Unit 2: Linear Functions and Systems of Linear Equations/Inequalities

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **9 Weeks**
Status: **Published**

Unit Rationale

A unit on Linear Functions and Systems of Linear Equations/Inequalities is a critical component of Algebra 1, providing students with essential skills for understanding and solving problems involving linear relationships. This unit focuses on linear functions, their properties, and how to work with systems of equations and inequalities. Here's a detailed rationale for including this unit:

1. Foundation of Algebraic Concepts

- **Understanding Linear Relationships:** Linear functions represent fundamental relationships between variables, where the relationship is constant. Mastery of linear functions is essential for understanding more complex functions and equations in algebra.
- **Basic Building Blocks:** Linear equations and inequalities serve as the foundation for more advanced mathematical topics. Understanding these concepts is crucial for tackling quadratic functions, polynomial equations, and other algebraic structures.

2. Development of Problem-Solving Skills

- **Solving Systems:** Systems of linear equations and inequalities teach students how to find solutions that satisfy multiple constraints simultaneously. This skill is applicable in many real-world scenarios, such as optimization problems and resource allocation.
- **Strategic Approaches:** Learning different methods for solving systems (e.g., graphing, substitution, elimination) helps students develop a strategic approach to problem-solving and choose the most efficient method for different contexts.

3. Real-World Applications

- **Modeling Real-World Situations:** Linear functions and systems can model a wide range of real-world situations, including financial planning, business projections, and engineering problems. Students learn to apply mathematical concepts to solve practical problems.
- **Decision Making:** Linear inequalities are used to represent constraints and make decisions based on those constraints. Understanding how to solve and interpret inequalities helps students make informed decisions in various contexts.

4. Graphical Interpretation

- **Visualizing Relationships:** Graphing linear functions and systems helps students visualize relationships between variables and understand how changes in one variable affect another.
- **Interpreting Solutions:** Graphical solutions to systems of linear equations and inequalities provide students with insights into the nature of solutions and the relationships between different equations.

5. Preparation for Advanced Topics

- **Introduction to Functions:** Linear functions are the simplest type of functions and serve as a gateway to understanding more complex functions, such as quadratic and exponential functions.
- **Foundational Skills:** Mastery of linear functions and systems prepares students for studying systems of nonlinear equations and inequalities, as well as exploring concepts in calculus and other advanced mathematics courses.

6. Development of Critical Thinking and Analytical Skills

- **Reasoning and Justification:** Working with linear functions and systems requires students to justify their steps and reasoning, enhancing their critical thinking and analytical skills.
- **Error Analysis:** Students learn to identify and correct errors in their solutions, which fosters persistence and attention to detail.

7. Enhancing Mathematical Literacy

- **Understanding Mathematical Language:** Learning to work with linear functions and systems helps students become familiar with mathematical notation and terminology, which is essential for interpreting and solving mathematical problems.
- **Building Confidence:** Mastery of these topics builds students' confidence in their mathematical abilities and prepares them for more complex problems and advanced topics.

8. Preparation for Standardized Testing

- **Test Preparation:** Linear functions and systems of equations and inequalities are commonly tested on standardized exams. Proficiency in these areas is essential for performing well on tests such as the SAT, ACT, and state assessments.

Including a unit on Linear Functions and Systems of Linear Equations/Inequalities provides students with essential algebraic skills that are foundational for further mathematical learning and real-world problem-solving. This unit helps students build a strong understanding of linear relationships, develop problem-solving strategies, and apply mathematical concepts to practical situations.

Topic 3: Linear Functions

Essential Questions

Pre-Assessments

Topic Readiness Assessments available at SavvasRealize.com

Instructional Plan

Lesson 3.1 Relations and Functions

Student Learning Intentions or We are learning to … (WALT)

- We are learning to understand that a relationship is a function if each element of the domain is assigned to exactly one element in the range.
- We are learning to determine a reasonable domain and identify constraints on the domain based on the context of the real-world problem.

Student Success Criteria … "I can statements"

- I can determine whether a relation is a function.

