie to inform local and state educators in charge of secondary school curricula about what was missing from Core Standards? Likewise, who was responsible for indicating what had to be added for pathways that would lead to admission to selective colleges and universities? Who was responsible for indicating what was needed for STEM areas before and after state boards and departments of education adopted them?

Fourth, whose responsibility is it now to ensure that at least some (if not an increasing number of) American high school students will be eligible for admission to selective academic institutions in this country? This is no small matter since their faculty and students have propelled this nation’s economic, scientific, and industrial development for over a century.

We hear no proponents or endorsers of Common Core’s standards warning this country about the effects of the college-readiness level in Common Core’s mathematics standards on post-secondary and post-baccalaureate academic and professional programs. We hear no proponents or endorsers of Common Core’s standards advising district superintendents and state education policy makers on the kind of mathematics curriculum and courses they need to make available in our secondary schools if our undergraduate engineering colleges are to enroll American students.

At this time we can only conclude that a gigantic fraud has been perpetrated on this country, in particular on parents in this country, by those developing, promoting, or endorsing Common Core’s standards. We have no illusion that the college-readiness level in ELA will be any more demanding than Common Core’s college-readiness level in mathematics.

<sup>1</sup><http://www.doe.mass.edu/boe/minutes/10/0323reg.pdf>

<sup>2</sup>Jason Zimba, August 2, 2013, “Critics’ math doesn’t add up.” Common Core Watch. Thomas B. Fordham Institute. <http://www.edexcellence.net/commentary/education-gadfly-daily/common-core-watch/2013/critics-math-doesnt-add-up.html>; Jason Zimba, August 8, 2013, “What I learned about the opposition to the Common Core State Standards when I testified in Indiana,” Common Core Watch, Thomas B. Fordham Institute. <http://www.edexcellence.net/commentary/education-gadfly-daily/common-core-watch/2013/what-i-learned-about-the-common-core-state-standards-when-i-testified-in-indiana.html>

<sup>3</sup><http://www.whitehouse.gov/issues/education/reform>

<sup>4</sup><http://www2.ed.gov/programs/racetothetop/index.html>

<sup>5</sup>Keep in mind that the final version was not released until June 2, 2010 and many changes were made behind the scenes to the public comment draft released in March 2010.

<sup>6</sup><http://nyceye.blogspot.com/2013/08/mass-standards-czar-stotskys-letter-on.html>

<sup>7</sup><ftp://math.stanford.edu/pub/papers/milgram/final-report-for-validation-committee.pdf>

<sup>8</sup>See Appendix A of the version of the Common Core Mathematics Standards posted in the late summer of 2010, after the release of the final version on June 2, 2010. There is a third pathway, and it is the “calculus pathway.” But since this pathway uses mathematics standards that were in the original version and, as Zimba pointed out in 2013, these standards are insufficient for reaching precalculus in high school, what was gained by listing them again?

<sup>9</sup>[www.corestandards.org/about-the-standards](http://www.corestandards.org/about-the-standards)

<sup>10</sup><http://www.edexcellence.net/commentary/education-gadfly-daily/common-core-watch/2013/critics-math-doesnt-add-up.html>

<sup>11</sup>John Fensterwald, January 17, 2010, “Common-core standards under fire,” Thoughts on Public Education, Silicon Valley Education Foundation. <http://toped.svefoundation.org/2010/01/17/common-core-standards-under-fire/>

<sup>12</sup>See <ftp://math.stanford.edu/pub/papers/milgram/validation-for-core-standards.pdf> (The “ftp://” in this URL is not a misprint and needs to be correctly entered.)

<sup>13</sup>February 2010 draft, page 32.

<sup>14</sup>Section IX will suggest some of the consequences of not having this material.

<sup>15</sup>The (non-existent) pathway to calculus was one of the strongest points that the Obama administration used to sell Common Core’s mathematics standards to the states. See endnotes 3 and 4.

<sup>16</sup>IHE is the acronym for “Institution of Higher Education.”

<sup>17</sup><http://www.isbe.net/assessment/pdfs/2013/parcc/PARCC-FAA-Spring13.pdf>

<sup>18</sup>Statement on Competencies in Mathematics Expected of Entering College Students (2013), <http://icas-ca.org/Websites/icasca/images/ICAS-Statement-Math-Competencies-2013.pdf>. See pps. 13-16 for details of minimal mathematics expectations for STEM.

<sup>19</sup>STEM in Postsecondary Education, 2012, NCES 2013152) (see, especially, Tables 2, 4, 7, and 12).

<sup>20</sup><http://theadvocate.com/home/6914390-125/common-core>