



SPRINGFIELD PUBLIC SCHOOLS
ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Springfield Public Schools **Springfield, New Jersey 07081**

Pre-Calculus

Curriculum Guide

2024

This curriculum may be modified through varying materials, techniques and strategies, as per a student's IEP.

Springfield Board of Education
Approved on August 26, 2024



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Springfield, New Jersey**

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Unit Overview Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Linear Relations and Functions

Unit Summary: Students will review functions and relations and operations with functions. They will evaluate, find the zeros of, write, and graph linear functions and inequalities. Students will write equations of parallel and perpendicular lines. They will use scatter plots and piecewise functions to model real-world data.

Primary Interdisciplinary Connections: *Science and Engineering*

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy

Unit Rationale: In this unit, students will learn various methods to analyze polynomial and rational functions which are fundamental to the study of higher mathematics.

Career Readiness (Standard 9):

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Learning Targets

Standards: A.CED; F.IF; F.BF

Content Statements: Create equations that describe numbers or relationships; Understand the concept of a function and use function notation; Interpret functions that arise in applications in terms of the context; Build a function that models a relationship between two quantities.

CPI#:	Cumulative Progress Indicator (CPI):
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.



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A.CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
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.
A.CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R .
F.IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.
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.
F.IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.
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.
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 $h(n)$ 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.
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.
F.BF.A.1	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c. (+) Compose functions. For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.
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.
SEL.PK-12.2.2	Recognize the skills needed to establish and achieve personal and educational



	goals.
SEL.PK-12.4.1	Develop, implement and model effective problem-solving, and critical thinking skills.
SEL.PK-12.5.2	Utilize positive communication and social skills to interact effectively with others.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions:

- How is it determined whether a relation is a function?
- How are operations with functions performed?
- How are functions and inequalities graphed and written?
- How are equations of parallel and perpendicular lines written?
- How is data modeled using scatterplots and regression equations?

Unit Enduring Understandings:

- There are many methods that help analyze and graph functions
- Numerous real-world problems can be modeled using functions

Unit Learning Targets:

Students will....

- Determine whether a given relation is a function
- Identify the domain and range of a relation or function and evaluate functions
- Perform operations with functions
- Find composite functions
- Iterate functions using real numbers
- Graph linear equations
- Find x- and y-intercepts of a line
- Find the slope of a line through two points
- Find zeros of linear functions
- Write linear equations and equations of parallel and perpendicular lines
- Determine whether a pair of lines is parallel, perpendicular or neither
- Use a linear regression model to predict the value of a dependent variable
- Climate Change Example: Students may create equations and/or inequalities to represent the economic impact of climate change.
- 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.
- 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.
- 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.
- 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 $c(m)$.



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- 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).



Evidence of Learning

Summative Assessment: Two quizzes, one unit test

Equipment Needed: Teacher laptop, student laptops, graphing calculator

Teacher Resources: Textbook, Notes on Chapter 1, Workbook Worksheets, Online Student Text, Glencoe Test Generator, OnCourse Assignments Generator

Formative Assessments:

- Students will be assessed on classwork assignments.
- Students will be assessed on group and individual projects.
- Students will be assessed on quizzes and tests.
- Students will be assessed on homework assignments.
- Students will be assessed on exit/entry tickets.



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Lesson Plans

Lesson	Time Frame
Lesson 1 Relations and Functions	1 class period
Lesson 2 Composition of Functions	2 class periods
Lesson 3 Graphing Linear Equations	1-2 class periods

Teacher Notes: Emphasize the importance of being fluent with different basic graphs.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<https://www.calc-medic.com/>

<https://tasks.illustrativemathematics.org/content-standards>

<https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx>



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Lesson Plan 1 Template

Content Area: Math Lesson Title: Relations and Functions Time Frame: 1 Class Period

