A Comparison of Three K-6 Mathematics Programs: Sadlier, Saxon, and SRA McGraw-Hill

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In this report we evaluate and compare the following three K-6 mathematics programs for grades 2 and 5:

Sadlier-Oxford: Progress in Mathematics

Saxon: Math, An Incremental Development, Third Edition

SRA McGraw-Hill: Explorations and Applications

These three programs are the only "basic," or complete, K-6 mathematics programs that were adopted by the state of California in its 1999 mathematics textbook adoption cycle. We evaluate the grade 2 and grade 5 material that was formally adopted for those grades by the California State Board of Education. For the Saxon publishers, that means "Math 2" for grade 2 and "Math 76" for grade 5. For the other two publishers, we use the publishers' grade level texts for grades 2 and 5.

The purpose of this evaluation is to rank these three programs against each other in a systematic and useful way. Our criteria include the principal mathematics content standards given in the California Mathematics Framework for grades 2 and 5. These content standards are quoted in the sequel. We also consider as criteria, the appropriate use of calculators, and the development of topics through correct and appropriate mathematical reasoning. Although, most of our criteria for evaluation are directly linked to the mathematics standards for California, we believe that they are of sufficient importance so as to be of value in a much broader context.

Our findings contradict an earlier evaluation conducted by members of "Mathematically Correct" posted at:

http://www.mathematicallycorrect.com/books.htm

That evaluation gave high marks to SRA McGraw-Hill: Explorations and Applications. Those high marks are not supported by our findings. In addition, we find that the Saxon math program for the grade levels we consider to be of greater merit than the Mathematically Correct report.

In what follows, we will refer to the three programs considered in this report as "Sadlier," "Saxon," and "SRA." In our evaluations, we do not consider any special California supplements to the basic programs created by these publishers. Saxon and SRA did create supplemental materials to address some shortcomings with respect to the California Mathematics Standards, and the interested reader is encouraged to contact the publishers for those materials.

Criteria

The following criteria were used in our evaluations of both the grade 2 and grade 5 programs:

- Incorporation of mathematical reasoning in the subject matter.
- Extent of and quality of calculator use

We do not attempt an evaluation of mathematical reasoning independent of subject matter. Rather we comment on mathematical reasoning in the context of specific mathematical topics listed below, when appropriate. Our evaluations of the extent and quality of calculator use appears at the beginning of our grade 2 evaluation and the beginning of our grade 5 evaluation. We also comment on calculator use in the context of specific mathematics content standards below.

Other general criteria which we do not evaluate here might be of interest. For example, an overabundance of extraneous distracting pictures and stories unrelated to mathematics can make a book bulky and difficult for students to carry. It can also be distracting. Parents, teachers, and administrators would be wise to take that issue into consideration when selecting mathematics textbooks. Also important is the quality of assessment materials that come with a mathematics program. All three of the programs considered here provide extensive assessment materials, but we did not evaluate them.

The major focus of this report is the comparison of the grade 2 and grade 5 Sadlier, Saxon, and SRA materials relative to specific California mathematics content standards.

The California mathematics standards are broken into the following four strands for the grades we consider: Number Sense (NS), Algebra and Functions (AF), Measurement and

Geometry (MG), and Statistics, Data Analysis, and Probability (SDAP). We use these abbreviations throughout this report.

Grade 2 Content Criteria

The list of Grade 2 California mathematics standards are exactly those standards identified in the California Mathematics Framework as the most important standards for grade 2. These standards are fully quoted in our analysis below.

NS 1.1, 1.3, 2.1, 2.2, 3.0. 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2
AF 1.1
MG 1.3, 2.0, 2.1, 2.2
SDAP 1.0, 2.0

We do not give a separate evaluation for each of NS 3.0 or MG 2.0, since the substandards for these general standards are already included in our evaluation. Because they are so closely related, we combined NS 5.1, 5.2 and also SDAP 1.0, 2.0 for evaluation purposes.

Grade 5 Content Criteria

Below is the list of standards for we consider for grade 5. These standards are fully quoted in our analysis below.

NS 1.2, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4, 2.5
AF 1.2, 1.4, 1.5
MG 1.1, 1.2, 1.3, 2.1, 2.2
SDAP 1.4, 1.5

The above standards include all of the major standards identified in the California Mathematics Framework for grade 5 , as well as NS 2.4, 2.5 which involve multiplication and division of fractions. We included these last two standards because of their great importance, even though they were not identified by the California Framework as major standards for grade 5.

Summary of Findings

For each of our criteria, except for mathematical reasoning, we ranked the three programs first, second, or third. In the case of a two-way tie for first, we assigned a score of 1.5. When all three programs met a criterion equally well, we gave each a numerical value of 2. Consideration of mathematical reasoning influenced the scores in each of the other criteria.

We caution the reader that our charts below provide only a rough summary of our evaluations. We have not attempted to assign weights to the standards we considered, even though some of the criteria are more important than others. Nevertheless, the average rankings from each chart are consistent with our own subjective evaluations of these programs. For second grade, the Sadlier-Oxford program was overall the strongest of the three. In particular, the mathematical reasoning in this program was the strongest overall. The Saxon Math 2 program was also strong and we recommend that program as well. The Saxon program has an attractive feature not reflected in our table, namely, the development of mathematical concepts and techniques is gradual, systematic, and accessible to students, in our opinion. The SRA McGraw Hill program by contrast was weak and we do not recommend it.

Grade 2

Criterion	Sadlier	Saxon	SRA
Calculator Use	2	1	3
NS 1.1	1.5	1.5	3
NS 1.3	1	3	2
NS 2.1	1.5	1.5	3
NS 2.2	1	2	3
NS 3.1	1	2	3
NS 3.2	1.5	1.5	3
NS 3.3	2	1	3
NS 4.1	1.5	1.5	3
NS 4.2	1	2	3
NS 4.3	3	1.5	1.5
NS 5.1, 5.2	1	2	3
AF 1.1	1	2	3
MG 1.3	2	2	2
MG 2.1	1.5	1.5	3
MG 2.2	3	1	2
SDAP 1.0, 2.0	2	2	2
Average Rank	1.6	1.7	2.7

Ranking: Sadlier 1st place, Saxon 2nd place, SRA 3d place

For fifth grade, in spite of our caveats, the chart below is consistent with our subjective evaluations of these programs. The Saxon math program is the strongest of the three, overall, and the strongest in terms of mathematical reasoning. The Sadlier program provides a solid foundation in grade-level content and we recommend it as well. By contrast, the SRA program has many weaknesses and we do not recommend it for classroom use.

