Ganado Unified School District
(Career Math 12th Grade)

PACING Guide: Career Math SY 2022-23

	AZ College and Career Readiness Standard	Essential Question (HESS Matrix)	Learning Goal	Vocabulary (Content/Academic)
References: **McGraw Hill Practical Business Math Procedures** **Points, Lines, and Planes** **Lesson 1-3** **Line Segments** **Lesson 1-4** **Distance** **Lesson 1-5**	**Standards for Mathematical Practices** ***(These will be applied in all units of study.)*** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.		**Timeline & Resources**	

Locating Points on a Number Line **Lesson 1-6 Locating Points on a Coordinate Place** **Lesson 1-7 Midpoints and Bisectors** ***MODULE 2 Angles and Geometric Figures*** **Lesson 2-1 Angles and Congruence** **Lesson 2-2 Angle Relationships** **Lesson 2-3 Two-Dimensional Figures** **Lesson 2-4**	**MODULE 1** **Tools of Geometry** **G.CO.1** Know precise definitions of geometric terms based on the undefined notion of point, line, distance along a line and distance around a circular arc. **G.MG.1** Use geometric shapes, their measures and their properties to describe objects (e.g. modelling a tree trunk or a human torso as a cylinder). **G.CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line. **G.GPE.6** Find the point on a directed line segment between two given points that partitions the segment in a given ratio. **MODULE 2**	**MODULE 1** **Tools of Geometry** How are points, lines, and segments used to model the real world?		**MODULE 1** **Tools of Geometry** Analytic geometry Axiom Axiomatic system Betweenness of points Bisect Collinear Congruent Congruent segments Coplanar Defined term Definition Directed line segment Distance Equidistant Fractional distance Intersection Line Line segment Midpoint Plane Point Postulate Segment bisector Space Synthetic geometry Theorem Undefined terms

Transformations in the Plane **Lesson 2-5 Three-Dimensional Figures** **Lesson 2-6 Two-Dimensional Representations of Three-Dimensional Figures** **Lesson 2-7 Precision and Accuracy** **Lesson 2-8 Representing Measurements**	**Angles and Geometric Figures** **G.CO.1** Know precise definitions of geometric terms based on the undefined notion of point, line, distance along a line and distance around a circular arc. **G.CO.2** Represent transformations in the plane using, e.g. transparencies and geometry software. describes transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g. translation versus horizontal stretch). **G.MG.1** Use geometric shapes, their measures and their properties to describe objects (e.g. modelling a tree trunk or a human torso as a cylinder). **G.MG.3** Apply geometric methods to solve problems. **G.CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a	**MODULE 2** **Angles and Geometric Figures** How are angles and two-dimensional figures used to model the real world?		**MODULE 2** **Angles and Geometric Figures** Accuracy Adjacent angles Angle Angle bisector Angle of rotation Approximate error Area Base of a pyramid or cone Bases of a prism or cylinder Center of rotation Circumference Complementary angles Component form Concave Cone Congruent angles Convex Cylinder Edge of a polyhedron Equiangular polygon Equilateral polygon Exterior Face of a polyhedron Geometric model Image Interior Line of reflection Linear pair Net Opposite rays Orthographic drawing

MODULE 3 Logical Arguments and Line Relationships **Lesson 3-1 Conjectures and Counterexamples** **Lesson 3-2 Statements, Conditionals, and Biconditionals** **Lesson 3-3 Deductive Reasoning**	line parallel to a given line through a point not on the line. **GPE.7.** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. **MODULE 3**			Perimeter Perpendicular Platonic solid Polygon Polyhedron Precision Preimage Prism Pyramid Ray Reflection Regular polygon Regular polyhedron Rigid motion Rotation Sides Significant figures Sphere Straight angle Supplementary angles Surface area Transformation Translation Translation vector Vertex Vertex of a polyhedron Vertical angles Volume

