Mathematics Subject Group Overview - Application - Year 1

Unit Title and Teaching Hours	Key Concept	Related Concepts	Global Context	Statement of Inquiry	Objectives	ATL Skills	Content (topics, knowledge, skills)
Number System, Part I 20 hours	Connections	Model	personal and cultural expression	Mathematicians connect operations with fractions & decimals to operations with whole numbers, and create models to show their comparisons.	knowing and understanding	communication	divide fractions in context, divide fractions with models, divide fractions pure computation, divide a mixed number by a fraction in context, divide with mixed numbers
Expressions & Equations 35 hours	Relationships	Equivalence	identities and relationships	Variable expressions serve a purpose-- they show relationships between properties that help us discover equivalence.	knowing and understanding, investigating patterns	transfer	distributive property, exponents, order of operations, words to expressions, algebraic substitution, equivalent expressions
Number System, Part 2 35 hours	Systems	Quantity	personal and cultural expression	We use systems to construct meaningful personal understanding and competency with operations.	knowing and understanding	organization	divide whole numbers, add,subtract, multiply, divide with decimals, GCF, LCM
Ratio & Proportional Relationships 30 hours	Change	Generalization	scientific and technical innovation: Systems, models, methods; products, processes and solutions	We generalize our understanding of "part" versus "whole," in fraction and use specific processes to change fractions to other forms.	applying mathematics in real-life contexts, communicating	information literacy	ratio and rate from word situations, equivalent ratios (tables, missing values in tables), plot pairs of values from ratio table, compare ratios with tables, unit/rate problems (pricing, constant speed), find percent as rate/100, find whole given part in a percent, use common fractions & percents to calculate parts of whole numbers, compare 2 whole as differences (part to part VS. part to whole ratios), use ratios to convert measurements
Geometry 35 hours	Relationships	Pattern, Measurement	orientation in space and time: Mensuration and standardization	Understanding form and measurement of form helps us logically predict outcomes in a scientific and technical world.	applying mathematics in real-life contexts	Tthinking	areas of triangles, special quads, polygons, problem solving w/area, volume of rectangular prisms (fraction lengths), V=lwh apply to real problems, draw polygons on coordinate plane given vertex coordinates, find length of side given 1st and 2nd coordinate, surface area
Statistics 25 hours	Global Interactions	Justification	globalization and sustainability	A statistician's choice of data display can lead people to justify choices that impact global interactions and sustainability.	communicating, investigating patterns	information literacy	center, spread, overall shape, display data in line plots, histograms, read/report # of observations given the data set, mean, median, mode, interquartile range, absolute deviation, relate choice of measure center to the shape & data distribution

Mathematics Subject Group Overview - Application - Year 2

Unit Title and Teaching Hours	Key Concept	Related Concepts	Global Context	Statement of Inquiry	Objectives	ATL Skills	Content (topics, knowledge, skills)
Rational Numbers: 35 hours	relationships	system, pattern	globalization and sustainability	Relationships that deal with global consumption can be organized using patterns found in number systems.	knowing and understanding	organization	~adding and subtracting rational numbers ~multiplying and dividing rational numbers ~decimals and percents
Ratios and Proportional Relationships: 30 hours	relationships	measurement, equivalence, quantity	identities and relationships	Quantifying equivalent mathematical relationships can lead to smart financial decisions.	knowing and understanding and investigating patterns	~transfer ~creative skills	~ratios and rates ~proportional relationships ~percents
Expressions and Equations: 20 hours	connections	models and equivalence	identities and relationships	If I can make connections, then I can balance and transfer my knowledge into a variety of educational opportunities.	communicating	reflection skills ~communication skills	~equivalent expressions ~equations ~inequalities
Geometry: 35 hours	form	space, measurement, representation	environments	Applying spatial reasoning skills helps me transform my environment.	applying mathematics in real-life contexts	~critical thinking skills ~transfer skills	~angles ~circles ~two-and three-dimensional shapes ~surface area and volume
Statistics: 30 hours	logic	data analysis	globalization and sustainability	If I can analyze the data given, and think logically about it, I will be sure to consider all possible outcomes of an event. I can use these skills to participate in the sustainability of my world.	investigating patterns and applying math in real life situation	~critical thinking skills ~transfer skills ~collaboration skills	~sampling ~comparing two populations
Probability: 30 hours	logic	representation	fairness and development	Using models to consider the chances and actual experimental samples for comparison, I can better understand fairness as I develop a deeper understanding of situations around me.	communicating	~ information literacy skills ~affective skills ~media literacy skill	~probability concepts ~compound events

