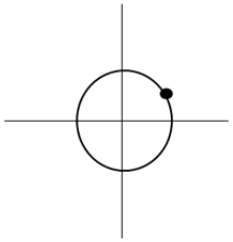
Number and Quantity: Quantities ★ (N-Q)

Reason qualitatively and use units to solve problems.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-Q.A.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Connections: *SCHS-S1C4-02*; *SSHS-S5C5-01*	A I ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	2.1 1.1	To scale drawings correctly to fit within an allotted space. To correctly model the drawing in fractions or decimals depending on use.	The scale on a drawing reads $\frac{1}{8}''=1'-0''$. The length of a wall is 3.5" on the drawing. What is the actual length of the wall on the project site? **Solution:** $\frac{3.5''}{1}\bullet\frac{1\ foot}{\frac{1}{8}''}=28\ ft$ (Use fractions or decimals…)
HS.N-Q.A.2. Define appropriate quantities for the purpose of descriptive modeling. Connection: *SSHS-S5C5-01*	A I A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision.	1.4 2.1	To reduce drawing or object to useable size	When working with a plumbing plan what is the nearest measurement you round to? **Solution:** $\frac{1}{8}''$
HS.N-Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	A I	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	1.5 2.1 2.7	To accurately represent drawing within acceptable limits based on use of client's wishes.	On a plan, the sides of an object at 10.55', 25.65' and 17.95'. What length of molding would you purchase? Convert decimal to feet and inches! **Solution:** 10.55' + 25.65' + 17.95' = 54.15' but molding is only sold in whole foot lengths so you would need to purchase 55'.

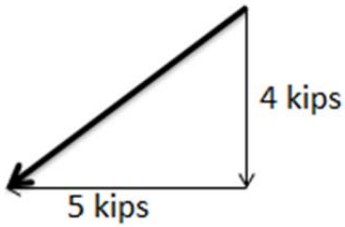
Number and Quantity: The Complex Number System (N-CN)

Represent complex numbers and their operations on the complex plane.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-CN.B.4. Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. Connection: *11-12.RST.3*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure.	3.1 2.3	To use CAD/VDCM to plot points	Project: Using CAD plot the point (3, 45°) or 3<45° in CAD. **Solution:** 

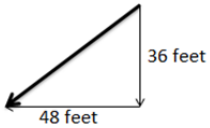
Number and Quantity: Vector and Matrix Quantities (N-VM)

Represent and model with vector quantities.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-VM.A.1. Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., *v*, |*v*|, ||*v*||, *v*).	+	*HS.MP.4.* Model with mathematics.	8.1 8.2	To assist in correctly designing building members	If a construction project has a dead load force of 5 kips in the x direction and wind load of 4 kips in the y direction, what is the resultant force and in what direction?  **Solution:** Resultant Force = $\sqrt{5^2 + 4^2} = \sqrt{41} \approx 6.4$ Resultant forces are the forces added together using the tip to tail method. Dead load is drawn in the –y direction and wind load is drawn in the x direction. These forces are at right angles so the Pythagorean theorem can be used.
HS.N-VM.A.2. Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	+	*HS.MP.2.* Reason abstractly and quantitatively.	3.1	To position a vector in standard form using a benchmark point	Given 2 points (1, 1) and (3, 4) place in standard form. **Solution:** $\langle 2,3 \rangle$

Number and Quantity: Vector and Matrix Quantities (N-VM)

Perform operations on vectors.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-VM.B.4. Add and subtract vectors.	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	7.7	To calculate the minimum length of a trench for piping	The piping on an old home has one pipe running 36 feet south and 48 feet west. The architect wants to update and run the piping at a minimum length. How long will the new pipe be and how much pipe will be saved?? **Solution:**  **Solution:** The new pipe will be 60 feet long saving 24 feet in length.
HS.N-VM.B.5. Multiply a vector by a scalar.	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	8.1 8.2	To assist in correctly designing building members.	If a dead load force of 5 kips in the x direction and wind load of 4 kips in the y direction with a resultant force of 6.4 kips. What is the new resultant force if all forces were doubled? **Solution:** $\sqrt{(2\bullet 5)^2+(2\bullet 4)^2}=12.8\,kips$ 12.8 kips

