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.	4.10 3.8	To demonstrate that in today's global market companies need to be aware of how currency values affect business transactions	A company has a subsidiary in Mexico where the currency is in pesos. If the subsidiary earned 12,102,282 pesos in quarter 1 what would that convert to in US dollars if the conversion rate is 1 Mexican peso = 0.08 US Dollars? **Solution:** $\frac{12{,}102{,}282\,\text{pesos}}{1} \bullet \frac{\$0.08\ \text{US}}{1\,\text{peso}} = \$968{,}182.56\,\text{US}$
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.	1.2 8.2	Determine short-term financial goals and plans, including income, spending, saving and investing.	In setting financial goals and plans, you first need to identify your current income, assets, and liabilities. Create a personal income and expenses statement and find your net worth or net loss for one month. To determine your net worth, create a personal balance sheet. Use a spreadsheet program to create both of these documents.
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.	7.3	To determine how taxes affect payroll and overall expenses. To apply tax laws to preparing deductions for	**Question 1** Using the Sample Tax Table below**,** find the tax for Mr. and Mrs. Larson, who are filing a joint return. Their taxable income is $25,300. **Sample Tax Table**

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Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
			8.2	employees To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	

At Least	But Less Than	Single	Married Filing Jointly	Married Filing Separately	Head of a Household
		Your tax is –			
25,200	**25,250**	3,359	2,934	3,359	3,176
25,250	**25,300**	3,366	2,941	3,366	3,184
25,300	**25,350**	3,374	2,949	3,374	3,191
25,350	**25,400**	3,381	2,956	3,381	3,199

Solution:

1. First, find the 25,300-25,350 taxable income line.
2. Next, find the column for married filing jointly.
3. Then read down the column.
4. The amount shown where the taxable income line and the filing status columns meet is $2,949.
5. This is the tax amount they should enter on their form.

Question 2

Using the same Sample Tax Table above, find the tax for a single person whose taxable income is $25,300.

Solution:

$3,374

Project

For people making the same amount, $25,300, find the difference between a

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***
					single person and a *married couple filing jointly*. What is the percentage difference? Show the work. **Solution:** $ 3,374 single person - 2,949 married couple filing jointly $ 425 Single: $3,374/$25,300 = .133 = 13% Married: $2,949/$25,300 = .117 = 12% Income = $25,300 T_S = $3,374 $Perc_s = \frac{3374}{25300} = 0.1334$ T_M = $2,949 $Perc_m = \frac{2949}{25300} = 0.1166$ $Perc_s \cdot Perc_m = 0.0165$ $\frac{Tax_s\ Paid}{Income} = \%_S$ $\frac{Tax_s\ Paid}{Income} = \%_M$ $\%_S - \%_M$ = difference in percent

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.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.	7.4 8.2	To evaluate purchasing and production decisions for a company To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	In January Sam noted that his company ordered 8 SanDisk Cruzers, 12 SanDisk Sports and 6 EmTec Animals. In February the company ordered 20 SanDisk Cruzers, 24 SanDisk Sports and 10 EmTec Animals. For March the order was 6 SanDisk Cruzers, 4 SanDisk Sports and 20 EmTec Animals. Create matrices and add. What is the total order for each type of thumb drives this quarter for each? **Solution:** $\begin{bmatrix} 8 \\ 12 \\ 6 \end{bmatrix} + \begin{bmatrix} 20 \\ 24 \\ 10 \end{bmatrix} + \begin{bmatrix} 6 \\ 4 \\ 20 \end{bmatrix} = \begin{bmatrix} 34 \\ 40 \\ 36 \end{bmatrix}$ Each set of data is displayed in its own matrix. The matrices are of the same dimension. Add corresponding elements.

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.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Connections: *9-10.WHST.1c*; *11-12.WHST.1c*	A I A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively.	2.3 2.2 8.2	To use formulas to compute financial information for businesses and individuals To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	The annual interest rate is 15%. The expression to compute interest is 1.15^t which can be rewritten as $\left(1.15^{\frac{1}{12}}\right)^{12t}$. What is the approximate equivalent? **Solution:** 1.012^{12t}
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 mortgage payments.* Connection: *11-12.RST.4*	A II ★	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.7.* Look for and make use of structure.	1.6		In February the Benzon family starts saving for a trip to Australia in September. The Benzons expect their vacation to cost $5,375. They start with $525. Each month they plan to deposit 20% more than the previous month. Will they have enough money for their trip?

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.	2.3 8.2	To determine how costs affect decision making for businesses To utilize appropriate software to generate business reports	**Question 1** After a soft drink maker includes a $1.00 rebate offer on each 24-pack, sales increase by 180,000 packs or 15% over the previous quarter. If 2% of the possible rebates are redeemed, how much will the company have to pay out in rebates? **Solution:** Let X = number of packs sold in previous quarter. .15 X = 180,000 Divide both sides by .15 X = 1,200,000 This quarter, the soft-drink maker sold 1,200,000 + 180,000 1,380,000 packs 1,380,000 x $1.00 x .02 (2%) = $27,600 **Question 2** If the soft drink maker earns a profit of $0.75 per 24-pack sold before the rebates are paid out, how much will the company make or lose as a result of the rebate promotion? **Solution:**

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***
					The company sold 180,000 extra packs at $0.75 profit per pack for a total of $135,000. Subtract what the company paid out in rebates ($27,600). The company made $135,000 - 27,600 $107,400
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.	2.3 8.2	To use the decision-making process involved in budgeting and purchasing for an organization To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	**Project** A local business is selling T-shirts and baseball caps to honor the town's university team that is going to the NCAA Tournament. The owner has budgeted *at most* $5,000 to buy the items and would like to have 450 of them to sell. The T-shirts cost him $10 each and the caps $12 each. He makes a better profit on the caps. 1. Create a system of inequalities that best describes this situation. 2. What is the greatest number of caps he can buy and still meet his budget and number of items to sell? **Solution:** $x \geq 0$ $y \geq 0$ $x + y \geq 450$ $10x + 12y \leq 5000$ $10x + 10y = 4500$ $(-)10x + 12y = 5000$ $-2y = -500$ $y = 250$ $x = 200$