Mathematics Subject Group Overview - Application - Year 3

Unit Title and Teaching Hours	Key Concept	Related Concepts	Global Context	Statement of Inquiry	Objectives	ATL Skills	Content (topics, knowledge, skills)
The Number Sense (3 weeks) 15 hours	Form	Simplification	Fairness and development	By understanding and following rules, we can have a predictable outcome	C. Communicating	Communication - I. Communication skills	Rational and Irrational Numbers
Expressions and Equations, Part 1 (6 weeks) 30 hours	Logic	Equivalence	Identities and relationships	Mathematicians use logic to discover the true identities of equivalent expressions.	A. Knowing & Understanding	Thinking - VIII. Critical-thinking skills	Linear Equations in one Variable - Integer Exponents - Scientific Notation
Expressions and Equations, Part 2 (6 weeks) 30 hours	Form	System	Orientation in space and time	Studying the form & interactions of systems can help us make real world decisions using local and global perspectives.	B.Investigating patterns	Thinking - IX. Creative-thinking skills	Proportional Realtionships, Lines, and Linear Equations - Systems of Linear Equations
Functions (7 weeks) 35 hours	Relationships	Change	scientific and technical innovation	Change in one variable affects change in another (relationship), though global interactions	C. Communicating	Self-management - IV. Affective skills	Defining and Comparing Functions - Linear Functions
Geometry (8 weeks) 40 hours	Form	Measurement	Personal and cultural expression	Understanding form and measurement of form helps us logically predict outcomes in a scientific and technical world.	D. Applying mathematics in real-life contexts	Social - II. Collaboration skills	Congruence - Similarity - Reasoning in Geometry - Using the Pythagorean Theorem - Surface Area and Volume
Statistics (5 weeks) 25 hours	Relationships	Pattern	Globalization and sustainability	The ability to analyze and interpret data helps to distinguish between false relationships and patterns (such as developing superstitions) from seeing two events happen in close succession versus identifying a credible correlation throughout differing parts of the globe.	A. Knowing & Understanding	Research - VI. Information literacy skills	Scatter Plots - Analyzing Categorical Data

Unit Title and Teaching Hours	Key Concept	Related Concepts	Global Context	Statement of Inquiry	Objectives	ATL Skills	Content (topics, knowledge, skills)
Real Numbers and Solving Equations/Inequalities (30 - 45 hours)	Logic	System	Personal and Cultural Expression: equations and variations	We use logic to make changes to systems that result in a clearer understanding of their true natures.	Knowing and Understanding; Communicating	Self Management: Organization Skills	Identify types of numbers and reason using the properties of real numbers, solve linear equations and inequalities, graph solutions to simple and compound single-variable inequalities, use formulas and solve literal equations, use proportional reasoning to solve problems, use conversion factors to convert rates
Relations, Functions, Sequences (15 hours)	Form	Representation	Identities and Relationships	By recognizing patterns in relations and sequences I can utilize form to represent situations with mathematical functions.	Investigating Patterns	Thinking: Creati	Define functions, use function notation, recognize and graph different types of functions (linear, quadratic, cubic, absolute value), identify arithmetic sequences, write function rules for sequences and to model real-world problems
Linear Functions (25 - 30 hours)	Relationships	Model	Orientation in Space and Time	I can use linear functions to model mathematical relationships on and off the coordinate plane that have a constant rate of change, or growth rate, and to solve real world problems.	Communicating	Thinking: Critical Thinking Skills	Find slope as rate of change, use linear functions to model situations, change between equivalent forms of linear equations, perform transformations on linear and absolute value functions, write an equation for a line of best fit to model data