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☐ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Be able to determine whether a given relation is a function • Be able to identify the domain and range of a relation or function • Be able to evaluate functions	Lesson Sequence 1. Present students the meteorology problem. 2. Give definitions of a relation, domain, and range. 3. Independently, students will research climate data from the Internet and use it to build a linear model 4. Students will be assessed on completion of the application problem set located in the textbook at the end of Chapter 1-1.	• Students will respond to verbal prompts during discussion of vocabulary and guided notes. • Circulate through the room as students complete practice problems in pairs to discuss their progress. • Circulate through the room as students complete the exit ticket and assist students as necessary. • Collect application problems to assess mastery.
Differentiation: Students will be paired so they are working with partners at similar or diverse ability levels, whatever is best for each student. Model example problems to students who may need assistance however students who have a firm understanding can continue onto guided notes examples independently. Application problems may be modified to fit a student's abilities.		



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Resources Provided:

- Guided notes
- Exit Ticket
- Access to the online textbook for application problems; access as well to textbook for student's preference.



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Lesson Plan 2 Template

Content Area: Math Lesson Title: Composition of Functions Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Perform operations with functions - Find composite functions - Iterate functions using real numbers	Lesson Sequence - Present the “Business” problem. - Review operations with functions (sum, difference, product, and quotient). - Have students work through examples 1- 3. - Review composition of functions. - Review Examples 4 and 5. - Ask students to work on “business” problems and discuss the results. - As a conclusion of their work, ask a couple of students to share their solutions with the class.	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to students during the process or after they finish to assess understanding. - Have students present solutions. - Collect application problems to assess student mastery.
Differentiation: Students will be working in pairs. Each student thinks of a function. Then both work together to find the sum, difference, product, and quotient of their functions and the composite of two functions.		
Resources Provided: - Problem Set - Access to online textbook - Graphing Calculators		



Lesson Plan 3 Template

Content Area: Math Lesson Title: Graphing Linear Equations Time Frame: 1-2 class periods

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Graph linear equations - Find the x- and y-intercepts of a line - Find the slope of a line through two points - Find zeros of linear functions	Lesson Sequence - Review definition of a linear equation, different forms of linear equation, and slope - Have students work through examples 1- 3. - Give definition of a linear function. - Show Example 4. - Ask students to work in groups to complete worksheet problems using TI-84 and Desmos software. - To conclude, ask students to complete exit card problems.	- Students respond to verbal prompts during initial discussion. - Circle the room to check for understanding. - Talk to each group during the process or after they finish to assess understanding - Have students present solutions to interesting problems - Collect exit cards to assess mastery
Differentiation:		



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Students will learn that $y = 0$ at the point where the graph of a linear equation crosses the x – axis. For similar reasons, $x = 0$ where the graph crosses the y -axis. For a given equation, students can easily find these points and use them to draw the graph of the equation.

Resources Provided:

- Laptops
- Graphing calculators
- Problem sets



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Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson *Strongly, Moderately* or *Weakly* meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher order thinking and problem solving skills	☐	☒	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☐	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☐	☒	☐
Provide opportunities for student reflection and self- assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Math	Grade Level: 11-12	Unit Title: Linear Relations and Functions
Created: 2024	Board Approved on:	



Unit Overview Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Systems of Linear Equations and Inequalities

Unit Summary: Students will review concepts of solving systems of linear equations and inequalities and operations with matrices.

Primary Interdisciplinary Connections: *Science and Engineering*

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy

Unit Rationale: In this unit, students will learn how to solve systems of linear equations using graphing and different algebraic methods.

Career Readiness (Standard 9):

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Learning Targets

Standards: A.CED; A.REI

Content Statements: Create equations that describe numbers or relationships; Solve equations and inequalities in one variable; Solve systems of equations

CPI#:	Cumulative Progress Indicator (CPI):
A.CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
A.REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.