Lesson 3-4 **Writing Proofs** **Lesson 3-5** **Proving Segment Relationships** **Lesson 3-6** **Proving Angle Relationships** **Lesson 3-7** **Parallel Lines and Transversals** **Lesson 3-8** **Slope and Equations of Lines** **Lesson 3-9** **Proving Parallel Lines** **Lesson 3-10** **Perpendiculars and Distance**	**Logical Arguments and Line Relationships** **G.CO.1** Know precise definitions of geometric terms based on the undefined notion of point, line, distance along a line and distance around a circular arc. **G.MG.3** Apply geometric methods to solve problems. **G.CO.9.** Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segments' endpoints. **G.CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.	**MODULE 3** **Logical Arguments and Line Relationships** What makes a logical argument, and how are logical arguments used in geometry?		**MODULE 3** **Logical Arguments and Line Relationships** Alternate exterior angles Alternate interior angles Biconditional statement Compound statement Conclusion Conditional statement Conjecture Conjunction Consecutive interior angles Contrapositive Converse Corresponding angles Counterexample Deductive arguent Deductive reasoning Disjunction Equidistant Exterior angles Flow proof Hypothesis If-then statement Inductive reasoning Interior angles Inverse Logically equivalent Negation Paragraph proof Parallel lines Parallel planes Proof Skew lines

	G.GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.			Slope Slope criteria Statement Transversal Truth value Two-column proof Valid argument
MODULE 4 ***Transformations and Symmetry*** **Lesson 4-1** **Reflections** **Lesson 4-2** **Translations** **Lesson 4-3** **Rotations** **Lesson 4-4** **Compositions of Transformations** **Lesson 4-5** **Tessellations** **Lesson 4-6** **Symmetry**	**MODULE 4** **Transformations and Symmetry** **G.CO.3** Given a rectangle, parallelogram, trapezoid or regular polygon describe the rotations and reflections that carry it onto itself **G.CO.4** Develop and use definitions of rigid motion of rotation, reflection and translation in terms of angles, circles, perpendicular lines, parallel lines, and line segments. **G.CO.5** Given a geometric figure and a rotation, reflection, or translation draw the transformed figure using, e.g. graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. **G.CO.6** Use geometric of rigid motions to transforms figures and to predict the effect of a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	**MODULE 4** **Transformations and Symmetry** How are rigid motions used to show geometric relationships?	**MODULE 4** **Transformations and Symmetry** -define congruence in terms of rigid motions -reflect figures -draw and analyze reflected figures -translate figures -draw and analyze translated figures -rotate figures -draw and analyze rotated figures -draw and analyze figures under multiple transformations -identify tessellations -identify line symmetry in two-dimensional figures -identify rotational symmetries in two-dimensional figures	**MODULE 4** **Transformations and Symmetry** Center of symmetry Composition of transformations Glide reflection Line of symmetry Line symmetry Magnitude Magnitude of symmetry Point of symmetry Point symmetry Regular tessellation Rotational symmetry Semiregular tessellation Symmetry Tessellation Uniform tessellation

MODULE 5 Triangles and Congruence **Lesson 5-1: Angles of Triangles** **Lesson 5-2: Congruent Triangles** **Lesson 5-3: Proving Triangles Congruent: SSS, SAS** **Lesson 5-4: Proving Triangles Congruent: ASA, AAS** **Lesson 5-5: Proving Right Triangles Congruent** **Lesson 5-6: Isosceles and Equilateral Triangles** **Lesson 5-7: Triangles and Coordinate Proof**	**MODULE 5** **Triangles and Congruence** **G.GPE.4** Use coordinates to prove simple geometric theorems algebraically. **G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. **G-CO.7** 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. **G-CO.8** Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. **G.CO.10** Prove theorems about triangles.	**MODULE 5** **Triangles and Congruence** How can you prove congruence and use congruent figures in real-world situations?	**MODULE 5** **Triangles and Congruence** -solve problems using the Triangle Angle-Sum Theorem -solve problems using the Exterior Angle Theorem -show that triangles are congruent -identify corresponding parts of congruent triangles -solve problems using the SSS/SAS/ASA Congruence Postulate -solve problems using the AAS Congruent Theorem -construct congruent triangles -solve problems using the LL, HA, LA and HL Theorem -solve problems involving isosceles and equilateral triangles -write coordinate proofs	**MODULE 5** **Triangles and Congruence** Auxiliary line Base angles of an isosceles triangle Congruent polygons Coordinate proofs Corollary Corresponding parts Exterior angle of a triangle Included angle Included side Interior angle of a triangle Isosceles triangle Legs of an isosceles triangle Principle of superposition Remote interior angles Vertex angle of an isosceles triangle
MODULE 6	**MODULE 6**	**MODULE 6**	**MODULE 6**	**MODULE 6**