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

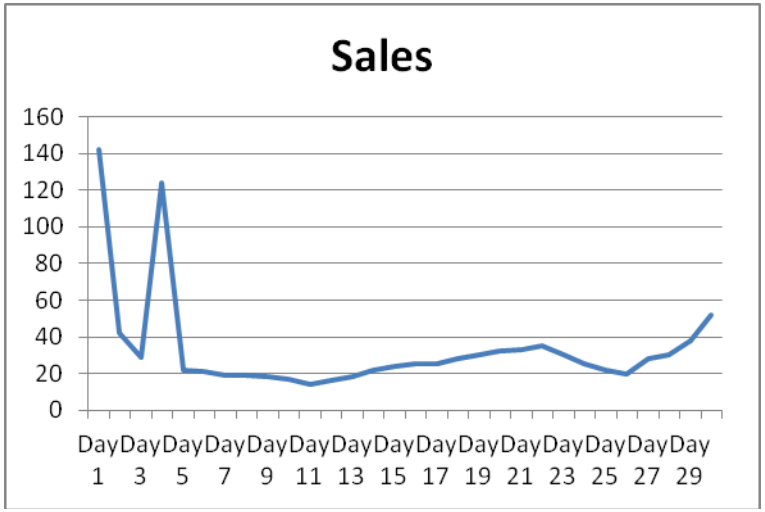
Solve systems of equations.

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.	8.2	To analyze how costs affect a store's revenue potential To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	During the busy holiday season, a store manager hires temporary workers, some who will work part-time and others who will work full-time. • The part-time employees will work 30 hours per week at $8.00 per hour. • The full-time employees will work 40 hours per week at $10.00 per hour. The manager hires 14 people and figures that the added staff will cost $4,320 per week. How many part-time workers (PT) and how many full-time workers (FT) did she hire? **Solution:** Let x = part-time workers Let y = full-time workers Each part-time worker will earn $240 per week. Each full-time worker will earn $400 per week. x + y = 14 240x + 400y = 4320 Multiply the equation by –240 –240x –240y = –3360 240x + 400y = 4320 Subtract the bottom from the top. 0x + 160y = 960 Divide by 160 y = 6 The manager hired 6 full time workers and therefore had to hire 8 part-time workers.

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.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	A I	*HS.MP.4.* Model with mathematics. HS.MP.5. Use appropriate tools strategically.	3.9		Lewis Publishing Company publishes a total of no more than 100 magazines every year. Researchers have found that at least 30 of these are women's magazines, but the company always publishes at least as many women's magazines as men's magazines. Find a system of inequalities that describes the possible number of men's and women's magazines that the company can produce each year consistent with these policies. Graph the solution set. Solution $X + Y \leq 100$ $X \leq 30$ $Y \leq x + 30$

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.	2.3 8.2	To analyze how different variables can affect the cash flow of a company by creating graphs and tables To utilize appropriate software to generate graphs	**Project** Start on Black Friday as Day 1 and assume a 30-day Christmas shopping period. The data is also confined to the statistical sample of sales of 1,000 items. 1. Create a graph of the number of items sold on each day of the shopping season. 2. Identify intervals where the graph is increasing and decreasing. 3. Identify the maximums and minimums. 4. Using knowledge of modern business, explain the spike on the 4th day of sales. **Solution:** 1. 

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***

2.

Day 1	142
Day 2	42
Day 3	29
Day 4	124
Day 5	22
Day 6	21
Day 7	19
Day 8	19
Day 9	18
Day 10	17
Day 11	14
Day 12	16
Day 13	18
Day 14	22
Day 15	24
Day 16	25
Day 17	25
Day 18	28
Day 19	30
Day 20	32
Day 21	33
Day 22	35
Day 23	30
Day 24	25

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***

Day 25	22
Day 26	20
Day 27	28
Day 28	30
Day 29	38
Day 30	52

Decreases from Day 1 to Day 3.
Increases from Day 3 to Day 4.
Decreases from Day 4 to Day 11.
Increases from Day 11 to Day 22.
Decreases from Day 22 to Day 26.
Increases from Day 26 to Day 30.

3. Maximum: 142
   Minimum: 14

4. The Monday after Black Friday is known as Cyber Monday. Cyber Monday is the busiest on-line shopping day of the year.

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.F-IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	A I A II + ★	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	7.4, 7.5, 7.6 8.2	To analyze and determine the future value of money and how it affects a company's growth To use appropriate hardware and software to generate business document/ reports	**Project:** Linear graph (a.) Sal purchases an iPad for $500 with his new VISA. The current promotion waives the 29.9% AYP on the first purchase. He pays the minimum monthly payments of $25. 1. Create a formula to show the running balance per month. 2. How long will it take Sal to pay off the iPad? 3. Create a graph to display the information. **Solution:** 1. Previous Balance – Payment = Current Balance 2. Y = $500 - $25X

X	Y
0	500
1	475
2	450
3	425
4	400
5	375
6	350
7	325
8	300
9	275
10	250
11	225
12	200
13	175
14	150

Functions: Interpreting Functions (F-IF)

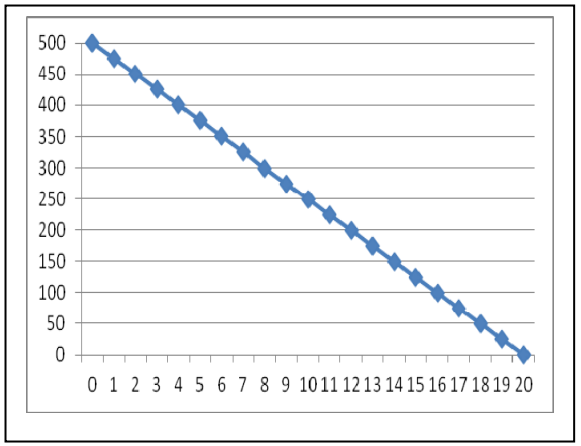
Analyze functions using different representation.