Grade 5

Criterion	Sadlier	Saxon	SRA
Calculator Use	2	1	3
NS 1.2	2	1	3
NS 1.4	2	1	3
NS 1.5	2	1	3
NS 2.1, 2.2	2	1	3
NS 2.3	1.5	3	1.5
NS 2.4, 2.5	2	1	3
AF 1.2, 1.4, 1.5	1	2	3
MG 1.1, 1.2, 1.3	1.5	1.5	3
MG 2.1, 2.2	2	2	2
SDAP 1.4, 1.5	2	2	2
Average Rank	1.8	1.5	2.7

Ranking: Saxon 1st place, Sadlier 2nd place, SRA 3d place.

Detailed Grade 2 Comparisons

Calculator Use in 2nd grade

It is the opinion of the authors of this document that calculators should not be used at all in grade 2 mathematics programs. Below is a summary of calculator usage in the programs considered in this report.

SRA

In the SRA series, calculator usage begins in Kindergarten and continues throughout the series. Calculator use seems to be an end in itself for this program.

Calculators are used for 6 different concepts in the text: addition, counting, functions, multiplication, skip counting, and subtraction. Below are some specific examples of calculator use in the SRA grade 2 program:

Lesson 29 introduces students to the calculator. The Teacher's Edition for grade 2 indicates that this is the first calculator activity lesson. According to the suggested teaching strategy, a teacher should "work with students as they practice using their calculators. Allow students time to experiment. Suggest they do the following: Press C (clear), then +1 = (the display should show 1) and then repeatedly press the = key. The display should then show 2,3,4..." The enrichment and reteaching lessons for Lesson 29 also use a calculator. The use here of calculators to find 4 + 7, and other similar single digit sums is inappropriate and possibly detrimental.

Lesson 46 is a review of addition and subtraction facts, and according to the Teacher's Edition, "can be done with a calculator by students who have mastered basic addition and subtraction facts."

Lesson 85 is devoted to the concept of function. The Teacher's edition says, "Have students use their calculators to help them complete the function tables on page 185." The rule for the functions involved are respectively: adding 4, subtracting 5, adding 3, subtracting 60. For example students use the calculator to computer 4+4, 0+3, 6–5 in this context. The most difficult problem for students posed here is: ? – 60 = 20. Find ?

For the lesson on page 186, students write a rule, and then use their calculators to check their answers. For example adding 2 to a number is one rule to be discovered from single digit data. In the reteaching page that accompanies Lesson 85 the instructions say "Review slowly how to use a calculator to find input and output numbers."

In Lesson 113 students are introduced to rounding. One part of the lesson explains how to round numbers to the nearest 10. It includes the following: "Is 35 closer to 30 or 40? Talk about it." No reference is given in the teacher's guide on how to explain or clarify. The students are then asked to round for addition estimates, and then compute the exact answers with calculators.

Lesson 117 is the first introduction to multiplication and it uses calculators to check students' answers to repeated addition.

The Teacher's Edition for Lesson 151 begins with, "Have students use calculators to complete page 341 on their own." The first problem is to compute 10 + 10 + 10 + 10 + 10. The second problem is to use their calculators to compute 20 + 20 + 20 + 20 + 20. The third problem is to find 300 + 200. Students are not expected to add three digit numbers without assistance from calculators.

Other Lessons incorporating calculator use include: Lessons 122, 125, 127, and 136.

Sadlier

In grade 2, four calculator lessons appear. In each case they follow lessons where calculations are done by hand. The publishers of Sadlier have indicated that references to calculators will be removed in the next edition.

Saxon

Calculators are not used at all in the Saxon Math 2 program.

Grade 2 California Standards Comparisons

NS 1.1 Count, read, write whole numbers to 1,000 and identify the place value for each digit

This standard is thoroughly covered in Saxon. In Sadlier and SRA numbers greater than 1000 were included. These two programs exceed this standard.

NS 1.3 Order and compare whole numbers up to 1,000 using the symbols <, =, >

Saxon

Ordering with the symbols <, =, > is done only for two digit numbers. However, the ordering is well integrated with calculation. For example after Lesson 120, students are asked to supply one of the symbols <, =, > in the blanks for:

6+3 ___ 2 x 5 16 - 7____ 10 27 + 23 ___ 5 x10

In addition students are asked to find whole numbers between two given whole numbers when three digits are involved, and to order a sequence of numbers from least to greatest or greatest to least. For example, the worksheet for Lesson 104, asks students to order the numbers 452, 573, 425, 537 from least to greatest. Although this standard is not technically fully addressed due to the absence of the appearance of three digit numbers with the symbols <, =, >, students in this curriculum will be adequately exposed to this standard.

Sadlier

This standard is directly and completely addressed. This grade 2 curriculum good use of number lines to assist students in visualizing the ordering of whole numbers.

SRA

This standard is completely addressed and exceeded by the grade 2 SRA curriculum. Arithmetic combinations of whole numbers up to three digits are combined with the ordering symbols <, =, > in insightful ways. However, the program over reaches in Lesson 101. Here students engage in a discovery learning project whose apparent goal is to introduce a result from geometry that says the sum of the lengths of any two sides of a triangle is greater than the length of the remaining side. There is no clear direction for this project either for teachers or for students, and the latter are likely to be confused as to the purpose of the project.

> *NS 2.1 Understand and use the inverse relationship between addition and subtraction (e.g., an opposite number sentence for 8 + 6 = 14 is 14 – 6 = 8) to solve problems and check solutions.*

Sadlier satisfies this standard completely.

Saxon satisfies this standard completely.

SRA does not explicitly satisfy NS 2.1. Fact families are never given explicitly. However, in Lesson 21 students are introduced implicitly to this important relationship between addition and subtraction. Students are required to find missing numbers in paired sentences like __ + 7 = 8 and 8 – 7 = __. We were unable to find examples of checking addition or subtraction by using the other operation.

> *NS 2.2 Find the sum or difference of two whole numbers up to three digits long*

Sadlier satisfies this standard completely with systematic and careful attention to understanding of place value. Clear and revealing Illustrations help to explain the role of regrouping in the addition and subtraction algorithms.

Saxon covers regrouping for addition and subtraction only for whole numbers two digits long, but with sums possibly exceeding 100. The concept of place value is very clearly developed with repeated reference to pennies and dimes and a gradual movement to abstraction. In addition, sums of three whole numbers each two digits long with possible sums exceeding 100 is developed with student practice.