Number and Quantity: Vector and Matrix Quantities (N-VM)

Perform operations on matrices and use matrices in applications.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-VM.C.6. Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. Connections: *9-10.RST.7*; *9-10.WHST.2f*; *11-12.RST.9*; *11-12.WHST.2e*; *ETHS-S6C2-03*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	8.1	To prepare a bill of materials	If the take-off amounts are a percentage, then the matrix can be represented by a scalar to find the over-estimate of material needed. Put the exact amount of material needed in the first matrix, take-offs in a second matrix as shown: Material / % / LF / Take-Off $2x4$ $2x6$ $2x8$ $2x10$ (1.05) x $\begin{bmatrix}600\\100\\120\\160\end{bmatrix}$ = $\begin{bmatrix}630\\105\\126\\168\end{bmatrix}$ Using matrix subtraction, what is the amount of material actually used if the take-off amount is the same and the leftovers of each board size are: $\begin{bmatrix}17\\2\\1\\0\end{bmatrix}$? **Solution:** $\begin{bmatrix}630\\105\\126\\168\end{bmatrix} - \begin{bmatrix}17\\2\\1\\0\end{bmatrix} = \begin{bmatrix}\mathbf{613}\\\mathbf{103}\\\mathbf{125}\\\mathbf{168}\end{bmatrix}$
HS.N-VM.C.7. Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. Connections: *9-10.RST.3*; *ETHS-S6C2-03*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	2.3 2.7	To calculate materials for quantity take off.	The house has 350 square feet of carpet, 400 square feet of tile and 290 square feet of hardwood flooring. The floor coverings are represented by the following matrix. $\begin{bmatrix}350\\400\\290\end{bmatrix}$ If the square footage is doubled, what is the resulting matrix? **Solution:**

Number and Quantity: Vector and Matrix Quantities (N-VM) **Perform operations on matrices and use matrices in applications.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
					$\begin{bmatrix} 700 \\ 800 \\ 580 \end{bmatrix}$
HS.N-VM.C.8. Add, subtract, and multiply matrices of appropriate dimensions. Connections: *9-10.RST.3*; *ETHS-S6C2-03*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	2.3 2.7	To calculate materials for quantity take off.	A living room with the dimensions of 20' by 30' requires 16 sheets of drywall and 600 square feet of tile. A bedroom with the dimensions 10' by 15' requires 10 sheets of drywall and 150 square feet of tile. This house has two bedrooms. Calculate the number of sheets of drywall and square feet of tile using matrices. **Solution:** $\begin{bmatrix} 16 \\ 600 \end{bmatrix} + 2\begin{bmatrix} 10 \\ 150 \end{bmatrix} = \begin{bmatrix} 36 \\ 900 \end{bmatrix}$

Algebra: Creating Equations ★ (A-CED)

Create equations that describe numbers or relationships.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-CED.A.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 1.4 1.5	To determine missing dimensions	An architect was looking over house plans. He noticed there was a missing dimension on the island the client had designed. He knew that the area of the island is to be 24 square feet and the length to be 8 feet. How wide must the island be to meet these requirements? **Solution:** x = length x(8 ft) = 24 square feet x = 3 feet
HS.A-CED.A.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	A I ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	2.1 2.2 2.5 2.7 7.6	To create an electrical plan that complies with state and/or local building codes.	The contractor is creating a electrical plan for a customer. He is planning the light switches and electrical outlets. The state requires at least 10 light switches for the house. The requirement for electrical outlets is no more than 20 for the house. The total light switches and electrical outlets may be no more than 50. What are the constraints? **Solution:** $x \geq 0$ $y \geq 0$ $x \geq 10$ $y \leq 20$ $x + y \leq 50$

