SAXON PUBLISHERS

SECONDARY MATHEMATICS SERIES

Algebra 1/2, Third Edition
Algebra 1, Third Edition
Algebra 2, Second Edition
Advanced Mathematics, Second Edition
Calculus, Second Edition

· SCOPE & SEQUENCE ·

Scope and Sequence

SAXON SECONDARY MATHEMATICS

SAXON PUBLISHERS, INC.

Scope and Sequence: Saxon Secondary Mathematics

Printed in the United States of America.

Reaching us via the Internet

WWW: www.saxonpub.com

E-mail: info@saxonpub.com

Saxon Publishers, Inc.
2450 John Saxon Blvd.
Norman, OK 73071

TABLE OF CONTENTS

Algebra Series

Algebra $\frac{1}{2}$	*Algebra 1*	*Algebra 2*
Third Edition	**Third Edition**	**Third Edition**

ARITHMETIC

	Algebra $\frac{1}{2}$ Third Edition Lesson(s)	*Algebra 1* Third Edition Lesson(s)	*Algebra 2* Third Edition Lesson(s)
Whole Numbers			
Know place values through hundred trillions	1		
Read and write whole numbers in words and digits	1		
Write whole numbers in expanded notation	1		
Round whole numbers	2	100	
Order whole numbers on a number line	2		
Operations With Whole Numbers			
Add whole numbers	1, 3	4, 6	
Subtract whole numbers	3	4, 6	
Multiply whole numbers	4, 8, 87	4, 9	
Divide whole numbers	4, 8, 40	4, 10	
Fractions			
Understand fractions	14, 28		
Convert fractions to decimal numbers	15, 55		
Convert fractions to percents	55		
Add fractions	30	1	
Add mixed numbers	34	1	
Subtract fractions	30	1	
Subtract mixed numbers	35	1	
Multiply fractions	19, 22	4	
Multiply fractions by whole numbers	18		
Find fractional parts of numbers	18, 48, 57		
Multiply mixed numbers	43	1	
Solve mixed number problems	57		
Divide fractions	19	4	
Divide mixed numbers	43	4	
Reduce and expand fractions	14		
Decimal Numbers			
Understand decimal numbers			
Read decimal numbers through millionths	6		
Order decimal numbers on the number line	8	4	
Understand repeating decimal numbers	15		104
Round decimal numbers	6		
Round repeating decimal numbers	15	63	
Convert decimal numbers to fractions	15		104
Convert decimal numbers to percents	55		

ARITHMETIC

Decimal Numbers (continued)	***Algebra* $\frac{1}{2}$ Third Edition Lesson(s)**	***Algebra 1* Third Edition Lesson(s)**	***Algebra 2* Third Edition Lesson(s)**
Add and subtract decimal numbers	6	4	
Multiply and divide decimal numbers	7	4	
Estimate with decimal numbers	7		
Understand and use scientific notation			
For large and small numbers	50	74	21, 42
With addition of exponents	76	74	21, 42
In multiplication	76	80	21, 42
In division		80	21, 42
In approximating			42
On a scientific calculator			68
In ideal gas law problems			69
Roman Numerals			
Know Roman numerals through thousands	107		

GRAPHS

Graphs of Data	***Algebra* $\frac{1}{2}$ Third Edition Lesson(s)**	***Algebra 1* Third Edition Lesson(s)**	***Algebra 2* Third Edition Lesson(s)**
Interpret and construct bar graphs	29		
Interpret and construct broken-line graphs	29		
Interpret and construct pie graphs	29		
Graphs on the Coordinate Plane			
Define *axes, coordinates, quadrants,* and *origin*	38	50	
Recognize and plot ordered pairs	38	50	
Use the distance formula			88
Graph linear equations			
Equation of a line	85	75, 106	8, 12, 14
By substitution	85	51	8
To solve systems of equations		81	23
Finding slopes	Top. I	75	12, 14
Slope formula	Top. I	98	87
y-intercept		75	8, 12, 14, 49
Vertical and horizontal lines	103, 116	51	12
Parallel lines		81, 107	20
Perpendicular lines			31

GRAPHS

Graphs on the Coordinate Plane (continued)	***Algebra $\frac{1}{2}$*** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Graph linear equations (continued)			
Using slope-intercept form		75	8, 12, 14
Given two ordered pairs		106	14
Given slope		107	14
Given experimental data			59, 72
Consistent, inconsistent, and dependent		81	84
Graph circles, ellipses, hyperbolas, and parabolas	Top. H	110	85, 95, 100

NUMBER SETS

Sets	***Algebra $\frac{1}{2}$*** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Use set notation	1	5, 56	117
Distinguish between finite and infinite		56	
Understand set membership		5, 56	
Represent subsets of the real numbers symbolically		61	117
Find intersections and unions of sets			122
Use Venn diagrams			122
Identify subsets	123	61	104
Real Numbers			
Classify the real numbers			
Natural (counting) numbers and whole numbers	1, 123	4, 5, 61	104, 117
Integers, rational numbers, and irrational numbers	2, 123	5, 61	104, 117
Prime and composite numbers	12	33	
On the number line	2		98
Compute sums, products, differences, and quotients of decimal numbers	6, 7	4	
Perform operations with integers			
Addition	69, 70, 74	5, 6	A
Subtraction	74	6	A
Multiplication	78, 81	9, 13	A
Division	81, 93	9, 13	A

