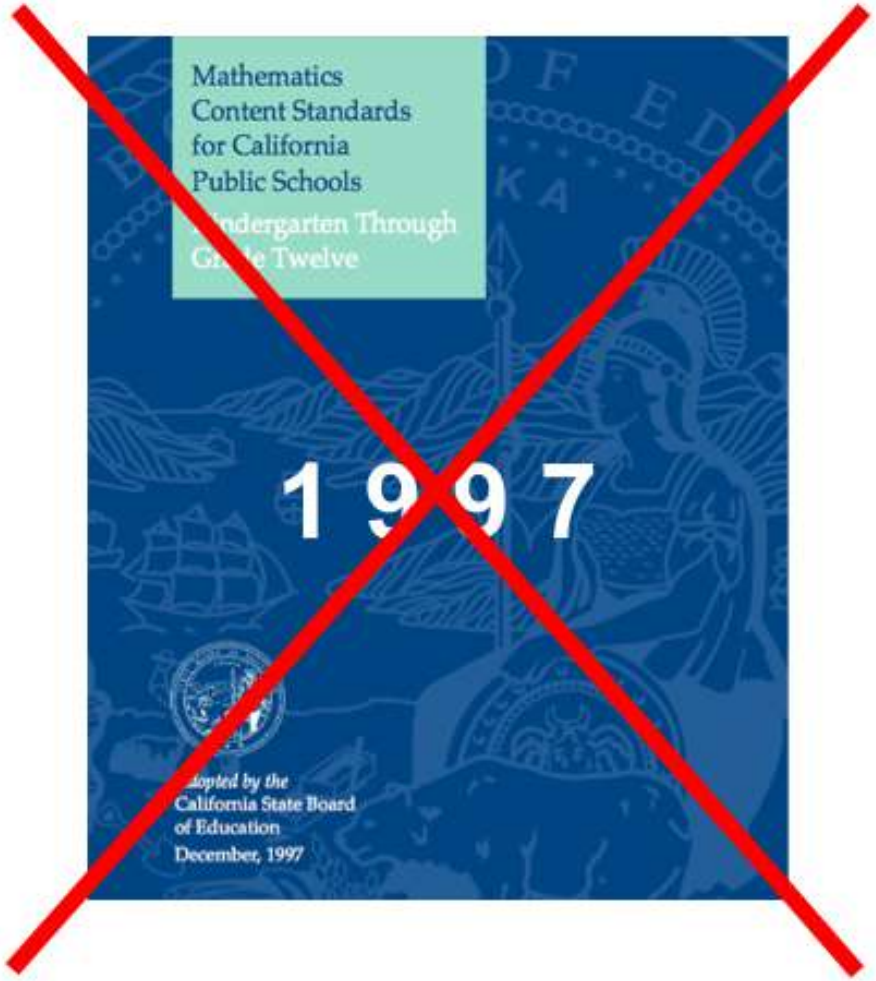
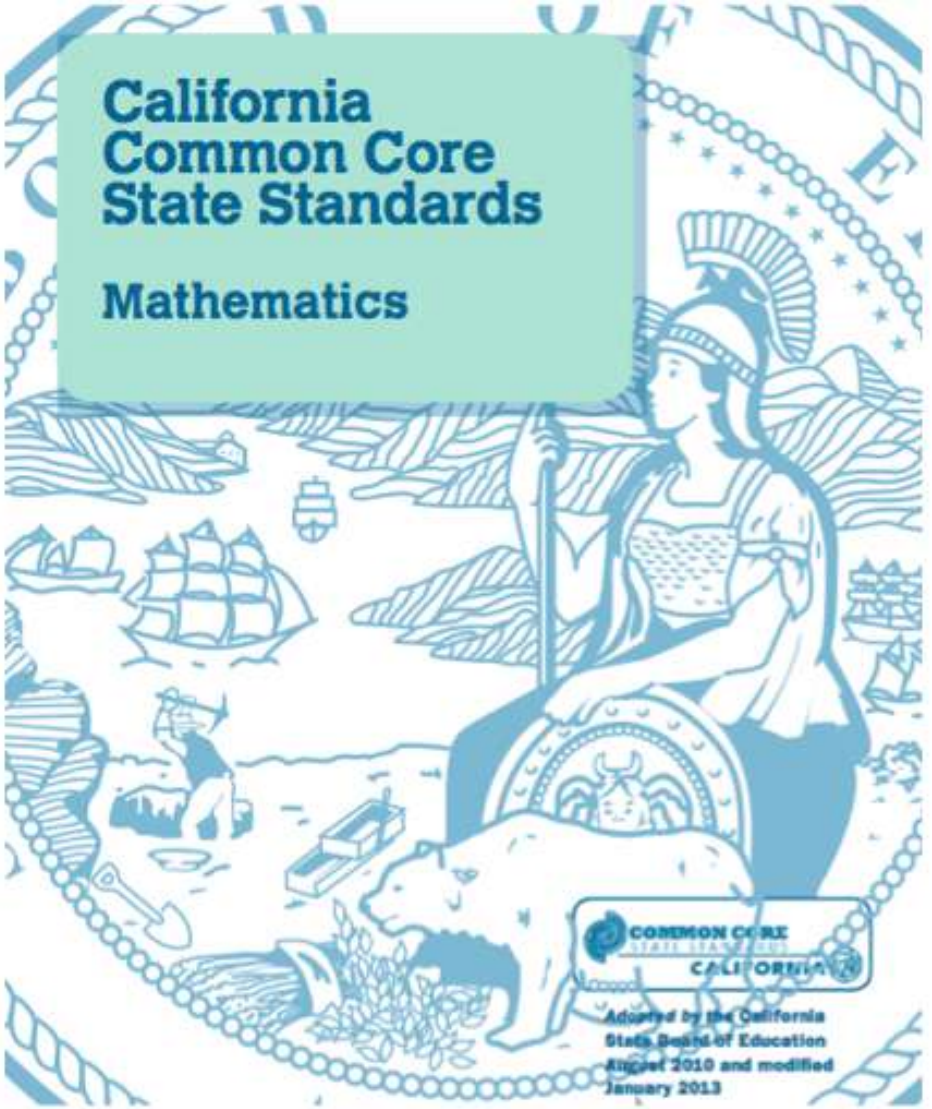
COMMON CORE PATHWAYS

Parent Meeting

COMMON CORE STANDARDS





Adopted by STATE of CALIFORNIA in 2010

Essential Question

Which pathway best serves our students?

Traditional Pathway - Keeps Geometry as a separate year long course taught between Algebra I and Algebra II.

Integrated Pathway - Distributes Geometry throughout both Algebra I and Algebra II over the course of three years.

