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.	3.2 3.4 3.5 4.1 4.2 4.3 4.4 5.7 6.5 7.1 7.5 8.5	To utilize units to compare scale drawings and actual building dimensions.	A contractor has budgeted for 500 square feet for a sun room. The scale drawing of the room measures 4 inches by 6 inches. If the scale used is $\frac{1}{4}$ inch = 1 foot, did the contractor stay within budget? **Solution:** $\frac{4''}{1} \bullet \frac{1\ ft.}{\frac{1}{4}''} = 16\ ft.$ $\frac{6''}{1} \bullet \frac{1\ ft.}{\frac{1}{4}''} = 24\ ft.$ $A = l \bullet w$ $A = 16\ ft. \bullet 24\ ft. = 384\ sq.\ ft.$ Yes, the contractor had budgeted for 500 square feet so he stayed within budget.
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.	3.4 3.5 4.1 4.2 4.3 4.4 5.1 5.2 5.6 5.7	To determine appropriate units for construction applications	A contractor needs to order concrete to pour a slab that measures 30' by 4' by 4". What measurement should he give to concrete company? **Solution:**

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***
			6.5 7.5 8.5 12.2 12.3 14.1 14.3		$V = l \bullet w \bullet h$ $V = (30\ ft)(40\ ft)(4\,inches)$ $V = (30\ ft)(40\ ft)\left(\frac{4\,inches}{1} \bullet \frac{1\ ft}{12\,inches}\right)$ $V = 400\,cubic\ feet$ $V = \frac{400\,cubic\ feet}{1} \bullet \frac{1\,cubic\ yard}{1}$ $V \approx 14.8\,cubic\ yards$ A concrete company delivers only whole cubic yards, so the contractor must order 15 cubic yards.
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.	3.2 3.4 3.5 3.6 4.1 4.2 4.3 4.4 5.1 5.2 5.3 5.4 5.6 5.7 6.1	To choose a level of accuracy in a construction situation.	Juan is the lead carpenter on a large construction project. A new hire approaches him to ask how accurately the measurements should be on a framing job. What should Juan tell him? Solution: $\frac{1}{8}$" is the industry standard for finishing and for finishing it is $\frac{1}{16}$".

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***
			6.2 6.3 6.5 6.6 6.7 7.1 7.2 7.3 7.4 7.5 8.1 8.2 8.3 8.4 8.5 10.4 10.5 11.1 11.2 11.3 11.4 12.1 12.2 12.3 12.4 13.2 13.3 13.4 13.5		

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***
			13.6 14.1 14.2 14.3 14.2 14.5 15.3 15.4		

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.	3.3 5.7 6.5 7.5 8.5 12.2	To use matrices to determine the amount of material needed in the construction process	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 $\begin{matrix} 2x4 \\ 2x6 \\ 2x8 \\ 2x10 \end{matrix}$ (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:** $\begin{bmatrix} 630 \\ 105 \\ 126 \\ 168 \end{bmatrix} - \begin{bmatrix} 17 \\ 2 \\ 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 613 \\ 103 \\ 125 \\ 168 \end{bmatrix}$
HS.N-VM.C.7. Multiply matrices by scalars to produce	+	*HS.MP.2.* Reason abstractly and quantitatively.	3.3 5.7 6.5	To determine the amount of material needed	If one house used the specified amount of lumber, how many of each type would be needed for building 12 exact copies of the same house?

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***
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.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	7.5 8.5 12.2	in the construction process for replication of multiple housing units.	Use scalar multiplication to determine the amount of materials needed for multiple units. Material for one house: $2x4$, $2x6$, $2x8$, $2x10$ Quantity: $\begin{bmatrix}600\\100\\120\\160\end{bmatrix}$ **Solution:** $12\begin{bmatrix}600\\100\\120\\160\end{bmatrix}=\begin{bmatrix}7200\\1200\\1440\\1920\end{bmatrix}$
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.	3.3 5.7 6.5 7.5 8.5 12.2	To use matrices to calculate total costs for different models of homes	What is the total cost of material for 6 model A homes, 5 model B homes and 20 model C homes if the materials cost matrix is $\begin{bmatrix}10\\20\\50\end{bmatrix}$? The total amount of materials needed per bedroom for the A, B, and C model of three bedroom homes is as shown. A = $\begin{bmatrix}45&60&50\\120&180&145\\50&66&58\end{bmatrix}$ B = $\begin{bmatrix}40&50&45\\110&160&135\\45&60&52\end{bmatrix}$ C = $\begin{bmatrix}65&90&78\\150&210&185\\70&88&78\end{bmatrix}$ **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***
					Multiply each materials matrix by the number of homes and the cost matrix to find the total cost of each material used. Cost of 6 model A = 6 X $\begin{bmatrix} 45 & 60 & 50 \\ 120 & 180 & 145 \\ 50 & 66 & 58 \end{bmatrix}$ X $\begin{bmatrix} 10 \\ 20 \\ 50 \end{bmatrix}$ = $\begin{bmatrix} 24900 \\ 72300 \\ 28320 \end{bmatrix}$ Cost of 5 model B = 5 X $\begin{bmatrix} 40 & 50 & 45 \\ 110 & 160 & 135 \\ 45 & 60 & 52 \end{bmatrix}$ X $\begin{bmatrix} 10 \\ 20 \\ 50 \end{bmatrix}$ = $\begin{bmatrix} 18250 \\ 55250 \\ 21250 \end{bmatrix}$ Cost of 20 model C = 20 X $\begin{bmatrix} 65 & 90 & 78 \\ 150 & 210 & 185 \\ 70 & 88 & 78 \end{bmatrix}$ X $\begin{bmatrix} 10 \\ 20 \\ 50 \end{bmatrix}$ = $\begin{bmatrix} 127000 \\ 299000 \\ 127200 \end{bmatrix}$ Now add the three resulting matrices numbers together to get the total for each item. $\begin{bmatrix} 24900 \\ 72300 \\ 28320 \end{bmatrix} + \begin{bmatrix} 18250 \\ 55250 \\ 21250 \end{bmatrix} + \begin{bmatrix} 127000 \\ 299000 \\ 127200 \end{bmatrix} = \begin{bmatrix} 170150 \\ 426550 \\ 176770 \end{bmatrix}$ Add each row together to get the total overall cost. $170,150 + $426,550 + $176,770 = $**773,470**