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

15	125
16	100
17	75
18	50
19	25
20	0

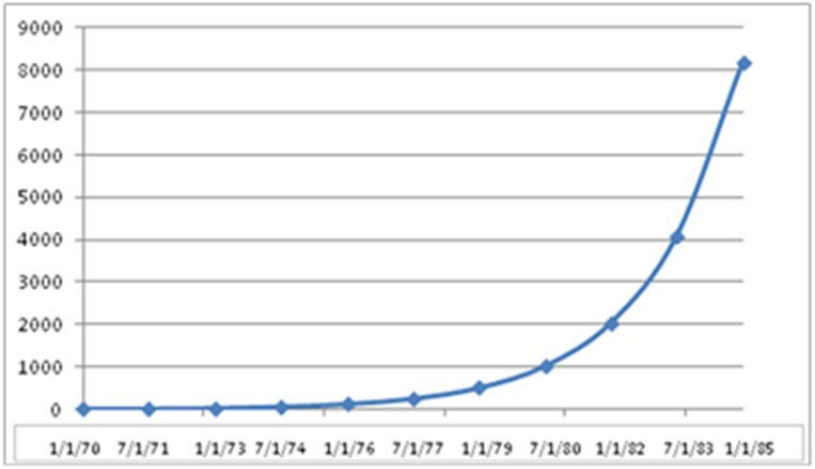
Sal will pay off the iPad in 20 months.

3. Graph



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***
a. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*	A II ★		7.4		**Project:** Exponential graph (e.) According to Moore's Law, the number of transistors that can fit on a chip will double every 18 months due to advancements in technology. The first chip in January 1, 1970, could fit 8 transistors. 1. Create a chart showing increments of 18 months and the number of transistors that fit on a chip accordingly, starting with January 1, 1970, and ending January 1, 1982. **Solution:** 
HS.F-IF.C.9. Compare properties of two functions each represented in	A I A II	*HS.MP.6.* Attend to precision. *HS.MP.7.* Look for	5.1	Analyze current and future staffing needs of	A. The Nordstrom Company will determine staffing needs for Black Friday based on last year's Black Friday's total revenue of $50,000. The sales associates sold an average of $2,000 each that day.

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***
a different way (algebraically, graphically, numerically in tables, or by verbal 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*		and make use of structure.		a business.	1. How many sales associates would be needed to increase this year's Black Friday's revenues to $56,000? 2. How many associates would be needed to increase the Black Friday's revenues to $64,000? 3. If the company's goal is sales revenue of $76,000, how many sales associates would they need that day? **Solution** Y = Revenue, X = Sales Associates Let Y = 56000, solve for X 1. Y = 2000X 56000 = 2000X $\frac{56000}{2000} = \frac{2000}{2000}X$ 28 = X For $56,000 in revenue28 sales associates 2. Let Y = $64,000. Ans. 32 sales associates 3. Let Y = $76,000. Ans.38 sales associates B. If the Nordstrom Company's Black Friday's expenses are $10,000, higher than projected, what would the staffing need be?

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***
					Solution Y = 2000X + 10,000 Solve for X 50000 = 2000X +10,000 -10000 -10000 40000 = 2000X 2000 2000 20 = X If the expenses are increased by $10,000, the number of associates is reduced to 20.

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.	1.2 1.3 1.4 7.2 7.6 8.2	To evaluate the overall cost of credit to a business To utilize appropriate software to generate graphs	A businessman takes out a short-term loan from a friendly and enterprising lender. The lender proposes an interesting agreement. There will be no compounding of interest of any kind. • If the borrower repays the loan in the first month after receiving it, he owes nothing but the principal. • If he pays it off in the second month, he owes the principal plus one percent of the principal. • If it is paid off in the third month, he owes the principal plus two percent of the principal, and so on. According to the agreement, he must pay all of the principal and whatever interest is owed all at once; he cannot make partial payments. **Solution:** A = Amount paid back P = Principal N = number of month in which it is paid back $A= f(n) = P(1+ (.01)(n-1))$ If it is paid off in the 3rd month, the interest is 2% (.02); if it is paid off in the 30th month, the interest is 29% (.29). Subtract one month from n then multiply it by .01 to get the correct interest rate. Then add that to 1 and multiply by the principal to get the amount that is owed. Note that if it is paid off in the 1st month, the equation is $A = P(1 + (.01)(1-1))$ or $A = P (1 + 0) = P$

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.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.			A recursive sequence uses the preceding number in the sequence to determine the next number. **Question 1:** Jose believes he can successfully sell vacuum cleaners on commission. He is told by the Acme Vacuum Cleaner, Inc., that all new sales staff must prove their capability before they will be allowed to share in a full commission of $60 per unit. Acme's sales manager explains that each new sales staff member will be paid sixty cents as commission for the first vacuum cleaner he or she sells and that the commission increases by twenty cents for each successive unit sold by the sales trainee, topping out at $60 per unit. What would Jose's commission be after he has sold 5 units? **Solution:** Use a recursive formula for determining a geometric sequence. The formula is: $a_n = a_{n-1} + d$ a_n = the nth number being sought a_{n-1} = the number in the sequence immediately preceding a_n d = the constant difference between each number in the sequence The formula therefore reads: $a_5 = a_{5-1} + \$0.20$ $a_5 = a_4 + \$0.20$ Since the 4^{th} number in the sequence is $1.20, $a_4 = \$ 1.20$

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***
					$a_5 = \$1.20 + \$0.20$ $a_5 = \$1.40$ **Question 2** Using the profit plan in the previous example, Jose figures he can sell 10 vacuum cleaners per week and wants to know how much profit he will earn per unit after he has sold 100 units. **Solution:** Use the explicit version of the arithmetic sequence formula to calculate this. The formula is: $a_n = a_1 + (n-1)d$ Let n = 100 Let $a_1 = \$0.60$ Let d = $0.20 $a_{100} = \$0.60 + (100 – 1)\$0.20$ A100 = $0.60 + (99)$0.20 A100 = $0.60 + $19.80 A100 = $20.40 Jose will receive a profit of $20.40 on his 100^{th} unit.

