Window Rock Unified School District #8
Curriculum Guide
SY 2021-2022

SUBJECT: Quantitative Reasoning **GRADE: 12** **TIMELINE: Quarter 1 (August 5 – Oct 8)**

Theme/Big Ideas for this Unit: NUMERICAL REASONING, NR. (Draw conclusions and/or make decisions based on analysis critique of quantitative information)

Essential Questions for these Units:
1. How do you use precision and accuracy in real-life situations related to measurement and significant figures?
2. How do estimation, graphs and mathematical models solve problems involving quantities that are not easily measured using proportionality?
3. How do you interpret and compare values solved in real life context? (i.e. fractions, decimals, rate, and percentages).

Standard	Content	Kid friendly Objectives	Assessment	Resources	Vocabulary
QR.NR.4: Use and justify estimation skills, and know why, how, and when to estimate results. Assess and justify the reasonableness of estimations using the context and comparisons to other known values.	Estimation, Graphs, and Mathematical Models	I will use estimation techniques. I will apply estimation techniques to information given by graphs. I will develop mathematical models that estimate relationships between variables. I will solve real-life problems, and interpret/ results, including the	Activities: Formative Assessment; Problem Solving; Group discourse/interpretation; Create graphs; diagrams; models to solve problems using technology. Interpret and communicate graphs, calculations. Summative Assessment	Blitzer, Robert (2016). Math for your world. 2nd edition. PEARSON. p. 13-49; p.52-101	Estimates Mathematical models Graphs

Standard	Content	Kid friendly Objectives	Assessment	Resources	Vocabulary
		evidence/proof underlying to the solution.			
QR.NR.2: Reason, model, and communicate with and about percentages (change, incorrect, deceptive, relative and absolute).	Percent Sales Tax and Discounts	I will express fraction as a percent I will express decimal as a percent I will express percent as a decimal I will identify ways percentage can be abused.	Activities: Formative Assessment; Problem Solving; Group discourse/interpretation Interpret and communicate calculations and results. Summative Assessment	Blitzer, Robert (2016). Math for your world. 2nd edition. PEARSON. Pages 430-474. 2.3: Deceptive and Misleading Numbers - Mathematics LibreTexts Air Travel Surges by 123%! (Beware of Misleading Data Like That) - The New York Times (nytimes.com)	Percentage change Deceptive Percentage Relative percentage Absolute percentage
QR.NR.1: Represent quantities, using equivalent forms when appropriate, to investigate and describe quantitative and geometric	Dimensional Analysis and Measurement	I will use dimensional analysis to change units of measurement. I will understand and use metric prefixes.	Activities: Formative Assessment; Problem Solving; Group discourse/interpretation Summative	Blitzer, Robert (2016). Math for your world. 2nd edition. PEARSON. Pages 532-565.	Metric system vs. English system Solid Dimensions (width, length, depth/height, area, volume) Density

Standard	Content	Kid friendly Objectives	Assessment	Resources	Vocabulary
relationships and solve problems in real-world contexts. **QR.NR.3:** Understand and compare magnitudes of numbers utilizing real-world context. Understand the importance and impact of unit selection.		I will convert units within the metric system. I will solve and interpret length area and volume in terms of the units used. I will solve and interpret mass/weight, and temperature in terms of the units used.	Assessment		

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SUBJECT: **GRADE: 12** **TIMELINE: Quarter 2 (October 12 – December 17)**

Theme/Big Ideas for this Unit: COVARIATIONAL REASONING, CR. (Engage in cognitive activities involved in coordinating two varying quantities, in reasoning about an association or relationship of bivariate data, and judge and interpret relationships between two quantities).

Essential Questions for these Units:

1. How do bivariate data relate to each other?
2. In what ways are proportional relationships and relationships that are not proportional judged and interpreted?
3. What solutions or models are appropriate in interpreting any given data set for use to get the best judgment/decision in certain real life context?