Instructional Strategies and Activities

- Habits of Mind: What other representations could you use to display the information? How do the characteristics of a situation impact the domain of a function that describes it? What are the advantages of using mapping diagrams when analyzing functions?
- Student textbook pages 83-88
- Vocabulary: continuous, discrete, domain, function, one-to-one, range, relation

Formative Assessments

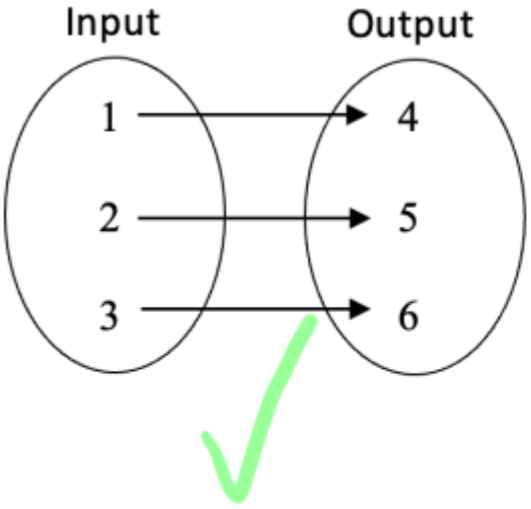
- 3-1 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 3-1
- Additional Practice 3-1
- Enrichment 3-1
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 8-17, 19, 21, 23-29; Advanced 8-13, 15, 17-29

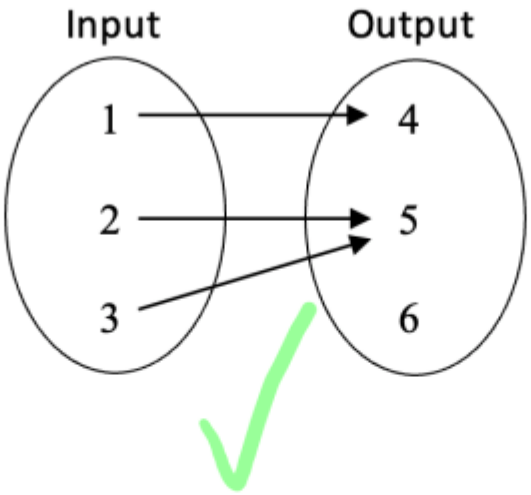
Reflections and Suggested Modifications

Common Error: x-values are the input while y-value are the output; x-values are the domain ("everything the light touches", the horizon, the independent variable) whereas the y-value is the range (the ups and downs, the dependent variable, needs the x to do help it explain the "why"), X can go to the same values of y (ex- relationships may date the same y), but one X-value cannot go to two different values of Y (cannot date the same person at the same time)- reason? You cannot have two values on x because it would not be a function due to the vertical line test.



Why is this a Function?

There is a unique input for each output. This is a special kind of function, called a 1:1 function!



Why is this a Function?

There is a unique input for each output. Even though, there is a repeating output, of 5, this is ok and still qualifies as a function!

Lesson 3.2 Linear Functions

Student Learning Intentions or We are learning to … (WALT)

- We are learning to write and evaluate linear functions using function notation.
- We are learning to graph a linear function and relate the domain of a function to its graph.
- We are learning to interpret functions represented by graphs, tables, verbal descriptions, and function

notation in terms of context.

Student Success Criteria … "I can statements"

- I can identify, evaluate, graph, and write linear equations.

Instructional Strategies and Activities

- Habits of Mind: Is it possible to find counterexamples? What can the relationship between the values of x and the values of y reveal about a function? How is a linear function related to a linear equation?
- Student textbook page 89-95
- Vocabulary: function notation, linear function, f(x) f stands for function and whatever is in the parenthesis is the "input" value

Formative Assessments

- 3-2 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 3-2
- Additional Practice 3-2
- Enrichment 3-2
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 9-12, 23, 25, 27-34; Advanced 9-13, 15, 17, 19-34

Reflections and Suggested Modifications

Vocabulary: domain, element, range, function notation, linear function

Common Error: checking the sign of the slope (negative or positive) and how it correlates to the situation in the problem, distributing the negative and understanding the difference between f(6)= - 6 - 2 and f(6)= - (6 - 2)

Lesson 3.3 Transforming Linear Functions

Student Learning Intentions or We are learning to … (WALT)

- We are learning to graph transformation of linear functions by identifying the effect of multiplying or adding specific values of k to the input or output of a function.
- We are learning to interpret the key features of the graph of a linear function and use them to write the

function that the graph represents.

Student Success Criteria … "I can statements"

- I can transform linear functions.