In SRA, some of the topics leading to the introduction of place value appear to be poorly ordered. For example on page 84, students are asked to convert between meters and centimeters, but place value beyond the tens column has not even been introduced at this point in the text. On page 80, students are expected to calculate 13 – 7 and then compute 130 – 70. Here again place value has not been sufficiently developed for students to have a conceptual understanding of what it is they are computing. Place value using pictures of sticks is nicely presented in Lessons 36 and 48, but some of the following lessons would benefit from clearer presentation. For example in Lesson 49 on page 105, an additional picture in which all of the bundles of ten sticks fall inside one circle would clarify the addition concept being presented. The use of dimes and pennies to explain addition is helpful and appropriate, but the sudden appearance of a nickel with the dimes and pennies on page 107 obscures the main concept of place value. However, many of the subsequent lessons on regrouping and place value are well done. Students are asked to add three whole numbers, with two digits each.

NS 3.1 Use repeated addition, arrays, and counting by multiples to do multiplication.

Sadlier develops this standard clearly and carefully. Using pictures of arrays, the text even establishes the commutative property of multiplication. The treatment of this standard is excellent.

Saxon satisfies this standard. The development is gradual and systematic. While arrays are used extensively, the commutative property is not yet introduced.

SRA introduces multiplication as repeated addition using pictures, but the pictures do not illuminate the concepts as clearly as those in Sadlier. The commutative property is suggested by two examples on page 267, but it appears that 6 x 3 = 3 x 6 only by coincidence. Another opportunity to establish the commutative property by rotating an array 90 degrees is missed on the bottom of page 267. An array of houses in 4 rows with 5 houses in each row is pictured next to a 5 by 4 array of balls. Students calculate 4 x 5 and 5 x 4 with these arrays, but the commutative property would have been nicely established if the objects in the two arrays were the same. The text jumps to the topic of area on page 269, asking students to estimate the area of the silhouette of a foot as the very first example. This is a poor choice and area is not even defined explicitly for rectangles with whole number sides. On the next page area is combined with the just introduced concept of multiplication. Students count the squares in a 10 by 10 array, a 3 by 5 array, and a 3 by 14 array. We suggest that 3 x 14 is premature at this stage. Additional exercises of reasonable quality appear in the following pages.

NS 3.2 Use repeated subtraction, equal sharing and forming equal groups with remainders to do division.

Sadlier marginally satisfies this standard in the grade 2 book. Division is introduced through forming equal groups and equal sharing, and primarily as the inverse operation to multiplication. Division with remainders is presented but not initially via repeated subtraction, at least not explicitly. Division by repeated subtraction only appears in the form of two examples (9 divided by 3 and 12 divided by 3), and both are done with the aid of a calculator, which is completely inappropriate and pointless.

In Saxon, division is introduced only through equal sharing with groups of two including a possible remainder of 1. Division by other divisors does not appear.

In SRA, division is introduced with a calendar on page 287. Students are asked to find the number of weeks in a given number of days. Division is formally introduced on the next page, but never explicitly explained. The following page returns to area, and addition lessons related to multiplication follow. Division as repeated subtraction, and division through equal groups are not developed.

NS 3.3 Know the multiplication tables of 2s, 5s and 10s (to "times 10") and commit to memory.

Sadlier carefully develops the multiplication tables for the factors 0, 1, 2, 3, 4, and 5 with the second factor ranging from 0 to 9. Extensive practice is provided. Multiplication by 10 is only lightly treated. Moreover, a misguided exercise set on page 397 calls upon students to find multiples of 10 using a calculator. The same exercise also inappropriately calls upon students to divide by 5 using a calculator.

Saxon covers multiplication tables for 0, 1, 2, 3, 4, 5, and 10. This standard is completely satisfied.

SRA provides exercises for multiplication, but we did not think that the multiplication tables for 2, 5, and 10 were sufficiently practiced to meet this standard.

NS 4.1 Recognize, name, and compare unit fractions from 1/12 to 1/2.

Sadlier has lessons and exercises well designed for students to recognize and name fractions from 1/10 to 1/2. There are some exercises calling for comparison of fractions as well. In two exercises, students are asked to estimate fractions from colored portions of geometric objects and then to color portions of other geometric objects which are approximately equal to a specified fraction. These exercises lend themselves to potential confusion as to the exact nature of what a fraction is.

Saxon has lessons and exercises well designed for students to recognize and name fractions from 1/8 to 1/2. We did not find lessons that called for comparisons of unit fractions. Saxon does, however, have excellent lessons on mixed numbers with guided student practice.

SRA has exercises designed for students to recognize and name fractions from 1/6 to 1/2, but does not call upon students to compare them. The introduction to fractions in Lesson 73 has deficiencies. A rectangle partitioned into 4 subrectangles with three of them colored is described as: "Three quarters of this rectangle are shaded." That is the full extent of the description of what a fraction is. Then students are asked to color various portions of a circle: 1/2, 1/4, 2/4, and 3/4. Unlike the Sadlier text, SRA does not explain that 3/4 for example indicates 3 parts out of 4 *equal* parts. The use of the term "quarter" instead of "fourth" weakens the lesson. However, in a previous lesson on telling time on a clock the term "quarter" was used and this allows students to draw upon that concept. Overall the introduction to fractions is weak.

NS 4.2 Recognize fractions of a whole and parts of a group (e.g., 1/4th of a pie, 2/3rds of 15 balls).

Sadlier satisfies this standard.

Saxon covers fractions of a whole broadly, but "parts of a group" is only discussed in terms 1/2 of a group, including the possibility of a remainder.

SRA satisfies this standard. However, Lesson 78 has a poorly designed exercise set that is likely to cause difficulties. A picture of 6 groups of bundled sticks appears at the top of the page. In the context of this text, we may assume that each bundle contains 10 sticks. The first question is: "1/4 of 60 = ___". Another question is: "1/2 of 100 = ___". It would be more appropriate at this early stage of fraction development to have problems such as: 1/2 of 60 = ___ or 1/3 of 60 = ____.

> *NS 4.3 Know that when all fractional parts are included, such as four-fourths, the result is equal to the whole and to one.*

Sadlier does not explicitly satisfy this standard, however, some exercises seem to require this understanding implicitly. For example, in one exercise on page 276, problem 10 says, "Joel and Pablo drew a set of 10 circles. Joel colored 2 blue and Pablo colored 7 red. What part of the set is left to color?"

Saxon satisfies this standard.

SRA satisfies this standard.

> *5.1 Solve problems using combinations of coins and bills.*
>
> *5.2 Know and use the decimal notation and the dollar and cents symbols for money.*

Sadlier does an excellent job with both of these standards. The decimal notation for money is nicely linked to place value for whole numbers (number of pennies) and the addition algorithm, including word problems.

Saxon narrowly satisfies NS 5.1. The money amounts the program considers are usually less than $1.00, though sums of money amounts sometimes exceed $1.00 and students make these calculations. NS 5.2 is satisfied.