Relationships in Triangles **Lesson 6-1: Perpendicular Bisectors** **Lesson 6-2: Angle Bisectors** **Lesson 6-3: Medians and Altitudes of Triangles** **Lesson 6-4: Inequalities in One Triangle** **Lesson 6-5: Indirect Proof** **Lesson 6-6: The Triangle Inequality** **Lesson 6-7: Inequalities in Two Triangles**	**Relationships in Triangles** **G.CO.9.** Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segments' endpoints. **G.CO.10** Prove theorems about triangles. **G.CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.	**Relationships in Triangles** How can relationships in triangles be used in real-world situations?	**Relationships in Triangles** -solve problems using perpendicular bisectors in triangles -solve problems using angle bisectors -solve problems using medians in triangles -solve problems using altitudes in triangles -solve problems using inequalities in the angles in a triangle -solve problems using inequalities in the angles and sides in a triangle -prove algebraic and geometric relationships by using indirect proof -apply the Triangle Inequality Theorem -apply the Hinge Theorem and its converse	**Relationships in Triangles** Altitude of a triangle Centroid Circumcenter Concurrent lines Incenter Indirect proof Indirect reasoning Median Orthocenter Perpendicular bisector Point of concurrency Proof by contradiction
MODULE 7	**MODULE 7**	**MODULE 7** **Quadrilaterals**	**MODULE 7** **Quadrilaterals**	**MODULE 7** **Quadrilaterals**

Quadrilaterals **Lesson 7-1: Angles of Polygons** **Lesson 7-2: Parallelograms** **Lesson 7-3: Tests for Parallelograms** **Lesson 7-4: Rectangles** **Lesson7-5: Rhombi and Squares** **Lesson 7-6: Trapezoids and Kites** ***MODULE 8 Similarity***	**Quadrilaterals** **G.MG.1** Use geometric shapes, their measures and their properties to describe objects (e.g. modelling a tree trunk or a human torso as a cylinder). **G.CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line. **G.GPE.4** Use coordinates to prove simple geometric theorems algebraically. **G-CO.11.** Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.* **MODULE 8 Similarity**	What are the different types of quadrilaterals, and how can their characteristics be used to model real-world situations? **MODULE 8 Similarity**	-solve problems involving the interior angles of polygons -solve problems involving the exterior angles of polygons -solve problems using the properties of parallelograms -solve problems involving the diagonals of parallelograms -solve problems using the properties of rectangles -solve problems using the properties of rhombi -solve problems using the properties of squares -solve problems using the properties of trapezoids -solve problems using the properties of kites **MODULE 8 Similarity**	Base angle of a trapezoid Bases of a trapezoid Diagonal Isosceles trapezoid Kite Legs of a trapezoid Midsegment of a trapezoid Parallelogram Rectangle Rhombus Square Trapezoid **MODULE 8 Similarity**

