



# Mathematics



# Mathematics

Math begins as a tactile and sensorial activity for children. All number concepts are taught by first introducing the quantity, then the symbol, and finally the symbol and quantity together. For example, numbers 1-10 are introduced using a series of rods that are counted and compared. As children's understanding deepens, they grasp the concepts of ones, tens, hundreds, and thousands through beads, squares, and blocks that help them relate smaller numbers to bigger ones. In the lower elementary years, students focus on building strength in mental math and mathematical reasoning. They embark on their earliest geometry lessons by learning about the history of shapes in helping humans build civilizations. Aside from Montessori materials, teachers utilize curricular materials, including The Key To Geometry™, Key to Fractions™, and Dimensions Math (Singapore Math)™. In Upper School, students develop a more sophisticated understanding of math and geometry. They deepen their number sense, particularly with fractions and decimals. Students also apply their mathematical knowledge to solve novel problems, not merely to carry out procedures for solving familiar ones.



Core	Major Topics	Skills	Children's House				Lower School					Middle School		
			SS	Age 3/4	Age 4/5	K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Base 10 Number System Whole Numbers	Numbers 1-10	Match symbol and quantity 1-10	●											
		Recognize and continue shape and color patterns	●											
		Sequence objects by size	●											
		Sort objects by attribute	●											
		Linear counting to 10	●											
		Compose, read, write, and compare numbers 1-10		●										
		Recognize even and odd numbers 1-10		●										
		Recognize & recall numbers 1-10		●										
		Sensorially trace numerals 0-9		●										
		Trace numerals 0-9		●	●									
		Write numerals 0-9		●	●	●								
	Numbers up to 100	Compose, read, write, and compare numbers			●									
		Count to 100			●									
		Skip count using bead bars & squares 2/3/4/5/10			●									
	Numbers up to thousands	Compose, read, write, and compare numbers with materials				●								
		Compose, read, write, and compare numbers in standard & expanded form					●	●						
		Skip count using squares and cubes of 1-10				●	●							
	Numbers up to millions	Compose, read, write, and compare numbers in standard & expanded form							●	●				
	Numbers up to billions	Compose, read, write, and compare numbers in standard & expanded form									●			

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			SS	Age 3/4	Age 4/5	K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Base 10 Number System Whole Numbers	Place value & number forms for all counting numbers	Digit, place, & value												
		Standard, expanded, and long word form												
		Expanded form with exponents												
	Number sets	Counting numbers												
		Whole numbers												
		Integers												
	Roman numerals	Read												
	Cardinal & ordinal numbers	Recall cardinal & ordinal numbers												
		Solve word problems												
	Add	Use objects to find sums to 10												
		Add 4 digit numbers using materials												
		Memorize addition facts												
		Draw pictures, number bonds, solve word problems for addition equations to 20												
		Add 4 digit numbers with regrouping (abstract)												
		Add any whole numbers												
	Subtract	Subtract 4 digit numbers using materials												
		Use objects to find differences from 10												
		Draw pictures, number bonds, solve word problems for subtraction equations to 20												
		Subtract 4 digit numbers with borrowing (abstract)												

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Base 10 Number System Whole Numbers	Subtract	Memorize subtraction facts						<div></div>							
		Subtract any whole numbers						<div></div>	<div></div>	<div></div>					
	Multiply	Multiply 4 digit numbers using materials				<div></div>									
		Multiply 4 digit numbers without regrouping (materials)					<div></div>								
		Memorize multiplication facts 2/3/5/10						<div></div>							
		Use bar models to represent & solve word problems of multiplication equations to 100						<div></div>	<div></div>						
		Multiply 4 digit numbers (abstract)						<div></div>							
		Memorize multiplication facts 4/6/7/8/9							<div></div>						
		Recall multiples of numbers 1-10.							<div></div>						
		Multiply 4 digit numbers with regrouping (abstract)							<div></div>						
		Multiply by a multiple of 10							<div></div>	<div></div>	<div></div>				
		Multiply any whole numbers							<div></div>	<div></div>					
		Exponents								<div></div>	<div></div>				
	Divide	Divide 4 digit numbers using materials				<div></div>									
		Divide 4 digit numbers without regrouping (materials)					<div></div>								
		Divide 4 digit numbers (abstract)						<div></div>							
		Use bar models to solve word problems of division equations to 100							<div></div>						
		Divide 4 digit numbers with regrouping (abstract)							<div></div>						
		Divide by a 1 digit number								<div></div>					