SRA introduces money through whole dollar amounts and supports place value with combinations of hundred dollar bills, ten dollar bills, and one dollar bills. The text also develops problems using cents only and includes addition and subtraction problems for them. Eventually, the "dollars problems" and the "cents problems" are merged by converting all money amounts to cents without any decimal. For example on page 334, a word problem requires the addition of $6.50 and 75c. Students are then guided to calculate 650c + 75c. The answer given in the teachers manual is 725c, and the answer is not expressed in the more standard notation $7.25. The conversion between notations is briefly treated on page 333, but NS 5.2 is only marginally met. The development of these standards is awkward.

AF 1.1 Use the commutative and associative rules to simplify mental calculations and to check results.

Sadlier satisfies this standard thoroughly. In addition to mental calculations simplified through rearrangements, students are asked to use the commutative property to check sums of two digit numbers by using the addition algorithm with the numbers reversed.

Saxon satisfies this standard. The ideas are well presented in Lesson 64 and sharpened in subsequent exercises.

SRA satisfies this standard only in Lesson 133 which is two pages of exercises for students. They are asked to calculate sums such as, 1 + 3 + 7 + 9. Students are directed to "Solve these problems. Use shortcuts if you can," but demonstrations are not given and no principles are articulated such as "numbers may be added in any order."

MG 1.3 measure the length of an object to the nearest inch and/or centimeter.

All three programs satisfy this standard.

MG 2.1 Describe and classify plane and solid geometric shapes (e.g., circle, triangle, square, rectangle, sphere, pyramid, cube, rectangular prism) according to the number and shape of faces, edges and vertices.

Sadlier devotes several lessons to this standard and identifies properties of geometric objects in terms of attributes. However, confusion may be introduced through a few poorly designed lessons. For example, on page 260, students are given a collection of squares, rectangles, circles, and triangles. They are instructed as follows:

"Color inside each figure that has the same shape [a picture of a yellow crayon is given]."
"Color inside those that have the same size [a picture of a blue crayon is given]."

Evidently, the intention is to color pairs of similar figures yellow and pairs of congruent objects blue. Of course, the latter must be colored both blue and yellow. This lesson is confusing. On page 259, students are taught a principle that is mathematically incorrect. The lesson considers polygons with vertices lying on a regular grid of dots, such as those determined by rubber bands on a geoboard. The lesson instructs students that two figures are congruent if the number of dots on the boundaries are the same and the number of dots within the figures are the same. This is false and a picture of a counter example appears on the same page. Sadlier's treatment of this standard is very mixed and would benefit from revisions and increased clarity of focus.

Saxon partially covers this standard. Much time is devoted to attributes like color, shape, and size which are irrelevant to this standard. However, attributes of rectangles such as 4 sides and four angles are discussed as well. Right angles are explained and shown in some plane figures. Models of solid figures are presented to children with names of the figures, but no attempt is made to classify them by attributes.

SRA does not satisfy this standard. Pictures of solid figures are given in Lesson 82 without any description of characterizing attributes. Pictures of non right prisms with hexagonal and triangular bases are given along with a right rectangular prism. Students are given no idea as to why they are all prisms. No picture of a cube is given and two different types of pyramids are given without explanation as to why they are both pyramids.

> *MG 2.2 Put shapes together and take them apart to form other shapes (e.g., two congruent right triangles can form a rectangle).*

Sadlier addresses this standard, but really misses the point. The idea of this standard is to introduce students to the important geometric idea of dissection. This is a prerequisite to understanding where the formulas for area and volume come from. See grade 5 MG 5.1.

Saxon satisfies this standard. For example, students are asked to cover a hexagon with 6 triangles. Rectangles are partitioned into two triangles, etc.

SRA directs students to discover how shapes may be put together or taken apart in useful ways in Lesson 79.

> *SDAP 1.0 Students collect, record, organize, display and interpret numerical data on bar graphs and other representations.*

> *SDAP 2.0 Students demonstrate an understanding of patterns and how they grow, and describe them in general ways.*

All three series satisfy these standards.

Detailed Grade 5 Comparisons

Calculator Usage

SRA

The use of calculators in the SRA grade 5 text is excessive and detrimental. We make specific comments on negative uses of calculators in the SRA program in the context of the California mathematics standards listed below in this report. The table below, however, summarizes more succinctly the use of calculators in the grade 5 SRA program.

Topic	number of uses of calculators
Decimals	38
Exponents	2
Fractions	13
Integers	2
Order of operations	3
Percents	4
skip counting	4
Whole numbers	32

In addition to these explicit uses of calculators, references are given in the teachers edition for software and a book for practice using a calculator for single digit arithmetic operations and calculator riddles.

Sadlier

We found approximately 20 instances of calculator use in the grade 5 Sadlier student book. For the most part, calculators were used for the same kinds of exercises studied in the accompanying lessons, but with larger numbers. An interesting use of the calculator occurred on page 305. After being given a unit conversion chart on the previous page, students are given the problem: "A leaky faucet drips 2 fl oz of water each hour. About how many gallons of water are lost from the faucet in a week? in a month? in a year? Share your results with a classmate." This is a reasonable use of the calculator in grade 5. Unfortunately, several inappropriate uses also appear in the Sadlier grade 5 text. For example, on page 385, the calculator is used to convert units within the metric system. For instance, students are asked to convert 1850 centimeters to millimeters using a calculator. In this case, and all other cases, this involves multiplying or dividing by powers of ten and consequently, just moving the decimal point. The use of calculators is completely inappropriate here. The use of calculators to find missing single digits in calculations using the standard addition or subtraction algorithm on page 335 is pointless and slightly destructive since it encourages calculator use when it is not needed. The use of fraction calculators on page 228 is cause for concern, as fraction arithmetic is an absolutely essential prerequisite for algebra and students may find they can dispatch with their fraction homework much rapidly with a calculator than without.

Saxon

Calculator use in the Saxon Math 76 is rare. In one instance, on page 355, calculators are used to convert fractions to decimals after instruction on the use of long division to achieve this. On page 581, calculators are appropriately used to compute compound interest.

Grade 5 California Standards Comparisons

> *NS 1.2 Interpret percents as part of a hundred; find decimal and percent equivalents for common fractions and explain why they represent the same value; and compute a given percent of a whole number.*

The California Math Framework addresses this standard on page 138 and advises:

"The fact that the fraction c/d is both 'c parts of a whole consisting of d equal parts' and 'the quotient of the number c divided by the number d' was first mentioned in the Number Sense Standards 1.5 and 1.6 of grade four. This fact must be carefully explained rather than decreed by fiat, as is the practice in most school textbooks...Once c/d is clearly understood to be the division of c by d, then the conversion of fractions to decimals can be explained logically."