Algebra: Seeing Structure in Expressions (A-SSE)
Interpret the structure of expressions.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-SSE.A.1. Interpret expressions that represent a quantity in terms of its context.	A I ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.7.* Look for and make use of structure.	3.3 5.7 6.5 7.5 8.5 12.2	To interpret an expression in terms of a construction application	A concrete company uses two different sized trucks to deliver their products. The first truck can deliver x cubic yards of concrete and the second can deliver y cubic yards. If the first truck makes A trips to the job site and the second truck makes B trips, what does x + y represent? **Solution:** x + y represents the number of cubic yards the two trucks can deliver on their first trip.

Algebra: Seeing Structure in Expressions (A-SSE)
Write expressions in equivalent forms to solve problems.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-SSE.B.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate*	A II ★	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with	1.7 5.1 5.2 5.3 5.4 5.6 5.7 6.5	To derive the formula and use it for finding the amount of material in a construction project that form a	A mason wants to calculate the number of bricks needed to construct a brick patio. The first row has 1024 bricks and the second has 512. Each additional row is half the previous row. Derive a formula and use it to find how many bricks will he need for an 8 row patio? **Solution:** 2040 bricks

Algebra: Seeing Structure in Expressions (A-SSE) **Write expressions in equivalent forms to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
mortgage payments. Connection: *11-12.RST.4*		mathematics. *HS.MP.7.* Look for and make use of structure.	6.6 6.7 7.1 7.2 7.3 7.4 7.5 8.1 8.2 8.3 8.5 12.2	geometric series.	

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.	1.4 3.4 3.5 4.2 4.3 4.4 5.1 5.2 5.3 5.4 5.6 6.3 6.5 6.6 6.7 7.2 7.5 8.1 8.2 8.3 8.5 10.4 10.5 12.1 12.2 12.3 15.3	To create an equation to determine unknown measurements.	A bathroom spa tub needs to be custom made to suit a homeowner's wishes. The tub will be a trapezoid shape with an area allotted of 15 square feet. The foreman realizes that he only knows the area and that one of the bases is 6 ft. with the height of 3 ft. Set up an equation to find the unknown base and solve it. Solution: $A=\frac{1}{2}(b_1+b_2)h$ $15\,sq.\ ft.=\frac{1}{2}(6\ ft.+x\ ft.)(3\ ft.)$ $15\,sq.\ ft.=\frac{3}{2}\ ft.(6\ ft.+x\ ft.)$ $\frac{2}{3\ ft.}\bullet\frac{15\,sq.\ ft.}{1}=6\ ft.+x\ ft.$ $10\ ft.=6\ ft.+x\ ft.$ $x=4\ ft.$
HS.A-CED.A.2. Create equations in	A I ★	*HS.MP.2.* Reason abstractly and	1.4 1.7	To determine the possible	A contractor purchases sinks for $85 and toilets for $90. He purchases two more toilets than sinks and the total cost is $1055. Let *s* represent the number of sinks and *t* represent the number of toilets. What is the number

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***
two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.		quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	5.7 6.5 7.5 8.5 12.1 12.2 12.3 12.4	combinations of materials that can be used to meet a budget constraint.	of sinks and toilets purchased by the contractor? Solution: $85*s* + $90*t* = $1055 *s* + 2 = *t* $85*s* + $90(*s* + 2) = $1055 $85*s* + $90*s* + $180 = $1055 $175*s* = $875 *s* = 5 sinks Substitute into *s* + 2 = *t* *t* = 7 toilets
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*	A I ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	5.7 6.5 7.5 8.5	To estimate the material needed for concrete/ masonry work.	A construction company has a maximum budget of $40,000 for the concrete/masonry work on a new home. The cost of the block will be at least twice as much as the cost of the concrete. Write a system of equations or inequalities to model the situation. Solution: x = cost of the block y = cost of concrete $x \geq 0$ $y \geq 0$ $x + y \leq \$40,000$ $x \geq 2y$