Systems of Linear Equations and Inequalities (15 - 25 hours)	Relationships	Equivalence	Orientation in Space and Time	Equivalent relationships between linear equations and inequalities let me model (on and off the coordinate plane) and solve problems about two or more quantities.	Knowing and Understanding	Social: Collaboration Skills	Solve problems using systems of equations with multiple methods (graphing, substitution, and elimination); Solve problems by graphing systems of inequalities
Exponents and Exponential Functions(20 - 25 hours)	Logic	Pattern	Globalization and Sustainability	By understanding the logic and patterns of exponents and exponential functions, I can model problems about growth and decay that impact global populations.	Applying Math in Real Life contexts	Research: Informtion Literacy Skills	Recognize exponential growth and decay situations and use exponential funtions to model change; simplify exponential expressions to equivalent forms using Laws of Exponents
Quadratic Functions and Polynomials (40 hours)	Form	Simplification	Scientifc and Technical Innovation	Understanding the form of quadratic equations and simplifying to create equivalent quadratic equations helps me solve problems involving scientific and technical applications.	Investigating Patterns	Thinking: Transfer Skills	Describe, simplify, and multiply polynomials. Recognize perfect square and difference of squares patterns. Factor polynomials. Solve quadratic equations by taking square roots, factoring and zero product property, completing the square, and the quadratic formula. Graph parabolas by finding key features from their equations (vertex, axis of symmetry, and intercepts), including vertex form. Apply quadratic equations to problems involving vertical motion, and area/volume. Describe the effect of transformations on quadratic functions (horizontal/vertical shift and stretch factor).

Statistics and Data Anaylsis (15-25 hours)	Relationships	Quantity	Fairness and Development	Data representations communicate relationships between quantities. Through data analysis future events can be predicted using past outcomes to promote fairness and development.	Applying Math in Real Life contexts	Research: Media Literacy Skills	Reason quantitatively and use units to solve problems; use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret the scale and the origin in graphs and data displays; define appropriate quantities for the purpose of descriptive modeling; summarize, represent, and interpret data on a single count or measurement variable; summarize, represent, and interpret data on two categorical and quantitative variables;

Mathematics Subject Group Overview - Application - Geometry

Unit Title and Teaching Hours	Key Concept	Related Concepts	Global Context	Statement of Inquiry	Objectives	ATL Skills	Content (topics, knowledge, skills)
Building Blocks of Geometry & Algebra Review - 10 hours	Form	Representation	Identities and relationships	Form and relationships impact representation	C - Communicating	Social skills - Collaboration	Experiment with transformations in the plane (CCSS: G-CO; 4.1.a) State precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. (CCSS: G-CO.1; 4.1.a.i) Express Geometric Properties with Equations (CCSS: G-GPE; 4.3.a) Use coordinates to prove simple geometric theorems algebraically. (4.3.a.ii) Find the point on a directed line segment between two given points that partitions the segment in a given ratio. (4.3.a.ii.3)
Algebra Review - 10 hours	Relationships	Equivalence	Globalization and sustainability	Different branches of mathematics be used to accomplish the same goals.	B - Investigating patterns	Self-management skills - Reflection skills	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.[i] (4.3.a.ii.2) "Graph linear functions and show intercepts. (2.1.c.ii) Construct linear functions, including arithmetic sequences, given a graph, a description of a relationship, or two input-output pairs. (2.2.a.ii) Create equations in two or more variables to represent relationships between quantities and graph equations on coordinate axes with labels and scales. (2.4.a.ii) Solve linear equations in one variable. (2.4.c.i) Solve systems of linear equations exactly and approximately, focusing on pairs of linear equations in two variables. (2.4.d.ii)
Geometric Constructions - 15 hours	Logic	Justification	Personal and cultural expression	Using logic to analyze and justify statements is a powerful tool.	C - Communicating	Communication skills - Reading, writing, and using language to gather and communicate information	Make geometric constructions. (CCSS: G-CO; 4.1.d) Make formal geometric constructions[i] with a variety of tools and methods.[ii] (CCSS: G-CO.12; 4.1.d.i) Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. (CCSS: G-CO.13; 4.1.d.ii) Understand and apply theorems about circles. (CCSS: G-C; 4.2.e) Construct the inscribed and circumscribed circles of a triangle. (CCSS: G-C.3; 4.2.e.ii)
Properties of Triangles, Congruence, and Proof - 20 hours	Form	Equivalence	Scientific and technical innovation	Logical processes can be used to demonstrate equivalence in form.	A - Knowing and understanding	Thinking skills - Critical Thinking	Understand congruence in terms of rigid motions. (CCSS: G-CO; 4.1.b) Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. (CCSS: G-CO.7; 4.1.b.iii) Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. (CCSS: G-CO.8; 4.1.b.iv) Prove geometric theorems. (CCSS: G-CO; 4.1.c) Prove theorems about lines and angles.[i] (CCSS: G-CO.9; 4.1.c.i) Prove theorems about triangles.[ii] (CCSS: G-CO.10; 4.1.c.ii)