Before comparing the treatment of NS 1.2 in the three series under examination here, we pause to elaborate on this statement in the Framework so as to have a point of reference for our evaluation.

By way of example, consider the fraction 3/4. This symbol may be intuitively understood to mean "three out of 4 equal parts" and can subsequently be identified as a point on the number line corresponding to the length of three segments, each of length 1/4, after the unit interval has been divided into four equal parts to illuminate the concept of 1/4.

Students are often told without explanation that 3/4 also means "3 divided by 4." What does this mean and how can it be explained? One way to understand this is with the help of a number line. The notion of "3 divided by 4" can be understood as the length of a segment which extends one fourth of the distance from the origin to the number 3 on the number line. Is the length of 3 segments, each 1/4 units long, the same as 1/4 of the distance to 3? Number line diagrams can be used to show these are the same. Alternatively, fraction addition or fraction multiplication may be used to check this. If 3/4 is one fourth the distance from 0 to 3, it should be the case that

$$\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} = 3$$

or that

$$4 \text{ x } \frac{3}{4} = 3.$$

Both equations can be verified directly. This approach provides an intuitive understanding in terms of lengths on a number line of the equivalence of 3/4 and "3 divided by 4." But what about the connection between fractions and decimals? If 3/4 really is "3 divided by 4" then shouldn't it follow that this fraction may be converted to a decimal by carrying out the long division process below:

$$\begin{array}{r} .75 \\ 4\overline{)3.00} \\ \underline{2\;8} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

The conclusion is that:

$$\frac{3}{4} = 0.75$$

Why does the long division algorithm correctly convert 3/4, or any fraction, to a decimal? Why is it always the case that dividing the numerator of a fraction by its denominator, using the long division algorithm, results in the correct decimal representation of the fraction?

We outline an explanation for this. The fraction 3/4 will be expressed as a decimal if we can find a whole number k that will make this expression true:

$$\frac{k}{100} = \frac{3}{4}$$

Here we sidestep the question of why the denominator of 100 will necessarily work, and suggest that a denominator of 10 can be excluded quickly by trial and error and that it is natural to try 100 next. Multiplying both sides of the above equation by 100 gives,

$$k = \frac{300}{4}$$

This fraction may be reduced to an integer by dividing numerator and denominator by 4,

$$k = \frac{300 \div 4}{4 \div 4}$$

or

$$k = 300 \div 4$$

This tells us that k is the solution to the long division problem $4\overline{)300}$, and accounting for the meaning of a decimal point, we are led to $4\overline{)3.00}$. The arguments given for this example are general and essentially explain why a fraction may be understood as its numerator divided by its denominator, and why long division correctly converts fractions to decimals.

We now turn to a comparison of not only this aspect of NS 1.2, but the other parts which involve percentages and decimals, for the three series.

Sadlier

On page 422, of the grade 5 book, students are introduced to the idea of percent via 10 by 10 grids of squares with some of them shaded in with various colors. The explanation given here is effective. On the next page, students are given the rule for converting from decimals to percents: move the decimal point two places. The treatment here would be strengthened by including a direct reference to fractions with denominators equal to 100. The connection to fractions is implied via pictures of the ten by ten grids of squares, but it should be made more explicit. On page 425 the connection is made more explicit in the context of money amounts. For example, the page includes statements like:

1 nickel = $0.05 = 5/100 of a dollar

These are identified by an arrow as 5%. The treatment in the grade 5 book would perhaps improve by interchanging pages 425 and 424 so as to make the connection between decimals and percents more clear. In the following pages, students are shown how to calculate a given percent of a given number and some word problems and applications are given. Converting from fractions to decimals is briefly treated on page 377 as part of a "Math Probe," following the Chapter 11 Review and Practice. The treatment explains how to convert from fractions to decimals by both the long division process and by multiplying both numerator and denominator of a fraction by an appropriate factor so that the resulting denominator is a power of 10. The lesson appears to be incidental due to its location after the chapter review, so that teachers might not include it. Moreover, no attempt to explain the issues we described above is given. Conversion from fractions to decimals is again addressed in the grade 6 book, but again without explanation for why dividing the numerator by the denominator of a fraction converts it to a decimal.

SRA

The treatment in the grade 5 book for this standard is weak and is compromised by the excessive use of calculators. This has the tendency to reduce the topic to a rote sequential button pressing exercise devoid of mathematical reasoning. The coverage of NS 1.2 begins in lesson 60 with a calculator exercise. Students divide whole numbers by other whole numbers on their calculators. On page 213, some connection is made to fractions and the long division algorithm, but the connection seems to be based on nothing more than coincidence. There is a lesson on page 214 to place fractions on a number line by converting them to decimals using a calculator. Some review is given on page 240 and again on page 262 and 264, 270, and lesson 103.

On page 468, Lesson 132, under "Decimal Equivalents of Fractions" students are taught how to convert fractions to decimals and add them using a calculator. The page begins:

"You have used calculators to do problems with whole numbers and decimals. In this lesson you'll learn to use the calculator for fraction problems."

"Can you solve this problem on your calculator?

1/4 + 2/3 = ?"

"Most calculators cannot display fractions. If you want to solve a problem like this with the calculator, you must change the fractions to decimal approximations or equivalents."

The text goes on to explain which buttons to press to convert 1/4 and 2/3 to decimals on a calculator.

1/4 becomes 0.25
2/3 becomes 0.666666

0.25 + 0.666666 = 0.9166666

Other examples involving fractions with nonterminating decimals are given.

On the next page, students are asked to complete a chart for the first three decimals for fractions with numerators and denominators ranging from 1 to 10. Students are encouraged to memorize the chart, once they have completed it, so that when they are using the calculator, "you can save time if you know the decimal equivalent or approximation." Students are told to keep the chart and use it to solve problems in this unit and "when you play the 'Up to 2' game (page 473)."

In Lesson 33, students use calculators to convert mixed numbers to decimals and then add them. In Lesson 140 on page 492, students are taught to convert from decimals to percentages by moving the decimal point. The explanation involves fractions and is adequate for the purpose. On the following page, students are given an explanation for finding a given percent of a given number and some exercises. In the following lesson, Lesson 141, students are taught to use the percent key on their calculators to convert from decimals to percents. They are told which keys on a calculator to press in order to increase a number by a given percent. In Lesson 143, students are shown how their calculators may be used to reduce a given price by a given percentage. For example, they press buttons corresponding to "8.75 - 20% =" While such a procedure works on a calculator the sequence of buttons may be misleading, since the product .20 x 8.75 does not appear in this sequence. However, a better treatment of mental estimation involving percentages is also given on pages 502 and 503. Lesson 148 begins with a good explanation of why 1/3 is 33 and 1/3%. It involves using the long division algorithm to divide 100 by 3 with an careful explanation that the remainder of 1 must again be divided into thirds. However, the second example of converting 4/9 to a percentage using the long division procedure is mechanical and poorly explained. In subsequent pages an explanation for mixed numbers to percents is given.