TRADITIONAL PATHWAY

A POSSIBLE "TRADITIONAL" PATHWAY *(to be included in the CA Framework)*

Geometry Algebra 1 & Algebra 2	"Algebra 1" **(focus is on linear, quadratic, and exponential functions)**	"Geometry"	"Algebra 2" **(focus is on higher degree polynomial, simple rational, logarithmic, and sinusoidal functions)**
Number & Quantity:	• Extend properties of exponents to rational exponents • Use properties of rational & irrational numbers • Reason quantitatively & use units to solve problems		• Perform arithmetic operations with complex numbers • Use complex numbers in polynomial identities & equations
Algebra:	• Interpret the structure of expressions • Write expressions in equivalent forms to solve problems • Perform arithmetic operations on polynomials • Create equations that describe numbers or relationships • Understand solving equations as a process of reasoning & explain the reasoning • Solve equations & inequalities in one variable • Solve systems of equations • Represent & solve equations and inequalities graphically		• Interpret the structure of expressions • Write expressions in equivalent forms to solve problems • Perform arithmetic operations on polynomials • Understand the relationship between zeros & factors of polynomials • Use polynomial identities to solve problems • Rewrite rational expressions • Create equations that describe numbers or relationships • Understand solving equations as a process of reasoning & explain the reasoning • Represent & solve equations and inequalities graphically
Functions:	• Understand the concept of function & use function notation • Interpret functions that arise in applications in terms of the context • Analyze functions using different representations • Build a function that models a relationship between two quantities • Build new functions from existing functions • Construct & compare linear, quadratic, & exponential models to solve problems • Interpret expressions for functions in terms of the situation they model • Apply quadratic equations to physical problems		• Interpret functions that arise in applications in terms of the context • Analyze functions using different representations • Build a function that models a relationship between two quantities • Build new functions from existing functions • Construct & compare linear, quadratic, & exponential models to solve problems • Extend the domain of trigonometric functions using the unit circle • Model periodic phenomena with trigonometric functions • Prove & apply trig identities
Geometry:		• Experiment with transformations in the plane • Understand congruence in terms of rigid motions • Prove geometric theorems & be able to use them • Make geometric constructions • Understand similarity in terms of transformations • Prove theorems involving similarity • Define trigonometric ratios & solve problems involving right triangles • Understand & apply theorems about circles • Find arc length & area of sectors of circles (define radian measure & convert between degrees & radians) • Translate between the geometric description & the equation for a conic section (circles & parabolas) • Use coordinates to prove simple geometric theorems algebraically • Explain volume formulas & use them to solve problems • Visualize relationships between 2D & 3D objects & identify 3D objects generated by rotation of 2D objects • Determine how changes in dimension affect perimeter, area, & volume • Apply geometric concepts in modeling situations	• Translate between the geometric description & the equation for a conic section (circles, parabolas, ellipses)
Statistics & Probability:	• Summarize, represent & interpret data on a single count or measurement variable (compare center & spread, account for effects of outliers) • Summarize, represent & interpret data on two categorical & quantitative variables (linear, quadratic & exponential models) • Interpret linear models (compute correlation coefficient of linear fit, distinguish between correlation & causation)	• Understand independence & conditional probability & use them to interpret data • Use rules of probability to compute probabilities of compound events in a uniform probability model. • Use probability to evaluate outcomes of decisions	• Summarize, represent & interpret data on a single count or measurement variable (mean & standard deviation of a data set to fit a normal distribution) • Understand & evaluate random processes underlying statistical experiments. • Make inferences & justify conclusions from sample surveys, experiments, & observational studies. • Use probability to evaluate the outcomes of decisions.

E. Fraser, Oceanside Unified Schools

INTEGRATED PATHWAY

A POSSIBLE "INTEGRATED" PATHWAY *(to be included in the CA Framework)*

Model Math 1, 2, 3
Model Math 1 & 2
Model Math 2 & 3
Model Math 1 & 3

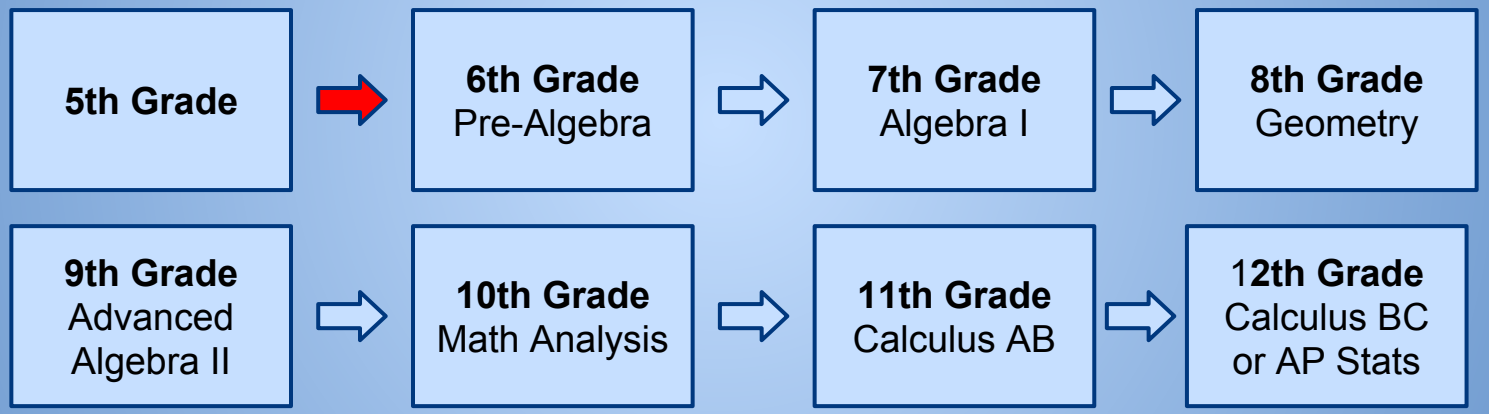
	Model Math 1 (Focus is on linear & exponential functions)	Model Math 2 (Focus is on quadratic functions)	Model Math 3 (Focus is on higher degree polynomial, sinusoidal, simple rational, and logarithmic functions)
Number & Quantity:	* Reason quantitatively & use units to solve problems	* Extend properties of exponents to rational exponents * Use properties of rational & irrational numbers * Perform arithmetic operations with complex numbers * Use complex numbers in polynomial identities & equations	* Use complex numbers in polynomial identities & equations
Algebra:	* Interpret the structure of expressions * Create equations that describe numbers or relationships * Understand solving equations as a process of reasoning & explain the reasoning * Solve equations & inequalities in one variable (including those with absolute value) * Solve systems of equations * Represent & solve equations and inequalities graphically	* Interpret the structure of expressions * Write expressions in equivalent forms to solve problems * Perform arithmetic operations on polynomials * Create equations that describe numbers or relationships * Solve equations & inequalities in one variable (including those with absolute value) * Solve systems of equations	* Interpret the structure of expressions * Write expressions in equivalent forms to solve problems * Understand the relationship between zeros & factors of polynomials * Use polynomial identities to solve problems * Rewrite rational expressions * Create equations that describe numbers or relationships * Understand solving equations as a process of reasoning & explain the reasoning * Represent & solve equations and inequalities graphically
Functions:	* Understand the concept of function & use function notation * Interpret functions that arise in applications in terms of the context * Analyze functions using different representations * Build a function that models a relationship between two quantities (integer inputs) * Build new functions from existing functions * Construct & compare linear, ~~quadratic~~, & exponential models to solve problems * Interpret expressions for functions in terms of the situation they model	* Interpret functions that arise in applications in terms of the context * Analyze functions using different representations * Build a function that models a relationship between two quantities * Build new functions from existing functions * Construct & compare linear, quadratic, & exponential models to solve problems * Apply quadratic equations to physical problems * Prove & apply trig identities ($\sin^2 T + \cos^2 T = 1$)	* Interpret functions that arise in applications in terms of the context * Analyze functions using different representations * Build a function that models a relationship between two quantities (Composition of functions & Inverse functions) * Build new functions from existing functions * Construct & compare linear, quadratic, & exponential models to solve problems * Extend the domain of trigonometric functions using the unit circle (define radian measure & convert between degrees & radians) * Model periodic phenomena with trigonometric functions
Geometry:	* Experiment with transformations in the plane * Understand congruence in terms of rigid motions * Make geometric constructions * Use coordinates to prove simple geometric theorems algebraically	* Prove geometric theorems & be able to use them(Vertical angle theorem, theorems about angles on parallel lines, triangle sum theorem, isosceles triangle theorem, midsegment theorem, triangle inequality theorem, theorems about parallelograms) * Understand similarity in terms of transformations * Prove theorems involving similarity * Define trigonometric ratios & solve problems involving right triangles * Understand & apply theorems about circles * Find arc length & area of sectors of circles * Translate between the geometric description & the equation for a conic section (circles & parabolas) * Use coordinates to prove simple geometric theorems algebraically * Explain volume formulas & use them to solve problems * Determine how changes in dimension affect perimeter, area, & volume	* Visualize relationships between 2D & 3D objects & identify 3 D objects generated by rotation of 2D objects * Apply geometric concepts in modeling situations * Translate between the geometric description & the equation for a conic section (circles, parabolas, ellipses) * Apply trigonometry to general triangles
Statistics & Probability:	* Summarize, represent & interpret data on a single count or measurement variable (compare center & spread, account for effects of outliers) * Summarize, represent & interpret data on two categorical & quantitative variables (linear, quadratic & exponential models) * Interpret linear models (compute correlation coefficient of linear fit, distinguish between correlation & causation)	* Understand independence & conditional probability & use them to interpret data * Use rules of probability to compute probabilities of compound events in a uniform probability model. * Use probability to evaluate outcomes of decisions	* Summarize, represent & interpret data on a single count or measurement variable (mean & standard deviation of a data set to fit a normal distribution) * Understand & evaluate random processes underlying statistical experiments. * Make inferences & justify conclusions from sample surveys, experiments, & observational studies. * Use probability to evaluate the outcomes of decisions.