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***
					Question 3 Tony is approached by a representative of Faceplant.com, a social networking company which is seeking advertisement revenue. Faceplant.com offers Tony a commission of 20% on every $100 advertisement unit he sells. Calculating, Tony figures that after selling 100 $100 advertisement units, he would receive $2,000. Tony instead suggests that Faceplant.com pay him $.01 on the first $100 advertisement unit and that the commission increase by a factor of 15% with each additional advertisement unit sold. Which is the better deal for Tony, the Faceplant.com original offer or Tony's counter-offer? **Solution:** Use the explicit formula for a geometric sequence to calculate how much commission Tony will receive on the 100^{th} advertisement unit. The formula is as follows: $$a_n = a_1 * r^{n-1}$$ Let n = 100 and r = 1.15 $a_{100} = \$0.01 * 1.15^{100-1}$ $a_{100} = \$0.01 * 1.15^{99}$ $a_{100} = \$0.01 * 1021142.131$ $a_{100} = \$10,211.42$

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***
					The better deal for Tony is his counter-offer ($10,211.42 commission for the 100th unit vs. $2,000.00).

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.5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. Connection: *ETHS-S6C2-03*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.	2.3 7.4 8.2	To assess long-term costs and to determine the value of assets at a given point in time To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	A woman buys a new machine for her business for $80,000. It depreciates 12% per year. When it gets down to a value of $24,000, it must be replaced. How long will that be? **Solution:** $24,000 = $80,000 $(.88)^t$ $\frac{24{,}000}{80{,}000} = \frac{80000}{80000}$ $.3 = (.88)^t$ $\log_{.88} .3 = \log_{.88} (.88)^t$ t – 9.4 years The machine must be replaced in 9.4 years.

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.	2.4 7.6 8.2	To analyze the cost of money over a specific time period and determine the best choice for a business To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	**Question 1:** The law firm of Dewy, Cheetem, and Howe is researching three wireless cell phone providers to determine which company offers the least expensive plan for the firm's cell phones. The three cell phone companies offer the following plans: Company A: $750 per month with a 5-cent per minute usage fee. Company B: $500 per month with a 10-cent per minute usage fee. Company C: $0 per month with a 20-cent per minute usage fee. 1. Create three equations that will show the total monthly cost of each plan based upon the minutes used. 2. Determine the monthly cost of each plan based on 1,000 minutes, 5,000 minutes, and 10,000 minutes of monthly usage. 3. Create a graph to display the information. 4. Which plan is the best deal at 1,000, 5,000, and 10.000 minutes? **Solution:** 1. Total Monthly Cost = y Total Monthly Minutes = x Company A: y = .05x + 750 Company B: y = .1x + 500 Company C: y = .2x + 0 2.

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

Construct and compare linear, quadratic, and exponential models and solve problems.

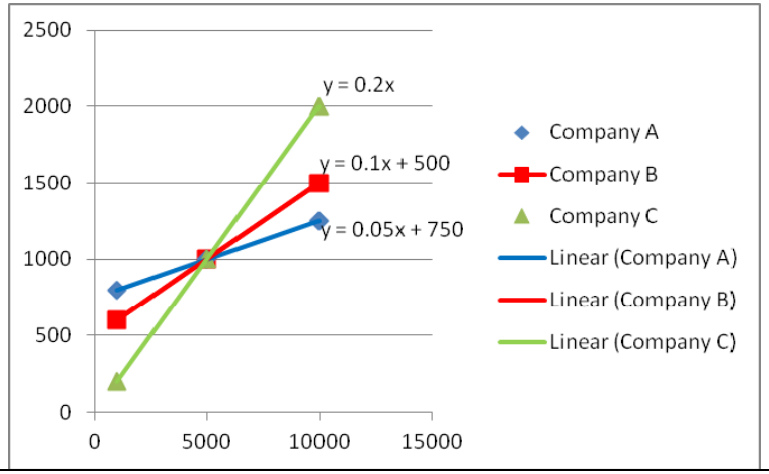
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***

Inserting x values of 1,000, 5,000, and 10,000 and solving for y yields the following y coordinates for each of the three companies. These y values represent the total monthly cost of each cell phone plan:

x	y	x	y	x	y
1,000	800	1,000	600	1,000	200
5,000	1,000	5,000	1,000	5,000	1,000
10,000	1,250	10,000	1,500	10,000	2,000

3.

Plot the x and y values on an xy coordinate chart as follows:

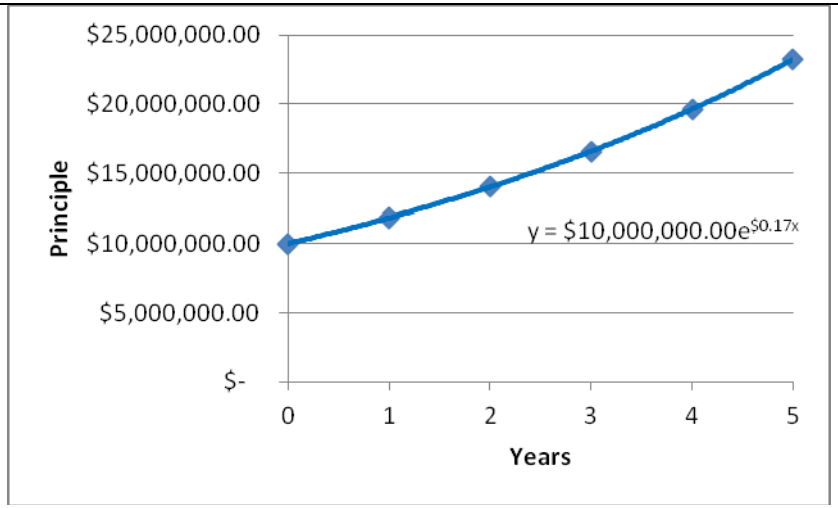


Functions: Linear, Quadratic, and Exponential Models ★ (F-LE) **Construct and compare linear, quadratic, and exponential models and solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
					4. At 1,000 minutes, Company C is the best deal. At 5,000 minutes, they are all the same. At 10,000 minutes, Company A is the best deal. **Question 2** Mercedes is the lending manager of the Medici Business Bank (MBB). A new business client, Oil Wildcatter Explorations (OWE), wants to borrow, unsecured, $10 million for off-shore oil exploration in the Gulf of California. Since an unsecured loan is risky, Mercedes proposes lending this sum at a rate of 17 % interest compounded monthly, provided that principal and interest are paid back in monthly installments over a five year period, with no balloon payment at the end. 1. Create an equation that shows the total return of principal plus interest after 5 years. 2. Create a chart showing the payback of principal plus interest over the 5 year period. **Solution:** 1. Use these variables: (a) A = Ending Amount; (b) P = beginning amount; (c) r = interest; (d) n = number of times interest is compounded per year; and (e) t = time in years The equation is as follows:

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***
					$A = P(1 + r/n)^{nt}$ Solve for A. The other variables will have the following values: P = $10,000,000; r = .17; n = 12; and t = 5 Solving: $A = P(1 + r/n)^{nt}$ $A = 10,000,000(1 + .17/12)^{12*5}$ $A = 10,000,000(1 + .0141666667)^{12*5}$ $A = 10,000,000(1.0141666667)^{12*5}$ $A = 10,000,000(1.0141666667)^{60}$ $A = 10,000,000(2.325733406)$ A = $23,257,334.06 2. The chart below shows the exponential increase in principal and interest over the five years of the loan:

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***
					

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.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a 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*	A I A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.8.* Look for and express regularity in repeated reasoning.	7.6 8.2	To analyze and prepare budgets for an organization to implement cost-saving measures To prepare cost analyses and determine the best choice for a business To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	An employer will be hiring new employees, but first she has to determine which of the following salary options would save her company money. Option 1 is starting at $40,000 a year and receiving a $5,000 raise each year. Option 2 is starting at $40,000 and receiving a 10% raise each year. 1. How much would Option 1 cost in the 10th year? 2. How much would Option 2 cost in the 10th year? 3. How much would Option 1 cost over ten years total? 4. How much would Option 2 cost over ten years total? **Solution:** 1. $90,000 Principal + (raise x number of years) P + r(n) 2. $103,749.70 $P(1+r)^n$ $40{,}000(1+.10)^{10} = \$103{,}749.70$ 3. $650.000 $\left(\frac{a+L}{2}\right)n$ $\left(\frac{First+Last}{2}\right)(10) = \left(\frac{40{,}000+90{,}000}{2}\right)(10)$ $(\$65{,}000)(10) = \$650{,}000$ 4. $637,496.98

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***
					The formula for determining how much Option 2 would cost over 10 years total is: $P[((1+r)^t - 1)t]$
HS.F-LE.A.4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *11-12.RST.3*	A II ★	*HS.MP.7.* Look for and make use of structure.	1.2 1.4 8.2	To determine the growth of investments at specific points in time To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	At what rate of continuously compounded interest would an initial investment of $9,000 triple in 15 years? **Solution:** In 15 years, the $9,000 will have become $27,000. $27,000 = 9,000e^{xt}$ x is the rate and t = 15. Thus, $27,000 = 9,000^{x \cdot 15}$ Divide by 9,000 and get $3 = e^{15x}$ $\ln 3 = \ln(^{15x}) = 15x$ 1.09861 = 15x x = .0732 x = 7.3% interest

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.	1.2	To understand the variables in the growth of money and how each variable works	**Question 1** Joseph buries $1,000 in his backyard and deposits $1,000 in a bank with a 3% simple annual interest. Write an equation that represents the total amount of money he has at time *n*. Show how the base and vertical shift are displayed in the explicit form of the function. **Solution:** The variables are as follows: A = Final value of the investment; P = Initial value of the investment; n = number of interest periods in years; r = rate of interest, and k = a constant (e.g. the money Joseph buried). In this case, P = 1,000, r = .03, and k = 1,000 The equation is as follows: A = P(1 +nr) + k Plugging in the above value: A = 1000(1 + .03n) + 1,000

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.	3.5 3.6 8.2	To comprehend how companies compete for market share using price To utilize financial data to make decisions and formulate plans To evaluate financial data to determine if financial goals were met To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	**Question 1** As a semester-long fundraiser, DECA and FBLA decided to sell candy. The two clubs took different approaches, with DECA selling the candy for a flat rate, while FBLA tried different prices in order to maximize profits in the shortest time. They each bought 1000 candy bars at 25 cents each. DECA sold the candy bars for 75 cents each and sold 100 each day. FBLA sold the candy for $1.00 each on the first day and sold 40 bars. The second day, they priced the bars at 90 cents each and sold 80 bars. The third day, they sold 90 bars at 80 cents each. The fourth day, they sold 160 bars at 70 cents each. The fifth day, they sold 300 bars at 60 cents each. The sixth day, they sold all the rest of their inventory at 50 cents per bar. 1. Create a chart. 2. How much total profit did DECA make at the end of six days? 3. How much profit did DECA make per day? **Solution:** 1. $300 2. $50 **Question 2** In the scenario above: 3. How much total profit did FBLA make at the end of six days? 4. How much average profit did FBLA make each day? 5. Which group was more successful? Explain. 6. At what price should FBLA sell their candy to maximize profits over a

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***

given time period?

Create a chart to answer questions 3, 4, 5, and 6.