A slightly stronger treatment of converting fractions to decimals using the division algorithm is given in the grade 6 book, but if falls far short of a coherent explanation.

Saxon

This Standard is already well developed in the text for the preceding year, Math 65. In that book, percentages are introduced to students using two models: portions of a dollar, and manipulatives which are wedges of a disk labeled by appropriate fractions and corresponding percentages. The use of a dollar to represent 100 allows students to identify monetary amounts with percentages directly and this approach is particularly well done in the Math 65 text. The fraction manipulatives are used in both the Math 65 and Math 76 text. The percent labels on them are used initially to build students' intuition for percents. The justifications for the conversions from the fractions to the corresponding percents are provided later. For example, on page 178 of the Math 65 text, there is a good explanation for why 1/3 is 33 and 1/3%. It involves using the long division algorithm to divide 100 by 3 with an careful explanation that the remainder of 1 must be again be divided into thirds. Students are given exercises which give further practice using other fractions. The same example is repeated in slightly abbreviated form in the Math 76 text on page 124. Converting percents to decimals is particularly well done. An example of the treatment appears in Lesson 33 on page 164. Percents are converted to fractions with denominator equal to 100, and then systematically and carefully reduced. Decimal place value is explained in Section 34 on page 168 and further explanation on converting from decimals to fractions is given in the following lesson on page 172. The procedure for converting from fractions to decimals using long division is explained in Section 73 beginning on page 354. Practice problems follow. In one of the few instances of calculator use in the Saxon series, students are allowed to use calculators to convert a few fractions and mixed numbers to decimals on page 355. In Lesson 93 on page 448, the conversion of fractions to percents is discussed again, this time by multiplying the fraction by 100%. Several examples and practice problems are given. The Math 76 text comes close to an explanation for why a fraction may be understood as the quotient of two integers, but still falls short of the explanation given by us above. Excellent practice converting between fractions, decimals, and percents is given in Lesson 98 on page 468, and further extensive practice is available from an appendix on page 708. Students receive extensive exposure to decimals, fractions, and percents in isolation and in combination throughout the Math 76 textbook.

Summary for NS 1.2 in all three series:

Saxon's treatment of this standard is much better and more extensive than that of the other two series. Sadlier's treatment is better than that of SRA's which relies heavily on rote calculator exercises.

> *NS 1.4 Determine the prime factors of all numbers through 50 and write numbers as the product of their prime factors by using exponents to show multiples of a factor (e.g., $24 = 2 \times 2 \times 2 \times 3 = 2^3 \times 3$)*

Sadlier

Sadlier meets this standard, except that exponential notation is not used until the grade 6 book. The concepts of prime and composite numbers are presented well in Chapter 4 and students use factor trees to factor numbers up to 144. A technology section on page 154 clouds the issues somewhat through the use of the squaring key on a calculator. The standard is completely met in the grade 6 text.

SRA

This standard is not met. The end Lesson 21 which is devoted to "customary measurement" includes a description of prime numbers as numbers that "have exactly two factors" and a description of composite numbers. The concepts of prime and composite numbers were briefly introduced in the Grade 4 book for this series and students are asked to find all factors of the whole numbers 1, 2, 3, 4, 5, and 6 on page 407. Some enrichment and additional practice exercises are available which ask students to list all factors of some larger numbers without distinguishing prime factors. While the definitions of prime and composite numbers given in the texts are correct, students may be unclear on the status of the number 1 which is neither prime nor composite. Nowhere in the grade 4 or 5 texts are students required to factor whole numbers as a product of prime numbers. Exponential notation is introduced in Lesson 149 on page 522 of the grade 5 book, but we were unable to find any use of exponents to factor numbers. Calculators are heavily utilized in the presentation of exponents.

Saxon

This standard is fully satisfied. Prime numbers are defined in Lesson 90 on page 340 of the Math 65 text. In a practice lesson in this section, students find all prime numbers less than 50. Prime numbers are again defined in the Math 76 text in lesson 61 on page 294. Students use a sieve to find all primes less than 50 by systematically eliminating multiples of primes found up to each stage of the process. Lesson 64 on page 308 provides two systematic methods to factor composite numbers as products of primes: sequential division and factor trees. In lesson 66, on page 318, prime factorization is used to reduce fractions. In Lesson 72, students learn exponent notation and use it to factor composites as products of primes. Exercises are provided later, including one that asks students to factor 700 as a product of primes using exponent notation (page 405).

NS 1.5 Identify and represent on a number line decimals, fractions, mixed numbers and positive and negative integers.

Saxon's treatment of this standard is by far the best of the three. The number line is systematically introduced in the Math 65 text starting on page 45. The treatment begins with the construction of a number line, with careful attention to the use of line segments of equal lengths for the location of tick marks. The development in this text is excellent. Worth noting is the use of the number line to motivate rounding of whole numbers. This appears on page 126 of the Math 65 text. Fractions on the number line are introduced on page 153 of the Math 65 text. The treatment includes a careful subdivision of the unit interval into line segments of equal lengths, according to the denominator of the fraction. Decimal locations are also well handled in the text. Negative integer locations on the number line are presented on page 519. A systematic continuation of the development of the number line continues in the Math 76 text, beginning with integers. Use of the number line exceeds this standard. It is used to give a more careful explanation of addition and subtraction of integers on page 614 of the Math 76 book.

Sadlier completely satisfies the standard in its grade 5 text. The treatment of number lines in the grade 4 text is well developed for positive decimals, fractions, mixed numbers and integers. Worth noting is the use of the number line to motivate rounding. This appears on pages 54 for rounding whole numbers and 422 for rounding decimals. Negative integers are introduced at the end of the grade 4 text using temperature scales and distance below sea level. The grade 5 text continues the development of the number line and treats the location of negative integers more systematically. The number line is again used for rounding of positive whole numbers on page 42, but it is peculiar that the xy-plane including the use of negative coordinates appears on page 452 before the number line for negative integers is developed on page 454 in the lesson immediately following that. Perhaps this ordering is intended to be motivational, but it does introduce a more complicated context for negative numbers prior to a simpler one. Integer addition is developed with the help of the number line on pages 458 and 460. This goes beyond the standard under consideration here.