NUMBER SETS

Real Numbers (continued)	*Algebra* $\frac{1}{2}$ Third Edition Lesson(s)	*Algebra 1* Third Edition Lesson(s)	*Algebra 2* Third Edition Lesson(s)
Perform operations with integers (continued)			
Symbols of inclusion			
Absolute value	69	5	A
Identifying negative numbers	69	5	
Opposites with multiple signs	78	7	
Within order of operations	91	11, 12	
Parentheses	82	12, 13	
Parentheses, braces, and brackets	91	13	
Understand elementary number theory			
Divisibility rules	10		
Prime and composite numbers	12	33	
Multiples	20		
Find least common multiples	20	43	
Find reciprocals	40	11	31
Find greatest common factors	13	34, 35	
Understand inverse operations	3, 4	9	
Use base 2			
Conversion between base 2 and base 10	Top. C		
Addition in base 2 and base 10	Top. C		
Know the properties of real numbers			
Chart of properties		App. A	
Commutative property of addition and multiplication	87	5, 10, App. A	A
Associative property of addition and multiplication	87	App. A	
Distributive property	103	17, 27, App. A	4
Additive inverse	39	App. A	
Multiplicative inverse	40	11, App. A	
Additive identity		App. A	
Multiplicative identity	23	App. A	
Multiplicative property			
Of zero		4, App. A	
Of –1	78	26	
Of 1	23	4, App. A	
Of equality	40, 84	24	4
Additive property			
Of zero		4, App. A	
Of equality	39, 84	23, 25	4

NUMBER SETS

Complex Numbers	***Algebra $\frac{1}{2}$*** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Understand imaginary numbers			51, 64
Use the standard form for complex numbers			51, 64, 104
Add complex numbers			51, 64
Multiply complex numbers			64, 81
Divide complex numbers			81
Multiply complex conjugates			81
Find complex roots of quadratic equations			62

MEASUREMENT

English Measurement	***Algebra $\frac{1}{2}$*** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Know U.S. Customary units of length	23	4	
Read rulers to nearest $\frac{1}{16}$th of an inch	113		
Metric Measurement			
Know the metric units of length	24		
Read metric rulers	113		
Know the metric units of volume	119		79
Conversion by Unit Multipliers			
Convert within English system			
in./ft, ft/yd, ft/mi	23	4	41
Multiple unit multipliers	33	10	41
Volume	118	53	41
Area	33	10	41
Rate			47
Convert within metric system			
cm/m, km/m	24	4	53
Multiple unit multipliers	33	10	53
Volume	119	53	79
Convert between English and metric units			
Length		4	53
Area		10	53
Volume		53	79

Ratio, Proportion, Percent, and Rate

	Algebra $\frac{1}{2}$ Third Edition Lesson(s)	*Algebra 1* Third Edition Lesson(s)	*Algebra 2* Third Edition Lesson(s)
Ratio			
Solve ratio word problems	36, 66	38	18
Express rates as ratios	36		
Compare unit prices	67		
Recognize implied ratios	75		
Solve rate problems	36	47	
Solve advanced ratio problems involving totals	100	39	18
Use the ideal gas laws			57, 69
Proportion			
Cross multiply to solve proportions	54, 59, 65	38	
Use scale factors on geometric shapes			22, 24
Use proportions with chemical compounds			37
Percent			
Find percents of numbers	53	47	7
Change percents to decimal numbers and to fractions	55		
Use the percent equation	53	47	7
Solve percent word problems	68	47, 58	9
Use fractional percents	108		
Use percents in chemical weight problems			53
Visualize percents using diagrams	68, 77	47	7, 9
Use percents greater than one hundred	77	47	7, 9
Solve percent increase/decrease problems	68, 80	47, 58	9, 101
Rate			
Change rates using multipliers			47
Solve uniform motion problems		92	22, 29, 34, 74
Solve boat-in-the-river problems			92

EXPONENTS AND ROOTS

Exponents	***Algebra $\frac{1}{2}$*** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Know order of operations with exponents	44	19, 21	
Evaluate expressions with exponents	47	19	2
Simplify powers of fractions	71	29, 57	2
Simplify powers of signed numbers	99		A, 2
Know the product theorem for exponents	101	21	2
Evaluate powers of negative bases	105	19	A, 2
Use negative exponents	106	29, 41, 57	2
Solve equations with exponents	117	88, 118, 119	115
Use zero as an exponent	106	29	
Know the quotient rule for exponents		40	
Know the power theorem for exponents		53	2
Use the y^x calculator key		114	68
Understand exponential increase and decrease		114	115
Understand and use fractional exponents			35, 109
Simplify a sum raised to a power			38, 109
Use exponents on a scientific calculator			68, 115
Use variables as exponents	54		83
Factor expressions with exponents			108
Roots			
Find square roots, cube roots, and fourth roots	44	19, 62	
Know order of operations with roots	44	19	
Evaluate expressions with roots	47	19, 62	
Take roots of fractions	71		
Estimate higher-order roots	Top. E		
Take roots of negative numbers	106	62	51
Know the product of square roots rule		63	20, 51
Add radical expressions		65, 66	20
Multiply radical expressions		84, 112	20, 67, 73
Find roots of large numbers		66	
Solve radical equations		108	48, 77
Know the quotient theorem for roots		116	32
Rationalize denominators			28, 46, 73
Simplify roots of roots			46, 47
Convert roots to fractional exponents			46, 47
Use Euler's notation			51
Evaluate roots with a scientific calculator			68

STATISTICS AND PROBABILITY

Probability	***Algebra* $\frac{1}{2}$ Third Edition Lesson(s)**	***Algebra 1* Third Edition Lesson(s)**	***Algebra 2* Third Edition Lesson(s)**
Use counting techniques to compute probability			
Simple probability	112	70	116
Independent events	114	70, 73	116
Product of probabilities	114	70	116
Find permutations	122		116
Statistics			
Use and construct stem-and-leaf plots	Top. B	85	129
Use and construct histograms	Top. B	85	
Use and construct box-and-whisker plots	Top. B	120	
Compute measures of central tendency	26	45	129
Understand normal curves			129
Compute standard deviation			129
Find averages			
Of several numbers	21		
Overall	41	52	
Weighted		65	

EXPRESSIONS

Simplifying Expressions	***Algebra* $\frac{1}{2}$ Third Edition Lesson(s)**	***Algebra 1* Third Edition Lesson(s)**	***Algebra 2* Third Edition Lesson(s)**
Combine like terms			
Simple	94	18	3
With exponents	102	21, 41	3
With negative exponents		41	3, 35
Simplify exponential expressions			
With exponentials and radicals/power rule	47, 54	19, 29, 53, 57	2, 109
With fractional exponents			35, 109
With variable exponents	54		83
With fractional base	71		
With signed numbers			
Explanation	99	6, 19	A
Evaluation with signed numbers	99	19	3
Multiplication and division		21, 40	
With negative signs/positive or negative exponents	106		A, 2
Distributive property and negative exponents		40	