Solution:

DAY	PRICE	NUMBER SOLD	PROFIT PER DAY	TOTAL PROFIT
1	$1.00	40	$75	$30.00
2	.90	80	65	52.00
3	.80	90	55	49.50
4	.70	160	45	72.00
5	.60	300	35	105.00
6	.50	330	25	82.50
Average	.75	1000	50	65.17
TOTAL				$391.00

3. $391
4. Divide total profit by number of days: $391/6 = $65.16
5. DECA made $300 in 6 days or $50 per day. FBLA made $391. in 6 days or $65 per day. FBLA was more successful.
6. 60 cents

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***
					Question 3 If FBLA sold candy at their optimum price, how much would they make in 10 days? Represent the data with a graph. **Solution:**  FBLA would make $1,050.00, more than twice what DECA would make.
HS.S-ID.A.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard	A I ★	*HS.MP.2*. Reason abstractly and quantitatively. *HS.MP.3*. Construct viable arguments and critique the reasoning of	1.2 1.5 8.2 9.2	To analyze a company's sales data over time to determine profitability	**Revise to tie solution to CTE standards.** **Project** Students may use spreadsheets, graphing calculators and statistical software for calculations, summaries, and comparisons of data sets. A company is comparing the weekly sales at two of its stores: Store A - $25,000, $23,000, $11,000, $31,000, $15,000, $9,000, $25,000, $14,000,

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***
deviation) of two or more different data sets. Connections: *SCHS-S1C3-06*; *ETHS-S6C2-03*; *SSHS-S1C1-01*		others. *HS.MP.4.* Model with mathematics. HS.MP.5. Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			$18,000 Store B - $21,000, $29,000, $13,000, $10,000, $18,000, $19,000, $21,000, $17,000, $11,000 Find the mean, median, mode, & interquartile range, for each store. **Solution:** To begin statistical analysis the weekly sales, covering 9 weeks of both stores, are ranked in order from lowest weekly sales to highest, as follows: Store A – 9000, 11000, 14000, 15000, 18000, 23000, 25000, 25000, 31000 Store B – 10000, 11000, 13000, 17000, 18000, 19000, 21000, 21000, 29000 Statistics is largely used to analyze data by comparing its center (known as the measure of central tendency) and its spread. The **mean** is found by taking the average of the sales for each store. The formula for determining the mean is: M = ∑x/n where M = mean, ∑x = sum of total sales, and n = number of weekly sales For Store A: ∑x = 9000 + 11000 + 14000 + 15000 + 18000 + 23000 + 25000 + 25000 + 31000 = 171000 n = 9 (nine weeks of sales)

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***
					Plugging these values into the formula: M = 171000/9 Mean = 19000 For Store B: ∑x = 10000 + 11000 + 13000 + 17000 + 18000 + 19000 + 21000 + 21000 + 29000 = 159,000 n = 9 (nine weeks of sales) Plugging these values into the formula: M = 159000/9 Mean = 17,667 Store A's mean ($19,000) is higher than Store B's mean ($17,667). **Median** represents the middle statistic in a string of statistics. Again, sales are ranked from lowest to highest. Because there are 9 sales for each, the mean will be the 5th statistic in order for each store (4 statistics are above and 4 are below, with the 5th statistic in the middle. For Store A: 9000, 11000, 14000, 15000, 18000, 23000, 25000, 25000, 31000 For Store B:

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***
					10000, 11000, 13000, 17000, 18000, 19000, 21000, 21000, 29000 For both stores, the median is the same: 18000. **Mode** denotes the most frequently found statistical value found in each string of statistical data. If no value repeats, there is no mode. There can be more than one set of repeaters (e.g. 4, 4, 5, 5, 5, 6), in which case the data that repeats the most (in this case 5) will be the mode. If more than one set of numbers repeat, but to the same degree (e.g. 4, 4, 5, 5, 6), then there would be as many modes as there are repeaters of the same degree (in this case, 4 and 5). Store A: The statistical value 25,000 is repeated twice, and there are no other repeaters. Therefore the mode for Store A is $25,000. Store B: The statistical value 21,000 is repeated twice, and there are no other repeaters. Therefore the mode for Store B is $21,000. Store A therefore has the higher mode, but the central tendency reflected by the mode in both stores is not strong since there are only two repeating statistics in each set of statistical values. **Interquartile range** describes the spread of each set of statistical values. To find the range, the lowest value is subtracted from the highest value and the result is the interquartile range. Store A interquartile range:

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***
					25000-15000 = 10000 Store B interquartile range: 21000-13000 = 8000 --- The **standard deviation** is a statistic that describes how tightly all the analytical data are clustered around the mean in a set of data. When the examples are bunched together, they form a steep bell-shaped curve on a chart, and this makes the standard deviation small. When the examples are spread apart and the bell curve is relatively flat, there is a relatively large standard deviation. To calculate standard deviation, find the mean of the data set and subtract the mean from each statistical value in the original data set, then square each result. Find their sum and divide that by the population size of the data set and take the square root of the entire result. The formula for this calculation is as follows: $$\sigma = \sqrt{\frac{\sum(x-\overline{x})^2}{N}}$$ where, $\sigma = the\ standard\ deviation$ $x = each\ value\ in\ the\ population$ $\overline{x} = the\ mean\ of\ the\ values$ $N = the\ number\ of\ values\ (the\ population)$

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***
					Store A standard deviation: Start by ordering the statistical data for store A: 9000, 11000, 14000, 15000, 18000, 23000, 25000, 25000, 31000 Mean = 19,000 (previously found above) Subtract the mean from these statistical values: 9000 – 19000 = -10,000; 11000 – 19000 = - 8000; 14,000 – 19000 = -5000; 15000 – 19000 = - 4000; 18000 – 19000 = - 1000; 23000 – 19000 = 4000; 25,000 – 19000 = 6000; 25000 – 19000 = 6000; 31000 – 19000 = 12000 Therefore, the revised statistical values are: - 10,000, - 8000, - 5000, - 4000, - 1000, 4000, 6000, 6000, and 12000. Next, square each result and add them together: $(-10{,}000^2) + (-8000^2) + (-5000^2) + (-4000^2) + (-1000^2) + (4{,}000^2) + (6000^2) + (6000^2) + (12{,}000^2) = 48666667$ Next, divide this result by N, which represents the population (total number of statistical values). N = 9 48666667/9 = 5407407.444 Then take the square root of that result and get: $\sqrt{5407407.444} = 2325$ Standard deviation for Store A = 2325.