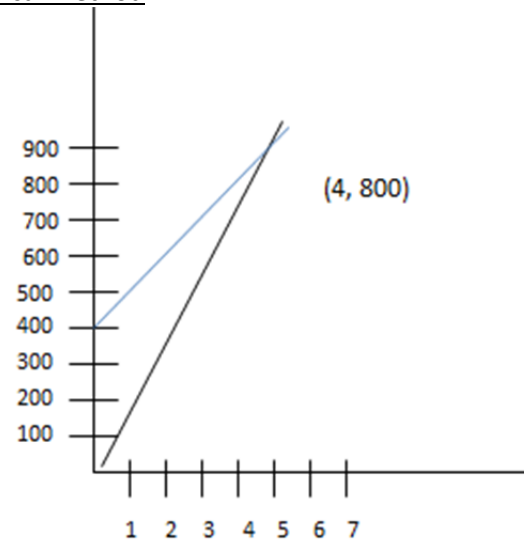
Algebra: Creating Equations ★ (A-CED) **Create equations that describe numbers or relationships.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
combinations of different foods.					
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.	1.4 1.7 3.1 3.2 3.3 3.4 3.5 3.6 4.1 5.1 5.2 5.3 5.4 5.6 5.7 6.2 6.5 6.6 6.7 7.2 7.3 7.4 7.5 8.1 8.2 8.5 10.3	To rearrange a formula to alter building size and location	What is the formula for the number of 2x8's used in framing a wall to solve for W if $t = \frac{wL}{s\,f} - \frac{L}{f}$? When t is the number of 2x8's, w is the width of the floor, L is the length of the floor, s is the space between 2x8's, and f is the length of each 2x8 (This will give possible widths given the other variables are known quantities.) **Solution:** • $t = \frac{wl}{sf} - \frac{L}{f}$ • $\frac{wL}{sf} - \frac{L}{f} = t$ • $\frac{wL}{sf} = t + \frac{L}{f}$ • $wL = sft + \frac{Ls\,f}{f}$ • $w = s\,(\frac{ft}{L} + 1)$

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***
			10.4 10.5 12.1 12.2 12.3 12.4 13.2 13.6 14.1 15.2		

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.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.	3.6 5.7 6.5 7.5 8.5	To solve quadratic equation to determine the dimensions of a room given the need for the "Golden Rule"	A contractor needs to find the length and width of a floor designed using the "Golden Rule" proportion (length is 1.62 times the width) when the floor area is 648 square feet? **Solution:** $648\ ft^2 = (1.62\,w)(w)$ $648\ ft^2 = 1.62\,w^2$ $\frac{648\ ft^2}{1.62} = \frac{1.62\,w^2}{1.62}$ $400 = w^2$ $w^2 - 400 = 0$ $(w+20)(w-20) = 0$ $w+20=0 \qquad w-20=0$ $w=-20 \qquad w=20$ $-20\ is\ extraneous$ W = 20 ft l = 1.62(20) = 32.4 ft

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

Solve systems of equations.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-REI.C.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Connection: *ETHS-S6C2-03*	A I A II	*HS.MP.2.* Reason abstractly and quantitatively. *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.	5.7 6.5 7.5 8.5	To solve a system of linear equations to analyze how costs affect a business operation.	Construction Company A charges $400 to pour the patio of a house and $100 per hour to finish the concrete. Construction Company B charges a flat $200 per hour to pour and finish a patio. After how many hours will the cost from the companies be equal and what would the cost be? Solution: 4 hours and cost $800 <u>graphical method</u>  <u>algebraic method</u>

Algebra: Reasoning with Equations and Inequalities ★ (A-REI) **Solve systems of equations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
					$y=100x+400$ $y=200x$ $200x=100x+400$ $100x=400$ $\frac{100x}{100}=\frac{400}{100}$ **x = 4 hours** **y = 200(4) = $800**

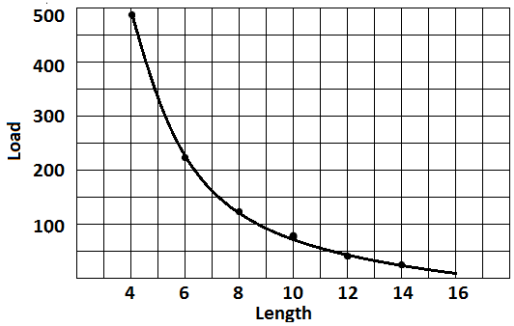
Algebra: Reasoning with Equations and Inequalities ★ (A-REI)

Represent and solve equations and inequalities graphically.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-REI.D.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	A I	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics.	1.7 1.8 5.7 6.5 7.5 8.5	To use a table of values or chart to determine post or beam sizes for specific uses	Given a fixed width and depth, graph the load for a beam based on its length on a coordinate system. Determine the curve of best fit and predict the capacity for a length of 16'.

Beam Width	Beam Depth	Beam Length	Beam Capacity
2"	6"	4'	492 lbs
2"	6"	6'	224 lbs
2"	6"	8'	126 lbs
2"	6"	10'	76 lbs
2"	6"	12'	43 lbs
2"	6"	14'	27 lbs

Answer:



Based on the best fit curve, a good estimate would be between 12-18 lbs.

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.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* Connections: *ETHS-S6C2.03*; *9-10.RST.7*; *11-12.RST.7*	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	5.1 13.1 13.2	Prepare and pour footings Assemble Water distribution and Waste, drain and vent piping	A concrete foreman needs to mix concrete for a sidewalk. He will need to calculate the ratio of Cement, sand and water to mix in order to pour the concrete. Plumber will need to calculate the slope of the drain over a given pipe run. He also needs to calculate the pressure drop of the water distribution system based on the amount of the fittings used to assemble the piping.