EXPRESSIONS

Simplifying Expressions (continued)	*Algebra* $\frac{1}{2}$ Third Edition Lesson(s)	*Algebra 1* Third Edition Lesson(s)	*Algebra 2* Third Edition Lesson(s)
Evaluate expressions with substitution			
For variables	32	18, 27, 28, 36, 42	3
With symbols of inclusion		14	3
With signed numbers	82	14	3
With signed numbers and symbols of inclusion		14, 16	3
Simplify expressions using			
Distributive property	103	17, 27, 30	4
Order of operations	31, 44	6, 11, 12	
With fractions	46, 52	4, 12, 36	
With symbols of inclusion	52, 91	97, 104	
Reduce expressions by common factor	14	35	25
Find the least common multiple of expressions		43	27
Find the greatest common factor of expressions		34, 35	
Simplify radical expressions			
Addition		65	20, 46
Multiplication		84, 112	20, 67, 73
Using conjugates			28, 46, 67, 73
Fractional exponents			46
Simplify polynomial expressions			
Monomials	Top. F	48	25
Binomials	Top. F	48	
Difference of two squares		73	39
Sum and difference of two cubes		96	108
Trinomials	Top. F	48	
Simple factoring		69, 73, 127	26
Common factors		74	26
Common factor sums		75	
Lead coefficients greater than one		127	105
Degrees of polynomials	Top. F	50	8
Addition of polynomials	Top. F	50	
Multiplication of polynomials	Top. F	51	16
Division of polynomials			
Simple	Top. F	88	16
Missing term in dividend		90	16
With two variables			103
Factoring by grouping		128	

EXPRESSIONS

Simplifying Expressions (continued)	*Algebra* $\frac{1}{2}$ Third Edition Lesson(s)	*Algebra 1* Third Edition Lesson(s)	*Algebra 2* Third Edition Lesson(s)
Simplify rational expressions		4, 36	27
Multiplication		4, 35, 93	36
Addition		44, 52	11, 27, 75
Factoring			
Before multiplication		35, 93	36
Before addition		101	27, 75
Division		55, 93	36
Denominators			
Factoring		35, 93, 108	36, 75
Rationalizing			
By multiplication by radical		116	28, 32
Using conjugates			67, 73
Simplify complex fractions	19, 43	55	28
Denominator-numerator same-quantity rule		55, 68	11, 28, 33
Multiplicative property of equality		68	33
Additive property of equality		55	33
Advanced		68	64, 82
Simplify complex numbers			
Addition of like terms			51
Euler's notation			51
Using conjugate of the denominator			81
Multiple step			64
Multiplication			51, 64
Division			81

EQUATIONS

Simplifying and Solving Equations	*Algebra* $\frac{1}{2}$ Third Edition Lesson(s)	*Algebra 1* Third Edition Lesson(s)	*Algebra 2* Third Edition Lesson(s)
Define equations and basic rules			
Simple	37	22	4
Conditional	37	22	
Equivalent	39	23, 67	4
Addition and subtraction rules	39	23	4
Multiplication and division rules	40	24	4
Use the fractional-part-of-a-number equation	48	28	5, 24
Solve abstract equations		81	40, 55, 70
Use the decimal-part-of-a-number equation	51	30	6
Solve equations with mixed numbers	56, 57	29, 57	4, 24
Solve equations using least common multiple			24
Use the percent equation	68, 77	47	7, 9
Solve multiple-step equations			
Using two rules	61	25	4
Format	84	26	4
Variables on each side of equals sign	95	26	4
Two-step	97	42	4
Multiple terms	96	26	6, 7
Multivariable abstract		42	4
Advanced			70
Solve equations that have negative coefficients	84	25	
Solve equations that have symbols of inclusion		31	
Solve equations using distributive property		31	4
Translate word phrases into algebraic expressions	86	30	5
Translate word sentences into algebraic equations	90	32	5
Solve equations involving variation			
Direct and inverse		113	60
Squared		117	
As ratio			80
Joint and combined			96
Solve rational equations	59, 65	78, 103, 104	40, 55, 70
Solve radical equations		108	48, 77

EQUATIONS

Linear Equations	*Algebra* $\frac{1}{2}$ Third Edition Lesson(s)	*Algebra 1* Third Edition Lesson(s)	*Algebra 2* Third Edition Lesson(s)
Find linear equations to fit experimental data			59, 72
Find equations of lines			
Using slope-intercept form		75	8, 12
Given two points		98, 106	14
Parallel to given lines		107	20
With given slopes		107	14
Finding slopes		98	87
Perpendicular to given lines			31
Horizontal and vertical lines		51, 106	12
Slope formula	Top. I	75	87
Distance formula		98	88
Graph linear equations			
Simple	85	51	8
Rearranging before graphing		56	23
For solution		81	23
Slope-intercept method		75	8
Solve two equations in two unknowns			
Substituting		50	13
For variable		54	13
One variable for another variable		56	13
Advanced			65, 97
Rearranging before substitution		59	
Subscripted variables		79, 87	17
With fractions and decimal numbers		83	
Using linear combination (elimination)			
With angular relationship			17
Elimination of a variable		67	15
Subscripted variables		71	17
With fractions and decimal numbers		83	59
By graphing		81	23
Consistent, inconsistent, and dependent equations		81	84
Solve three equations in three unknowns			76, 90, 106

EQUATIONS

Quadratic Equations	***Algebra* $\frac{1}{2}$** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Solve by factoring	117	88	38, 50, 105
Use difference of two squares theorem		96	39, 45
Complete the square		118	50, 58, 62
Use the quadratic formula		119	71
Identify lead coefficients			58
Use discriminants			93
Other Types of Equations			
Solve logarithmic equations			113, 118
Solve exponential equations			115
Solve exponential growth problems		114	115
Find compound interest with calculator		114	115
Find roots of equations		96	
Lead coefficients of completing the square			58
Complex roots			62
Using quadratic formula		119	71
Irrational roots			86, 95, 96
Discriminants			93
Solve equations with applications			
Simple and compound interest	109	114	115
Markup and markdown	110		101
Commission and profit	111		
Coin problems		83	111
Chemical mixture problems			52, 61
Age problems			120
Explore nonlinear equations			
Circles and ellipses			85, 95
Parabolas	Top. H	110	100
Hyperbolas			95
Solve systems of equations			
Using elimination and substitution			85
By completing the square			100