Polygons and Properties of Quadrilaterals - 15 hours	Relationships	Generalization	Scientific and technical innovation	Careful observation of systems permits generalization.	D - Applying mathematics in real-life contexts	Thinking skills - Creative thinking	Prove geometric theorems. (CCSS: G-CO; 4.1.c) Prove theorems about triangles (midsegments).[i] (CCSS: G-CO.10; 4.1.c.ii) Prove theorems about parallelograms.[ii] (CCSS: G-CO.11; 4.1.c.iii)
Transformations - 15 hours	Relationships	Pattern and Space	Identities and relationships; Transition	We can create visual interest by using patterns of transformation in space	B - Investigating patterns	Communication skills	Experiment with transformations in the plane. (CCSS: G-CO; 4.1.a) Represent transformations in the plane using[i] appropriate tools. (CCSS: G-CO.2; 4.1.a.ii) Describe transformations as functions that take points in the plane as inputs and give other points as outputs. (CCSS: G-CO.2; 4.1.a.iii) Compare transformations that preserve distance and angle to those that do not.[ii] (CCSS: G-CO.2; 4.1.a.iv) Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. (CCSS: G-CO.3; 4.1.a.v) Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. (CCSS: G-CO.4; 4.1.a.vi) Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using appropriate tools.[iii] (CCSS: G-CO.5; 4.1.a.vii) Specify a sequence of transformations that will carry a given figure onto another. (CCSS: G-CO.5; 4.1.a.viii) Understand congruence in terms of rigid motions. (CCSS: G-CO; 4.1.b) Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure. (CCSS: G-CO.6; 4.1.b.i) Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. (CCSS: G-CO.6; 4.1.b.ii)
Area - 10 hours	Form	Quantity	Orientation in space and time	Measurement is a form of describing quantity.	D - Applying mathematics in real-life contexts	Research skills - Information literacy skills	Find arc lengths and areas of sectors of circles. (CCSS: G-C; 4.2.f) Derive the formula for the area of a sector. (CCSS: G-C.5; 4.2.f.ii) Explain volume formulas and use them to solve problems. (CCSS: G-GMD; 4.4.a) Give an informal argument[i] for the formulas for the circumference of a circle and area of a circle. (CCSS: G-GMD.1; 4.4.a.i) Apply geometric concepts in modeling situations. (CCSS: G-MG; 4.5.a) Apply geometric methods to solve design problems (with area).[ii] (CCSS: G-MG.3; 4.5.a.iii)

The Pythagorean Theorem and Coordinate Geometry - 10 hours	Logic	Model	Orientation in space and time	Using position to model relationships is a logical way to draw conclusions.	A - Knowing and understanding	Thinking skills - Critical Thinking	Define trigonometric ratios and solve problems involving right triangles. (CCSS: G-SRT; 4.2.c) Use the Pythagorean Theorem to solve right triangles in applied problems. (CCSS: G-SRT.8; 4.2.c.iii) Express Geometric Properties with Equations. (CCSS: G-GPE; 4.3.a) Translate between the geometric description and the equation for a conic section. (CCSS: G-GPE; 4.3.a.i) Derive the equation of a circle of given center and radius using the Pythagorean Theorem. (CCSS: G-GPE.1; 4.3.a.i.1) Complete the square to find the center and radius of a circle given by an equation. (CCSS: G-GPE.1; 4.3.a.i.2) Use coordinates to prove simple geometric theorems algebraically. (CCSS: G-GPE; 4.3.a.ii) Use coordinates to prove simple geometric theorems[i] algebraically. (CCSS: G-GPE.4; 4.3.a.ii.1) Use coordinates and the distance formula to compute perimeters of polygons and areas of triangles and rectangles. (CCSS: G-GPE.7; 4.3.a.ii.4)
Volume - 10 hours	Logic	Space	Fairness and development	Use of logic in the arrangement of space greatly impacts fairness in resource management.	C - Communicating	Social skills - Collaboration	Explain volume formulas and use them to solve problems. (CCSS: G-GMD; 4.4.a) Give an informal argument[i] for the formulas for the volume of a cylinder, pyramid, and cone. (CCSS: G-GMD.1; 4.4.a.i) Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. (CCSS: G-GMD.2; 4.4.a.ii) Visualize relationships between two-dimensional and three-dimensional objects. (CCSS: G-GMD; 4.4.b) Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. (CCSS; G-GMD.4; 4.4.b.i) Apply geometric concepts in modeling situations. (CCSS: G-MG; 4.5.a) Use geometric shapes, their measures, and their properties to describe objects.[ii] (CCSS: G-MG.1; 4.5.a.i) Apply concepts of density based on area and volume in modeling situations.[iii] (CCSS: G-MG.2; 4.5.a.ii) Apply geometric methods to solve design problems (with volume).[iv] (CCSS: G-MG.3; 4.5.a.iii)

