

Discrete Mathematics and Modeling 1-2 Curriculum

Concept Units Discrete	Standards	Related State Standard*	Common core Standards **	Student Friendly Learning Target	Technology Standard
Algebra Modeling: Function and Behaviors	Identify behaviors of Linear, Polynomial, Exponential, and Logistic Functions both algebraically and graphically.	S3C2-15	F-LE-3	<ul style="list-style-type: none"> I can identify an appropriate mathematical model given a graph 	<ul style="list-style-type: none"> Use GRAPH feature to explore transformation of graphs Use STAT and EDIT feature to enter lists of data Use WINDOW feature to optimize viewing window for a data set Use REGRESSION features to generate an algebraic model of a data set Use DIAGNOSTIC feature to select best model (R-value) Use STAT Plot to create scatter plots
		S3C2-17	F-IF-7.c F-IF-7.d	<ul style="list-style-type: none"> I can predict end behavior of a function 	
		S3C2-7	F-IF-7.c F-IF-7.d	<ul style="list-style-type: none"> I can find domain, range, zeroes and asymptotes of many functions 	
	Compare behaviors of Linear, Polynomial, Exponential, and Logistic Functions both algebraically and graphically.	S3C4-2	F-IF-4 F-IF-5 F-IF-6 F-IF-9 F-LE-3	<ul style="list-style-type: none"> I can describe commonalities and differences among Linear, Polynomial, Exponential, and Logistic Functions looking at algebraic forms and graphs. 	
S4C2-1 S4C2- 2		A-SSE-3.b F-BF-3 F-LE-5	<ul style="list-style-type: none"> I can transform polynomial and exponential graphs by changing parameters. 		
Algebra Modeling: Functions and Applications	Model linear, polynomial, exponential and logistic functions as applied to real-life applications.	S3C4-6 S5C2PO6	S-ID-6.a S-ID-6.b S-ID-6.c S-ID-7 S-ID-8 F-LE-1 (a-c) F-LE-2,3	<ul style="list-style-type: none"> I can plot data with or without technology. I can use data plots to generate a set of possible functions to model the data. I can generate a model using given set of data. I can recognize flaws or gaps in the model. 	
	Use models to make predictions and informed decisions.	S3C4-7 S3C4PO9 S3C4-10	F-LE 1. b-c F-LE-5	<ul style="list-style-type: none"> I can use a model to draw conclusions, make inferences, and make predictions 	

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Data Modeling: Collection	Solve problems by estimating and computing with one-variable and two-variable data.	S2C1-1	S-ID-5	<ul style="list-style-type: none"> I can estimate the value of either the independent or dependent variable give one of the values. 	<ul style="list-style-type: none"> Use a graphing calculator and/or excel spreadsheet to display collected data. Select appropriate technology devices to collect and record data
	Explain how sampling methods, bias, and the phrasing of questions asked during data collections impact the conclusions that can be drawn.	S2C1-4	S-IC-1 S-IC-3	<ul style="list-style-type: none"> I can describe the method used for collecting data. I can determine what population is represented by the sampling method. I can explain what inferences may or may not be drawn based on the sampling method. I can be critical of possible sources of bias and recognize effects of this bias. 	
	Explain the differences between randomized experiments and observational studies and determine the appropriateness of using each in given situations.	S2C1-6	S-IC-5	<ul style="list-style-type: none"> I can determine whether a study is an experiment or observational study. I can describe the results of these studies using appropriate language describing inference or correlation. 	
Data Modeling: Representation	Represent data with plots on the real number line (dot plots, histograms, and box plots).		S-ID 1	<ul style="list-style-type: none"> I can represent data using histograms, dot plots and box plots 	<ul style="list-style-type: none"> Use STAT Plots to create various graphs
	Compare data sets using graphs & summary statistics, including variance & standard deviation, with or without technology.	S2C1-2	S-ID-2	<ul style="list-style-type: none"> I can compare two sets of data and describe differences in center, spread and distribution. 	<ul style="list-style-type: none"> Use STAT and EDIT feature to enter lists of data. Use STAT and