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.	8.1	To calculate the pitch of a roof to determine if it meets code.	The county requires that the pitch of a roof be at least 1:6 and at most 1:4. In construction, the pitch of a roof is the ratio of the rise to the half-span. In math terms this is the average rate of change. If a roof has a rise of 6 feet and a span of 30 feet does it meet code? Solution: $\frac{1}{6}=.1\overline{6}$ $\frac{1}{4}=.25$ So $\frac{1}{6}<pitch<\frac{1}{4}$ Our roof is $\frac{6}{15}=\frac{2}{5}=.4$ $.4>.25$ not less than so it does not meet code.

Functions: Interpreting Functions (F-IF) **Analyze functions using different representation.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
		HS.MP.5. Use appropriate tools strategically. *HS.MP.6.* Attend to precision.			
a. Graph linear and quadratic functions and show intercepts, maxima, and minima. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*	A I ★		9.2 9.3	Understand the basic operation of the HVAC system	A mechanic needs to understand the Temperature and Pressure relationship of the refrigerant. As a mechanic in the HVAC industry a service person should understand the relationship of heat load in order to maintain the proper cooling load. Calculate the heat load of a given room. A=windows B=lighting, C=occupancy Use industry standards for the constant values of A, B and C
HS.F-IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Connection: *11-12.RST.7*	A I A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure.	3.4	Relate information from blueprints to actual job	A foreman needs to layout building lines for exterior walls of a structure. He will need to scale the drawing and calculate the actual location for his layout lines. Scale = ¼" is equal to 1' 4"(4')=16ft
HS.F-IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal	A I A II	*HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.	14.1	To compare two data sets using Ohm's Law	Use Ohm's Law to calculate the resistance for each circuit. Write a statement that best represents the resistance of the two circuits and determine which will need a larger gage of wire. Circuit 1 $E=IR$ $E=10I$ Circuit 2

Functions: Interpreting Functions (F-IF)

Analyze functions using different representation.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *9-10.RST.7*					<table><tr><td>Amps</td><td>0.8</td><td>1.1</td><td>1.3</td><td>1.9</td></tr><tr><td>Volts</td><td>3.2</td><td>4.4</td><td>5.2</td><td>7.6</td></tr></table> Solution: Circuit 1 has greater resistance which means it will need the larger gage of wire.

Functions: Building Functions (F-BF)

Build a function that models a relationship between two quantities.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-BF.A.1. Write a function that describes a relationship between two quantities. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*	A I A II + ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *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.	8.1 9.1 9.3	Construct a roof Identify types of insulation Energy efficiency	A truss builder needs to lay out a truss for a repair to a roof. He will need to calculate the pitch of the roof in order to build the truss. Rise / Run = Slope, pitch An HVAC tech is verifying the efficiency of a system and has to calculate the relationship of the temperature and insulation relationship of the home. A change in temp = a change in insulation the insulation value is constant.
a. Determine an explicit expression, a recursive process, or steps for calculation from a context. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *9-10.RST.7*; *11-12.RST.7*	A I A II ★		13.2	Assemble DWV piping	A plumber needs to install a new drain line. He will need to calculate the slope of the drain for a run of 25 feet. Rise/Run= Slope The drain will start 1 ft under the floor and tie in to the main at 25 ft away. If he is dropping the line ¼" every foot what will the slope be?
b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a*	A II ★		9.2	HVAC intro	A HVAC tech is called out for a home that is hot. He needs to verify the factors that could be happening to make the home warm. He can use math to prove the operation of the AC system. The outside air temp is 110 degrees, the person feels hot after working outside, the home is at 82 degreees and has been all year. Prove using math how this could happen. F(Heat feel)= outside air increase+personal feel –cooling system

Functions: Building Functions (F-BF) **Build a function that models a relationship between two quantities.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03* *Continued on next page*					
c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a*	+ ★		6.5	To write a function for the number of floor joists	To estimate the number of floor joists needed to construct a floor assembly. The number of floor joists is represented by the function $f(x)=\frac{x}{16}+1$ where x is the distance in feet. To convert the feet to inches use the function g(x) = 12 x. To write a function for number of joists do a composition of functions. Solution: $(f \circ g)(x)=\frac{12x}{16}+1$

Functions: Building Functions (F-BF) **Build a function that models a relationship between two quantities.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
function of time. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*					
HS.F-BF.A.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.8.* Look for and express regularity in repeated reasoning.	13.2	Assemble DWV system	When installing a drain system you need to slope the piping to drain properly. Please determine the slope for a drain pipe that begins at 2 feet above grade and will drain to the main sewer 40 feet away. The slope would be equal to a pitch of 1 and 4.

Functions: Building Functions (F-BF)

Build new functions from existing functions.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-BF.B.3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.* Connections: *ETHS-S6C2-03*; *11-12.WHST.2e*	A I A II	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	13.3 14.1	Assemble a water distribution system Electrical Service requirements	Determine the effect on a water supply system if you have to move a fixture 15 feet down the wall. We can prove this with math f(x)+k F(x)+k f(x)+15 will move the water fixture 15 feet up on a linear graph. The electrical service for a building needs to be evaluated for current load sizing. How do you display a change on the graph using a function of X? F(x)+K f(x)+2 open slots will be positive on a graph F(x)-k f(x)-4 you do not have open slots and it will move to the right or negative on the graph. This will mean you need a new panel or can add breakers.