Instructional Strategies and Activities

- Habits of Mind: How does looking at a table of values help you understand the translations?
- Student textbook page 96-102
- Vocabulary: transformation, translation

Formative Assessments

- 3-3 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 3-3
- Additional Practice 3-3
- Enrichment 3-3
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 10-24, 26, 28, 30-37; Advanced 10-16, 19-21, 23-37

Reflections and Suggested Modifications

Vocabulary: horizontal, vertical, transformation, translation

Common Error: Some students may think that when adding a positive number to the input of an equation the graph of the line should shift to the right, but if k is positive, the value of y increase and the graph of the function shifts to the left.

Lesson 3.4 Arithmetic Sequences

Student Learning Intentions or We are learning to … (WALT)

- We are learning to write arithmetic and geometric sequences both recursively and with an explicit formula.
- We are learning to use explicit formulas and recursive formulas to model real-world situations.

Student Success Criteria … "I can statements"

- I can identify and describe arithmetic sequences.

Instructional Strategies and Activities

- Habits of Mind: What information would you need from the table to write a linear equations that represents the pattern? Can a recursive formula have a negative common difference? Explain how you can use the recursive formula to find the value of any term in an arithmetic sequence
- Student textbook page 104-111
- Vocabulary: arithmetic sequence, common difference, explicit formula, recursive formula, sequence, term of a sequence

Formative Assessments

- 3-4 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 3-4
- Additional Practice 3-4
- Enrichment 3-4
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 10-33, 37-39, 43, 48; Advanced 10-16, 20-26, 30-48

Reflections and Suggested Modifications

Vocabulary: arithmetic sequence, common difference, explicit formula, recursive formula, sequence, term of a sequence

Common Error: Knowing the constant of an equations versus the variable (changing factor) when setting up equations, jumping to conclusions with arithmetic sequences- have students remember the rhyme "Before you answer, beware! Check the difference between each pair!"

Lesson 3.5 Scatter Plots and Lines of Fit

Student Learning Intentions or We are learning to … (WALT)

- We are learning to fit a function to linear data shown in a scatter plot and use fitted functions to solve problems in the context of the data.
- We are learning to interpret the slope of a trend line within the context of data.

Student Success Criteria … "I can statements"

- I can use a scatter plot to describe the relationship between two data sets.

Instructional Strategies and Activities

- Habits of Mind: What features of two data sets help you determine whether the data sets have a negative, a positive, or no association? What argument can you construct to defend a prediction based on a trend line?
- Student textbook page 112-119
- Vocabulary: negative association, negative correlation, no association, positive association, positive correlation, trend line

Formative Assessments

- 3-5 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 3-5
- Additional Practice 3-5
- Enrichment 3-5
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 9-18, 21-28; Advanced 9-15, 18-28

Reflections and Suggested Modifications

Common Error: trend lines may or may not have the data points as it is representation of the gist of the data

Lesson 3.6 Analyzing Lines of Fit

Student Learning Intentions or We are learning to … (WALT)

- We are learning to compute and interpret the correlation coefficient for linear data.
- We are learning to plot and analyze residuals to assess the fit of a function.
- We are learning to distinguish between correlation and causation.

Student Success Criteria … "I can statements"

- I can find the line of best fit of data set and evaluate its goodness of fit

Instructional Strategies and Activities

- Habits of Mind: Is there a limit to the number of lines that might be used to fit a set of points on a graph? How are a strong negative correlation and a weak correlation different? What argument can you construct to explain why a given relationship would not be casual?
- Student textbook page 120-128
- Vocabulary: causation, correlation coefficient, extrapolation, interpolation, line of best fit, linear regression, residual

Formative Assessments

- 3-6 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 3-6
- Additional Practice 3-6
- Enrichment 3-6
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 8-20, 23-30; Advanced 8-15, 18-30

Reflections and Suggested Modifications

Common Error: Student graphing predicted values rather than residuals. Remind students that residual are the remaining or leftover part which is the difference between the predicted versus the actual; the pattern in residual plot indicates there is a good correlation and that the linear model is a good fit, but the pattern actually represents a poor correlation. If the residual plot DOES NOT have a pattern, then the linear model is a good fit for the data.