Algebraic Skills

Understanding Functions	***Algebra* $\frac{1}{2}$ Third Edition Lesson(s)**	***Algebra 1* Third Edition Lesson(s)**	***Algebra 2* Third Edition Lesson(s)**
Define *domain, range, independent variable,* and *dependent variable*		84	94
Use function notation	Top. G	28, 87	94
Use the vertical line test		28, 87	
Represent functions as ordered pairs		84	94
Manipulating and Evaluating Functions			
Multiply functions			102
Add functions			102
Graph and evaluate exponential functions			115
Evaluate trigonometric functions	Top. J		43

Trigonometry and Logarithms

Trigonometry	***Algebra* $\frac{1}{2}$ Third Edition Lesson(s)**	***Algebra 1* Third Edition Lesson(s)**	***Algebra 2* Third Edition Lesson(s)**
Define and use *sine, cosine,* and *tangent*	Top. J		43
Evaluate trigonometric and inverse trigonometric functions with a scientific calculator			43
Solve right triangles			44, 49
Use trigonometry to work with vectors			
Addition			63
Negative			76
Force vectors at a point			78
Logarithms			
Solve logarithmic equations			118
Know the laws of logarithms			122
Find logarithms with a scientific calculator			113
Find antilogarithms with a scientific calculator			113

GEOMETRY

Lines, Points, Segments, and Planes	***Algebra $\frac{1}{2}$*** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Identify lines			
Intersecting		2	A, 1
Parallel	Top. D	2	A, 1, 25
Transversals	Top. D		1, 49
In space			127
Skew			127
Perpendicular bisectors	Top. A		13
Identify points and find distances between points	9	60, 72, 91	A, 125
Identify segments	9	1	A
Characteristics		1	A
Proportional			1
Bisectors	Top. C		13, 125
Identify planes and planes in space	115	15, 20, 60, 72, 91	A, 127
Angles			
Identify vertices of angles	98	2, 3	A
Identify kinds of angles			
Right, acute, straight, and obtuse angles	9	8	A
Complementary and supplementary angles	98		A
Adjacent angles	98		A
Vertical angles			A, 30
Reflex angles			A
Corresponding interior and exterior angles	Top. D		30
Alternate interior and exterior angles	Top. D		30
Remote interior angles			31
Measure angles with a protractor	98		
Use inscribed angles			11
Construct angle bisectors	Top. C		123
Find the sum of the angles in a polygon			35
Use angles with vectors			
To find rectangular coordinates			54
To change from rectangular to polar form			59
Addition			63
Negative			76
Force at point			78
Define negative angles on the coordinate plane			72
Use angles in circles to form major and minor arcs	Top. D		56

GEOMETRY

Polygons	***Algebra $\frac{1}{2}$*** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Classify polygons			
Convex and concave	115	2	1
Equilateral and equiangular	104	2	1
By number of sides			
Triangles	104, 115	2	1
Quadrilaterals	115	2	1
Inscribed		2	35
Squares	115	2	126
Trapezoids	115	2	126
Parallelograms	115	2	37, 39, 126
Rhombuses	115	2	39, 126
Rectangles	115	2	126
Pentagons	115	2	1
Hexagons	115	2	1
Understand congruence of polygons	115		32, 124
Understand regularity of polygons	115	2	1
Translate, rotate, and reflect polygons	115	110	32
Recognize symmetry of polygons	115		1, 37, 126
Identify vertices of polygons	115	2	1
Draw diagonals of polygons	115	8	1, 37, 39, 126
Circles			
Identify parts of circles			
Radii and diameters	60	3, 8	B
Chords	60		B, 56
Arcs, sectors, and central angles	Top. D		B, 11, 56
Secants and tangents			56
Draw circumscribed and inscribed circles			128
Use degree measures	Top. D	15, 20	B

GEOMETRY

Triangles	***Algebra $\frac{1}{2}$*** **Third Edition Lesson(s)**	***Algebra 1*** **Third Edition Lesson(s)**	***Algebra 2*** **Third Edition Lesson(s)**
Classify triangles			
Right, obtuse, acute, scalene, isosceles, and equilateral	104	15, 20	1
30°-60°-90° triangles	Top. A		66
45°-45°-90° triangles	Top. A		79
Prove congruence of triangles	115		19, 32, 37, 124
Find measures of angles	104	15, 20	1, 7
Solve similar triangle problems			
Two triangles	65		18, 19, 22, 54
Overlapping triangles			24, 26
Geometric Solids			
Identify cylinders and prisms	73	60, 72, 91	B
Identify circular and right circular cones	120	60, 72, 91	B
Identify rectangular and square pyramids	120	60, 72, 91	
Identify spheres	120	60, 72, 91	B
Perimeter and Circumference			
Compute perimeters of shapes	9	3	B
Define π	60	3	B
Compute circumferences			
Circles	60	3	B
Semicircles	64	3	B
Area			
Find areas of polygons			
Rectangles and squares	17	8	B
Triangles	27	8	B, 13
Parallelograms and trapezoids	116	8	B
Find areas of complex shapes			
Made of two or more polygons	17	2, 3	B
Made of polygons and semicircles	64	2, 3	B
As differences	25		
Find areas of circles, sectors, and semicircles	60, 64	3	B