E. Fraser, Oceanside Unified School

Lets Look At Where the 1997 Standards Took Us...

Skipping 6th Grade Standards and Content

- To accelerate in Middle School students skipped 6th grade Math and were placed in Pre-Algebra

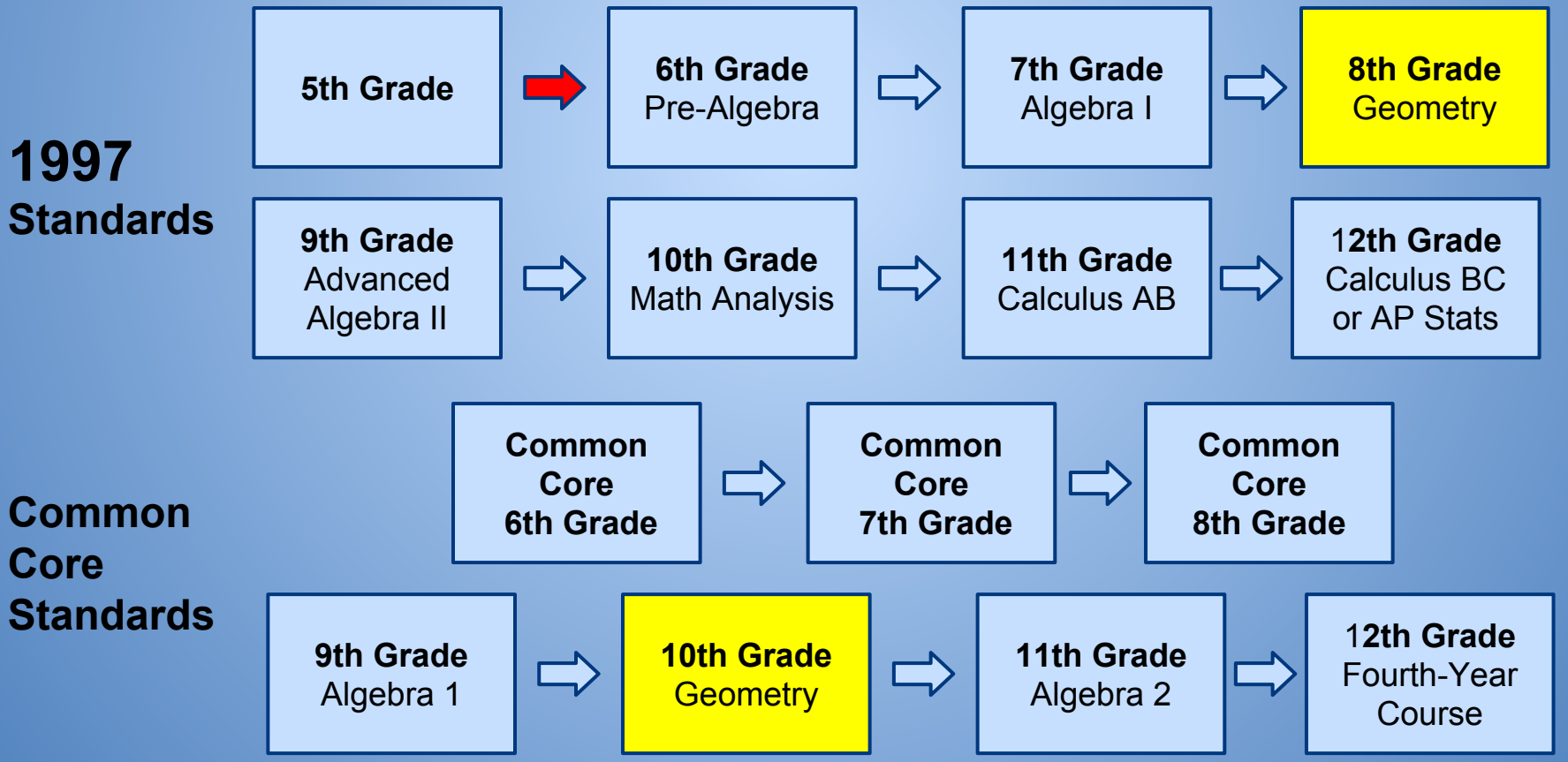


NEW CC 8th Grade Standards

- **1997 CA State Standards** only had state standards for 6th and 7th grade, NO standards for 8th grade.
  - Lessened rigor for 8th graders with Algebra Readiness or Pre-Algebra.
  - Provided opportunities for further acceleration for advanced students.

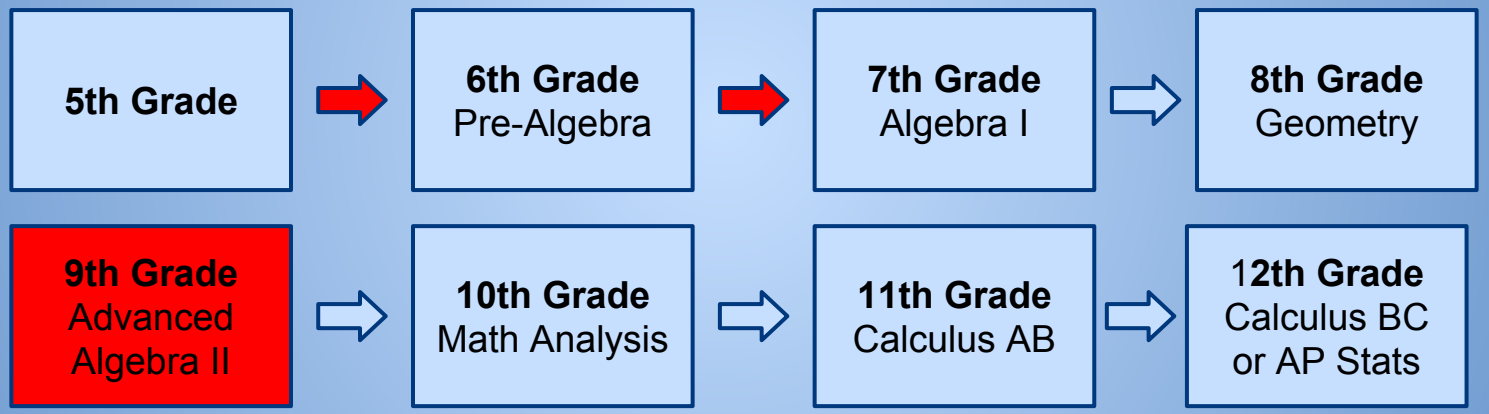
2 Year Acceleration in Middle School

- Skipping a grade plus having no 8th grade standards allowed for a 2 YEAR JUMP in middle school.



How has the 1997 Standards serviced our students?