Algebra: Creating Equations ★ (A-CED) **Create equations that describe numbers or relationships.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-CED.A.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	A I ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5*. Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	2.1 2.2 2.3 2.4	To rearrange formulas to make them more useable in the field	On an architectural draft, the designer used many circles to represent items in the plan. The designers stated the circumference of each of each but the contractor needs to find the radius. If he rearranges the equation in terms of the radius, what would it be? **Solution:** $r = \frac{C}{2\pi}$

Algebra: Reasoning with Equations and Inequalities ★ (A-REI)

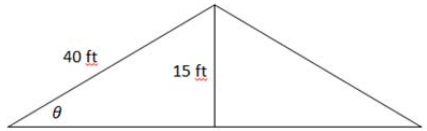
Solve equations and inequalities in one variable.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-REI.B.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	A I	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 1.4 1.5	To solve problems arising in architectural drafting	The face of a building is 15', 10' and x feet. What dimension would give the building a maximum length of 30 feet? **Solution:** x = missing length 15' + 10' + x $\leq$ 30" x $\leq$ 5'
HS.A-REI.B.4. Solve quadratic equations in one variable.	A I A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 1.4 1.5	To calculate the dimension of a room given an area or volume	A room has square footage of 300 sq. ft. What is the length and the width of this room if the length is 13 feet longer than the width of the room? **Solution:** Area = 300 sq. ft. w = width w + 13 = length $w(w+13)=300\ ft^2$ $w^2+13w-300\ ft^2=0$ $(w+25\ ft)(w-12\ ft)=0$ $w+25\ ft=0 \quad or \quad w-12\ ft=0$ $w=-25\ ft \qquad w=12\ ft$ w = -25 is extraneous because width cannot be negative w = 12 ft therefore length = 12 ft + 13 ft = 25 ft

Functions: Interpreting Functions (F-IF)

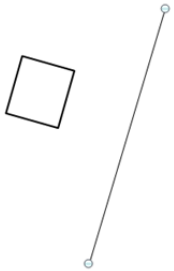
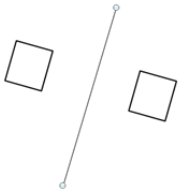
Interpret functions that arise in applications in terms of context.

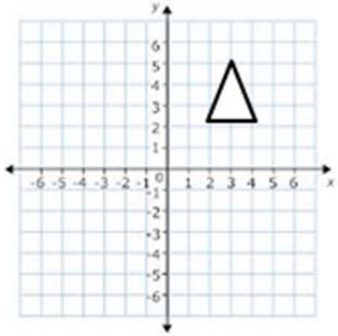
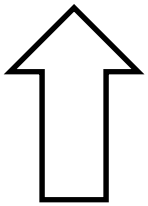
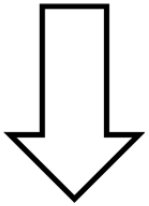
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-IF.B.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. Connections: *ETHS-S1C2-01*; *9-10.RST.3*	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4*. Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 1.4 1.5 7.5	To calculate elevations given a slope.	A roof "drops" 12 feet over a total length of 48 feet. What is the average rate of change? **Solution:** rate of change = $\frac{\Delta y}{\Delta x} = \frac{12\ feet}{48\ feet} = \frac{1}{4}$

Functions: Trigonometric Functions ★ (F-TF) **Model periodic phenomena with trigonometric functions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-TF.B.7. Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. Connections: *ETHS-S1C2-01; 11-12.WHST.1a*	+ ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.5.* Use appropriate tools strategically.	7.5	To draft a roof truss	An architect ordered the roof truss below.  The architect needed to know what angle this truss made. Find θ. **Solution:** $\sin\theta = \frac{15}{40}$ $\theta = \sin^{-1}\left(\frac{15}{40}\right)$ $\theta = 22^{\circ}$

Geometry: Congruence (G-CO)

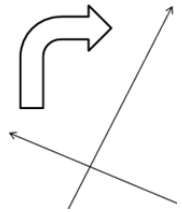
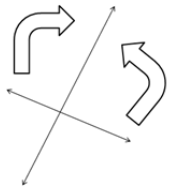
Experiment with transformations in the plane.