GEOMETRY

Surface Area and Volume	*Algebra* $\frac{1}{2}$ Third Edition Lesson(s)	*Algebra 1* Third Edition Lesson(s)	*Algebra 2* Third Edition Lesson(s)
Find surface areas of geometric solids			
Right circular cylinders	73, 88	15	B
Triangular prisms and rectangular pyramids	49, 88	15	B
Right circular cones	120	60, 72, 91	B
Spheres		60, 72, 91	B
Complex shapes as the base	88	8	B
Find volumes of geometric solids			
Right cylinders and prisms	45	15, 20	B
Complex shapes as the base	45	15, 20	B
Cones, pyramids, and spheres	120	72, 91	B
Constructions			
Copy angles using compass and straight edge	Top. A		123
Construct perpendicular bisectors	Top. A		123
Construct triangles and rectangles	Top. A		123
Construct angle bisectors	Top. A		123
Copy line segments	Top. A		123
Postulates			
Understand Euclid's postulates			30
Pythagorean Theorem			
Find side lengths	117	97	10
Graph points to find distance		98	10
Prove the Pythagorean theorem	117		128
Proofs			
Prove theorems about lines, segments, or rays			125, 127
Prove theorems about angles			19, 30, 31, 125
Prove theorems about circles			56, 89, 125, 126
Prove theorems about parallelograms			37, 39
Prove theorems about rhombuses			39
Prove theorems about isosceles trapezoids			126
Prove theorems about triangles			19, 30, 31, 124, 128

Advanced Mathematics

Second Edition

FOUNDATIONS

	Lesson(s)
Calculator	
Perform two-variable analysis	45
Use graphing calculators	125
Find roots of equations	125
Solve systems of equations	125
Exponentials and Logarithms	
Factor exponentials	19
Solve exponential equations	82
Evaluate exponential functions	88
Understand and use logarithms	
Convert logarithms to exponentials	26
Use logarithms in problems	26, 59, 98
Use the rules of logarithms	40, 49
Evaluate logarithmic functions	49
Change bases	98
Use logarithms in calculations	103
Solve logarithmic inequalities	111
Find antilogarithms	51, 67
Find common logarithms	51
Find natural logarithms	51
Graph logarithms	65
Evaluate logarithms	82
Complex Numbers	
Understand and use complex numbers	5, 10
Factor complex numbers	46
Graph complex numbers	64
Express complex numbers in polar form	64
Find sums and products of complex numbers	64
Rationalize denominators	10
Find complex roots of equations	46, 95

Equations and Inequalities

Equations and Inequalities	Lesson(s)
Use the Pythagorean theorem and inequalities	3, 93
Solve fractional equations	6
Solve radical equations	6
Solve abstract equations	16
Use designated roots to identify equations	38
Use synthetic division	113
Use the remainder theorem	115
Use the rational roots theorem	117
Find roots of polynomial equations	118
Systems of Equations and Inequalities	
Solve systems of three equations	6
Use systems to solve application problems	18
Solve nonlinear systems	19
Solve systems of two inequalities	56
Use formulas to solve systems of equations	66
Use matrices to solve systems of equations	101, 120

Functions and Graphs

Functions	Lesson(s)
Use function notation	21, 24, 31
Evaluate functions	21
Understand domain and range	21
Identify relations	21
Use function tests	21
Use absolute value functions	22
Graph reciprocal functions	22
Understand asymptotes	22, 78, 106, 122
Understand function arguments	40
Find inverse functions	40
Use linear variation	62
Graph piecewise functions	121
Graph the greatest integer function	121
Graph rational functions	122

Functions and Graphs

Lines	**Lesson(s)**
Write equations of lines	10, 37
Use the distance formula	35, 37
Understand lines as locuses	37
Write equation of a line equidistant from two points	37
Use the midpoint formula	37
Know forms of linear equations	
Slope-intercept form	39
General form	39
Double-intercept form	39
Point-slope form	39
Two-point form	39
Find distances from points to lines	58
Polynomials and Polynomial Functions	
Complete the square	10
Use the quadratic formula	11
Use abstract coefficients	62
Graph polynomial functions	114
Determine the region of interest	116
Use the rational roots theorem	117
Use Descartes' rule of signs	119
Find upper and lower bounds	119
Find irrational roots	119
Conics	
Know the general conic sections	42, 123
Circles	42, 63
Parabolas	54, 58, 68
Ellipses	71, 89, 106
Hyperbolas	78, 106
Translations	68, 106
Complete the square to graph conic sections	54

GEOMETRY

Foundations of Geometry	Lesson(s)
Know terms and definitions	1
Understand planes	1
Use tick marks	1
Define cylinder surfaces	2
Use scale factors	3, 5
Find lengths of diagonals of rectangular solids	5
Understand similarity	8
Find lengths of proportional segments	8
Understand congruence	9
Use Euclid's ten postulates	15
Understand symmetry	31
Understand reflections	31
Understand translations	31
Angles	
Understand angles	1
Understand parallel lines	1
Identify and use transversals	1
Identify alternate and corresponding angles	1
Use angle bisectors	8
Use angles greater than 360°	36
Circles	
Find areas of circles and sectors	1
Know properties and parts of circles	11
Use intersecting secants and tangents	13
Use chord products	13
Polygons	
Define convex and concave polygons	3
Identify similar polygons	3
Find the sum of the angles in a polygon	12
Identify quadrilaterals	33
Know the properties of parallelograms	33
Understand regular polygons	73

GEOMETRY

Polygons (continued)	**Lesson(s)**
Work with triangles	
Areas	2, 56
Pythagorean theorem and inequalities	3, 93
Similar triangles	3
Side ratios	8
Overlapping triangles	30
Solving for unknown lengths	72
Missing parts	97
The ambiguous case	97
Work with trapezoids	
Areas	33, 56
Properties of	33
Planar Area	
Find areas of rectangles	1, 2
Find areas of sectors of circles	1
Find areas of triangles	2, 56
Find areas of segments of circles	56
Surface Area	
Find lateral surface areas	2
Find surface areas of cones	2
Find surface areas of spheres	2
Volume	
Find volumes of cylinders and prisms	2
Find volumes of cones and pyramids	2
Find volumes of spheres	2
Constructions	
Construct segments	4
Construct bisecting angles	4
Construct perpendiculars	4
Construct triangles	4
Construct parallel lines	4