Lesson 8-1: Dilations **Lesson 8-2: Similar Polygons** **Lesson 8-3: Similar Triangles AA Similarity** **Lesson 8-4: Similar Triangles SSS and SAS Similarity** **Lesson 8-5: Triangle Proportionality** **Lesson 8-6: Parts of Similar Triangles**	**G.SRT.2** Given two figures, use the definition of similarity in terms of similarity transformation to decide if they are similar; 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. **G.SRT.4** Prove theorems about triangles. **G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. **G.GPE.5** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. **G.CO.10** Prove theorems about triangles. **G.CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a	What does it mean for objects to be similar, and how is similarity useful for modeling in the real world?	-draw and analyze dilated figures using tools or functions -solve problems using the definition of similar polygons -solve problems involving identifying the corresponding parts of similar polygons -solve problems involving identifying similar polygons based on corresponding sides and angles -solve problems using the AA Postulate of triangle similarity -solve problems involving parts of similar triangles -solve problems using the SSS and SAS Theorems of triangle similarity -prove geometric theorems using triangle similarity -use the Converse of the Triangle Proportionality Theorem to determine if lines are parallel -solve problems and prove relationships using the Triangle Midsegment Theorem and its corollaries	Center of dilation Dilation Enlargement Midsegment of a triangle Nonrigid motion Reduction Scale factor of a dilation Similar polygons Similarity ratio Similarity transformation Similar triangles

	line parallel to a given line through a point not on the line. **G-CO.2** Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). **G-SRT.1.** Verify experimentally the properties of dilations given by a center and a scale factor: -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. -The dilation of a line segment is longer or shorter in the ratio given by the scale factor. **G-SRT.3** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.			

Timeline & Resources	AZ College and Career Readiness Standard	Essential Question (HESS Matrix)	Learning Goal	Vocabulary (Content/Academic)
MODULE 9 Right Triangles and Trigonometry **Lesson 9-1: Geometric Mean** **Lesson 9-2: The Pythagorean Theorem and Its Converse** **Lesson 9-3: Coordinates in Space** **Lesson 9-4 Special Right Triangles** **Lesson 9-5: Trigonometry** **Lesson 9-6: Applying Trigonometry** **Lesson 9-7: The Law of Sines** **Lesson 9-8: The Law of Cosines**	**MODULE 9** **Right Triangles and Trigonometry** **G.SRT.4** Prove theorems about triangles. **G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. **G.SRT.6** Understand 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. **G.SRT.7** Explain and use the relationship between the sine and cosine of complementary angles. **G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. **G.SRT.9** Derive the formula A= (1/2)ab sin © for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. **G.SRT.10** Prove the Laws of Sines and Cosines and use them to solve problems.	**MODULE 9** **Right Triangles and Trigonometry** How are right triangle relationships useful in solving real-world problems?	**MODULE 9** **Right Triangles and Trigonometry** -solve problems using geometric mean and relationships between parts of a right triangle when an altitude is drawn to the hypotenuse -solve problems suing the Pythagorean Theorem and its converse -graph points and find distances using the Distance Formula in three dimensions -solve problems using the properties of 45-45-90 and 30-60-90 right triangles -solve problems using the trigonometric rations for acute angles -derive and use a formula for the area of a triangle using trigonometry -solve problems using the Law of Sines and the Law of Cosine -determine whether there given measures of a triangle define 0, 1, or 2 triangles using the Law of Sines	**MODULE 9** **Right Triangles and Trigonometry** 30-60-90 triangle 45-45-90 triangle angle of depression angle of elevation cosine geometric mean indirect measurement inverse cosine inverse sine inverse tangent octant ordered triple Pythagorean triple sine solving a triangle tangent trigonometric ratio trigonometry