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Data Modeling: Representation (continued)	Draw a line-of-best fit for a scatterplot with or without technology, describe how the correlation coefficient relates to fit, and explain when it is appropriate to use the regression equation to make predictions.	S2C1-8	S-ID-6 (a-c) S-ID-8	<ul style="list-style-type: none"> • I can approximate a line of best fit by hand given a set of data. • I can use technology to find the line of best fit given a set of data. • I can describe how the dependent variable changes with respect to the independent variable. • I can use the correlation coefficient to make a judgment about how well the line fits the data. • I can use the correlation coefficient to determine if the linear correlation is positive or negative and describe this relationship in the context of the given applied problem. 	CALC to get summary statistics. <ul style="list-style-type: none"> • Use STAT, EDIT, WINDOW feature to enter and graph data. • Use STAT, CALC, 1-VAR STAT to calculate the line of best fit.
	Represent data on two quantitative variables on a scatterplot, and describe how the variables are related.		S-ID 6 a&b	<ul style="list-style-type: none"> • I can observe the graph of a set of data and its associated regression line and determine if linear regression is an appropriate modeling tool for the data. 	
	Fit a function to the data; use functions fitted to data to solve problems in the context of data.		S-ID 6 c	<ul style="list-style-type: none"> • I can fit a function to a data set and use the function to solve problems. 	
	Informally assess the fit of a function by plotting and analyzing residuals		S-ID 6 b	<ul style="list-style-type: none"> • I can assess the fit of a function. 	

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	Use matrices to organize and represent data.	S2C1-9	N-VM 6	<ul style="list-style-type: none"> I can create a matrix that represents data in a useful form. 	
Data Modeling: Interpretation	Compute and explain summary statistics for distribution of data including measures of center and spread, including variance and standard deviation.	S2C1-3	S-ID 2 S-ID 3	<ul style="list-style-type: none"> I can explain the relevance of the central tendency, variance, and standard deviation. I can choose the best method available for my data. I can interpret the meanings of the different statistics in context and explain why one or more may be useful in the given situation. 	<ul style="list-style-type: none"> Analyze data and create a database report from information manipulation in a variety of ways to support decisions (census data) Routinely and ethically use production tools, communication tools and research skills solve a problem
	Identify misleading uses of data and explain why they are misleading.	S2C1-5	S-ID 3 S-ID 5	<ul style="list-style-type: none"> I can identify misleading uses of data and explain why they are misleading. I can create representations of data that are misleading and explain how they can be altered to more accurately represent the data. 	
	Determine when arguments based on data mistake correlation for causation.	S2C1-7	S-ID 9	<ul style="list-style-type: none"> I can determine whether a study is observational or experimental and use this information to determine whether a statement of correlation or causation can be made. 	
Combinatorics	Use Binomial Theorem to solve problems	S5C2-09	A-APR 5	<ul style="list-style-type: none"> I can apply the Binomial Theorem to demonstrate the relationship between coefficients & combinations for $(a+b)^n$. 	<ul style="list-style-type: none"> Use ${}_nC_r$ Use ${}_nP_r$
	Use Pascal's Triangle to solve problems	S5C2-09	A-APR 5	<ul style="list-style-type: none"> I can use Pascal's Triangle to determine the multiple that applies 	

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Combinatorics (continued)				to any term for the polynomial $(a+b)^n$.	
	Analyze binomial coefficients, entries of Pascal's Triangle and combinations	S5C2-02	A-APR 5	<ul style="list-style-type: none"> I can determine any specified term of a polynomial using Pascal's Triangle and combinations. 	
	Demonstrate the connection between binomials coefficients, entries of Pascal's Triangle & combinations	S5C2-02.	A-APR 5	<ul style="list-style-type: none"> I can demonstrate how the binomial coefficients entries of Pascal's Triangle and combinations are related. 	
	Use the Counting principle, to include repetition.	S2C3-01	A-APR 5	<ul style="list-style-type: none"> I can apply the counting principle with or without replacement. 	
	Apply the sum rule, product rule & Inclusion/Exclusion principle.	S2C3-01	SCP 7-8	<ul style="list-style-type: none"> I can apply rules of probability to determine the probability of related events. 	
	Use the combinations & permutations formulas, with & without replacement	S2C2	SCP 9	<ul style="list-style-type: none"> I can correctly use the combination & permutation formulas for any given situation. 	
Probability	Apply probability concepts to calculate the probability of informed events	S5C2-06.	SCP II	<ul style="list-style-type: none"> I can determine the probability of an event. 	<ul style="list-style-type: none"> Create a graphical representation of a normal distribution curve
	Make informed decisions in practical situations	S5C2-06	SMD 7	<ul style="list-style-type: none"> I can use probability to make decisions. 	
	Use the principal characteristics of normal distribution to estimate probabilities	S5C2-05	SMD-5	<ul style="list-style-type: none"> I can apply the characteristics of normal distribution to probable outcomes. 	
	Estimate probabilities and predict outcomes using one- &	S5C2-03 S2C2-02	SMD 3-4	<ul style="list-style-type: none"> I can estimate probabilities. I can estimate outcomes using one- 	