Sequences and Series

Sequences and Series	Lesson(s)
Use the fundamental counting principle	38
Use binomial expansion	77, 102
Work with arithmetic progressions	86
Find arithmetic means	86, 99
Work with geometric means and progressions	91, 99
Use sequence notation	99
Solve sequence problems	99
Find sums of arithmetic series	104
Find sums of geometric series	104
Convergent geometric series	107
Use the binomial theorem	112

Matrices

Matrices	Lesson(s)
Find determinants	69, 101, 105
Use Cramer's rule	74
Understand independent equations	101
Use matrices to solve systems of equations	101, 120
Use expansion by cofactors	105
Add matrices	108
Multiply matrices	108
Understand matrix algebra	120
Find inverse matrices	120

Trigonometry

Functions and Graphs	Lesson(s)
Evaluate in 45°-45°-90° triangles	20
Evaluate in 30°-60°-90° triangles	20
Evaluate sums of trigonometric functions	24, 36
Determine signs of trigonometric functions	27
Find related angles	27
Use the unit circle	29
Use the four quadrantal angles	29
Know the signs in each quadrant	32

TRIGONOMETRY

Functions and Graphs (continued)	**Lesson(s)**
Know the reciprocal trigonometric functions	32, 41
Know the inverse trigonometric functions	32
Use angles greater than 360°	36
Use radian measures of angles	39
Evaluate trigonometric functions in radians	39
Understand periodic functions (sinusoids)	43
Write equations of sinusoids	43
Graph trigonometric functions	43, 94
Graph inverse trigonometric functions	110
Understand vertical sinusoidal translations	47
Evaluate powers of trigonometric functions	48
Find phase shifts of sinusoids	57, 66
Find periods of sinusoids	57, 66
Use De Moivre's theorem	79
Sketch sinusoids	84
Identities and Inequalities	
Use the triangle inequality postulate	3, 93
Define sine, cosine, and tangent	14
Solve problems with angles of elevation and depression	14
Convert rectangular to polar form/reverse	14
Add vectors using trigonometry	30
Solve trigonometric equations	50, 52, 85
Inviolable argument	52
Factorable trigonometric equations	60, 84
Loss of solutions by division	60
Use the law of sines	72, 96
Simplify functions of $(-x)$	76
Simplify functions of "the other angle"	76
Prove trigonometric identities	76, 80, 93
Use the law of cosines	81
Know and use the sum and difference identities	87, 100
Know and use the tangent identities	87
Know and use the double-angle identities	90, 96
Know and use the half-angle identities	90
Know and use the product identities	100

Applied Mathematics

Word Problems	Lesson(s)
Solve number problems	18
Solve money problems	18
Solve variation problems	18
Solve digit problems	18
Solve mixture problems	18
Solve age problems	25
Solve rate problems	25
Solve abstract rate problems	28, 44
Solve boat-in-the-river problems	36
Convert with unit multipliers	53
Solve angular velocity problems	53
Solve clock problems	85
Statistics and Probability	
Use summation notation	34
Use linear regression	34, 45
Use two-variable analysis	45
Use single-variable analysis	61
Understand the normal distribution	61
Draw box-and-whisker plots	61
Compute percentiles	70
Compute *z* scores	70
Compute permutations	38, 92
Notation	41
Conditional permutations	45
Circular permutations	55
Distinguishable permutations	55
Compute combinations	75, 92
Compute simple probability	83
Independent events	83
With replacement	83
Either of two events	92

PROOFS

Elements of Proofs	**Lesson(s)**
Understand basic logic and reasoning	7
State the contrapositives of conditional statements	7
State the converses and inverses of conditional statements	7
Do proof outlines	9
Do formal proofs	15
Theorems	
Prove the chord-tangent theorem	12
Prove theorems about secants and tangents	13
Prove theorems about chord products	13
Prove the Pythagorean theorem	17
Prove similarity of triangles	17
Prove the law of sines	96
Prove that equal angles imply proportional sides	96

Calculus

Second Edition

FOUNDATIONS

Real Numbers	**Lesson(s)**
Identify the subsets of the real numbers	1
Identify the order properties of the real numbers	1
Identify the properties of the real number field	1
Discuss 0, 1, π, and e	7, 98, 102
Graph absolute value inequalities	9
Use interval notation	15
Algebra	
Solve equations and systems of equations	1, 2, 9, 16
Simplify expressions	1, 2
Factor	1
Use factorial notation	1
Use summation notation	1
Translate verbal descriptions into algebraic equations	5
Convert between logarithmic and exponential forms	9, 12, 58
Distinguish between zeros, roots, and x-intercepts	10
Characterize quadratic equations	10
Use the remainder theorem to evaluate polynomials	10
Use synthetic division	10
Use the rational roots theorem	10
Derive and use properties of logarithms	16, 20
Recognize conics by their equations	22
Use the binomial theorem	22
Solve exponential growth problems without calculus	26
Understand irreducible quadratic factors and their graphical significance	33
Geometry	
Use the midpoint and distance formulas	2
Write the equation of a line in various forms	2
Use the Pythagorean theorem	8
Use similar triangles	8
Translate or reflect graphs	7, 21
Understand tangents and slope graphically	15

FOUNDATIONS

Logic	Lesson(s)
Identify the contrapositives, converses, and inverses of a conditional statement	3
Understand the logical equivalences of conditional statements to their contrapositives and of converses to inverses	3
Construct biconditional statements using *iff* (if and only if)	3
Trigonometry	
Convert between radian measure and degrees	4
Define the trigonometric ratios	4
Evaluate trigonometric expressions	4, 12, 13
Simplify trigonometric expressions	4, 8, 12
Use the unit circle to evaluate trigonometric functions	7, 8, 30
Find the centerline, amplitude, phase angle, and period of sinusoids and use them in graphing	7
Derive or use trigonometric identities	8, 12, 76
Identify the meaning of *cofunctions*	8
Identify the inverse trigonometric functions	13, 58
Solve trigonometric equations	13, 23
Graphing Calculator	
Graph functions	2, 6, 7, 12, 20, 23, 40, 59, 60, 66, 68
Use zooming features	2, 6, 7, 12, 21, 23, 40, 60
Use specific window settings	2, 7, 10, 59
Use tracing features	2, 6, 14, 15
Change modes	6, 7, 23
Find intersection points	2
Find zeros of polynomials	2, 10
Find zeros of functions	10, 59, 60, 93
Evaluate functions	6, 14
Verify domains and ranges of functions	6
Generate tables of function values	6, 14, 26, 79
Evaluate exponentials	7, 20
Evaluate logarithms	9, 20
Use the absolute value function	12
Approximate limits	14, 26
Approximate slopes of curves	19, 27, 31, 134
Graph conics	20, 23