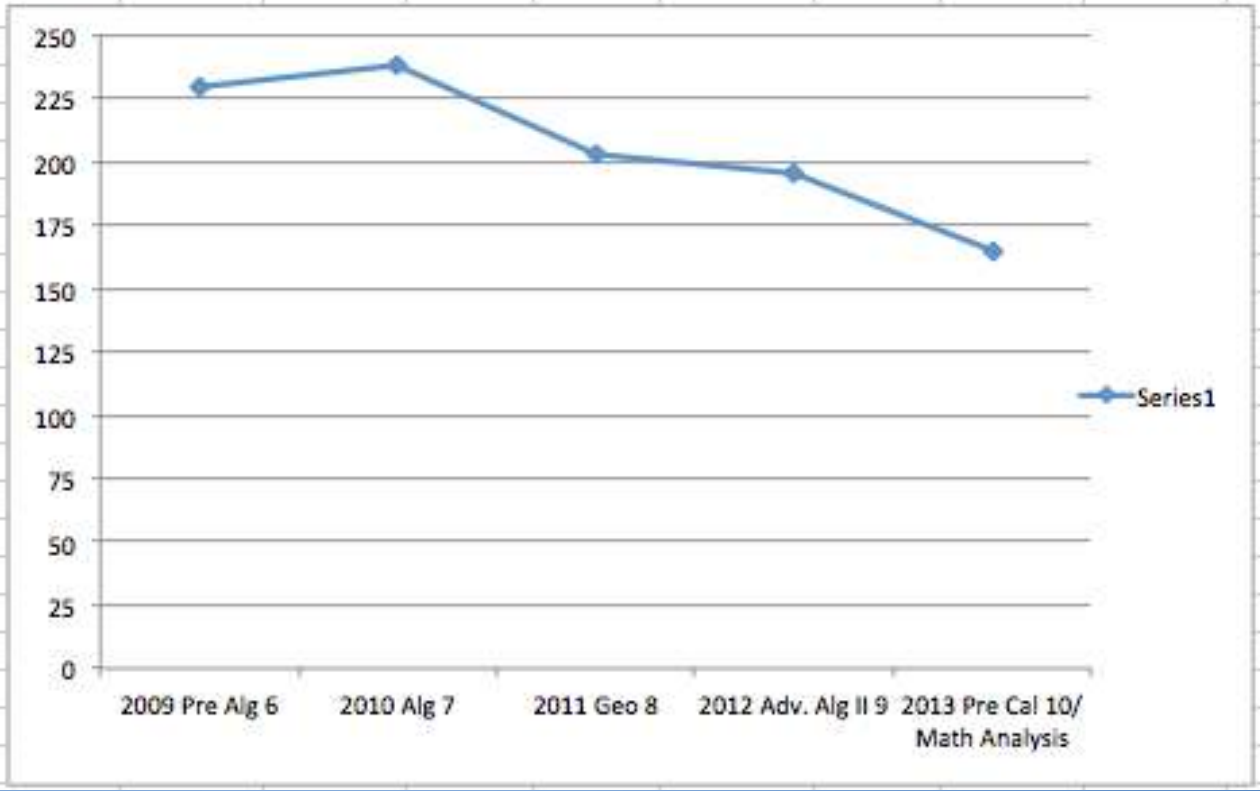
- Correlation from 6th grade Pre-Algebra does not fit Calculus BC enrollment numbers.



Percentage of students drop from advanced track either prior or during Advanced Algebra II.

		Pre Alg 6		Alg 7		Geo		Adv. Alg II		Pre Cal/Math Analysis
	6th	6th	7th	7th	8th	8th	9th	9th	10th	10th
	2008/09		2009/10		2010/11		2011/12		2012/13	
TMS	573	63	594	70	597	67				
SMS	472	62	491	63	529	36				
WSMS	378	70	391	64	386	59				
DMMS	204	35	233	41	257	41				
MVHS							603	66	589	57
VMHS							845	92	810	82
MMHS							580	37	575	26
Total	1627	230	1709	238	1769	203	2028	195	1974	165

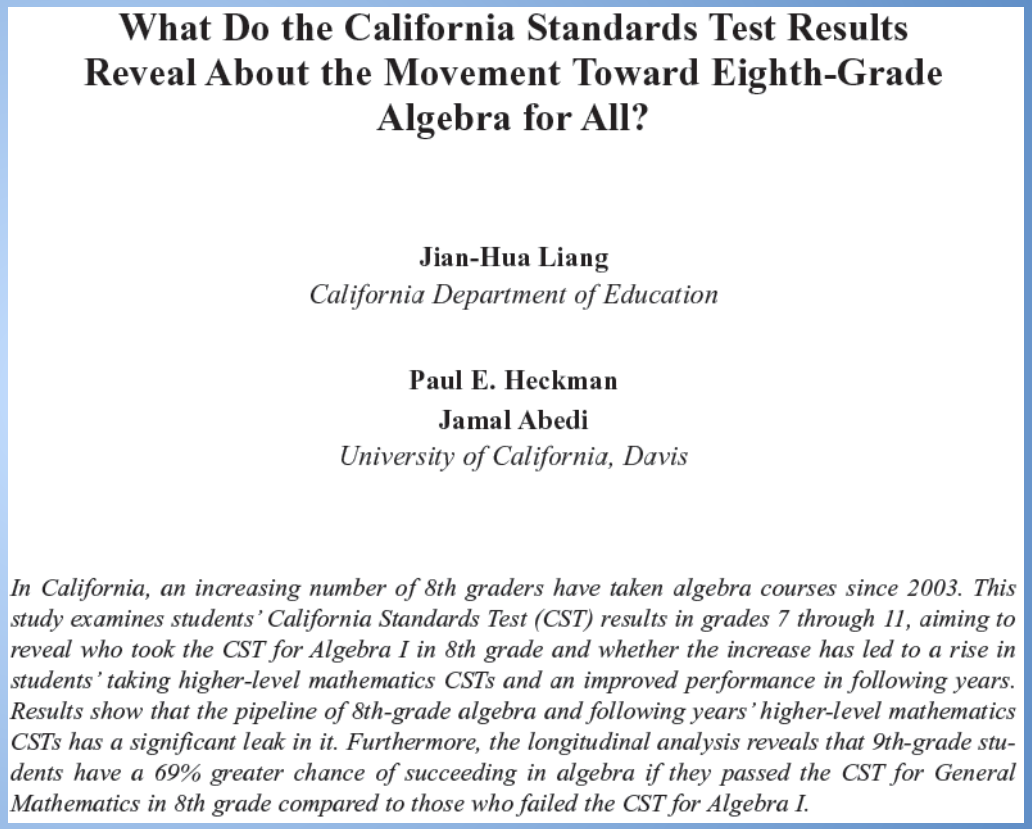
2009 Pre Alg 6	230
2010 Alg 7	238
2011 Geo 8	203
2012 Adv. Alg II 9	195
2013 Pre Cal 10/Ma	165



From Sunny to Dr. Jacob on Acceleration (August 25, 2013)

As far as taking AP tests, it is more important that students take an all around challenging curriculum than race to and extra math AP course. In admission to UC the readers are aware of AP courses, but not so much the test scores, and so if the student had honors courses that lead to an AP course in grade 12 that is going to be about as strong as they can do. If this rush leads to weaker grades overall the student is much worse off. What I've seen over the past 25 years teaching at UCSB is that the BC Calculus really doesn't move students much further forward mathematically (perhaps one quarter, ten weeks, at most) and I would much rather see them have a thorough preparation including applications of geometry in the years prior to calculus. The students who don't have these preliminary experiences have tremendous difficulty in my differential equations and multivariable calculus courses (certainly those in my classes when I interview them). I know it is hard to persuade parents that their students shouldn't race to get calculus, but I really wish they wouldn't. So I like your plan. Keep up the good work.

Grade 9 Students have a 69% greater chance of succeeding in algebra if they passed the CST for General Mathematics in Grade 8 compared to those who failed the CST for Algebra 1.



What Do the California Standards Test Results Reveal About the Movement Toward Eighth-Grade Algebra for All?

Jian-Hua Liang
California Department of Education

Paul E. Heckman
Jamal Abedi
University of California, Davis

In California, an increasing number of 8th graders have taken algebra courses since 2003. This study examines students' California Standards Test (CST) results in grades 7 through 11, aiming to reveal who took the CST for Algebra I in 8th grade and whether the increase has led to a rise in students' taking higher-level mathematics CSTs and an improved performance in following years. Results show that the pipeline of 8th-grade algebra and following years' higher-level mathematics CSTs has a significant leak in it. Furthermore, the longitudinal analysis reveals that 9th-grade students have a 69% greater chance of succeeding in algebra if they passed the CST for General Mathematics in 8th grade compared to those who failed the CST for Algebra I.

Common Core Standards

- Increased Rigor in Algebra I Course
- Does Not Allow Grade Level Standards to be Skipped
- Provides opportunity to create a solid District Math Program to service our students transitioning into Algebra I.
- Change in End of Year Assessment to Smarter Balanced
- Redesign of SAT to reflect Common Core Standards

Increased Rigor in Algebra I

NOT YOUR MOTHER'S ALGEBRA 1

(based on sample "Traditional" pathway in CA Framework draft)

Common Core Grade 8	▪ Pre-Algebra ▪Some "1997 High School Geometry" ▪"1997 Algebra 1A"	**Common Core Algebra 1**	▪"1997 Algebra 1B" ▪"1997 Algebra 2A" ▪Some Statistics Topics
Common Core Geometry	▪More "1997 High School Geometry" ▪Transformational Geometry ▪Probability from "1997 Algebra 2"	**Common Core Algebra 2**	▪ "1997 Algebra 2B" ▪ Introductory Trig ▪ Some AP Statistics

"These Standards are not intended to be new names for old ways of doing business. They are a call to take the next step."