Functions: Building Functions (F-BF)

Build new functions from existing functions.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-BF.B.4 Find inverse functions. Connection: *ETHS-S6C2-03*	A II +	*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.			
a. **N/A**					
b. **N/A**	+				
c. Read values of an inverse function from a graph or a table, given that the function has an inverse.	+		9.2	HVAC intro	AS a HVAC tech you will need to understand the refrigerant chart. Please review the chart below and tell me how this information is related to one another.

Functions: Linear, Quadratic, and Exponential Models ★ (F-LE) **Construct and compare linear, quadratic, and exponential models and solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. Connections: *ETHS-S6C2-03*; *SSHS-S5C5-03*	A I ★	*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.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
a. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. Connection: *11-12.RST.4*	A I ★		8.1 13.2 13.3	Construct a roof Assemble DWV system	When constructing a roof, one needs to ensure that the roof is on the same plan. How do we ensure the roof is on that plane? How do we prove this using math? Rise over Run equal Slope/pitch
HS.F-LE.A.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a	A I A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.8.* Look for and express regularity in	9.1 9.2 13.2 13.3	Assemble DWV system	When installing a drain system, who do we establish a slope of that drain pipe? Does this pipe need to maintain this slope? How can we verify this slope using math? Rise over run=slope Measure the rise and run of the example provided and establish the slope at various places along the pipe.

Functions: Linear, Quadratic, and Exponential Models ★ (F-LE) **Construct and compare linear, quadratic, and exponential models and solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
graph, a description of a relationship, or two input-output pairs (include reading these from a table). Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *11-12.RST.4*; *SSHS-S5C5-03*		repeated reasoning.			

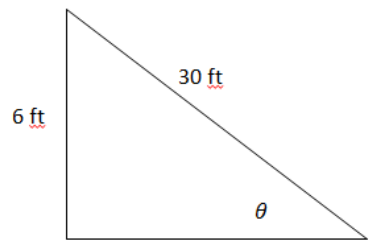
Functions: Linear, Quadratic, and Exponential Models ★ (F-LE)

Interpret expressions for functions in terms of the situation they model.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*;*SSHS-S5C5-03*; *11-12.WHST.2e*	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics.	6.5	To interpret the parameters in a linear equation of the square footage of a floor system and the cost	A contractor has been keeping track of flooring jobs as represented in the following table. Square footage (A) / Cost © 100 / $2750 250 / $6800 1000 / $27,050 1500 / $40,550 Find whether the data represents a linear or exponential function, find the function that defines the data and explain what each parameter represents. Solution: Linear F = 27A + 50 The 27 represents that each square foot costs $27 to construct and the 50 represents $50 fixed cost.

Functions: Trigonometric Functions ★ (F-TF)

Model periodic phenomena with trigonometric functions.

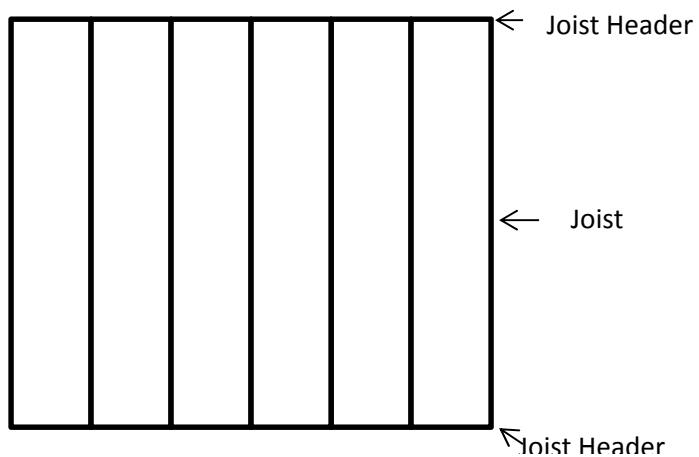
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-TF.B.7. Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate 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.	8.1	To use inverse functions to solve roofing situations	A roof is constructed and the foreman needs to find the angle of elevation for the following plan. Use a protractor to verify your answer is reasonable.  Solution: $\sin\theta = \frac{6}{30}$ $\theta = \sin^{-1}\left(\frac{6}{30}\right) = 11.5^{o}$

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.3. Given a rectangle, parallelogram, trapezoid, or regular polygons, describe the rotations and reflections that carry it onto itself. Connections: *ETHS-S6C1-03*; *9-10.WHST.2c*	G	*HS.MP.3* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.	3.2 3.1 4.2 5.6 6.6 6.7 7.2 7.3 10.1-.3 11.1-.4	Becoming familiar with necessary vocabulary	Create a poster displaying the various mathematical terms used in construction. Ensure you are using all terms and drawings.
HS.G-CO.A.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. Connections: *ETHS-S6C1-03*; *9-10.WHST.4*	G	*HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.	8.1	Determining dimensions for Roofing systems	Use the drawings provided to verify the dimensions for a building when you reflect that drawing down?
HS.G-CO.A.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g.,	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use	3.5	Identify drawing dimensions	Use the drawings provided to verify the dimensions for a building when you reflect that drawing down?