FOUNDATIONS

Graphing Calculator (continued)	Lesson(s)
Use function variables	23
Find local extrema	40
Approximate definite integrals	53, 59, 60, 67
Graph sequences	105
Graph parametric equations	106
Graph polar equations	110
Basics of Functions	
Represent functions as rules to be applied to specified sets, as tables of values where members in one set are uniquely paired to members of another, and as graphs of such paired values	6
Evaluate functions	6
Use function notation	6
Use the vertical line test	6
Determine whether mappings are functions	6
Find the domains and ranges of functions	6, 18
Add, subtract, multiply, divide, and compose functions	18
Find and evaluate inverse functions	58
Understand properties of even and odd functions	68, 86

FUNCTIONS, GRAPHS, AND LIMITS

Analysis of Graphs	Lesson(s)
Graph functions and equations	
Trigonometric functions	7, 30
Inverse trigonometric functions	13
Exponential functions	7
Logarithmic functions	12
Absolute value functions	9
Piecewise functions	9
The greatest integer function	9
Rational functions	9, 21, 28 33, 41, 80
Conic sections	10, 20, 22, 23
Reciprocal functions	30
Parametric equations	106
Polar curves	107, 110, 118

FUNCTIONS, GRAPHS, AND LIMITS

Analysis of Graphs (continued)	Lesson(s)
Graph functions and equations (continued)	
Vector functions	123
Using technology	2, 6, 7, 12, 20, 23, 40, 59, 60, 66, 68, 106, 110, 118;
Find points of intersection	2
Find zeros of functions	2, 10, 15, 33
Identify the intervals on which a function is increasing (or decreasing)	15, 45
Determine local and global extrema	36, 40, 45, 63
Limits of Functions	
Understand limits graphically	11, 14, 17, 70
Understand limits using epsilon-delta proofs	103
Calculate limits using algebra	14, 17
Approximate limits from graphs and data tables	11, 14, 17
Calculate one-sided limits	11, 14
Calculate limits that are disguised derivatives	28
Evaluate $\lim_{x \to 0} (1 + x)^{1/x}$	11
Evaluate $\lim_{x \to 0} \frac{\sin x}{x}$	11, 101
Approximate limits using technology	14
Find limits of sums, differences, products, and quotients	70
Use the squeeze theorem	70
Find limits of compositions	70
Use change of variables	70
Evaluate limits using logarithms	111
Asymptotic and Unbounded Behavior	
Understand asymptotes graphically	11, 21, 28
Understand infinite and undefined limits	17, 70
Find limits using asymptotes	17, 28, 80
Find asymptotes of rational polynomial functions	21, 28, 41
Graph functions with asymptotes	21, 28, 30, 41, 80
Find asymptotes using limits	21, 80
Compare relative magnitudes of functions	28, 41, 80

FUNCTIONS, GRAPHS, AND LIMITS

Continuity as a Property of Functions	Lesson(s)
Understand continuity graphically	11, 75, 82
Understand continuity in terms of limits	75, 82
Use the maximum-minimum value existence theorem (Extreme Value Theorem)	63, 85
Use the critical number theorem	63
Understand point continuity	75
Understand interval continuity	75
Use the Intermediate Value Theorem	75, 85
Parametric, Polar, and Vector Functions	
Understand parametric equations	106
Convert between parametric and rectangular coordinates	106
Graph parametric equations	106
Use parametric equations to describe projectile motion	140
Understand polar coordinates	107
Convert between polar and rectangular coordinates	107
Graph rose curves, limaçons, and lemniscates	110, 118
Understand vectors	108, 123
Perform vector addition, subtraction, and scalar multiplication	108
Find unit and normal vectors	108
Graph vector functions	123

DERIVATIVES

Concept of the Derivative	Lesson(s)
Understand the derivative geometrically	19, 24, 40, 44, 49, 82
Define *derivative* as the limit of a difference quotient	19, 24, 44
Understand the derivative as an instantaneous rate of change	19, 40
Prove the sum and difference rules for derivatives	25
Prove the product rule for derivatives	31
Prove the quotient rule for derivatives	42
Find differentials of functions	29, 31, 42
Describe the relationship between differentiability and continuity	82

DERIVATIVES

Derivative at a Point	Lesson(s)
Calculate slope at a point	15, 19, 27, 31, 34, 106, 134
Find the line tangent to a curve at a point	15, 27, 119
Find the line normal to a curve at a point	40
Approximate slopes using technology	19, 27, 31
Approximate rate of change from graphs and tables	26
Find critical numbers	36
Find instantaneous rate of change	40, 142
Use the derivative at a point for local linear approximation	99
Derivative as a Function	
Use various notations for the derivative of a function	19, 29, 55
Relate the characteristics of the graphs of functions and their derivatives	36, 45, 49, 63
Relate the increasing and decreasing behavior of functions to the signs of their derivatives	45, 49
Translate verbal descriptions into equations involving derivatives	46, 63
Derive the Mean Value Theorem	85
Understand consequences of the Mean Value Theorem	85
Second Derivatives	
Find inflection points	33, 49
Understand the relationships between the graphs of functions, their first derivatives, and their second derivatives	45, 49, 61, 63, 119
Understand the relationship of the sign of the second derivative to concavity	49, 119
Applications of the Derivative	
Use differentiation to analyze linear motion	40, 54, 65
Interpret the derivative as a rate of change	40, 46, 49, 140
Analyze curves in rectangular form	45, 49, 104
Model rates of change	46, 54, 65, 78, 88, 115
Solve related-rates problems	46
Use derivatives in optimization problems	52, 63
Use L'Hôpital's Rule	79
Use implicit differentiation to find the derivative of an inverse function	92, 102
Use Newton's method	93