— CCSS (2010, p.5)

Skipping Grade Level Standards

Mastery of the algebra content, including attention to the Standards for Mathematical Practice, **is fundamental for success in further mathematics and on college entrance examinations. Skipping over material to get students to a particular point in the curriculum will create gaps in the students' mathematical background.** In order to accelerate, students must prove that they are proficient in the CA CCSSM for grades K–8 (CCSSI 2010)**. Appendix A**

Students Who May Be Ready for Acceleration

Understanding that the CA CCSSM are more rigorous than California's previous standards for mathematics, **there will still be some students who are able to move through the mathematics quickly.**

These students may choose to take an **accelerated or enhanced mathematics program** beginning in eighth grade (or even earlier) so they can take college-level mathematics in high school. However, **the previous course sequences for acceleration will need to be updated, considering the increased rigor of the CA CCSSM**.

Students Who May Be Ready for Acceleration

Students who are capable of moving more quickly deserve thoughtful attention, both to ensure that they are challenged and that they are mastering the full range of mathematical content and skills—**without omitting critical concepts and topics.**

Care must be taken to ensure that students master and fully understand all important topics in the mathematics curriculum, and that the continuity of the mathematics learning progression is not disrupted.

Appendix A

Student State Assessment SBAC

- Taken Electronically

- Pilot this year

- 2014-15 First year of Test

- Smarter Balanced Assessment - Information Online

STAR

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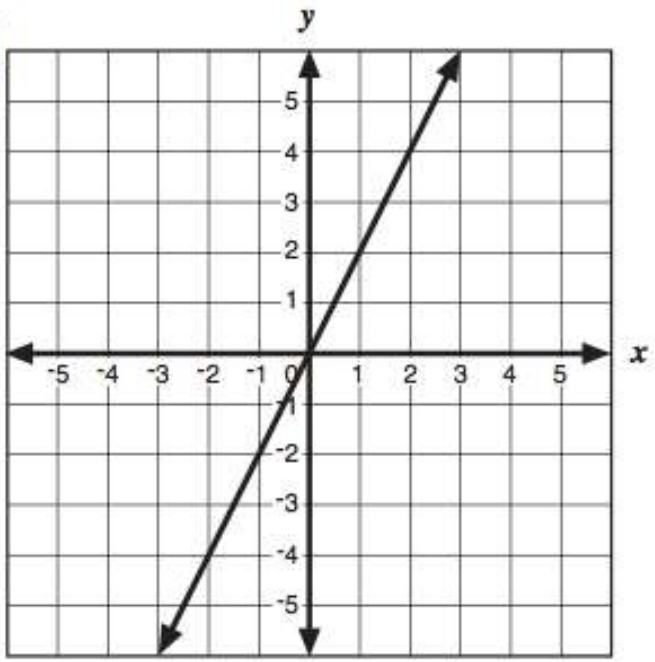


Which equation *best* represents the graph above?

A $y = x$

B $y = 2x$

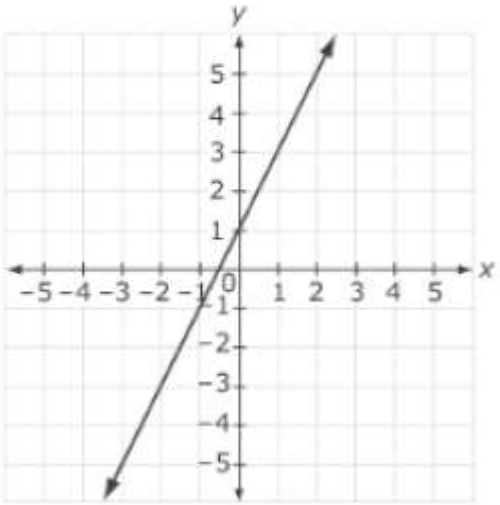
C $y = x + 2$

D $y = 2x + 2$

SBAC

771

Look at this graph of a function.



Which equation represents a function with a rate of change that is **greater than** the rate of change of the function shown in the graph?

Ⓐ $y = 3x - 1$

Ⓑ $y = \frac{x}{2} + 4$

Ⓒ $y = 2x + 2$

Ⓓ $y = \frac{x}{3} - 3$

STAR

5 The weekly milk order for the Tranquility Inn includes 40 gallons of low-fat milk and 15 gallons of chocolate milk. What is the ratio of the number of low-fat gallons to chocolate gallons in the Tranquility Inn's weekly milk order?

A 3:1

B 5:1

C 5:3

D 8:3

CSM10813

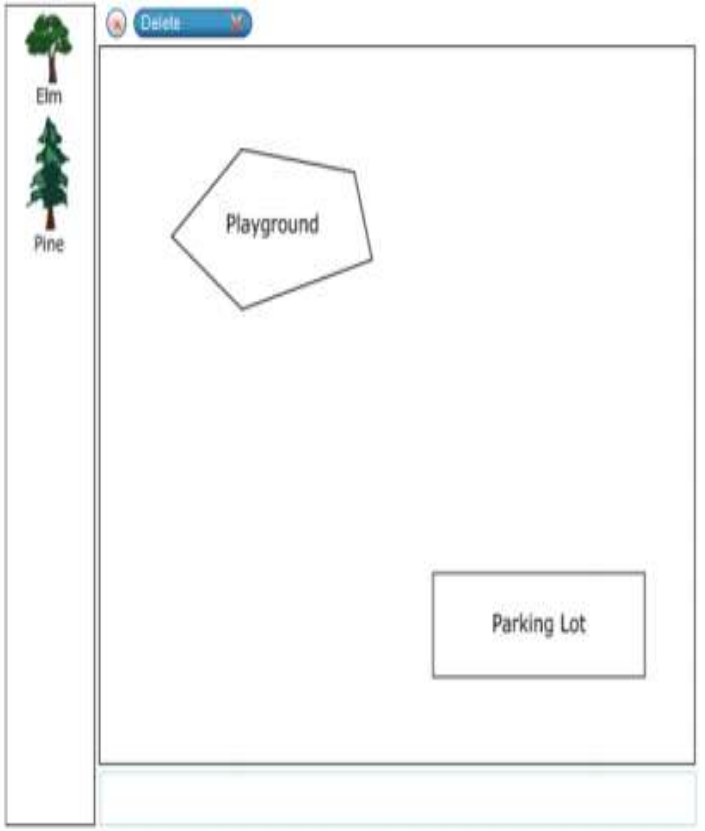
SBAC

636

A landscape designer is planning the layout of trees in a park.

- There are two types of trees: elm and pine.
- There should be at least 16 total trees but no more than 30.
- The ratio of elm trees to pine trees will be 3:2.

Drag trees anywhere to the model to show a possible number of each type of tree.



What prepares students best for SATs?