Similarity and Trigonometry - 30 hours	Form	Simplification	Identities and relationships	Simplifying common patterns helps describe relationships.	D - Applying mathematics in real-life contexts	Thinking skills - Critical Thinking	Understand similarity in terms of similarity transformations. (CCSS: G-SRT; 4.2.a) Verify experimentally the properties of dilations given by a center and a scale factor. (CCSS: G-SRT.1; 4.2.a.i) Show that a dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. (CCSS: G-SRT.1a; 4.2.a.i.1) Show that the dilation of a line segment is longer or shorter in the ratio given by the scale factor. (CCSS: G-SRT.1b; 4.2.a.i.2) Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar. (CCSS: G-SRT.2; 4.2.a.ii) Explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. (CCSS; G-SRT.2; 4.2.a.iii) Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. (CCSS: G-SRT.3; 4.2.a.iv) Prove theorems involving similarity. (CCSS: G-SRT; 4.2.b) Prove theorems about triangles (similarity).[i] (CCSS: G-SRT.4; 4.2.b.i) Prove that all circles are similar. (CCSS: G-C.1; 4.2.b.ii) Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. (CCSS: G-SRT.5; 4.2.b.iii) Define trigonometric ratios and solve problems involving right triangles. (CCSS: G-SRT; 4.2.c) Explain that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. (CCSS: G-SRT.6; 4.2.c.i) Explain and use the relationship between the sine and cosine of complementary angles. (CCSS: G-SRT.7; 4.2.c.ii) Use trigonometric ratios to solve right triangles in applied problems. (CCSS: G-SRT.8; 4.2.c.iii) Apply geometric concepts in modeling situations. (CCSS: G-MG; 4.5.a) Apply geometric methods to solve design problems (with ratios and similarity).[ii] (CCSS: G-MG.3; 4.5.a.iii)
Circles - 20 hours	Relationships	Form	Scientific and technical innovation: Mathematical puzzles, principles, and discoveries	We use mathematical principles to discover relationships between forms in a circle.	B - Investigating patterns	Self-management skills - Reflection skills	Understand and apply theorems about circles. (CCSS: G-C; 4.2.e) Identify and describe relationships among inscribed angles, radii, and chords.[i] (CCSS: G-C.2; 4.2.e.i) Prove properties of angles for a quadrilateral inscribed in a circle. (CCSS: G-C.3; 4.2.e.iii) Find arc lengths and areas of sectors of circles. (CCSS: G-C; 4.2.f) Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality. (CCSS: G-C.5; 4.2.f.i)

Probability - 15 hours	Relationships	Pattern	Fairness and development	Understanding the relationships within the patterns of likelihood is a powerful way of managing inequality.	A - Knowing and understanding	Social skills - Collaboration	Understand independence and conditional probability and use them to interpret data. (CCSS: S-CP; 3.3.a) Describe events as subsets of a sample space[i] using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events.[ii] (CCSS: S-CP.1; 3.3.a.i) Explain that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. (CCSS: S-CP.2; 3.3.a.ii) Using the conditional probability of A given B as P(A and B)/P(B), interpret the independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. (CCSS: S-CP.3; 3.3.a.iii) Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.[iii] (CCSS: S-CP.4; 3.3.a.iv) Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.[iv] (CCSS: S-CP.5; 3.3.a.v) Use the rules of probability to compute probabilities of compound events in a uniform probability model. (CCSS: S-CP; 3.3.b) Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. (CCSS: S-CP.6; 3.3.b.i) Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. (CCSS: S-CP.7; 3.3.b.ii) Analyze the cost of insurance as a method to offset the risk of a situation (PFL) (3.3.c)