Standard	Content	Objectives	Assessment	Resources	Vocabulary

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QR.CR.3. Identify, create, and use appropriate models for bivariate data sets (i.e. linear, exponential) to estimate solutions for contextual questions, identify patterns and identify how changing parameters affect the models.	Graphing and solving Linear Functions Scatter Plots, Regression Lines, and Correlation Coefficients	I will use function notation. I will graph linear functions. I will obtain information about a function from its graph. I will write linear equations that model data. I will create a scatter plot for a set of data. I will obtain the correlation coefficient and the equation of the regression line. I will interpret information given in a scatter line. I will interpret the correlation coefficient.	Activities: (Formative Assessment) Data representation; Problem Solving; Group discourse/interpretation; Create graphs; diagrams; models to solve problems manually and using technology. Interpret and communicate calculations and results. Interpret relationships between bivariate data.	Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 214-280; p.358-427	Function and function notations Bivariate data Linear functions Modeling linear functions Regression lines Correlation coefficient

	Linear Systems Solve Exponential Functions	I will use substitution method of solving systems of lines. I will use graphing method to solve systems of lines. I will interpret the solutions of systems of line. I will interpret the graphs of quadratic functions and exponential functions. I will model quadratic functions and exponential functions. I will interpret the graphs and the models for exponential functions.			Linear systems Quadratic functions Modeling quadratic functions Exponential functions

QR.CR.1. Analyze and compare growth and decay using absolute and relative change utilizing real-world contexts.	Exponential Growth and Decay Absolute and relative change	Graph exponential growth and decay Find rate of change in exponential growth and decay	Interpret and communicate calculations and results.	Algebra 2. Pearson. P441-488 Relative vs Absolute Change - Analysis Mistakes (dataschool.com) Exponential Growth and Decay: Relative Growth Rate (onemathematicalcat.org)	Exponential growth and decay. Absolute change Relative change
QR.CR.2. Compare reason and communicate about proportional and non-proportional models utilizing real-world contexts.	Mathematical Modeling Direct variation and inverse variation	I will set up proportionality to solve problems using proportions. I will set up non-proportional models to solve problems. I will set up and solve direct variation and inverse variation models.	Activities: (Formative Assessment) Data representation; Problem Solving; Group discourse/interpretation; Create graphs; diagrams; models to solve problems using technology. Interpret and communicate calculations and results.	Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 247-269	Proportions Cross products Variation

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SUBJECT: Quantitative Reasoning **GRADE: 12** **TIMELINE: Quarter 2 (October 12 – December 17)**

Theme/Big Ideas for this Unit: STATISTICAL & PROBABILISTIC REASONING, SPR. (Generate new understandings of probability and statistics)

Essential Questions for these Units:

1. How are questions that can be addressed statistically, using the basic concepts of probability be formulated?
2. What ways can data be collected, organized, represented/displayed in relevant and accessible manner?
3. How do you interpret results using the data to develop inferences, models, and predictions?

Standard	Content	Objectives	Assessment	Resources	Vocabulary

QR.SPR.1. Reason and communicate about the validity of claims based on empirical, theoretical, and subjective probabilities. Draw conclusions or make decisions related to risk, pay-off, expected value, and false negatives/positives in various probabilistic contexts. Encompasses: P.S-CP.B.9. Use permutations and combinations to compute probabilities of compound events and solve problems.	Fundamental Counting Principles; Probability Permutations and Combinations Theoretical and Empirical Probabilities	I will use the fundamental counting principles to count permutations. I will evaluate factorial notation. I will distinguish between combination and permutation problems. I will use permutation and combination formulas to calculate probabilities I will use theoretical and empirical probabilities.	Activities: Practice factorial Distinguish the use of combination and permutation models. Solve and interpret problems that involve permutation and combination using real world context.	Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 668-676 Subjective Probability: Definition & Examples - Statistics How To Sign In - Apex Learning (apexvs.com). Prob & Stat semester 1 Charles, R. I. (2015).Algebra 2 Common Core. PEARSON Education, Inc. p. 674-739	Empirical probability Theoretical probability Subjective probability Expected value Payoff False negative/positive Permutation Combination Factorial