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A.REI.C.5	(+) Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
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.
A.REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.
A.REI.C.8	Represent a system of linear equations as a single matrix equation in a vector variable.
A.REI.C.9	Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).
SEL.PK-12.2.2	Recognize the skills needed to establish and achieve personal and educational goals.
SEL.PK-12.4.1	Develop, implement and model effective problem-solving, and critical thinking skills.
SEL.PK-12.5.2	Utilize positive communication and social skills to interact effectively with others.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions:

- How are systems of equations and inequalities solved?
- How are matrices defined?
- How are matrices added, subtracted, and multiplied?
- How are matrices used to represent transformations?
- How are determinants evaluated and used to find inverses of matrices?
- How is linear programming used to solve problems?

Unit Enduring Understandings:

- There are many different ways to solve systems of linear equations
- Systems of linear equations are widely used in real life problems.

Unit Learning Targets:

Students will....

- Solve systems of equations graphically and algebraically
- Solve systems of equations involving three variables algebraically
- Model data using matrices
- Add, subtract, and multiply matrices
- Use matrices to determine the coordinates of polygons under a given transformation
- Evaluate determinants and find inverses of matrices
- Graph systems of inequalities
- Find the maximum and the minimum value of a function defined for a polygonal convex set
- Use linear programming procedure to solve applications



Evidence of Learning

Summative Assessment: Two quizzes, one unit test

Equipment Needed: Teacher laptop, student laptops, graphing calculator

Teacher Resources: Textbook, Notes on Chapter 2, Workbook Worksheets, Online Student Text, OnCourse Assignments

Formative Assessments:

- Students will be assessed on classwork assignments.
- Students will be assessed on group and individual projects.
- Students will be assessed on quizzes and tests.
- Students will be assessed on homework assignments.
- Students will be assessed on exit/entry tickets.



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Lesson Plans

Lesson	Time Frame
Lesson 1 Solving Systems of Equations in Two Variables	1 class period
Lesson 2 Solving Systems of Equations in Three Variables	2 class periods
Lesson 3 Determinants and Multiplicative Inverses of Matrices	1 class period

Teacher Notes: Use the graphing calculator to show how to solve systems using matrices.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<https://www.calc-medic.com/>

<https://tasks.illustrativemathematics.org/content-standards>

<https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx>



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Lesson Plan 1 Template

Content Area: Math Lesson Title: Solving Systems of Equations in Two Variables Time
 Frame: 1 Class Period

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Be able to solve systems of equations graphically - Be able to solve systems of equations algebraically using substitution - Be able to solve systems of equations algebraically using elimination	Lesson Sequence - Show students examples of linear equations and their solutions. - Discuss “consumer choices” problem and have students locate appropriate data online. - Students will be asked to work in pairs on the Desmos activity. - Students then show their work to the partners and discuss the results. - The student pairs then present problems to the whole group.	- Students respond to verbal prompts during initial discussion - Circle the room as students are working to check for understanding - Talk to each pair during the process or after they finish to assess understanding - Collect problem set to assess mastery
Differentiation: Students may be grouped so that they are working with partners at similar ability levels. Problem sets may be modified to address needs of individual learners.		
Resources Provided: - Guided notes - Exit Ticket - Access to the online textbook for application problem access as well as textbook for student's preference		



Lesson Plan 2 Template

Content Area: Math Lesson Title: Solving Systems of Equations in Three Variables Time
 Frame: 2 class periods

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Solve systems of equations in three variables algebraically - Solve systems of equations in three variables using technology	Lesson Sequence - Present graphical representation of a system in three variables and its solution. - Show students Examples 1 and 2. - Discuss “Sports” problem and find the solution together - Ask students to give some examples of similar problems from “real life” where they will need to use three variable systems. - Demonstrate use of matrix function on calculator to solve 3 variable systems	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to students during the process or after they finish to assess understanding. - Have students present solutions. - Collect application problems to assess student mastery.



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| | 6. As a conclusion of their work, ask student volunteers to share their examples with the class and show their solutions. | |
|--|---|--|

Differentiation:

Students will identify and evaluate different methods for solving a system of equations in three variables and talk about the methods they prefer. Have advanced students work on systems involving more than three variables.