EDWEEK Articles

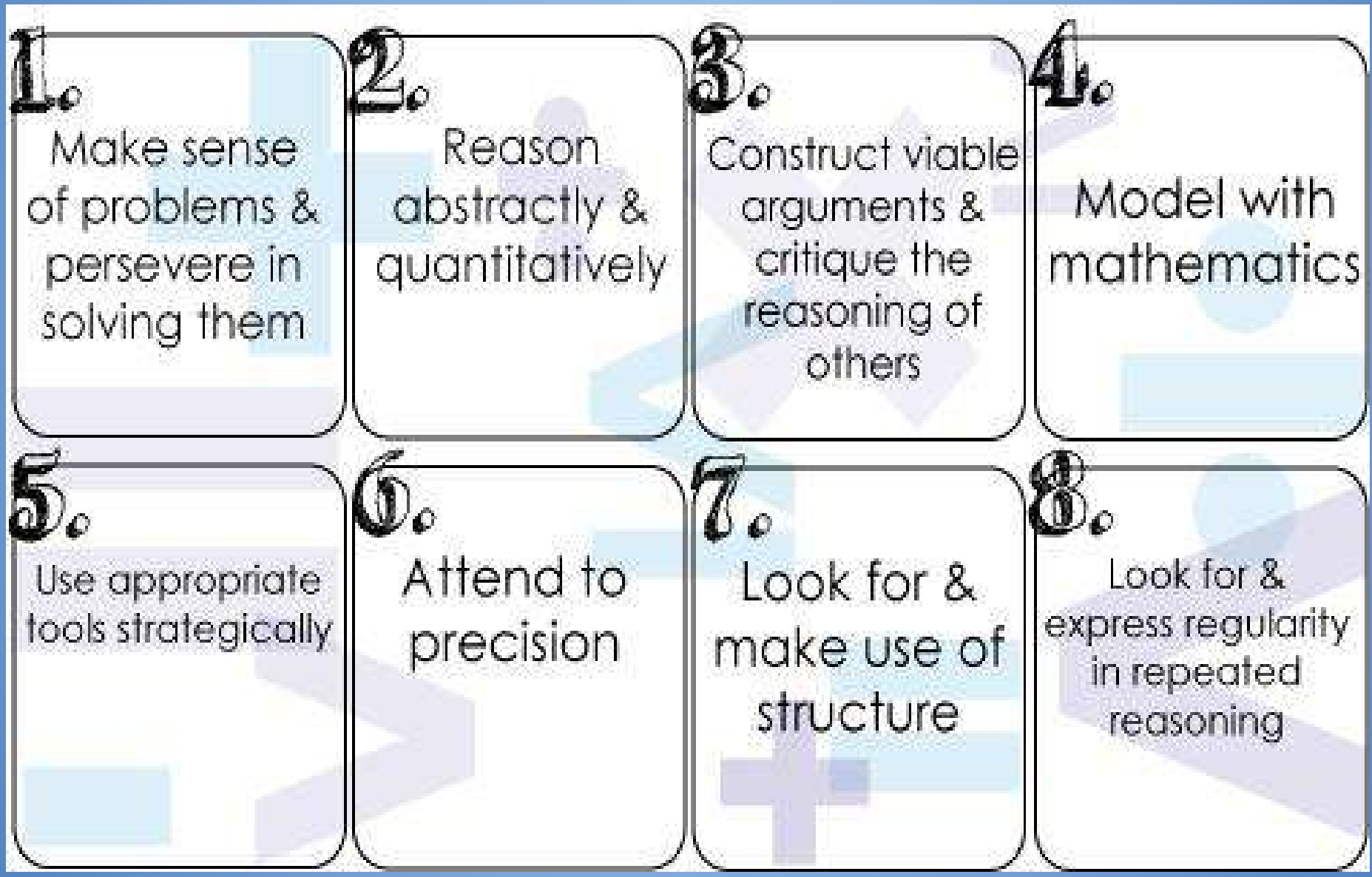
Education Week - May 16, 2012
Newly elected College Board president wants SAT to reflect Common Core.

Education Week - August 13, 2013
College Board redesigning four of its testing programs, PSAT, SAT, Readistep (8th and 9th), and Accuplacer (used by colleges for placement). The new designs will reflect Common Core State Standards.

EdWeek Blog - December 4th, 2013
Redesigned SAT that reflects CCSS will debut Spring of 2016, and the PSAT in Fall 2015.

How Does This Impact My Student Next Year?

Standards of Mathematical Practice



If your student is currently in 5th

CC 6th Grade Math *	CC 7th Grade Math *	CC 8th Grade Math *	CC Alg I Math I	CC Geo Math II	CC A2 Math III	Precalc or Higher Course

* With Math Support Class

CC 6th Grade Math	CC 7th Grade Math	CC 8th Grade Math	CC Alg I Math I	CC Geo Math II	CC Alg 2 Math III	Precalc or Higher Course

Enhanced CC 6th Grade Math	EnhancedCC 7th Grade Math	EnhancedCC 8th Grade Math	Enhanced CC Alg I Math I	Enhanced CC Geo Math II	Enhanced CC Alg 2 Math III	AP Calc

If your student is currently in 6th

CC 7th Grade Math *	CC 8th Grade Math *	CC Alg I Math I	CC Geo Math II	CC Alg 2 Math III	Pre-Calc or Higher course

* With Math Support Class

CC 7th Grade Math	CC 8th Grade Math	CC Alg I Math I	CC Geo Math II	CC Alg I Math III	Pre-Calc or Higher Course
Enhanced CC 7th Grade Math	EnhancedCC 8th Grade Math	EnhancedCC Alg I Math I	Enhanced CC Geo Math II	Enhanced CC Alg 2 Math III	AP Calc
1997 Algebra I	1997 Geometry	1997 Algebra II	Pre-calc	AP Calc	AP Calc/ AP Stats

If your student is currently in 7th

CC 8th	CC A1 Math I	CC Geo Math II	CC A2 Math III	Pre-Calc or Higher course
CC8th	CC A1 Math I	CC Geo Math II	CC A2 Math III	Pre-Calc or Higher course
1997 Alg I	1997 Geo	1997 Alg 2	Pre-Calc	AP Calc
1997 Geo	1997 Alg 2	Pre-calc	AP Calc	AP Calc/ AP Stats

* With Math Support Class

If your student is currently in 8th

Alg I	Geo	Alg 2	Pre-Calc or Higher Course
Geo	Alg 2	Pre-Calc	AP Calc
Adv. Alg 2	Pre-calc or Math Analysis	AP Calc	AP Calc/ AP Stats

What are the next steps?

1. Choose the pathway that best serves our students.

2. High School would focus on SMP's, Performance Tasks and transitioning to SBAC assessments.

3. Middle School will Pilot CC (6-8) curriculum for textbook adoptions.

Feedback/Questions

Parent Resource
http://www.cde.ca.gov/re/cc

Additional Resources

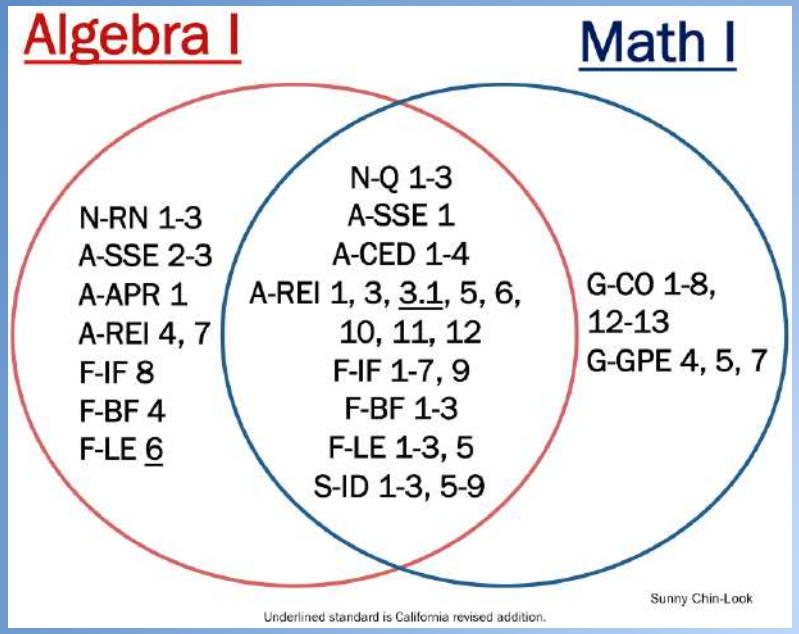
The following slides were not included in the presentation, but provide extra information on Common Core.