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			SS	Age 3/4	Age 4/5	K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	
Base 10 Number System Whole Numbers	Divide	Divide by a multiple of 10									<div></div>				
		Divide by a 2 digit number									<div></div>				
	Estimate	Round numbers to the nearest 10						<div></div>	<div></div>						
		Round numbers to the nearest 100							<div></div>						
		Round numbers to the nearest 1,000							<div></div>						
		Round any whole number									<div></div>	<div></div>			
		Estimate by mental math: sums, differences, products, & quotients									<div></div>	<div></div>			
	Order of operations	PEMDAS									<div></div>	<div></div>			
		GEMDAS										<div></div>	<div></div>		
	Number theory	Find factors of a number (materials)								<div></div>					
		Find common multiples of numbers 1-10 (materials)								<div></div>					
		Rainbow method									<div></div>				
		Prime & composite numbers									<div></div>				
		Divisibility rules									<div></div>	<div></div>			
		Factors & multiples for any whole numbers									<div></div>	<div></div>			
		GCF or LCM using listing method									<div></div>				
		Prime factorization										<div></div>			
		Square or cube roots using prime factorization											<div></div>		
		GCF or LCM using prime factorization										<div></div>			
		GCF or LCM using ladder method											<div></div>		

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			SS	Age 3/4	Age 4/5	K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Fractional Numbers	Number theory	Word problems with GCF or LCM												
	Integers	Four operations												
		Exponents												
		Opposites												
		Absolute value												
		Compare & order												
		GEMDAS												
	Decimals	Read, write, & compare using materials												
		Tenths												
		Hundredths												
		Thousandths												
		Number line												
		Digit, place, & value												
		Standard form												
		Expanded form												
		Expanded form with exponents												
		Long word form												
		Compare & order												
		Round & estimate												
		Add & subtract												

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Fractional Numbers	Decimals	Multiply by a multiple of 10									<div></div>				
		Multiply by a decimal									<div></div>				
		Divide by a multiple of 10									<div></div>				
		Divide by a 2 digit whole number									<div></div>				
		Divide by a decimal									<div></div>				
		Word problems									<div></div> <div></div>	<div></div>			
		Money - cents								<div></div> <div></div>	<div></div>				
		Ruler - cm										<div></div>			
	Fractions	Name				<div></div>									
		Write & read					<div></div>								
		Equivalent fractions						<div></div> <div></div>	<div></div>						
		Number line									<div></div>				
		Fraction as division									<div></div> <div></div>				
		Simplest form									<div></div> <div></div>				
		Types of fraction									<div></div> <div></div>				
		Convert mixed numbers & improper fractions								<div></div> <div></div>	<div></div>				
		Add or subtract with like denominators								<div></div> <div></div>					
		Add or subtract with unlike denominators (LCD)									<div></div>				
		Add mixed numbers with regrouping										<div></div>			
		Subtract mixed numbers with borrowing										<div></div>			



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			SS	Age 3/4	Age 4/5	K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Fractional Numbers	Fractions	Fraction of a number												
		Cross cancellation												
		Multiply fractions												
		Divide by multiplying the reciprocal												
		Multiply or divide mixed numbers												
		Strategies to compare & order												
		Solve word problems with bar models												
		Ruler - inches												
	Percents	Basics												
		Percent of a number												
		Mental math												
		Word problems												
		Percent change												
		Calculate discount, tips, taxes, profit, interest, commission, markup, etc.												
		Percent & proportions												
	Conversions	Memorize halves to elevenths												
		Decimals & percents												
		Decimals to fractions by reading												
		Fractions to decimals using friendly denominators												
		Fractions to decimals by long division												