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***
					Store B standard deviation Start by ordering the statistical data for store B: 10000, 11000, 13000, 17000 + 18000, 19000, 21000, 21000, 29000 Mean = 17,667 (previously found above) Subtract the mean from these statistical values: 10000 – 17667 = -7667; 11000 – 17667 = - 6667; 13,000 – 17667 = -4667; 17000 – 17667 = - 667; 18000 – 17667 = 333; 19000 – 17667 = 1333; 21,000 – 17667 = 3333; 21000 – 17667 = 3333; 29000 – 17667 = 11333 Therefore, the revised statistical values are: -7667, -6667, -4667, -667, 333, 1333, 3333, 3333, and 11333. Next, square each result and add them together: $(-7667^2) + (-6667^2) + (-4667^2) + (-667^2) + (333^2) + (1333^2) + (3333^2) + (3333^2) + (11333^2) = 278000001$ Next, divide this result by N, which represents the population (total number of statistical values). N = 9 278000001/9 = 30888889 Take the square root of that result and get: $\sqrt{30888889} = 5558$ Standard deviation for Store B = 5558 The standard deviation for Store A is 2325, and for Store B it is 5558. As stated

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***
					previously the smaller standard deviation (in this case of Store A) is caused by a steeper bell shaped curve of data than for Store B.

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

Summarize, represent, and interpret data on two categorical and quantitative variables.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-ID.B.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.9*; *11-12.WHST.1a-1b*; *11-12.WHST.1e*	A I ★	*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.8.* Look for and express regularity in repeated reasoning.	2.5 3.9 8.2	To differentiate business trends in markets To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	Deborah's company conducts market research to determine which type of advertising is most effective. Ages 12 and under: electronic ads 27,274, print ads 1,119 Ages 13-17: electronic ads 22,108, print ads 8,540 Ages 19-24: electronic ads 28,486, print ads 9,114 Ages 25-29: electronic ads 31,609, print ads 5,031 Ages 30-39: electronic ads 26,402, print ads 10,820 Ages 40-49: electronic ads 20,144, print ads 21,715 Ages 50-59: electronic ads 18,032, print ads 32,540 Ages 60 and over: electronic ads 12,767, print ads 42,982 1. Create a two-way frequency table to display the relationships between the age groups and their preferences. **Solution:** **Age Groups** / **Electronic Ads** / **Print Ads** 12 and under / 27,274 / 1,119 13-17 / 22,108 / 8,540 19-24 / 28,486 / 9,114 25-29 / 31,609 / 5,031 30-39 / 26,402 / 10,820 40-49 / 20,144 / 21,715 50-59 / 18,032 / 32,540 60 and over / 12,767 / 42,982 2. Use the data above to create a relative frequency table. **Solution:**

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

Summarize, represent, and interpret data on two categorical and quantitative variables.

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

Age Groups	Electronic Ads	Print Ads
12 and under	14.60%	.85%
13-17	11.83%	6.48%
19-24	15.25%	6.91%
25-29	16.92%	3.82%
30-39	14.13%	8.21%
40-49	10.78%	16.47%
50-59	9.65%	24.68%
60 and over	6.83%	32.60%

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.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.	1.5	To demonstrate the need for complete analysis using a number of comparative ratios	On the weekend of December 25-27 of 2009, a movie titled *Law-Abiding Citizen* was the 31st highest grossing movie of the week. It had been out for 11 weeks. But on that weekend, *Law-Abiding Citizen* showed an increase in ticket sales of 58.3%. In fact, nine movies that had been in theaters for multiple weeks defied the odds and improved over the previous week. While it is logical to assume that the holiday weekend was the cause of the increases, that is not always the case. Three times in the past 10 years, total ticket sales were down on the holiday weekend compared to the previous weekend. Over the past 20 years, the average increase on that weekend was a modest 12.5%.

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***
					But in 2009, it was 97.5%. It was the year of *Avatar*, the biggest money-making movie of all time. In what theater owners refer to as "spill-over effect," people flocked to the theaters, found that *Avatar* was sold out, and just decided to see a different movie. *Blind Side* in its 6th week was up 14.9% and *Where the Wild Things Are*, in its 11th week, was up 251%. 1. Does the increase in ticket sales on holiday weekends involve correlation or causation? 2. Does the increase on the holiday weekend of 2009 because of the *Avatar* spill-over involve correlation or causation? **Solution:** Correlation. People tend to go to the movies more on holiday weekends, but the holiday does not make them go the movies. Causation. These people were already at the theater and wanted to see something, so they went to see something else.

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

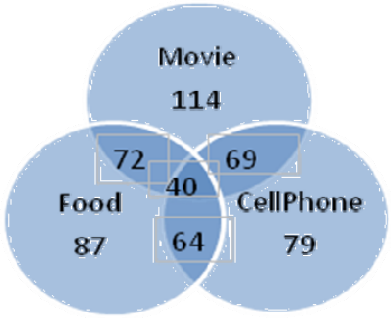
Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-IC.B.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. Connections: *ETHS-S6C2-03*; *11-12.RST.9*; *11-12.WHST.1e*	A II ★	*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.	3.6	To determine how research data can provide a basis for decision making.	The formula for margin of error is: $\sqrt{\frac{P(1-P)}{n}} \cdot 1.96$ where P is the percentage of the total number of people in the overall population who were actually surveyed. If one has a population of 1000 and 50 people are surveyed, then P = .05, 1-P=.95, and n =1000. What is the only way to get a margin of error equal to zero? **Solution:** The only way would be to survey every person in the population. That way, the survey sample and population are the same. Then, the equation would be $\sqrt{\frac{1(1-1)}{1000}} = \sqrt{\frac{0}{1000}} = 0$ Unless everybody in the overall population is surveyed, there will always be a margin of error. The key is to get as small a margin of error as possible without spending time on too large a sample. It is a matter of what is acceptable to the survey taker(s).