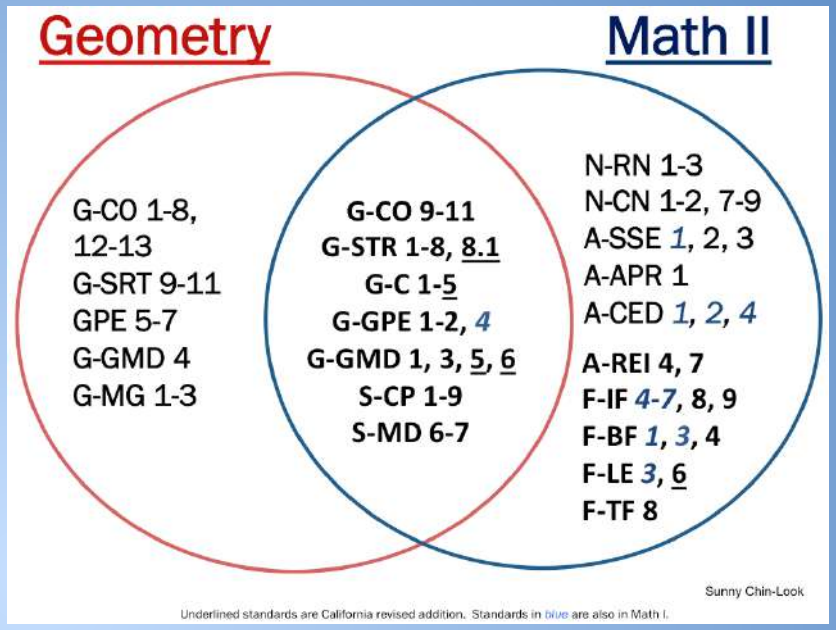
COMMON CORE STANDARDS ABBREVIATIONS

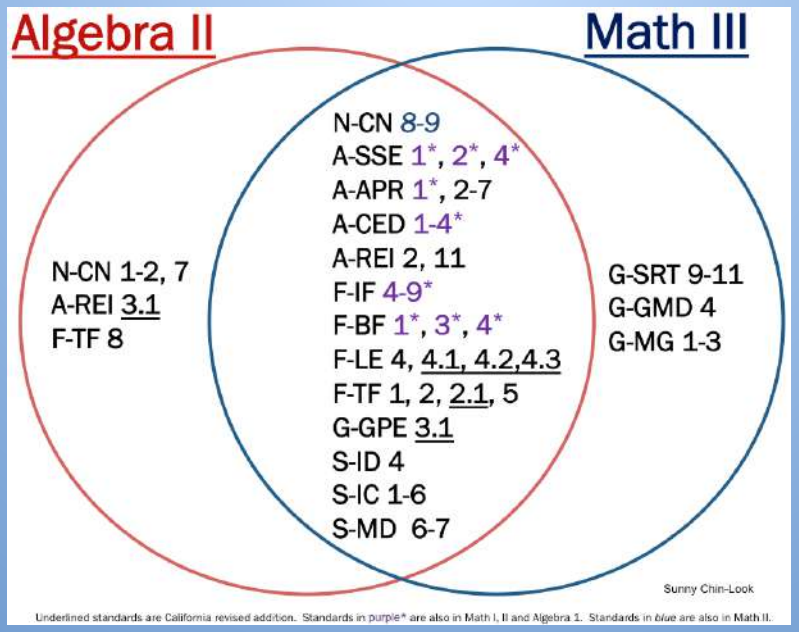
Notation	Conceptual Category	Domain
N	Number and Quantity	CN = The Complex Number System Q = Quantities RN = The Real Number System
A	Algebra	APR = Arithmetic with Polynomials and Rational Expressions CED = Creating Equations REI = Reasoning with Equations and Inequalities SSE = Seeing Structure in Expressions
F	Functions	BF = Building Functions IF = Interpreting Functions LE = Linear, Quadratics, and Exponential Models TF = Trigonometric Functions
G	Geometry	C = Circles CO = Congruence GMD = Geometric Measurement and Dimension GPE = Expressing Geometric Properties with Equations MG = Modeling with Geometry SRT = Similarity, Right Triangles, and Trigonometry
S	Statistics and Probability	CP = Conditional Probability and the Rules of Probability IC = Making Inferences and Justifying Conclusions ID = Interpreting Categorical and Quantitative Data MD = Using Probability to Make Decisions

Printed by the Riverside County Office of Education

COMMON CORE STANDARDS ORGANIZATION



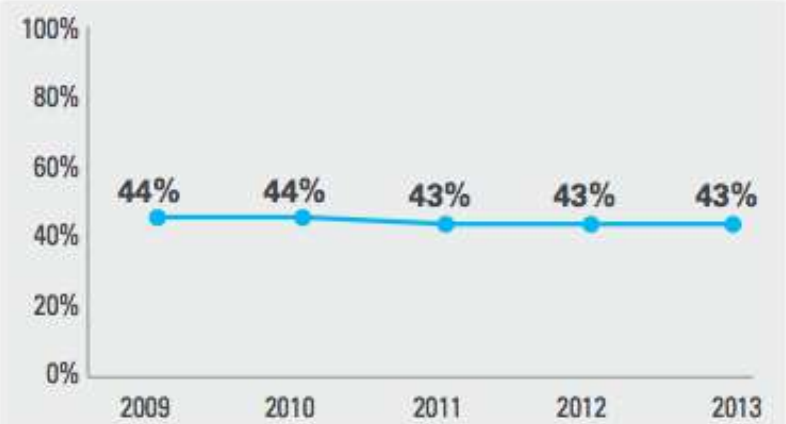




2013 SAT® Report on College & Career Readiness

FINDINGS FROM THE CLASS OF 2013

The SAT College and Career Readiness Benchmark



43%
Met the SAT Benchmark

57%
Did Not Meet the SAT Benchmark

While it is widely acknowledged that increasing college completion is critical to sustaining our nation's competitiveness and prosperity long into the future, gains will only be possible if more students graduate from high school having acquired the skills and knowledge that research demonstrates are critical to college and career readiness.

The College Board's *2013 SAT Report on College & Career Readiness* reveals that only 43 percent of SAT takers in the class of 2013 met the SAT College and Career Readiness Benchmark. This percentage has remained virtually unchanged during the last five years, underscoring the need to dramatically increase the number of students who graduate from high school with the skills and knowledge that research demonstrates are critical to college and career readiness.

SOURCE: http://media.collegeboard.com/homeOrg/content/pdf/sat-report-college-career-readiness-2013.pdf

EDUCATION WEEK

Published Online: May 16, 2012

Incoming College Board Head Wants SAT to Reflect Common Core

By Catherine Gewertz

One of the chief architects of the Common Core State Standards was named the next president of the **College Board** today and said one of his top priorities is to reshape the organization's influential college-admissions test, the SAT, to better reflect the new standards.

David Coleman will assume his new duties on Oct. 15, replacing Gaston Caperton, who is stepping down after 13 years as the College Board's president, according to an announcement from the New York City organization also known for its Advanced Placement program.

Until then, Mr. Coleman will continue his work with **Student Achievement Partners**, a group he founded with two others who served as lead writers of **the common standards** in mathematics and English/language arts.

SOURCE: http://www.edweek.org/ew/articles/2012/05/16/32collegeboard.h31.html

EDUCATION WEEK

Published Online: August 13, 2013

College Board Expands Common-Core Testing Plans

By Catherine Gewertz

The College Board is redesigning four of its testing programs so they reflect the Common Core State Standards and can be used for accountability, a project that adds yet another player to the list of companies seeking to take on new roles in a shifting nationwide assessment landscape.

The New York City-based nonprofit announced last year that it would align its college-entrance exam, the SAT, to the common standards. But its plans have expanded to include three other products: ReadiStep, aimed at 8th and 9th graders; the PSAT, typically taken by 10th and 11th graders; and Accuplacer, used by colleges to determine course placement for incoming students.

Test redesigns are still largely in the discussion stage, according to David Coleman, who took over as the College Board's president last October after serving as a chief writer of the common standards in English/language arts. The organization is talking with policymakers and educators in states at the K-12 and higher education levels, he said.

SOURCE: http://www.edweek.org/ew/articles/2001/08/14/01test.h33.html

Rollout of New SAT Delayed by One Year

By **Caralee Adams** on December 4, 2013 10:05 AM

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Tweet

A newly redesigned SAT that is more closely aligned with the Common Core State Standards will likely debut in the spring of 2016, a year later than the College Board initially predicted.

News of the delay went out Tuesday to College Board members in an email from President David Coleman. In a statement a day later to Education Week, the College Board said that it was in response to feedback from its members that officials decided to adjust the schedule for the release of the revised Prelimary SAT/National Merit Scholarship Qualifying Test and the revised SAT.

"This change in the timing of the redesign will serve our members in higher education by providing two years to plan for the redesigned exam and it will allow students to take the revised PSAT/NMSQT before the revised SAT," according to the College Board statement. "Our goal is to deliver an assessment system that is focused, useful, and clear. Member input will continue to be integral to this work and we look forward to sharing additional information regarding the revision of our exams in the spring."