DERIVATIVES

Applications of the Derivative (continued)	**Lesson(s)**
Use slope fields	104
Analyze curves in parametric, polar, and vector forms	106, 134, 140
Use Euler's method	133
Computation of Derivatives	
Compute derivatives using the definition	19, 24, 25, 44
Find derivatives of constant functions	19
Find derivatives of polynomial functions	19, 24, 25, 48
Find derivatives of sums, products, differences, and quotients	25, 31, 42, 48, 50, 85
Find derivatives of exponential functions	26, 48, 72, 102
Find derivatives of logarithmic functions	26, 48, 72, 102
Find derivatives of trigonometric functions	26, 48, 101
Find derivatives of inverse trigonometric functions	64
Find derivatives of absolute value functions	72, 96
Compute and evaluate high-order derivatives	27, 119, 124, 142
Differentiate implicitly	34, 64, 84, 124
Use substitution	37, 48, 50
Use the chain rule	44, 48, 50, 136
Use logarithmic differentiation	84
Find derivatives of functions defined by definite integrals	98
Find the derivatives of parametric, polar, and vector functions	106, 119, 134, 142

INTEGRALS

Reimann Sums	**Lesson(s)**
Learn the concept of a Reimann sum	39, 43, 47
Compute Reimann sums using left, right, and midpoint evaluation points	39
Compute Reimann sums using circumscribed and inscribed (upper and lower) rectangles	39, 43
Interpretations and Properties of Definite Integrals	
Define *definite integral* as the limit of a Reimann sum	47
Use geometry to evaluate definite integrals	47, 68

INTEGRALS

Interpretations and Properties of Definite Integrals (continued)	Lesson(s)
Interpret the definite integral of the rate of change of a quantity on an interval as the change of the quantity on the interval	62, 90
Use additive properties of definite integrals	47, 57, 96, 125, 131, 137
Use linearity of definite integrals	47, 57
Applications of Integrals	
Find the areas of regions determined by rectangular curves	47, 59, 60, 67
Solve mechanical work problems	62, 77
Solve accumulation problems	62, 74, 77
Find the volumes of solids of revolution using disks	71, 73, 94
Find the forces of fluids on sides of tanks	74
Find the distances traveled by moving particles on lines	78, 90
Find the volumes of solids of revolution using washers	81, 94
Find the volumes of solids of revolution using shells	87, 94
Use the Mean Value Theorem for Integrals	89
Find the average values of functions	89
Find the volumes of solids with known cross sections	97
Define the natural logarithm function using a definite integral	98
Find the lengths of rectangular curves	109
Find the lengths of parametric curves	114
Find the areas of regions determined by polar curves	129
Fundamental Theorem of Calculus	
Use the Fundamental Theorem to evaluate definite integrals	47
Use the Fundamental Theorem to represent particular antiderivatives	98, 102, 136
Analyze functions defined by integrals	98, 102, 136
Prove the Fundamental Theorem	103
Techniques of Antidifferentiation	
Use knowledge of derivatives to determine antiderivatives	32, 38, 64, 73
Find antiderivatives of constants	35
Find antiderivatives of products of constants and functions	35
Find antiderivatives of power functions	35
Antidifferentiate sums	38

INTEGRALS

Techniques of Antidifferentiation (continued)	**Lesson(s)**
Antidifferentiate	38
Antidifferentiate exponential functions	73
Antidifferentiate logarithmic functions	73
Antidifferentiate trigonometric functions	76, 83, 100
Use substitution of variables	51, 56, 66, 76
Change limits of definite integrals	66
Antidifferentiate by parts	69, 122
Use partial fractions	115, 120, 126
Use trigonometric substitution	112, 113
Evaluate improper integrals	125, 131
Perform piecewise integration	137
Applications of Antidifferentiation	
Use antidifferentiation to analyze linear motion	78
Find specific antiderivatives using initial conditions	88
Solve separable differential equations	88
Model exponential growth by separable differential equations	88
Model logistic growth by separable differential equations	115
Numerical Approximation of Definite Integrals	
Use Reimann sums to approximate definite integrals	43, 47
Use the trapezoidal rule to approximate definite integrals	95
Use Taylor series to approximate definite integrals	148
Use technology to approximate definite integrals	53, 59, 60, 67

POLYNOMIAL APPROXIMATIONS AND SERIES

Concept of Series	**Lesson(s)**
Define sequence	105
Define *series* as the limit of a sequence of partial sums	116
Define *convergence* and *divergence* of series	116, 121
Use technology to explore convergence and divergence of series	127
Understand arithmetic of series	121

Polynomial Approximations and Series

Series of Constants	Lesson(s)
Represent repeating decimal numbers as series	117
Determine whether geometric series converge or diverge	117
Calculate the sums of convergent geometric series	117
Use geometric series to solve applied problems	117
Determine whether telescoping series converge or diverge	117
Calculate the sums of convergent telescoping series	117
Determine whether *p*-series converge or diverge	127
Understand the harmonic series	127
Use the integral test to determine whether series converge or diverge	128
Use the integral test to prove the convergence rules for *p*-series	128
Use the basic comparison test to determine whether series converge or diverge	128
Use the ratio test to determine whether series converge or diverge	130, 145
Use the root test to determine whether series converge or diverge	130
Use the limit comparison test to determine whether series converge or diverge	132
Determine whether alternating series converge or diverge	135, 138
Calculate error bound of alternating series approximation	139
Taylor Series	
Find the Maclaurin series for e^x	55
Find the Maclaurin series for $\sin x$	55, 147
Find the Maclaurin series for $\cos x$	55
Find the Maclaurin series for $\frac{1}{1 + x}$	143, 146
Compare graphs of functions and their Taylor polynomials	55, 141
Approximate functions using Taylor polynomials	141, 143
Express functions as general Taylor series centered at $x = a$	141
Find Lagrange error bound for Taylor polynomials	144
Determine radius and interval of convergence	145
Form new Taylor series by differentiating	146
Form new Taylor series by integrating	146
Define functions by power series	146, 147
Form new Taylor series by substituting	147