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***
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*		appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			

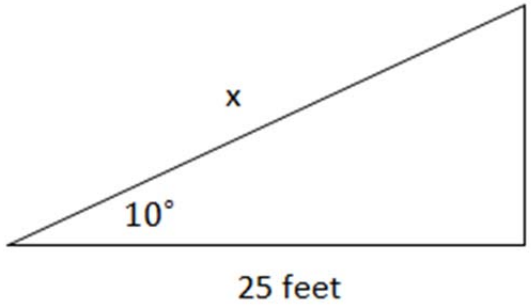
Geometry: Congruence (G-CO)

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, 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*	G	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6*. Attend to precision.	2.1 6.6	To use a variety of tools (compass and straightedge) to make a plan of a floor assembly	Project: Use a plan of a floor assembly using a compass and a straightedge. Solution: This project will include the skills of copying a segment to replicate floor joists, constructing perpendicular and parallel lines, bisecting a segment. 

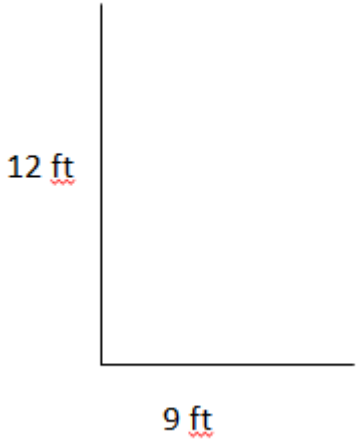
Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT) **Understand similarity in terms of similarity transformations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations 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.	3.2 3.4 3.5 4.1 4.3 4.4	To create a scale model of a residential construction project and construct a dilation of the plan identifying the scale factor.	Project: Create a scale model of a residential construction. Pick a point and construct a dilation of the plan with that point as the center. Identify the scale factor.

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT) **Prove theorems involving similarity.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.B.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. 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.	8.1	Determining dimensions for Roofing systems	From a blueprint a roof system needs to be constructed. The triangle for the roof measures 8", 8" and 12" the real life model should be three times this size. What would you need to build the real life model? 8x3=24 8x3=24 8x12=96 24"+24"+96"= 146"

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.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. Connection: *ETHS-S6C1-03*	G		8.1	Determining dimensions for Roofing systems	From a blueprint a roof system needs to be constructed. The triangle for the roof measures 8", 8" and 12" the real life model should be three times this size. What would you need to build the real life model? 8x3=24 8x3=24 8x12=96 24"+24"+96"= 146"
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.	8.1	To use trigonometric ratios to calculate the length of a roof line	The roof angle θ is 10° and the half-span is 25 feet. What is the length of the roof line?  Solution:

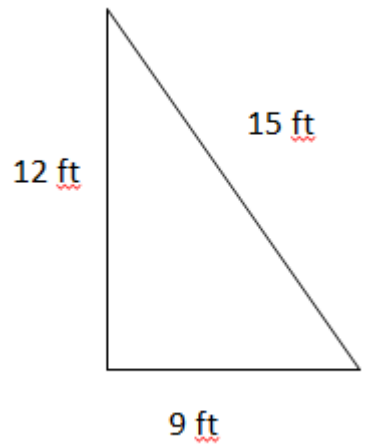
Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)

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***
			4.1 5.6 6.6 7.2 8.1	To use the Pythagorean Theorem to verify is a frame is" square" (has a right angle)	$\cos 10^{o} = \frac{25}{x}$ $x = 25.4\ ft$ A construction foreman needs to make sure that a form is "square" for the following structure.  Solution:

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)

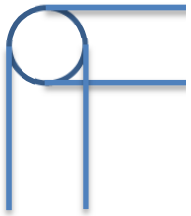
Define trigonometric ratios and solve problems involving right triangles.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
					 Foreman measures the hypotenuse and applies the dimensions to the Pythagorean Theorem to verify. Solution: The foreman creates the following equation and states whether it is true or false. $(12)^2 + (9)^2 = (15)^2$ 144 + 81 = 225 True so the structure is "square".

Geometry: Circles (G-SRT) **Apply trigonometry to general triangles.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.D.9. Derive the formula *A* = ½ *ab* sin© for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. Connection: *ETHS-S6C1-03*	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.7.* Look for and make use of structure.	5.6 6.6 7.2 8.1	Establish building lines.	You are building a fence around a triangular construction site. You want to know the area of the site that you are enclosing. You conduct a site survey and measure the side to your right is 450 feet and the measure to your left is 1,000 feet. The angle between the two sides is 40 degrees. Solution: A = ½ (450)(1,000)sin(40) A = 144,627.2 ft^2
HS.G-SRT.D.11. Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). Connections: *11-12.WHST.2c*; *11-12.WHST.2e*	+	HS.MP.1. Make sense of problems and persevere in solving them. HS.MP.4. Model with mathematics.	4.2	Establish building lines and recognize trade-specific layout.	You are conducting a site survey. There is a lake across from you that you need to know the length of. The length to your right is 1260 ft. and the length to your left is 780 ft. The angle between the two lengths is 67 degrees. What is the distance of the lake? Solution: $x^2 = (1260)^2 + (780)^2 – 2(1260)(780)\cos(67)$ x = 1194.9 = 1195

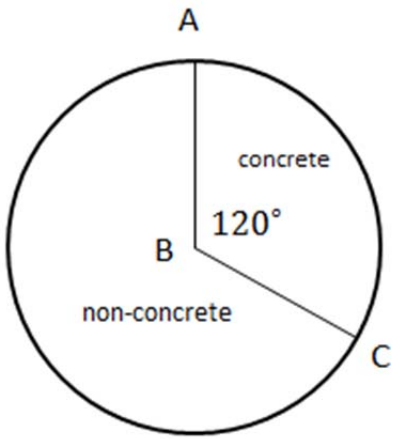
Geometry: Circles (G-C)

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.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.	5.6 7.1 13.2	Layout a concrete sidewalk	A customer requests a 4 foot wide sidewalk with a 90 degree bend as shown below.  The teacher instructs the students that the horizontal and vertical lines are tangent to the circle.