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This

could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

Topic 4 Systems of Linear Equations and Inequalities

Essential Questions

Pre-Assessments

Topic Readiness Assessments available at SavvasRealize.com

Instructional Plan

Lesson 4.1 Solving Systems of Equations by Graphing

Student Learning Intentions or We are learning to … (WALT)

- We are learning to graph linear equation in two variables to find an approximate solution.
- We are learning to write a system of linear equations in two variables to represent real-world problems

Student Success Criteria … "I can statements"

- I can use graphs to find approximate solutions to systems of equations.

Instructional Strategies and Activities

- Habits of Mind: Other than graphing, how else could you determine that a system has infinitely many solutions?
- Student textbook page 137-143
- Vocabulary: intersection, solution of a system of linear equation, system of linear equations

Formative Assessments

- 4-1 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 4-1
- Additional Practice 4-1
- Enrichment 4-1
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 8-19, 21, 23-29; Advances 8-13, 15, 17-29

Reflections and Suggested Modifications

Common Error: y needs to have a coefficient of 1 when put into slope-intercept form. When transferring from standard form to slope-intercept form, students should remember to divide the coefficient of y.

Lesson 4.2 Solving Systems of Equations by Substitution

Student Learning Intentions or We are learning to … (WALT)

- We are learning to use the substitution method to solve systems of equations.
- We are learning to represent situations as systems of equations and interpret solutions as viable/nonviable options for the situation.

Student Success Criteria … "I can statements"

- I can solve a system of equations using the substitution method.

Instructional Strategies and Activities

- Habits of Mind: specific to the word problems presented
- Student textbook pages 144-150
- Vocabulary: solution of a system, substitution, substitution method, system of linear equations

Formative Assessments

- 4-2 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 4-2
- Additional Practice 4-2
- Enrichment 4-2
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 10-25, 27, 29, 31-38; Advanced 10-17, 19, 21, 23, 25-38

Reflections and Suggested Modifications

Common Error: Use of the distributive property when simplifying and multiply each term in the parenthesis by the factor outside, making sure to pay attention to all coefficients and dividing the proper sign when isolating a variable

Lesson 4.3 Solving Systems of Equations by Elimination

Student Learning Intentions or We are learning to … (WALT)

- We are learning to solve systems of linear equations and prove that the sum of one equation and multiple of the other produces a system with the same solutions as the original system.
- We are learning to represent constraints with a system of equations in a modeling context.

Student Success Criteria … "I can statements"

- I can solve systems of linear equations using the elimination methods

Instructional Strategies and Activities

- Habits of Mind: How do you know what method to use and when? How could write an equivalent system of equations for both systems? Explain the difference between solving a system of equations using a substitution and solving a system of equations using elimination.
- Student textbook pages 151-157
- Vocabulary: coefficient, elimination, opposites

Formative Assessments

- 4-3 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 4-3
- Additional Practice 4-3
- Enrichment 4-3
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 10-24, 26, 27, 31-38; 10-15, 17, 19, 21, 23, 25-38

Reflections and Suggested Modifications

Common Error: Coefficient must be OPPOSITE to be eliminated when eliminating a variable- you may need to multiply by -1 in order for terms to become opposite.

Lesson 4.4 Linear Inequalities in Two Variables

Student Learning Intentions or We are learning to … (WALT)

- We are learning to graph solutions to linear inequalities in two variables.
- We are learning to represent constraints with inequalities and interpret solutions as viable or nonviable options in the modeling context.

Student Success Criteria … "I can statements"

- I can graph solutions to linear inequalities in two variables

Instructional Strategies and Activities

- Habits of Mind: How are less than and less than or equal to graphs similar? different?
- Student textbook page 158-164
- Vocabulary: linear inequality in two variables, solution of a linear inequality in two variables

Formative Assessments

- 4-4 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 4-4
- Additional Practice 4-4
- Enrichment 4-4

- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 10-25, 28-33; Advanced 10-21, 24-33

Reflections and Suggested Modifications

Common Error: all ordered pairs on the boundary line are NOT solutions when dashed (> or <); they are only solutions when the line is solid ($\geq$ or $\leq$)

Lesson 4.5 Systems of Inequalities

Student Learning Intentions or We are learning to … (WALT)

- We are learning to graph the solution set of systems of linear inequalities in two variables.
- We are learning to interpret solutions of linear inequalities in a modeling context.