SRA satisfies the standard but requires the use of "Enrichment" and "Reteaching" materials to accomplish this. In addition, the concept of negative numbers is introduced via calculators inappropriately. Negative integers and some relationship to number lines is treated as early as grade 3 in this series, but the treatment is poor and relies on mindless calculator manipulations with little explanation throughout the series. The treatment is confused. For example, on page 67 of the grade 4 text, subtracting a positive number is associated with the negative of that number in a completely incoherent way.

> *NS 2.1 Add, subtract, multiply and divide with decimals; add with negative integers; subtract positive integers from negative integers; and verify the reasonableness of the results*

> *NS 2.2 Demonstrate proficiency with division, including division with positive decimals and long division with multiple digit divisors*

Before comparing the treatments of these standards of the texts under consideration, we comment on the part of NS 2.1 that deals with adding and subtracting integers. A full explanation relies on the relationship between addition and subtraction. In particular, $a - b = c$ means $a = c + b$. Subtraction can be defined in this fashion, as the inverse operation to addition.

For example, let $a = -4$ and $b = 7$ in the equations $a - b = c$ and $a = c + b$. Then

$-4 - 7 = -11$ because $-4 = -11 + 7$. More explicitly, $-4 - 7 = [-4 + (-7)]$ because $-4 = [-4 + (-7)] + 7$. In the last equation, $[-4 + (-7)]$ plays the role of "c" in $a = c + b$. From this observation we see that $a - b = a + (-b)$. This is essentially why subtraction is the same as adding the opposite of a number.

Sadlier

The Sadlier-Oxford program has good coverage of addition, subtraction, and multiplication of decimals. Explicit procedures are explained and some explanation involving place value is also given. Division is also covered up to two digit divisors, but the divisors are always whole numbers. Addition with negative integers is explained using a number line on pages 458 through 460. The use of color schemes for arrows along a number line beginning on page 458 could be coordinated with the color of "counter chips" with advantage to the students. The text appropriately employs "counter chips" with two different colors to illuminate addition and subtraction of integers. However, subtraction of negative integers is not developed very thoroughly. Sadlier's text meets these standards.

SRA

Exploration and Applications introduces addition and subtraction of decimals using money amounts in an effective fashion. All four arithmetic operations for decimals are well covered in the text. The explanation for converting division problems involving decimals to long division problems with integer divisors, by moving the decimal point to the left an appropriate number of place holders, is particularly well developed. Use of calculators is frequent and not always appropriate. The treatment of negative integer addition and subtraction is poor, relying on calculators for justifications. See the section on NS 1.5. The SRA text marginally meets these standards overall, though it exceeds portions of them.

Saxon

The Math 65 text introduces addition and subtraction of decimals using money amounts in an effective fashion. There is a nice explanation of the placement of the decimal point in multiplying decimal numbers on pages 450 to 454 in the Math 65 text. On page 509 of the Math 65 text a good explanation is given for converting division problems involving decimals to long division problems with integer divisors, by moving the decimal point to the left an appropriate number of place holders. The Math 76 text continues and reviews the arithmetic operations for decimals. Students are given frequent and excellent practice. The equivalence between subtracting a number and adding its opposite is informally but effectively developed on page 614. This treatment helps to lay the foundation for later study of algebra. The Saxon series exceeds these standards.

> *NS 2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in simplest form.*

All three series satisfy NS 2.3 through the use of sample problems and exercises. Saxon provides only a few practice word problems involving addition or subtraction of fractions and mixed numbers, and there is little variation of type. Sadlier and SRA meet this standard completely.

NS 2.4 Understand the concept of multiplication and division of fractions.

NS 2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.

Sadlier

The Sadlier-Oxford text introduces multiplication of proper fractions via an area model on page 198 of the grade 5 text. The development is careful and well done. Systematic practice is given in the exercises, and the method is extended to improper fractions and whole number factors. On page 204, the method for canceling common factors in the numerator of one fraction and the denominator of the other fraction is explained in a purely mechanical fashion. No explanation is given for why this cancellation results in a correct answer in terms the earlier material on equivalent fractions or by multiplying by a fraction equivalent to 1. For example, using cancellation, we can compute:

$$\frac{2}{3} \times \frac{1}{2} = \frac{\cancel{2}}{3} \times \frac{1}{\cancel{2}} = \frac{1}{3}$$

But the cancellation should be explained and justified. One explanation proceeds as:

$$\frac{2}{3} \times \frac{1}{2} = \frac{2 \times 1}{3 \times 2} = \frac{2}{6} = \frac{2 \div 2}{6 \div 2} = \frac{1}{3}$$

The point of cancellation is to avoid multiplying and dividing the numerator and denominator by the same factor of 2. Cancellation is a shortcut. A more direct explanation which relies on the concept of fraction multiplication and the commutative property, already developed in the Sadlier text at this point, proceeds as:

$$\frac{2}{3} \times \frac{1}{2} = \frac{2 \times 1}{3 \times 2} = \frac{1 \times 2}{3 \times 2} = \frac{1}{3} \times \frac{2}{2} = \frac{1}{3} \times 1 = \frac{1}{3}$$

In this calculation, the 2's cancel because $\frac{2}{2}$ is equivalent to 1. Explanations like these connect computational methods to mathematical reasoning called for by the California

Mathematics Framework. Division of fractions is introduced on page 212 using instructive, conceptual diagrams with practice problems for students. This is followed by a section on reciprocals of fractions properly explained with practice sets. The next section beginning on page 216 explains the procedure for dividing whole numbers by fractions again with useful pictures and practice problems. In this section students are told that dividing by a fraction is achieved by multiplying the dividend by the reciprocal of the divisor. The method is explained well and practice given, but here again, an opportunity to provide insight for the students is missed. The mathematical reason for multiplying by the reciprocal is not given. This can be explained using the example on page 216 like this:

$$4 \div \frac{2}{3} = ?$$

Our goal is to find the number designated by the question mark. Because division is the inverse operation for multiplication, the answer must satisfy

$$? \times \frac{2}{3} = 4$$

By the 4th grade California Algebra and Functions Standard 2.2, "equals multiplied by equals are equal," so we can multiply both sides by the reciprocal of $\frac{2}{3}$.

$$? \times \frac{2}{3} \times \frac{3}{2} = 4 \times \frac{3}{2}$$

Since $\frac{2}{3} \times \frac{3}{2} = 1$, this gives

$$? = 4 \times \frac{3}{2}$$

In other words, $4 \div \frac{2}{3} = 4 \times \frac{3}{2}$. This method works for all examples and it justifies the "invert and multiply" rule. The relationship between multiplication and division cannot be avoided in the justification of this rule. The Sadlier-Oxford text continues with a systematic development of fraction division and many opportunities for practice. Well written word problems for fraction multiplication and division appear on page 232 and 233. The Sadlier-Oxford text satisfies standards NS 2.4 and 2.5, but is weak in the necessary mathematical reasoning for this topic.