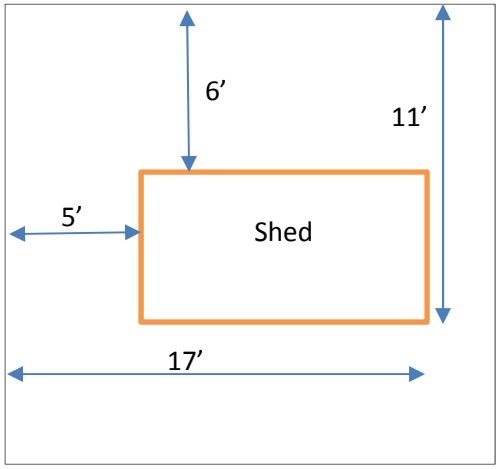
Geometry: Circles (G-C)

Find arc lengths and areas of sectors of circles.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-C.B.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. Connections: *ETHS-S1C2-01*; *11-12.RST.4*	G	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others.	5.7	To calculate the amount of concrete needed for edging in the shape of an arc or for the area of the sector.	A client wants to have concrete poured according to the following diagram. Calculate the edging needed and the surface area of the sector.  Solution: $\overset{\frown}{AB}$ = 25.1 feet Area of sector = 150.8 sq ft

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.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. Connections: *ETHS-S1C2-01*; *9-10.RST.3*; *11-12.RST.3*	G ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	4.2	Determine the location and size of a building	A shed is being built on a lot as shown below. Use the distance formula to determine the length of the diagonal .  $\sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2}$ $\sqrt{(17 - 5)^2 + (11 - 6)^2}$ $\sqrt{144 + 25}$ $\sqrt{169}$ Diagonal =13'

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.	5.7	To use the formula for volume of a cylinder to compute the volume, which can then be used to compute cost	A client wants the roof of a ramada to be held up by cylindrical concrete posts. Each post will have a diameter of 1 foot and a height of 12 feet. To mix each cubic foot of concrete costs $12. The cost to finish the posts cost $750 and the roof will be an additional $1000. What is the cost of the ramada? Solution: Per post: $V = \pi r^2 h$ $V = \pi (.5\ ft)^2 (12\ ft)$ $V = 9.42\, cubic\ ft \approx 9.5\, cubic\ ft$ 4 posts = 4(9.5 cubic ft) = 38 cubic ft Cost to mix: $\frac{38\ ft^3}{1} \bullet \frac{\$12}{1\ ft^3} = \$456$ Cost of project: $456 + $750 +$1000 = $2206

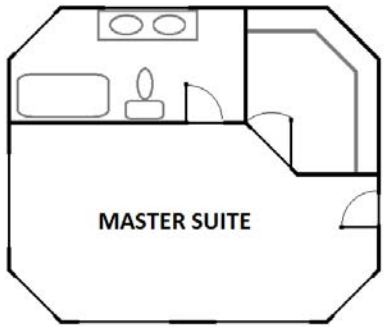
Geometry: Geometric Measurement and Dimension (G-GMD)

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.	3.2 3.4 5.6 6.2 7.1	Identify Size of lumber	Have students measure the actual size of standard framing lumber. | | Actual Width | Actual Height | | 2x4 | 3 ½" | 1 ½" | | 2x6 | 5 ½" | 1 ½" | | 1x3 | 2 ½" | ¾" |

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

Apply geometric concepts in modeling situations.

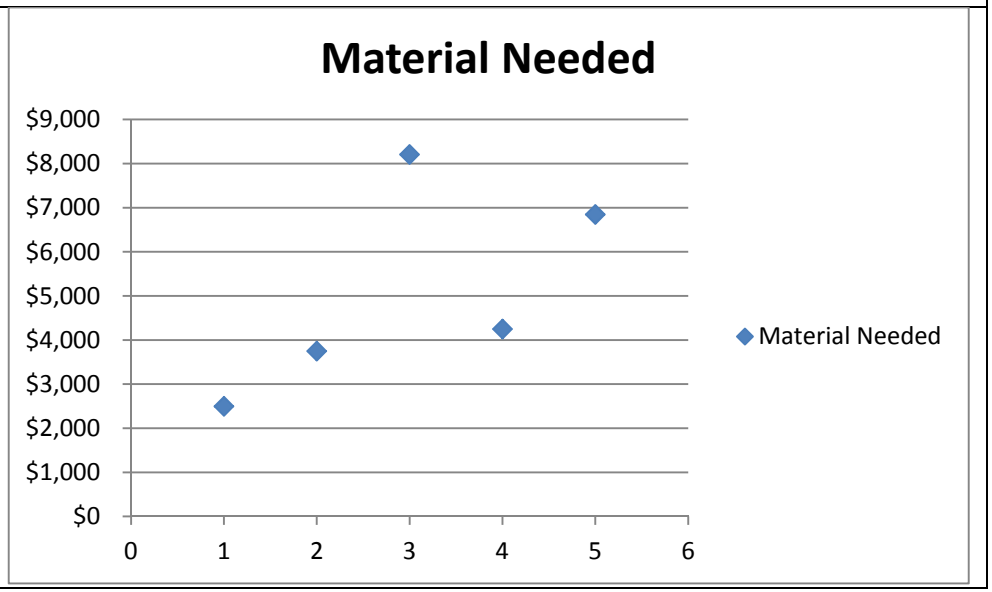
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-MG.A.1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). Connections: *ETHS-S1C2-01*; *9-10.WHST.2c*	G ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	3.4 3.5 4.1 5.7 6.5 6.6 7.1 8.5	To apply geometric properties to projects to aid in design, construction and cost estimates.	Project: The diagram at the right is for a master suite as sketched by the client. The client wants the contractor to add appropriate measurements and to use geometric shapes, their measures and properties to describe the plan and estimate cost. 
HS.G-MG.A.2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). Connection: *ETHS-S1C2-01*	G ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	5.7 13.1	To use the concepts of density to construction designs	A plumbing company finished a water storage tank that has the following dimensions, 40 feet by 20 feet by 8 feet. It takes 47,872 gallons to fill the pool and its weight is 2,988,551 pounds. What is the weight of 1 cubic foot of water? Solution: 62.5 pounds
HS.G-MG.A.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or	G ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4.* Model with mathematics.	3.5 3.6 6.6 12.1	To apply geometric methods to design and cost a floor assembly to accommodate	Project: Design a two-story floor assembly that would accommodate the needs of a person using a wheelchair.