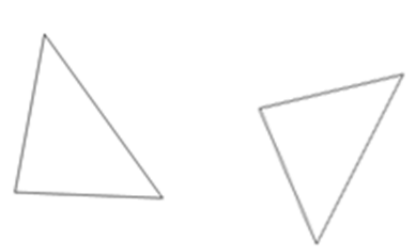
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.A.2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe 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). Connection: *ETHS-S6C1-03*	G	*HS.MP.5.* Use appropriate tools strategically.	4.2 4.3 4.4 4.6	To use CAD to "mirror" an object around a point or line	**Project:** Use CAD to "mirror" the square about the line.  **Solution:** 
HS.G-CO.A.3. Given a rectangle, parallelogram, trapezoid, or regular polygons, describe the rotations and reflections that carry it onto itself.	G	*HS.MP.3* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools	4.2 4.3 4.4 4.6	To follow rotations and reflections using CAD	**Project:** Using CAD draw the triangle after it has been translated -3 horizontally and +2 vertically.

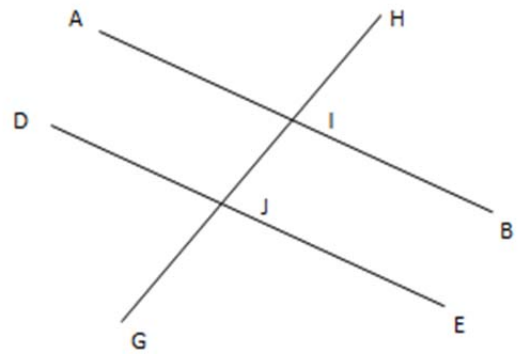
Connections: *ETHS-S6C1-03*; *9-10.WHST.2c*		strategically.			
HS.G-CO.A.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. Connections: *ETHS-S6C1-03*; *9-10.WHST.3*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	4.6	To use CAD to rotate, reflect or translate an object.	**Project:** Use CAD to rotate the following figure 180°.  **Solution:** 

Geometry: Congruence (G-CO)

Understand congruence in terms of rigid motions.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.B.6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. Connections: *ETHS-S1C2-01; 9-10.WHST.1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	4.6	To predict the effect of a given rigid motion on a given figure	**Project:** Use CAD to rotate (mirror) the following object about a user coordinate system.  **Solution:** 
HS.G-CO.B.7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others.	4.4 4.6	To use CAD to determine the soundness of a truss.	**Project:** Use the tools on CAD to determine if the triangles (which could represent trusses) are congruent.

corresponding pairs of sides and corresponding pairs of angles are congruent. Connection: *9-10.WHST.1e*					

Geometry: Congruence (G-CO) **Prove geometric theorems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.C.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 segment's endpoints.*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.	4.4 4.6	To use CAD tools to create congruent angles.	**Project:** Use CAD tools to prove that $\angle HIB \cong \angle DJG$ given that $\overline{AB} \parallel \overline{DE}$. 

Geometry: Congruence (G-CO)

Prove geometric theorems.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
Connections: *ETHS-S1C2-01*; *9-10.WHST.1a-1e*					
HS.G-CO.C.10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.* Connections: *ETHS-S1C2-01*; *9-10.WHST.1a-1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.	4.4 4.6	To check plans for accuracy	**Project:** Use CAD tools to prove that $\angle ABC \cong \angle ACB$ given $\mathrm{V}ABC$ is an isosceles triangle.
HS.G-CO.C.11. Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use	2.1 2.2 2.3 2.7 4.4 4.6	To check plans for accuracy	On a blueprint plan, an object in the shape of a parallelogram is drawn. Two opposite angles measure 70°. What would be the measures of the other two angles? **Solution:** 110°

Geometry: Congruence (G-CO) **Prove geometric theorems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. Connection: *9-10.WHST.1a-1e*		appropriate tools strategically.			