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PS-MD.A.2. Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. P.S-MD.A.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.	Sampling and Visual Displays of Data	I will describe population and sample. I will select appropriate sampling technique for specific data set. I will organize and display data. I will identify deceptions in visual displays of data. I will develop a probability distribution for a set of data.	Activities: Determine the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices. Find the expected grade under various grading schemes. Use technology in calculating expected value (excel; calculator)	Expected Value in Statistics: Definition and Calculations (statisticshowto.com) 4.2 Mean or Expected Value and Standard Deviation | Texas Gateway Descriptive Statistics: Definition & Charts and Graphs - Statistics How To	Sample Population Frequency distribution

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SUBJECT: Quantitative Reasoning **GRADE: 12** **TIMELINE: Quarter 3 (January 5 – March 11)**

Theme/Big Ideas for this Unit: STATISTICAL & PROBABILISTIC REASONING, SPR. (Generate new understandings of probability and statistics)

Essential Questions for these Units:

1. How are questions that can be addressed statistically, using the basic concepts of probability be formulated?
2. In what ways can data be collected, organized, represented/displayed in relevant and accessible manner?
3. How do you interpret results using the data to develop inferences, models, and predictions?

Standard	Content	Objectives	Assessment	Resources	Vocabulary

QR.SPR.2. Analyze statistical information and identify limitations, strengths, or lack of information in studies including data collection methods (e.g. sampling, experimental, observational) and possible sources of bias. Identify errors or misuses of statistics to justify particular conclusions. Encompasses: P.S-IC.B.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	Analyzing and Interpreting Statistical Information	I will describe the population in a study. I will select an appropriate sampling technique. I will organize and present data. I will identify possible of sources of bias in sampling and experiments. I will identify errors and misuses of statistics.	Activity: Research statistical study or experimental survey. Read and analyze the data presented. Critique the result of the survey/study including but not limited to: Sampling technique used, observations, possible sources of bias, errors, or misuses of statistics. No right or wrong answers.	Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 720-734	Bias Errors

QR.SPR.3. Represent numerical summaries and visual displays of real-world data to make informed decisions. Reason, communicate, and describe strengths, limitations, and fallacies of various displays. Encompasses P.S-IC.B.6 Evaluate reports based on data.	Analyzing numerical and visual representations. Deceptions and Misleading Information in Visual Displays	I will construct frequency distribution, histograms, and frequency polygons. I will identify deceptions in visual displays of data.	Activity: Research a study or a survey that uses a visual display. Interpret its strengths and limitations, and the fallacies you find.	Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 720-734	

QR.SPR.4. Represent center, shape, and spread of two or more data sets. Reason, communicate, and compare data sets in context.	Measure of Central Tendency Measures of Dispersion Normal Distribution	I will calculate mean, median, and mode. I will interpret the mean, median, mode in real life context. I will explain percentiles and quartiles. I will determine the range and midrange for a data set. I will recognize the characteristics of normal distribution and explain/use the 68-95-99.7 Rule. I will find scores at a specified standard deviation from the mean. I will convert data item to a z-score.	Activities: Data presentation, calculation, and interpretation (student created).	Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 735-770	Center/ central tendency: mean, median, mode Spread Standard deviation Normal distribution

		I will use and interpret margin of errors. I will recognize and interpret distributions that are not normal.			

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SUBJECT: Quantitative Reasoning **GRADE: 12** **TIMELINE: Quarter 4 (March 21- May 26)**

Theme/Big Ideas for this Unit:

A. **DISCRETE MATHEMATICAL REASONING, DMR. (**Study of vertex-edge graphs and adjacency matrices to model and make informed decisions related to paths, circuits, networks, and relationships)
B. **FINANCIAL REASONING, FR. (**contextual applications that facilitate opportunities to learn the basics of spending and saving, credit and debt, employment and income, investing, risk management and insurance, and financial decision making).

Essential Questions for these Units:

A. 1. What are matrices and vertex edge graphs?
2. How do you use matrices vertex edge graphs and adjacency matrices to model and make informed decisions related to paths, circuits, networks, and relationships in real-world settings.

B. 1. How is budget related to income and expenses?
1. What are the available investment strategies that can be used to make sound planning and decision making?
2. How is mathematics important in sound financial planning and success?