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***
minimize cost; working with typographic grid systems based on ratios). Connection: *ETHS-S1C2-01*		*HS.MP.5.* Use appropriate tools strategically.		the needs to a physically challenged person needing assistance	

Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID) **Summarize, represent, and interpret data on a single count or measurement variable.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots). Connections: *SCHS-S1C1-04*; *SCHS-S1C2-03*; *SCHS-S1C2-05*; *SCHS-S1C4-02*; *SCHS-S2C1-04*; *ETHS-S6C2-03*; *SSHS-S1C1-04*; *9-10.RST.7*	A I ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	5.7 6.5 7.5 8.5 9.3	To represent the amount of material needed to frame a floor assembly with dot plots	A construction foreman kept track of the amount of material (in dollar cost) needed to frame a number of different types of floors. Job Number — Material Needed 1 — $2,500 2 — $3,750 3 — $8,210 4 — $4,250 5 — $6,850 Represent the data with dot plots. Solution:

Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)

Summarize, represent, and interpret data on a single count or measurement variable.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
					

Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID)

Interpret linear models.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-ID.C.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Connections: *SCHS-S5C2-01*; *ETHS-S1C2-01*; *ETHS-S6C2-03*; *9-10.RST.4*; *9-10.RST.7*; *9-10.WHST.2f*	A I ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematic. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	1.1 1.7 1.8	Use data to evaluate the rate of change.	Create a scatter plot graphing the results from the chart below. Create a best fit line for each fatality category and calculate the slope of each. Which category has seen the greatest decrease? FATALITIES: 2005, 2006, 2007, 2008, 2009 FALLS: 394, 433, 447, 332, 283 STRUCK BY: 130, 120, 106, 108, 79 ELECTROCUTIONS: 107, 126, 108, 89, 89 CAUGHT IN/BETWEEN: 111, 96, 98, 92, 34
HS.S-ID.C.9. Distinguish between correlation and causation. Connection: *9-10.RST.9*	A I ★	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision.	1.2 1.4 1.7 9.1 9.2 13.1 13.5 13.6 14.3 14.4	To distinguish between causation and correlation regarding Ohm's Law and providing an explanation.	A construction teacher states "In a circuit with 50 volts, as you raise the resistance the amperage goes up." The teacher instructs students to decide if this is an example of causation or correlation and explain their reasoning. Solution: Causation. According to Ohm's Law E = IR as the volts are raised so is the amperage. Students may supply examples to explain their reasoning.

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.	1.10	Using data to analyze a safety situation	3 framing companies have provided information related to hospital work related injuries as shown below. Which company has the best safety record?

Company	# of Employees	# Injuries last year	Answer (Injury/Emp)
A	30	2	2/30= 0.07
B	10	1	1/10 = 0.10
C	17	3	3/17=0.18

Company A has the best safety record since it has the lowest injury per employment ratio

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

Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-IC.B.6. Evaluate reports based on data. Connections: *11-12.RST.4*; *11-12.RST.5*; *11-12.WHST.1b*; *11-12.WHST.1e*	A II ★	*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	1.1 3.3 5.7 6.5 7.5 8.5	Examine actual cost vs. budget	A project has been completed to build a new house. The budgeted and actual costs are shown below. Was the project completed within budget? What is the difference and percent difference between the actual and budgeted cost for each category. Also create a histogram of the costs.

	Budgeted Cost	Actual Cost	Difference	% Difference
Foundation	$15000	$15550		
Framing	$22000	$21250		
Plumbing	$12000	$14000		
Electrical	$8000	$7600		
Finish	$8000	$9250		
Total				

Solution

	Budgeted Cost	Actual Cost	Difference	% Difference
Foundation	$15000	$15550	$550	3.7%
Framing	$22000	$21250	($750)	-3.4%
Plumbing	$12000	$14000	$2,000	16.7%
Electrical	$8000	$7600	($400)	-5.0%
Finish	$8000	$9250	$1,250	15.6%
Total	$65,000	$67,650	$2,650	4.1%

Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC) **Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
		reasoning.			