MODULE 10 CIRCLES	**MODULE 10 Circles**	**MODULE 10 Circles**	**MODULE 10 Circles**	**MODULE 10 Circles**
Lesson 10-1 Circles and Circumference **Lesson 10-2 Measuring Angles and Arcs** **Lesson 10-3 Arcs and Chords** **Lesson 10-4 Inscribed Angles** **Lesson 10-5 Tangents** **Lesson 10-6 Tangents, Secants and Angle Measures** **Lesson 10-7 Equations of Circles** **Lesson 10-8 Equations of Parabolas**	**G.C.1** Prove that all circles are similar. **G.C.2** Identify and describe relationships among inscribed angles, radii, and chords. -relationship between central, inscribed, and circumscribed angles; -inscribed angles on a diameter are right angles; -the radius of a circle is perpendicular to the tangent where the radius intersects the circle. **G.C.3** Construct the inscribed and circumscribed circles of a triangle. **G.C. 4** Construct a tangent line from a point outside a given circle to the circle. **G.C.5** 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; derive the formula for the area of a sector. **G.GMD.1** Given an informal argument for the formulas for the circumference of a circle, area of a	How can circles and parts of circles be used to model situations in the real world	-use the formula for circumference of a circle -prove all circles are similar -find measures of angles and arcs using the properties of circles -solve problems using the relationships between arc, chords, and diameters -solve problems using inscribed angles -solve problems using inscribed polygons -solve problems using relationships between circles, tangents, and secants -construct inscribed and circumscribed circles -use equations of circles to solve problems -graph equations of parabolas	adjacent arcs arc arc length center of circle central angle of a circle chord of a circle circle circumscribed angle circumscribed polygon common tangent concentric circles congruent arcs degree diameter of a circle directrix focus inscribed angle inscribed polygon intercepted arc major arc minor arc parabola pi point of tangency radian radius of a circle secant semicircle tangent to a circle

	circle, volume of a cylinder, pyramid, and cone. **G.GPE.1** Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and the radius of a circle given by an equation. **G.CO.13** Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle; with a variety of tools and methods. **G.GPE.4** Use coordinates to algebraically prove or disprove geometric relationships. Relationships include: proving or disproving geometric figures given specific points in the coordinate plane; and proving or disproving if a specific point lies on a given circle.			

MODULE 11 Measurement	**MODULE 11 Measurement**	**MODULE 11 Measurement**	**MODULE 11 Measurement**	**MODULE 11 Measurement**
Lesson 11-1 Areas of Quadrilaterals **Lesson 11-2 Areas of Regular Polygons** **Lesson 11-3 Areas of Circles and Sectors** **Lesson 11-4 Surface Area** **Lesson 11-5 Cross Sections and Solids of Revolution** **Lesson 11-6 Volume of Prisms and Pyramids** **Lesson 11-7 Volume of Cylinders, Cones, and Spheres** **Lesson 11-8 Applying Similarity to Solid Figures** **Lesson 11-9 Density**	**G.MG.2** Apply concepts of density based on area and volume in modelling situations (e.g. persons per square mile, BTUs per cubic foot). **G.MG.3** Use volume formulas for cylinders, pyramids, cones and spheres to solve problems. **G.GMD.1** Analyze and verify the formulas for the volume of a cylinder, pyramid, and cone. **G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems utilizing real-world context. **G.GMD.4** Identify the shapes the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	How are measurements of two- and there-dimensional figures useful for modeling situations in the real world?	-find areas of quadrilaterals using formulas -find areas of regular polygons using formulas -find areas of circles and sectors using formulas -find surface areas of there-dimensional solids -identify cross sections of three-dimensional solids -identify three-dimensional objects generated by rotations of two-dimensional objects -find volumes of similar two- and there-dimensional figures -solve real-world problems involving density using area and volume	Altitude of a parallelogram Altitude of a prism or cylinder Altitude of a pyramid or cone apothem axis of a cone axis of a cylinder axis symmetry base edge base of a parallelogram center of a regular polygon central angle of a regular polygon chord of a sphere composite figure composite solid congruent solids conic sections cross section decomposition density diameter of a sphere height of a parallelogram height of a solid height of a trapezoid lateral area lateral edges lateral faces lateral surface of a cone lateral surface of a cylinder plane symmetry

				radius of a regular polygon radius of a sphere regular pyramid sector similar solids slant height of a pyramid or right cone solid of revolution tangent to a sphere