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Probability (continued)	two-variable data	S5C2-06		& two-variable data.	
	Determine conditional probability	S5C2-06 S5C3-03 S2C2-04	SCP 3 & 5	<ul style="list-style-type: none"> I can determine the probability of an event given specific conditions. 	
	Determine if two events are dependent or independent	S5C2-06 S2C2-04	SCP 2	<ul style="list-style-type: none"> I can determine if the probability of one event impacts the probability of a second event. 	
	Determine the probability given a complementary event	S5C2-06 S2C2-04	SCP 1 & 6 (Underlying for these standards.)	<ul style="list-style-type: none"> I can determine the probability of an event not occurring. 	
Vertex Edge Modeling	Determine a Hamilton path and circuit.	S2C4.1	CM-DM 1	<ul style="list-style-type: none"> I can find a Hamilton path. I can find a Hamilton circuit 	<ul style="list-style-type: none">
	Create vertex edge graphs from an adjacency matrix	S2C4.2	CM-DM 1	<ul style="list-style-type: none"> I can read a vertex graph and build an adjacency matrix. 	<ul style="list-style-type: none">
	Create an adjacency matrix from a vertex edge graph	S2C1.9	CM-DM 1	<ul style="list-style-type: none"> I can read an adjacency matrix and create a vertex edge graph. 	<ul style="list-style-type: none">
	Explain the difference between a path, a circuit and a walk.	S2C4.1	CM-DM 1	<ul style="list-style-type: none"> I can explain the difference between a path, a circuit, and a walk. 	<ul style="list-style-type: none">
	Determine an Euler path and circuit.	S2C4.1	CM-DM 1	<ul style="list-style-type: none"> I can find an Euler path. I can find an Euler circuit 	<ul style="list-style-type: none">
	Devise, analyze and apply algorithms for solving vertex edge graphs	S2C4.3	CM-DM 3	<ul style="list-style-type: none"> I can analyze algorithms for solving vertex edge graphs. 	<ul style="list-style-type: none">
	Interpret row sums and the nth	S2C4.4	CM-DM	<ul style="list-style-type: none"> I can interpret row sums and the 	<ul style="list-style-type: none">

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	power of adjacency matrices for vertex edge graphs.		4	nth power of adjacency matrices.	
Trees	Use vertex edge graph coloring to model and solve conflict problems.	S2C4.3	CM-DM 2	<ul style="list-style-type: none"> I can color a graph with four colors or less. 	<ul style="list-style-type: none"> Use calculators to perform operations
	Create spanning trees	S2C4-03	CM-DM 2	<ul style="list-style-type: none"> I can create a spanning tree I can determine and justify if a graph is a tree or not. 	
	Create a minimum spanning tree for weighted directed and un-weighted undirected graphs.	S2C4-03	CM-DM 2	<ul style="list-style-type: none"> I can construct a minimum spanning tree from a weighted directed graph I can construct a minimum spanning tree from an un-weighted directed graph. 	
	Create a maximum spanning tree for weighted directed and un-weighted directed graphs including planned redundancy.	extension	CM-DM 1	<ul style="list-style-type: none"> I can construct a maximum spanning tree from a weighted directed graph I can construct a maximum spanning tree from an un-weighted directed graph. 	

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Analysis of Change	<p>Distinguish between situations that can be modeled with linear functions and with exponential functions.</p> <ul style="list-style-type: none"> ➤ Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. ➤ Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. ➤ Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. 	S3C4-02 S3C4-04 S5C2-07	F-LE 1a F-LE 1b F-LE 1c F-LE 2 F-LE 3	<ul style="list-style-type: none"> • I can describe the behavior of a function. • I can identify the maximum and/or the minimum of a function. • I can determine the interval over which a function increases, decreases, or stays the same. • I can use the maximum or minimum of a function and determine the relative steepness of the function. 	<ul style="list-style-type: none"> • I can use the regression capabilities of the graphing calculator (linear, quadratic, cubic, power, exponential) to fit a model to a set of data points. • I can use the CALC function on the graphing calculator to determine the maximum and minimum value of a function.
	<p>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).</p> <p>-Observe using graphs and</p>			<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • After I analyze the behavior of a function, I can use that behavior to determine the appropriate window settings for graphing the function on the calculator.

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	<p>Write a function that describes a relationship between two quantities.</p> <ul style="list-style-type: none"> ➤ Determine an explicit expression, a recursive process, or steps for calculation from a context. ➤ Combine standard function types using arithmetic operations. ➤ Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. 	<p>S3C4-01 S3C4-03</p>	<p>F-BF 1a F-BF 1b F-BF 2</p>	<ul style="list-style-type: none"> • I can explain how a change in the variable x leads to a change in the variable y. • I can solve word problems involving change by writing an appropriate model. 	

*Based on AZ Mathematics College and Work Readiness Standards

** Aligned with the Common Core Standards