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Measurements	1-D geometric measurements	Perimeter of polygons							<div></div>						
		Perimeter of rectangles & squares								<div></div>					
		Missing length using perimeter									<div></div>	<div></div>			
		Pythagoras theorem											<div></div>		
		Circumference											<div></div>		
	2-D geometric measurements	Area by counting								<div></div>	<div></div>				
		Area of rectangle or square L x W (L x L) less than 100								<div></div>					
		Area of rectangle or square L x W (L x L)									<div></div>				
		Missing length given area									<div></div>	<div></div>			
		Area of triangle										<div></div>			
		Composite rectangular areas									<div></div>				
		Composite areas, including triangles										<div></div>			
		Area of circles											<div></div>		
	3-D geometric measurements	Measure volume with nonstandard units	<div></div>	<div></div>											
		Measure volume in cups & teaspoons (practical life)			<div></div>										
		Volume by counting								<div></div>	<div></div>	<div></div>			
		Volume of rectangular prisms WxLxH or AxH									<div></div>	<div></div>			
		Volume of liquids								<div></div>		<div></div>			
		Missing length given volume										<div></div>			
		Volume of irregular rectilinear solids										<div></div>			

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Measurements	Money	Name coins and value												
		Count coins												
		Count bills & coins												
		Add & subtract money												
	Time	Recall age, read visual daily schedule, birthday celebrations												
		Read daily schedule, describe seasons												
		Name days of the week												
		Name months of the year												
		Use sand timers 30s/1min/3min												
		Create daily schedule & monthly calendars												
		Recall functions of hand on an analog clock												
		Read time on the hour/half hour												
		Use a daily checklist												
		Read time to the quarter hour												
		Use a daily schedule to plan day												
		Create year calendar												
		Read time on an analog clock												
		Use a weekly planner												
		Calculate elapsed time												
		Use a weekly planner												

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			SS	Age 3/4	Age 4/5	K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Measurements	Time	Use a monthly calendar to manage projects												
	Length	Measure length in customary units												
		Measure length in metric units												
		Convert length within same system of measurement												
	Mass	Measure mass in customary units												
	Temperature	Temperature in °F												
		Temperature in °C												
	Weight	Measure weight in customary units												
		Measure weight in metric units												
		Convert weight within same system of measurement												
	Capacity	Measure capacity in customary units												
		Measure capacity in metric units												
		Convert capacity within same system of measurement												
	Conversions	Conversion factor - metric or customary												
		Multiply to smaller units												
		Divide to larger units												
	Comparison	Order set of 5 objects based on size attributes												
		Order set of 10 objects based on 2 attributes of length												
		Order set of 5 objects based on weight												

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Geometry	Comparison	Order set of 10 objects based on 4 attributes of length												
		Order, compare, & describe sets of objects based on attributes of length, height, width, volume, and weight												
	Operations	Add or subtract												
		Multiply or divide												
		Fraction of a measurement												
	1 to 3 Dimensions	Points												
		Rays, segments, lines												
		Planes												
		Parallel/perpendicular/skew												
	Angles & lines	Classify angles												
		Measure using protractor												
		Estimate, measure, & draw angles												
		Angles greater than 180 degrees												
		Perpendicular & parallel lines												
		Angle sum												
		Angle pairs - complementary & supplementary												
		Angle pairs - adjacent angles												
		Angle pairs - linear angles												
		Angle pairs - vertical angles												

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Geometry	Polygons & circles	Naming 3- to 10-sided								<div></div>				
		Classify polygons (regular, convex, simple)								<div></div>				
		Classify triangles by sides								<div></div>				
		Classify triangles by angles								<div></div>				
		Identify base & height of triangle									<div></div>			
		Classify quadrilaterals								<div></div>				
		Circle vocabulary								<div></div>				
	Solids	Prisms								<div></div>				
		Pyramids								<div></div>				
		Nets								<div></div>				
		Face, edge, vertex of a polyhedron								<div></div>	<div></div>			
		Cylinders								<div></div>				
		Cones								<div></div>				
	Congruence & symmetry	Congruence & similarity								<div></div>				
		Line symmetry								<div></div>				
		Rotational symmetry & angle of rotation								<div></div>	<div></div>			
	Coordinate plane	Ordered pairs								<div></div>				
		Coordinate plane (1st quadrant)								<div></div>				
		Coordinate plane (4 quadrants)								<div></div>				
		Graphing relationship between two quantities								<div></div>				