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP)

Understand independence and conditional probability and use them to interpret data.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-CP.A.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). Connection: *11-12.WHST.2e*	A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.	3.7 8.2	To determine the best product for a specific market To utilize appropriate software to generate graphs.	The manager of a mall is creating the advertising budget for the next quarter. He collects the following data: On a Saturday afternoon between noon and 1:00 p.m., 222 people entered the Westside Mall. Before they left, 114 attended a movie, 87 ate at the food court, and 79 were approached by the salesperson at the cell phone kiosk. • 72 ate at the food court and attended a movie • 69 saw a movie and were approached by the cell phone salesperson • 64 ate at the food court and were approached by the cell phone salesperson • 40 ate at the food court, saw a movie, and were approached by the cell phone salesperson 1. What product and/or service should receive the largest share of the advertising budget? Explain. 2. How many people saw a movie but did not eat at the food court? 3. Create a Venn diagram to display the data. **Solution:** 1. Movie theater. More than half of the people who entered the mall (114 out of 222) went to the movies. A substantial number of the people who went to the movies also ate at the food court (72). 2. 114 (movie) – 72 (movie and food) = 42 3.

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP) **Understand independence and conditional probability and use them to interpret data.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
					
HS.S-CP.A.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students*	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	3.7 3.9 8.2	To determine the best product for a specific market To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	At a restaurant called Just Enchiladas, all dishes served (or take-out orders) include three enchiladas and nothing else. The owner keeps track of all sales for a week and notes the gender of the customer in each case. The results are: <u>Men</u> Beef 240 orders Chicken 154 Cheese 128 Combination (of 2 or more types) 48 <u>Women</u> Beef 127 orders Chicken 148 Cheese 102 Combination (of 2 or more types) 0 1. Create a frequency table. 2. What is the probability that a man will order cheese enchiladas?

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP)

Understand independence and conditional probability and use them to interpret data.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. Connections: *ETHS-S6C2-03*; *11-12.RST.4*; *11-12.RST.9*; *11-12.WHST.1e*		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.			3. What is the probability that a woman will order chicken enchiladas? 4. Does the fact that no women ordered a combination plate during that week mean that no woman will ever order one? **Solution:** 1.

	Beef	Chicken	Cheese	Combination	Total
Men	240	154	128	48	570
Women	127	148	102	0	377
Total	367	302	230	48	947

2. $\frac{128}{570} = .225$ OR 22.5%

3. $\frac{148}{377} = .3925$ OR 39.3%

4. No. The most one can conclude is that it is very unlikely, but without an infinite sample one can't be certain that it will never happen.

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP) **Understand independence and conditional probability and use them to interpret data.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-CP.A.5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* Connections: *11-12.RST.4*; *11-12.RST.5*;*11-12.WHST.1e*	A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision. *HS.MP.8.* Look for and express regularity in repeated reasoning.	3.7 8.2	Analyze how advertising influences consumer choices. To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	In a small town, 28% of all new cars were bought at Fred's Dealership. Each new vehicle purchase comes with the option of receiving a high-end stereo installed at a discount. If 64% of the new cars were bought at Fred's Dealership, what percent of those purchased also had the stereos installed at Linda's Stereo Emporium? Answer: P(Second|First) = P(First and Second/P(First) = 0.28/0.64 = .4375 = 43.75% 1.

Statistics and Probability: Using Probability to Make Decisions ★ (S-MD)

Use probability to evaluate outcomes of decisions.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-MD.B.5. Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Connections: *SSHS-S5C2-03*; *SSHS-S5C5-03*; *SSHS-S5C5-05*; *ETHS-S1C2-01; ETHS-S6C2-03*	+ ★	*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.	5.1 8.2	To understand the probabilities associated with decisions (risk vs. reward) To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	**Question** Complete analysis to match CTE Standard. Matt is the owner of a business located in South Texas. His insurance agent will insure him against tornados, hurricanes, and monsoon damage at a cost of $80,000 per year. He does the research and learns that in his area the probability of getting hit by a tornado is $\frac{1}{100}$. The probability of getting hit by a hurricane is $\frac{1}{50}$. The probability of monsoon damage is $\frac{1}{25}$. What is the probability of getting hit by any of those in a given year? **Solution:** The probability of any of those happening is the sum of the probabilities. $\frac{1}{100}+\frac{1}{50}+\frac{1}{25}=$ Find the common denominator. $\frac{1}{100}+\frac{2}{100}+\frac{4}{100}=\frac{7}{100}$

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.1. Study the following topics related to vertex-edge graphs: Euler circuits, Hamilton circuits, the Travelling Salesperson Problem (TSP), minimum weight spanning trees, shortest paths, vertex coloring, and adjacency matrices. Connections: *ETHS-S6C2-03*; *11-12.RST.4*; *11-12.RST.5*; *11-12.RST.9*; *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.	6.1 6.2 6.3 6.4 6.5		See Project on page 52

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.2. Understand, analyze, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings. Connections: *ETHS-S6C2-03*; *11-12.RST.9*; *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	6.1 6.3		Private company trash pick-up within the network (Use project on Pg. 52)

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***
		reasoning.			
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	6.1 6.3		A city planner in charge of the development of roads for a recreational area. The graph shows locations in the area, the possible roads that could be built between locations, and the cost in thousands of dollars to build each road. Find the smallest possible cost of building enough roads to connect the locations. Given a connected graph with weights on the edges: 1. List the edges of the graph by increasing weights. 2. Choose the edge with the smallest weight. 3. Continue to choose the next edge with the smallest weight as long as choosing that edge does not create a circuit. 4. Stop when the result is a spanning tree. The graph show is the original path and also shows the spanning tree that would be produced by apply the algorithm. The smiles possible cost to build roads connecting all the sites would be built a road between the theater and restaurant (2), between the restaurant and amusement park (3), between the amusement park and hotel (8), between the hotel and the sports complex (9), and between the sports complx and the museum (10). There is a minimum total cost of $32,000 to build the roads at the recreational area.

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***
		repeated reasoning