Geometry: Congruence (G-CO) **Make geometric constructions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.D.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,*	G	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6*. Attend to precision.	2.1 2.2 2.3 2.7 4.4 4.6	To orient drawings using CAD or drawing by hand with drafting tools. To give students a working knowledge of terminology to accurately create drawings.	**Project:** Using CAD draw two lines 1" apart for a distance of 4". Using CAD draw a line perpendicular to a line through the midpoint of the second line.

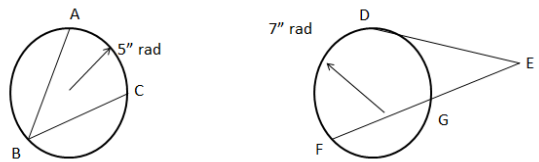
Geometry: Congruence (G-CO) **Prove geometric theorems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line. Connection: *ETHS-S6C1-03*					
HS.G-CO.D.13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. Connection: *ETHS-S6C1-03*	G	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	2.1 2.2 2.3 2.7 4.4 4.6	To use fundamental drafting techniques	**Project:** Using CAD construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT) **Understand similarity in terms of similarity transformations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.A.1. Verify experimentally the properties of dilations given by a center and a scale factor: Connections: *ETHS-S1C2-01*; *9-10.WHST.1b*; *9-10.WHST.1e*	G	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.5*. Use appropriate tools strategically.	1.1 1.2 1.4 1.5 2.1 2.2 2.3 2.7 4.4 4.6	To verify scale and auxiliary drawings and sections	**Project:** Using CAD, take a given geometric shape and create an auxiliary view with a scale of 1' = $\frac{1}{2}$".

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT) **Define trigonometric ratios and solve problems involving right triangles.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.C.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. Connections: *ETHS-S6C2-03*; *9-10.RST.7*	G ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4*. Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	7.5	To calculate missing lengths	How much material is needed to cover a roof with a rise of 5', a run of 12' and a width of 50'? **Solution:** a = 5', b = 12 $a^2+b^2=c^2$ $5^2+12^2=c^2$ $25+144=c^2$ $169=c^2$ $c=13'$ with 50' width (13') (50') = 650 square feet

Geometry: Circles (G-C)

Understand and apply theorems about circles.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-C.A.2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the 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.*Connections: *9-10.WHST.1c;* *11-12.WHST.1c*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.	2.1 2.2 2.3 2.7 4.4 4.6	To provide students with necessary vocabulary and CAD commands	**Project:** Redraw the figures below half scale and measure the parts indicated below.  a. Angle ABC b. Chord AB c. Chord BC d. arc AC e. tangent ED f. chord EG g. line segment EG
HS.G-C.A.4. Construct a tangent line from a point outside a given circle to the circle. Connection: *ETHS-S6C1-03*	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.	2.1 2.2 2.3 2.7 4.4 4.6	To calculate necessary lengths for construction layout.	**Project:** Construct a vertical curve using the information below. Then identify the radius point, the PC, PT, PVI on your construction. 1. The entry grade is 2%. 2. The exit grade is 4%. 3. The radius is 300'.

Geometry: Expressing Geometric Properties with Equations (G-GPE)

Use coordinates to prove simple geometric theorems algebraically.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-GPE.B.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. Connections: *ETHS-S1C2-01*; *9-10.RST.3*	G	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.8*. Look for and express regularity in repeated reasoning.	2.1 2.2 2.3 2.7 4.4 4.6	To use fundamental drafting techniques	**Project:** Use CAD to find the midpoint of a directed line segment or to partition the directed line segment into a 2:3 ration.