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Geometry	Coordinate plane	Transformations - translation (conceptual)												
		Transformations - reflection (conceptual)												
		Transformations - rotation (conceptual)												
		Transformations - translation (coordinates)												
		Transformations - reflection (coordinates)												
		Transformations - rotation (coordinates)												
Data, Graphs, & Statistics	Data	Conduct survey & represent result (pictograph/tally chart)												
		Conduct survey & represent result (bar graph scales of 1)												
		Collect data & represent result (line graph)												
	Central tendency	Conceptualize average as expected result & calculate within a range of known math fact												
		Mean, median, mode, range, outlier												
		Find missing data given central tendency												
	Frequency table	Frequency table												
	Graph	Bar, line, histogram												
		Scatterplot												
		Circle graph												
		Dot plot												
		Stem & leaf plot												
		Quartiles, box & whiskers plot												

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Probability	Basic probability	Theoretical probability							<div></div>	<div></div>				
		Experimental probability								<div></div>				
		Expected outcomes								<div></div>				
		Tree diagram & independent events									<div></div>	<div></div>		
		With and without replacement									<div></div>	<div></div>		
	Counting principle	Combinatorics										<div></div>		
		Permutations & factorials										<div></div>		
Ratios & Proportions	Ratios & rates	Ratio & rates								<div></div>	<div></div>			
		Equivalent ratios								<div></div>	<div></div>			
		Unit rates, unit price, & better buy									<div></div>			
		Word problems & bar models									<div></div>	<div></div>		
		Speed									<div></div>	<div></div>		
	Proportions	Solve proportions								<div></div>	<div></div>			
		Scaled drawing								<div></div>	<div></div>			
		Similar shapes									<div></div>	<div></div>		
		Percent problems										<div></div>	<div></div>	
	Number sense	Identify missing 3D puzzle piece (size & color)		<div></div>	<div></div>									
		Identify missing addend up to 10				<div></div>								
		Identify missing addend up to 20					<div></div>							



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Algebra	Number sense	Identify missing subtrachend/minuend up to 20												
		Identify missing multiplicand/multiplier/divisor up to 100												
		Generate a list of possible solutions for equations missing both addends/multiplier/multiplicand, etc												
		Number patterns												
	Pre-algebra	Translate												
		Evaluate												
		Formal check for solution to equation												
		Solve 1-step equation mentally												
		Inverse operation												
	Basic algebra	Combine like terms												
		Distributive property												
		Solve 2-step equation												
		Solve multistep equation												
		Solve equation with variables on both sides												
		Solve word problems algebraically												
		Clear fractions & decimals												
		Literal equations												
	Inequalities	Solve basic inequalities												
		Solve multi-step inequalities												
		Compound inequalities												

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Algebra	Inequalities	Absolute value inequalities												
		Word problems												
	Functions	Relations/coordinate plane												
		Function notation												
		x- and y-intercept												
		Slope												
		Point slope form												
		Slope intercept form												
		Parallel/perpendicular												
	Systems	Graphing												
		Substitution												
		Elimination												
		Word problems - coin, age, motion, mixture												
	Factoring	GCF												
		Difference of squares												
		A = 1												
		Perfect squares												
		A > 1												
		Grouping												
		Zero product property												

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Algebra	Factoring	Word problems												
	Rational Expressions	Exponent rules (positive only)												
		Exponent rules (including negative)												
		Power to a power												
		GCF & LCM of monomials (p.f. & division ladder)												
		Simplify monomials												
		Multiply & divide monomials												
		Multiply & divide scientific notation												
		Add & subtract monomials												
		Multiply & divide polynomials												
		Simplify complex rational expressions												
		Equations												
		Word problems												
	Radicals	Simplify												
		Multiply & divide												
		Rationalize denominator												
		Add & subtract												
		Equations												
		Pythagorean theorem												