When he took the reins at the College Board last year, **Coleman indicated** that he wanted to make major changes to the SAT to better align the exam with the new Common Core State Standards. Then in February, **news of the redesign was official** and feedback was solicited.

The newly revised PSAT/NMSQT will roll out in the fall of 2015, as planned.

SOURCE: http://blogs.edweek.org/edweek/college_bound/2013/12/roll_out_of_new_sat_and_psat_delayed_by_one_year.html

Vision

"The most necessary task of civilization is to teach people how to think. It should be the primary purpose of our public schools . . . The trouble with our way of educating is that it does not give elasticity to the mind. It casts the brain into a mold. It insists that the child must accept. It does not encourage original thought or reasoning, and it lays more stress on memory than observation."

-- Thomas A. Edison

Discussion of Benefits

Integrated

- Eliminates algebra gap (and Geometry gap)
- Better treatment of geometry through integration
- Connections within mathematics topics
- More equitable
- Forces change-no familiar classes
- Separates linear and quadratic mathematics
- Broadens definition of mathematics
- World Class
- Cuts ties with outdated practices, attitudes, and curriculum

Traditional

- Better treatment of geometry through focused curriculum
- More comfortable for teachers and parents
- Parents understand names
- Easier to double enroll (algebra and geometry)

Consistency

- Grades K-8 are Integrated

K	1	2	3	4	5	6	7	8
Geometry								
Measurement and Data						Statistics and Probability		
Number and Operations in Base Ten						The Number System		
Operations and Algebraic Thinking						Expressions and Equations		
Counting and Cardinality			Number and Operations—Fractions			Ratios and Proportional Relationships		Functions

The Geometry Gap

- We really have in mind here geometry at the secondary and undergraduate levels. We claim that it is a serious mistake to regard geometry as just one more topic in mathematics, like algebra, trigonometry, differential calculus, and so on. In fact, geometry and algebra, the two most important aspects of mathematics at these levels, play essentially complementary roles. Geometry is a source of questions; algebra is a source of answers. Geometry provides ideas, inspiration, insight; algebra provides clarification and systematic solution.

- Quotes from *Mathematical Reflections, In a Room with Many Mirrors* by Peter Hilton, Derek Holton, Jean Pedersen© 1997 Springer-Verlag New York, Inc

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The Effects of Content Organization and Curriculum Implementation on Students' Mathematics Learning in Second-Year High School Courses

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We examined curricular effectiveness in high schools that offered parallel paths in which students were free to study mathematics using 1 of 2 content organizational structures, an integrated approach or a (traditional) subject-specific approach. The study involved 3,258 high school students, enrolled in either Course 2 or Geometry, in 11 schools in 5 geographically dispersed states. We constructed 3-level hierarchical linear models of scores on 3 end-of-year outcome measures: a test of common objectives, an assessment of problem solving and reasoning, and a standardized achievement test. Students in the integrated curriculum scored significantly higher than those in the subject-specific curriculum on the standardized achievement test. Significant student-level predictors included prior achievement, gender, and ethnicity. At the teacher level, in addition to Curriculum Type, the Opportunity to Learn and Classroom Learning Environment factors demonstrated significant power in predicting student scores, whereas Implementation Fidelity, Teacher Experience, and Professional Development were not significant predictors.

Key words: Curricular effectiveness; Curriculum; HLM; Integrated curriculum; Secondary mathematics

Indiana Department of Education
SUPPORTING STUDENT SUCCESS

High School Mathematics Pathways: Helping Schools and Districts Make an Informed Decision about High School Mathematics

Defining the Two Pathways

For the purposes of planning for high school curriculum, Indiana Department of Education (IDOE) is setting forth two possible paths for high school mathematics: a traditional pathway and an integrated pathway. It is important to note that *Indiana is not mandating either approach;* however, IDOE encourages districts to carefully consider both options before making a decision.

Rather, the pathways are models of two approaches to organizing content into coherent, comprehensive and rigorous courses that should lead Indiana's students to college and career readiness. Schools are encouraged to read about these pathways in order to determine what best suits their individual needs. Print versions of these course described below, including the standards for each potential course, are available on the Department of Education website.

Traditional Pathway

This option involves offering three high school courses called Algebra I, Geometry, and Algebra II. Although these courses retain their traditional names, the standards for each, and the organization of the standards, are significantly different than the current Indiana courses. In addition, each of the three new courses includes a unit in Probability and Statistics.

Integrated Pathway

The second option involves three high school courses called Integrated Mathematics I, Integrated Mathematics II, and Integrated Mathematics III. The integrated courses include Algebra, Geometry, and Statistics standards in each course. This integration allows students not only to continue to systematically build proficiency in each domain (Algebra, Geometry, and Statistics/Probability) each year, but also attempts to help students see the connections and interrelationships between these three domains of mathematics.

Choosing a Pathway: Common Misconceptions

Before choosing a pathway, school corporations might wish to consider common misconceptions associated with the high school pathways.

Three common misconceptions are:

1) The requirements of integrated mathematics are less rigorous than of traditional mathematics courses;
2) State assessments are only aligned with the traditional pathway; and
3) Integrated textbooks only teach through "applied" situations and fail to address procedural fluency. These misconceptions are described in greater detail below.

Rigor of Requirements

Standards covered in the three-year integrated sequence are the exact same standards as those covered in a three-year traditional sequence. Although in the past, integrated mathematics courses were typically offered only to students who were unable to succeed in a traditional Algebra or Geometry class; this need not be the case. In designing the new model pathways, Achieve and other national mathematics experts paid close attention to *ensuring that both paths are equally rigorous*. The difference between the two courses lies in the sequencing of the standards, rather than in the standards themselves.

Applications and Procedures

To many high school mathematics teachers, the terms "integrated" and "applied" or "in context" are synonymous. Although many integrated textbooks present material in applied situations, the two terms are not inextricably linked. The current *Pre-Calculus* course, for example, follows an integrated model, incorporating algebra, trigonometry, geometry, and data analysis into one course without ever being viewed as "applied math." Grades K-8 are also integrated courses.

The strength of the integrated model is not that standards are taught in context, but rather that they are viewed as connected to other standards, both within and across mathematical domains. Understanding and utilizing these connections becomes vital to long-term success in mathematics and STEM disciplines – which has become important for all students, as nearly all career paths now require students to at least be proficient in the STEM disciplines (IDOE STEM guidance document).

HIGHEST PRIORITY

Tulare County Office of Education
Jim Vidak, County Superintendent of Schools

"Some of the highest priority for college and career readiness comes from Grades 6-8. This body of material involves powerfully used proficiencies such as applying ratio reasoning in real world and mathematical problems, computing fluently with positive and negative fractions and decimals, and solving real-world and mathematical problems involving angle measure, area, surface area, and volume.

- Jason Zimba

Examples of Structure in the *Common Core State Standards'* for Mathematical Content

As of November 2013…

Incomplete list of Integrated Districts

San Diego County
Oceanside USD
San Diego USD
San Dieguito Union HSD
Vista USD

San Joaquin County
Escalon USD
Ripon USD

Santa Barbara County
Santa Ynez Valley

Santa Clara County
Campbell Union HSD
East Side Union HSD

Stanislaus County
Ceres
Modesto City
Oakdale
Turlock

Tulare County
Alpaugh USD
Burton SD
Dinuba USD
Exeter USD
Lindsay USD
Porterville USD
TCOE – La Sierra

Shasta County
Shasta Union HSD
Gateway USD

San Bernardino County
Chaffey Joint Union HSD
Redlands
San Bernadino

Tuolumne County
Big Oak Flat Groveland USD
Sonora Union HSD
Summerville Union HSD

INTEGRATED STATES
North Carolina
Utah
West Virginia

A Joint Position Statement of the MAA and the NCTM on Teaching Calculus (2012)

…the ultimate goal of the K–12 mathematics curriculum should not be to get students into and through a course in calculus by twelfth grade but to have established the **mathematical foundation that will enable students to pursue whatever course of study interests them when they get to college.**

http://www.maa.org/news 2012_maanctm.html