Resources Provided:

- Problem Set
- Access to online textbook
- Graphing Calculators



Lesson Plan 3 Template

Content Area: Math Lesson Title: Determinants and Multiplicative Inverses of Matrices
 Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Be able to evaluate determinants • Be able to find inverses of matrices • Be able to solve systems of equations by using inverses of matrices	Lesson Sequence 1. Introduce students to the “investment” problem. 2. Show students how to find a determinant using both minors and diagonals. 3. Show students Examples 1 and 2. 4. Give definition of Identity Matrix for multiplication and Inverse Matrix. 5. Show examples 3-5 using matrix functionality on TI-84. 6. Ask students to work in groups to solve similar problems. Share the results. 7. Review some examples. 8. As a conclusion, give an exit card problem.	• Students respond to verbal prompts during initial discussion. • Circle the room to check for understanding. • Talk to each group during the process or after they finish to assess understanding • Have students present solutions to interesting problems • Collect exit cards to assess mastery



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Differentiation:

Show students the method of diagonals. Some visual learners will benefit from it. Also allow advanced students to find the determinant of 4×4 matrix as a challenge problem.

Resources Provided:

- Laptops
- Graphing calculators
- Problem sets



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Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson *Strongly*, *Moderately* or *Weakly* meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher-order thinking and problem solving skills	☐	☒	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st-century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with the teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☐	☒	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Systems of Linear Equations and Inequalities

Created: 2024

Board Approved on:



Unit Overview Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** The Nature of Graphs

Unit Summary: Students will review concepts of symmetry of graphs. Students will identify and sketch families of graphs that include polynomials, absolute value functions, greatest integer functions, rational functions, and square root functions. Students will also find and graph inverses of functions and identify asymptotes associated with rational functions. They identify critical points and end behavior of the graphs of polynomial functions and solve problems involving direct, inverse, and joint variations.

Primary Interdisciplinary Connections: *Science and Engineering*

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy

Unit Rationale: This unit involves the study of various families of functions including quadratic, cubic, radical, rational, absolute value and cube root. Students will learn how to perform a variety of transformations on these functions and to identify many features of each, including intercepts, end behavior, asymptotes, and extrema. Students will also learn to find and verify inverses of functions.

Career Readiness (Standard 9):

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Learning Targets

Standards: A.REI; F.IF; F.BF

Content Statements: Solve equations and inequalities in one variable; Analyze functions using different representations; Build new functions from existing functions.

CPI#:	Cumulative Progress Indicator (CPI):
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A.REI.B.4	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.
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. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior. f. (+) Graph trigonometric functions, showing period, midline, and amplitude.
F.IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.
F.IF.C.9	Compare properties of two functions each represented in 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.
F.BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
F.BF.B.4	Find inverse functions. a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$. b. (+) Verify by composition that one function is the inverse of another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.



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	d. (+) Produce an invertible function from a non-invertible function by restricting the domain.
SEL.PK-12.2.2	Recognize the skills needed to establish and achieve personal and educational goals.
SEL.PK-12.4.1	Develop, implement and model effective problem-solving, and critical thinking skills.
SEL.PK-12.5.2	Utilize positive communication and social skills to interact effectively with others.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions:

- How are functions, relations, inverses, and inequalities graphed?
- What are the properties of functions and how can symmetry, continuity, end behavior, and transformations of graphs be analyzed?
- How are asymptotes and extrema of functions found?
- How are problems involving direct, inverse, and joint variation solved?

Unit Enduring Understandings:

- There are many different ways to investigate a function and its graph.
- Direct, inverse, and joint variation are widely used in real life problems.

Unit Learning Targets:

Students will....