SRA

The treatment of multiplication of fractions in the 5th grade SRA text is poor. Division of fractions is completely missing. It is covered in the 6th grade text, though poorly.

There is an attempt to explain multiplication of fractions on page 480 of the 5th grade text using essentially an area model. While the explanation reveals why the denominators of two multiplied fractions must themselves be multiplied to give the denominator of the product, there is no coherent explanation for why the numerators must also be multiplied to give the numerator of the resulting product of the fractions.

The treatment of division of fractions in the 6th grade includes presenting the notion of reciprocals of fractions. There are some features here which are well done. Students get practice in multiplying a number by a rational number and then that product is multiplied by the reciprocal of the rational number. This shows that multiplying by a rational number and multiplying by its reciprocal are inverse operations. However, the explanation of division by fractions is botched. On page 304 of the grade 6 text, one finds, "Multiplying by the reciprocal of a number does the opposite of multiplying by the number." Following this prescription, what do we infer between 5x3 = 15 and 5 x 1/3 = 5/3, for example? The explanation given on page 304 for the rule for dividing by a fraction is confusing and not well supported. The approach given here is not beyond repair, but the explanations need to be much more carefully made. The comments in the preceding paragraph on Sadlier's treatment of this topic apply here as well.

Saxon

Multiplication of fractions is explained in the Math 65 text using fraction manipulatives. Pictures in the text, beginning on page 324 help to motivate the procedure for multiplying fractions. This approach is perhaps not as effective as the area model used by Sadlier's text, however, it leads in a natural way to an intuitive understanding of division by fractions, at least for simple examples. On page 401 of the Math 65 text, the notion of reciprocals is introduced in a clear, coherent fashion. In the following section fraction division is explained using the ideas of reciprocals as follows. On page 404, the fraction division example of 1/2 divided by 2/3 is given. This is at first interpreted to mean, "How many 2/3's are in 1/2?" The text immediately acknowledges that the answer is less than 1, so the question needs to be changed to "How much of 2/3 is in 1/2?" This question is supported by a helpful picture. The text then reminds the students of reciprocals and reduces the problem to a simpler one. The question posed is, "how many 2/3's are in 1?" The question is answered and identified as the reciprocal, 3/2. The text returns to the original question of 1/2 divided by 2/3. It then argues that the answer should be 1/2 times the answer to 1 divided by 2/3. The development proceeds along similar well supported arguments from this point. Although this treatment of fraction division is clearer than what one finds in most texts, it would be improved with further elaboration on the problem 1 divided by 2/3. Here, the inverse relationship between multiplication and division could be invoked with great advantage. 1 divided by 2/3 = 3/2 because 3/2 x 2/3 =1. The treatment in the Math 76 text is similar. The relevant pages in the Math 76 text are 142, 148, 242, 260, 345. Canceling common factors before multiplying fractions is treated on page 333, and is well done. Word problems for multiplying and dividing fractions abound in both the Math 65 and Math 76 texts.

> *AF 1.2 Use a letter to represent an unknown number; write and evaluate simple algebraic expressions in one variable by substitution.*

AF 1.4 Identify and graph ordered pairs in the four quadrants of the coordinate plane.

AF 1.5 solve problems involving linear functions with integer values; write the equation; and graph the resulting ordered pairs of integers on a grid.

All three standards are met and exceeded by Sadlier.

Saxon develops AF 1.2 and 1.4 thoroughly and effectively, but does not cover AF 1.5.

SRA develops AF 1.2 awkwardly. Students are called upon to solve for an unknown variable, but we were unable to find exercises which involved only the preliminary skill of substituting numbers for variables. SRA thoroughly covers AF 1.4 and partially covers AF 1.5. Integer coordinates from linear functions are plotted, but students never actually write an equation. Instead the authors develop their own notation involving arrows to designate linear functions. Use of technology is excessive here. For example, to calculate coordinates for the function, $y = x - 5$, students are told to "use a computer or other means to draw [a graphing chart] and calculate these charts."

MG 1.1 Derive and use the formula for the area of a triangle and of a parallelogram by comparing it with the formula for the area of a rectangle (i.e., two of the same triangles make a parallelogram with twice the area; a parallelogram is compared with a rectangle of the same area by pasting and cutting a right triangle on the parallelogram).

MG 1.2 Construct a cube and rectangular box from two-dimensional patterns and use these patterns to compute the surface area for these objects.

MG 1.3 Understand the concept of volume and use the appropriate units in common measuring systems (i.e., cubic centimeter [cm^3], cubic meter [m^3], cubic inch [in^3], cubic yard [yd^3]) to compute the volume of rectangular solids.

Sadlier satisfies all three of these standards. SRA satisfies MG 1.1, but we were unable to find material related to MG 1.2. SRA addresses MG 1.3, but does not take advantage of earlier presentations of area in grade 4 to recognize that the volume of a right prism is the area of the base times the height. We note that the grade 4 text states misleadingly on page 516, "1 cubic centimeter is about the same volume as 1 milliliter." In fact, they are exactly the same. Saxon's Math 76 thoroughly covers MG 1.1. The concept of surface area is well presented on pages 672 and 673, but not through the use of two dimensional patterns as called for in MG 1.2. We consider this deviation to be of minor importance. The Math 76 thoroughly covers MG 1.3 and goes beyond in its discussion of volume of a cylinder.

MG 2.1 Measure, identify and draw angles, perpendicular and parallel lines, rectangles and triangles by using appropriate tools (e.g., straight edge, ruler, compass, protractor, drawing software).

MG 2.2 Know that the sum of the angles of any triangle is 180^o and the sum of the angles of any quadrilateral is 360^o and use this information to solve problems.

Sadlier satisfies both of these standards. SRA satisfies both of these standards. Saxon' s Math 76 text satisfies both standards except that we were unable to find a statement or exercise for the sum of the angles in a quadrilateral. However, the use of compass and straightedge are included for classical constructions for bisecting angles and line segments.

SDAP 1.4 Identify ordered pairs of data from a graph and interpret the meaning of the data in terms of the situation depicted by the graph

SDAP 1.5 Know how to write ordered pairs correctly; for example (x, y).

Sadlier, Saxon and SRA satisfy both of these standards.

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