Missing or Delayed in Common Core's Mathematics Standard
(reviewed/revised by mathematician James Milgram)

Kindergarten – Grade 7:

- CC does not require proficiency with addition and subtraction until Grade 4 (a grade behind our international competitors).
- CC does not require proficiency with multiplication using the standard algorithm (step-by-step procedure for calculations) until Grade 5 (a grade behind standard expectations).
- CC does not require proficiency with division using the standard algorithm until Grade 6 (two grades behind our international competitors).
- CC starts teaching decimals in Grade 4 (about two years behind the more rigorous states).
- CC fails to teach in K-7 key geometrical concepts (e.g., sum of angles in a triangle, isosceles and equilateral triangles, etc.).
- Excludes fluent conversion between different forms of fractions – regular fractions, decimals, and percents
- CC fails to teach prime factorization. Consequently, it does not include teaching about least common denominators or greatest common factors.
- Compound interest and the associated formula, $(x^{(n+1)} - 1)/(x-1) = 1 + x + x^2 + \ldots + x^n$. This is or used to be a seventh grade or at latest, eighth grade topic.

Algebra 1: Missing components needed for Algebra 2 and Calculus:

1. Division of monomials and polynomials (only addition/subtraction/multiplication are covered)
2. Derivation and understanding of slopes of parallel and perpendicular lines
3. Manipulation and simplification of rational expressions
4. Multi-step problems with linear equations and inequalities
5. Multi-step problems with four operations between polynomials
6. Multi-step problems involving manipulation of rational expressions
7. Solving two linear inequalities in two variables and sketching the solution sets

The following were added to California's Common Core version:

8. Solve problems with equations and inequalities with absolute value
9. Solve problems with quadratic expressions

Algebra 2: Some key topics missing:

1. Writing quadratic polynomials in two or three variables as sums or differences of perfect squares. (KEY for the study of conic sections, which, in turn, underlies almost everything that is done in STEM areas.)

2. Detailed study of surfaces of revolution coming from quadratic polynomials as described above. In particular, the focus here should be on parabolic mirrors and their applications.

3. Introduction of the foci and the directorix for conics and their applications to parabolas and parabolic mirrors, and also for ellipses and elliptic surfaces with applications to things like whispering galleries and Kepler's laws.

4. Definition and implications of the eccentricity for conic sections.

5. Structure of logarithms to base 10, e, or general base, b. Conversion between bases, calculation of explicit values in simple cases.

Geometry: Some key topics missing (Properties of triangles and circles)

(1) Students should know that every triangle is circumscribed by a unique circle with center at the intersection point of the three perpendicular bisectors of the edges (also, that all three DO intersect in a single point).
(2) They should know that every right triangle has the center of the circumscribing circle on its hypotenuse, and conversely.
(3) They should know that the angle subtended by an arc on the circle (the angle obtained by drawing the two lines from the center to the ends of the arc), is twice the angle subtended by the ends of the arc and any point in the complement of the arc.

Pre-calculus and/or Algebra 2 and trigonometry: Key topics missing

1. Partial fraction decomposition of relatively simple rational functions and their graphs. Specifically, Understand that a function of the form $(ax + b)/((x-r)(x-s))$ can always be written as a sum $(l/(x-r)) + (m/(x-s))$, where, in this case $l + m = a$, and $rm + ls = -b$. Apply this to the determination of the graphs of such functions.

2. Graph functions in polar coordinates. Key examples, circles ($r = 2\cos(t)$), Cardioids ($2 + 2\cos(t) = r$), Rose petal curves ($r = \sin 5t$), lemniscate ($r^2 = 4\sin(2t)$).

Algebra 2: Missing components needed for Calculus

- **composite functions**
- **combinations and permutations**
- **finite and infinite arithmetic and geometric sequences**
- **mathematical induction**

Note that all four topics above are quite "formal" in line with the overly formal treatment of algebra in Core Standards. The topics sketched in above are much more "realistic" in terms of the actual needs of students wishing to major in ANY technical area in college.

See: http://concernedpvparents.org/2014/05/27/cc-math-dumbed-down-proof/