Student Success Criteria … "I can statements"

- I can graph and solve a system of linear inequalities.

Instructional Strategies and Activities

- Habits of Mind: What would the graph of a system of inequalities with no solution look like? What do the nonoverlapping portions of the shaded regions represent?
- Student textbook pages 165-170
- Vocabulary: solution of a system of linear inequalities, system of linear inequalities, half-plane, intersection, plane

Formative Assessments

- 4-5 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 4-5
- Additional Practice 4-5
- Enrichment 4-5
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials

- Assignment Guide: Basic 10-25, 28, 30, 32-37; Advanced 10-15, 20-37

Reflections and Suggested Modifications

Common Error: Have students identify if the lines will solid or dashed and whether the will shade above or below; y = n is the horizontal line that crossed the y axis whereas x = m is the vertical line that crossed the x-axis.

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)

English Language Learners

*SCIOP/WIDA levels will allow the teacher to determine what supports are appropriate. Reach out to the MLL teacher for suggestions.

Native language support: The teacher provides auditory or written content to students in their native language. Sentence Stems

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

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Special Education Students

*Always reference the students IEP for specific accommodations or modification per student need.

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Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the

concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

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Gifted & Talented Strategies

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Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

*Reach out to the Student Support team for assistance.

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers.

Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

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Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

Standards

New Jersey Student Learning Standards: Content Area

MATH.K-12.1	Make sense of problems and persevere in solving them
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically

MATH.K-12.6	Attend to precision
MATH.K-12.7	Look for and make use of structure
MATH.K-12.8	Look for and express regularity in repeated reasoning
MATH.9-12.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.
MATH.9-12.A.REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
MATH.9-12.A.REI.C.6	Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.
MATH.9-12.A.REI.C.8	Represent a system of linear equations as a single matrix equation in a vector variable.
MATH.9-12.A.REI.D	Represent and solve equations and inequalities graphically
MATH.9-12.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.

Integration of Computer Science and Design Thinking

Computers store data that can be retrieved later. Data can be copied, stored in multiple locations, and retrieved.

Complex tasks can be broken down into simpler instructions, some of which can be broken down even further.

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math

SOC.K-12.1	Developing Questions and Planning Inquiry
	Language: System and structure, effective use, and vocabulary
MATH.9-12.S.IC	Making Inferences and Justifying Conclusions

Integration of Career Readiness. Life Literacies and Key Skills

TECH.9.4.2.CI	Creativity and Innovation
TECH.9.4.2.CT	Critical Thinking and Problem-solving
	A variety of diverse sources, contexts, disciplines, and cultures provide valuable and necessary information that can be used for different purposes.
	Digital tools can be used to display data in various ways.

21st Century Life and Career

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term

	consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media Literacy

Diversity, Equity, and Inclusion

NCTM: Access and Equity in Mathematics Education

A Pathway to Equitable Math Instruction

Provide students with opportunities to give feedback to teachers about the classroom and instruction.

• Verbal Example: Fist to five, How well do you understand what we talked about today? Fist to five, How well did I teach this today?

• Classroom Activity: Exit tickets or surveys that ask students to identify how well teachers taught, what helped them learn, what got in the way of their learning, etc.

Treat mathematics as a language that everyone is learning while authentically centering students home languages.

• Classroom Strategies: Color-coding ideas, learning vocabulary in student languages, visual and kinesthetic learning, representations of learning without words.

• Classroom Activity: Multilingual Frayer Models for
definitions or concepts

Incorporate true culturally relevant pedagogy, practice, and curriculum.

• Verbal Example: What are some of your family traditions that you are proud of? Would you be okay if we brought some of those into the classroom?

• Classroom Activity: Use Ankara fabric to teach mathematical concepts such as tessellations, fractions, area, percentages, etc.

Incorporate the history of mathematics into lessons.

• Verbal Example: Why do you think we call it Pythagorean's theorem, when it was used before he was even born? What should we call it instead?
• Classroom Activity: Learn about different bases and numerical ideas: Base 2, binary and connections to computer programming, how the Yoruba of Nigeria used base 20, and how the Mayans conceptualized the number 0 before the first recording of it

Solicit student ways of thinking and processing.
• Verbal Example: How might you all go about this? What do you notice?
• Classroom Activity: Incorporate explorations, where students interact with mathematics in a way that allows them to "discover" or experience mathematics.