Standard	Content	Objectives	Assessment	Resources	Vocabulary

QR.DMR.1. Understand, analyze, and apply vertex-edge graphs to model and make informed decisions related to paths, circuits, networks, and relationships in real-world settings. Encompasses: P.CM-DM.A.1. Study the following topics related to vertex-edge graph: Euler circuits, Hamilton circuits, the Travelling Salesperson Problem (TSP), minimum weight spanning trees, shortest path, vertex coloring, and adjacency matrices.	Vertex-Edge graphs Euler Paths and Circuit Theorem	I will explain vertex-edge graphs I will identify even and odd vertices I will identify Euler circuit or Euler path. I will identify Hamilton circuit or Hamilton path. I will solve the salesperson Problem and other problems in real life context using vertex edge graphs.	Activities: Solve vertex-edge Graphs problems. Solve the Travelling Salesperson Problem (TSP)	Angel, A. R., Abbott, C. D., and Runde, D.C. (2009). Survey of mathematics with applications. PEARSON Education. p. 297-309; page 335. https://youtu.be/2RdnHdbgvNg?t=7 https://youtu.be/zUbDK04flO4?t=22 https://youtu.be/aXaVIxvweHA?t=11 https://youtu.be/5M-m62qTR-s https://youtu.be/AamHZhAmR7o Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 35-36	Vertex-edge graphs Degree of a vertex Vertices of Odd degree Vertices of Even degree Euler path Circuit Hamilton Path Hamilton Circuit

QR.DMR.2. Devise, analyze, and apply algorithms for solving vertex-edge graph problems. P.CM-DM.A.3				https://youtu.be/5hPfm_uqXmw https://youtu.be/x6N5FK6ArRk?t=6	

QR.DMR.3. Extend work with adjacency matrices for graphs, such as interpreting row sums and using the nth power of the adjacency matrix to count paths of length n in a graph. P.CM-DM.A.4	Adjacency Matrix	I will create adjacency matrix form a vertex edge graph. I will create adjacency list.	Activity: Create an adjacency matrix from a vertex-edge graph.	Angel, A. R., Abbott, C. D., and Runde, D.C. (2009). Survey of mathematics with applications. PEARSON Education. p. 297-309; page 335. https://youtu.be/2RdnHdbgvNg?t=7 https://youtu.be/zUbDK04flO4?t=22 https://youtu.be/aXaVIxvweHA?t=11 https://youtu.be/5M-m62qTR-s https://youtu.be/AamHZhAmR7o Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 35-36	Adjacency list Adjacency matrix loop

QR.FR.1. Identify and research a career goal. Develop a plan and time table for achieving it including educational/training requirements, costs, and other factors (e.g. cost versus savings, income and debt). **QR.FR.2.** Understand and apply strategies to monitor income and expenses, plan for spending, implement a diversified investment strategy, and save for future goals.	Simple interests and compound interests Annuities, Methods of savings and Investments	I will use the formula to calculate interests I will determine the best method of saving and investments	Activity: Savings activity. Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 476-509	Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 431-530. Angel, A. R., Abbott, C. D., and Runde, D.C. (2009). Survey of mathematics with applications. PEARSON Education. p. 223-235.	Simple Interest Compound Interest Investment Costs annuity

QR.FR.3. Use models to solve and communicate about contextual financial questions such as credit card debt, installment savings, amortization schedules, mortgage and other loan scenarios.	Car Loans Credit cards	I will compute the monthly payment and interest costs for a car loan. I will understand the types of leasing contracts I will calculate interests on credit cards the minimum monthly payment. I will differentiate credit cards from debit cards.	Activity: Buying a car and preparing the monthly payment. Blitzer (2016).Math for your World 2nd edition; Pearson Education. p. 476-509		Loan

QR.FR.4. Identify and explain personal and societal consequences of financial decisions.	Home ownership	I will understand mortgages. I will compute the monthly payment and interest costs for a mortgage. I will prepare a financial plan.	Activities: Buying a house and preparing a monthly payment. Use a worksheet (excel) to prepare a financial plan that would detail income and expenses, savings and investment.		Mortgage Interest costs