Geometry: Geometric Measurement and Dimension (G-GMD)

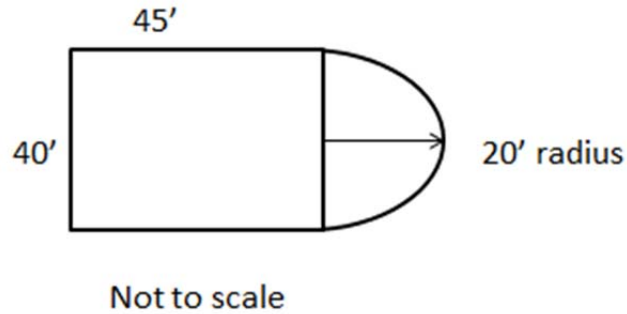
Explain volume formulas and use them to solve problems.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-GMD.A.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. Connection: *9-10.RST.4*	G ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively.	2.1 2.2 2.3 2.7 4.4 4.6 7.1	To calculate the volume of shapes	How much storm water would a retention facility hold if it had: Top contour measured 10" by 10" Bottom contour measured 0' by 0' Depth of 9 feet **Solution:** Use the volume of a pyramid for your calculation $V = \frac{Base \bullet height}{3}$ $V = \frac{10^2 \bullet 9}{3}$ = 300 cu. ft.

Geometry: Geometric Measurement and Dimension (G-GMD) **Visualize relationships between two-dimensional and three dimensional objects.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-GMD.B.4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. Connection: *ETHS-S1C2-01*	G	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	8.1 8.2	To create two-dimensional cross-sections of three-dimensional objects	**Project:** Use CAD to create a two-dimensional cross-section of given three-dimensional objects.

Geometry: Geometric Measurement and Dimension ★ (G-MG)

Apply geometric concepts in modeling situations.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-MG.A.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). Connection: *ETHS-S1C2-01*	G ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.2 1.3 1.4 1.5 2.1 2.2 2.3 2.7 4.4 4.6	To layout a site plan given design constraints	 If a gallon of paint covers 400 sq. ft., how many gallons of paint would be required to cover a rectangular room 10' high with the dimensions of 20' by 45' with a semicircular entrance with a 20' radius? Ignore the doors and windows. See above diagram. **Solution:** Area of walls: (perimeter of base) (wall height) $\left(2(45')+40'+(\pi \bullet 20')\right)(10')$ $1928\, sq.\ ft.$ Amount of paint needed: $1928\, sq.\ ft. \bullet \frac{1\, gallon}{400\, sq.\ ft.} = 4.8\, gallons$ So 5 gallons of paint need to be purchased.

Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC)

Understand and evaluate random processes underlying statistical experiments.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-IC.A.1. Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population.	A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision.	7.1	To use statistics to make decisions for planning and designing	Given the following estimated population data for your urban planner for the adjacent area, what is one type of commercial project that would be LEAST suited for your property? **Average age of population** / **Number of people** 1-10 / 5,000 11-24 / 8,000 25-35 / 20,000 35-55 / 7,000 55+ / 2,000 **Solution:** Given the demographics of the population a senior recreation facility would be one of the least appealing projects.

Contemporary Mathematics: Discrete Mathematics ★ (CM-DM)

Understand and apply vertex-edge graph topics.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
AZ.HS.CM-DM.A.3. Devise, analyze, and apply algorithms for solving vertex-edge graph problems. Connections: *ETHS-S6C2-03*; *11-12.RST.3*; *11-12.RST.4*; *11-12.RST.9*; *11-12.WHST.1a*; *11-12.WHST.1b*; *11-12.WHST.1e*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning	7.1 7.11	To create a construction schedule	Find the shortest possible construction time for a project using the following construction times and sequencing. Construct s vertex-edge graph to show the sequencing and the construction schedule. **Solution:** The vertex-edge graph will show: B dependent activity is D D dependent activity is E E dependent activity is F F dependent activity is G That leaves C as the only activity without a dependent activity.

Activity	Duration	Predecessor
Surveying	5 days	-
Construction Layout	2 days	A
City's inspector approval	1 day	A
Rough Grading	14 days	B
Final Grading	2 days	D
Re-staking	1 day	E
Final Construction	30 days	F