Reorganize your classroom teaching around concepts, and teach them more like a web rather than discrete sets of knowledge.
• Verbal Example: How does this connect to what you've learned in the past? How can you use that knowledge today?
• Classroom Activity: Learning webs that connect content

Start with more complex math problems and scaffold as necessary.
• Verbal Example: If we wanted to build a rocket, what are all the things we might need to know before we get started? Along the way, we decided that we want the rocket to reach the moon. What do we need to consider now?
• Classroom Activity: When solving equations, start with the most complex problem, generate ideas for how to solve it, and use the simpler equations as examples to support those ideas.

Offer a variety of ways to demonstrate thinking and knowledge.
• Verbal Example: Show your thinking with words, pictures, symbols.

Ask other questions that will demonstrate learning when it is not clear to you how students know the answer.
• Verbal Example: If you were working with a fellow mathematician who was absent this day, what might you tell them to help them learn it?

Learn about, engage with, and incorporate ethnomathematics.
• Verbal Example: Reflect on your day so far. What math have you already used today?
• Classroom Activity: Community walks to engage with slope.

Co-construct knowledge in the classroom.
• Verbal Example: Let's get into partners and do a think pair-share. We will incorporate everyone's ideas and try to synthesize them.
• Classroom Activity: Have students create mathematical definitions in their own words in groups, and bring

the groups together to co-construct mathematical definitions as a class

Choose problems that have complex, competing, or multiple answers.
• Verbal Example: Come up with at least two answers that might solve this problem.
• Classroom Activity: Challenge standardized test questions by getting the "right" answer, but justify other answers by unpacking the assumptions that are made in the problem.
• Classroom Activity: Deconstructed Multiple Choice
- given a set of multiple choice answers, students discuss why these answers may have been included (can also be used to highlight common mistakes).

Identify what is right about the thinking, and highlight the mistake in what is factually or procedurally accepted.
• Verbal Example: You recognized that you had to combine the constants 27 and 9, could you explain your thinking?
• Classroom Activity: Error Analysis worksheets that highlight what is the right idea behind the mistake.

Using thoughtful questioning to solicit mathematical thoughts rather than telling.

• Verbal Example: What would a mathematician who is confused ask about this question?

• Classroom Activity: After students demonstrate knowledge of a topic, have them play a game where they have to explain their topic to a fellow mathematician and a skeptic. Develop their own reflective questioning/explaining in all three roles.

Create multiple ways of participating that honor myriad ways of thinking and being.
• Verbal Example: For this section, feel free to work alone, in pairs, trios, or quads (let them choose).
• Classroom Activity: Community circles or storytelling circles, incorporating dance, music, song, call and response, and other cultural ways of communicating.

Climate Change

Math Climate Change Companion Guide

• S.ID.B.6a Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.
Climate Change Example: Students may use linear or exponential functions fitted to geoscience data to solve problems and analyze the results from global climate models to make an evidence-based forecast of the current rate of global climate change.

• F.IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
Climate Change Example: Students may use function notation to determine the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline), m, where c(m) is the number of

molecules of carbon dioxide.
• F.IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.
Climate Change Example: Students may relate the domain of a function c(m) representing the amount of carbon dioxide produced by burning m molecules of ethane (gasoline), to its graph in order to determine the appropriate domain for c(m).
• F.IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
Climate Change Example: Students may calculate the average rate of change of a function c(m) presented symbolically or as a table, where c(m) represents the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline).

• 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.
Climate Change Example: Students may create equations and/or inequalities to represent the economic impact of climate change.
• A.CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
Climate Change Example: Students may represent constraints describing the economic impact of climate change by equations, inequalities, and/or by systems of inequalities, and interpret solutions as viable or nonviable options.
• A.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law to highlight resistance R.
Climate Change Example: Students may rearrange formulas related to the economic impact of climate change to highlight a quantity of interest, using the same reasoning as in solving equations.

• 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.
Climate Change Example: Students may use units to guide the solution of multi-step problems about how variations in the flow of energy into and out of the Earth's systems result in climate change. Note: Changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.
• N.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
Climate Change Example: Students may define appropriate quantities for a descriptive model of how variations in the flow of energy into and out of Earth's systems result in climate change. Note: changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.