- Use algebraic tests to determine whether the graph of a relation is symmetrical
- Classify functions as even or odd
- Identify transformations of simple graphs
- Sketch graphs of related functions
- Graph polynomial, absolute value, and radical inequalities in two variables
- Solve absolute value inequalities
- Determine inverses of relations and functions; graph functions and their inverse
- Determine whether a function is continuous or discontinuous
- Identify the end behavior of functions
- Determine whether a function is increasing or decreasing on an interval
- Construct and graph functions with gap discontinuity
- Find the extrema of a function
- Graph rational functions
- Determine vertical, horizontal, and slant asymptotes
- Solve problems involving direct, inverse, and joint variations



Evidence of Learning

Summative Assessment: Two quizzes, one unit test

Equipment Needed: Teacher laptop, student laptops, graphing calculator

Teacher Resources: Textbook, Notes on Chapter 3, Workbook Worksheets, Online Student Text, Glencoe Test Generator

Formative Assessments:

- Students will be assessed on classwork assignments.
- Students will be assessed on group and individual projects.
- Students will be assessed on quizzes and tests.
- Students will be assessed on homework assignments.
- Students will be assessed on exit/entry tickets.



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Lesson Plans

Lesson	Time Frame
Lesson 1 Symmetry and Coordinate Graphs	1 class period
Lesson 2 Families of Graphs	2 class periods
Lesson 3 Graphs of Nonlinear Inequalities	1 class period

Teacher Notes: Emphasize the importance of the general shapes of the graphs and what it tells students about their equations.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<https://www.calc-medic.com/>

<https://tasks.illustrativemathematics.org/content-standards>

<https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx>



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Lesson Plan 1 Template

Content Area: Math Lesson Title: Symmetry and Coordinate Graphs Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☐ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Be able to use algebraic tests to determine if the graph of a relation is symmetrical - Be able to classify functions as even or odd	Lesson Sequence - Discuss with students even and odd symmetry. - Show Examples 1-3. - Discuss “crystallography” problem. - Ask students to pair-share and determine their own examples of odd and even symmetry. - Students work on the Desmos activity. - Students then show their work to their partners and discuss the results. - The teacher brings the students back together and asks for examples of non-symmetric graphs.	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to each pair during the process or after they finish to assess understanding - Collect problem set to assess mastery
Differentiation: Students will create shapes out of wax paper that have either line or point symmetry. They will use the pare-folding method or turn the shapes about a fixed point to verify the type of symmetry. Students will use straight pins to hold shapes at a fixed point while they rotate them.		



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Resources Provided:

- Guided notes
- Exit Ticket
- Access to the online textbook for application problems. Access to the textbook (student's preference).



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Lesson Plan 2 Template

Content Area: Math Lesson Title: Families of Graphs Time Frame: 2 class periods

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Identify transformations of simple graphs including translations, reflections, stretches and compressions - Sketch graphs of related functions	Lesson Sequence - Review 8 parent graphs. - Show students examples of transformation and ask them to check it with graphing calculators. - Ask students to work out Examples 1 - 5. - Discuss the “Entertainment” problem on Desmos and find the solution in pairs. - As a conclusion of their work, ask students to complete exit cards.	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to students during the process or after they finish to assess understanding. - Have students present solutions. - Collect application problems to assess student mastery.
Differentiation: Students will work in groups to determine whether families of functions have the same symmetries as parent functions. Students will also use graphing calculators to help them discuss and test their conjectures		
Resources Provided:		



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- Problem Set
- Access to online textbook
- Graphing Calculators



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Lesson Plan 3 Template

Content Area: Math Lesson Title: Graphs of Nonlinear Inequalities Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Be able to graph polynomial, absolute value, and radical inequalities in two variables - Be able to solve absolute value inequalities	Lesson Sequence - Show students Examples 1-4 and ask them to use their graphing calculator to confirm the graphs. - Complete the “pharmacology” problem together and discuss the results. - Ask students to work in groups to solve a similar problem. Ask student groups to present their solutions to the whole class. - As a conclusion, ask students to complete exit card problems.	- Students respond to verbal prompts during initial discussion. - Circle the room to check for understanding. - Talk to each group during the process or after they finish to assess understanding - Have students present solutions to interesting problems - Collect exit cards to assess mastery
Differentiation: Students will be working in groups and sharing their results.		
Resources Provided: - Laptops - Graphing calculators - Problem sets		



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Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson *Strongly*, *Moderately* or *Weakly* meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher-order thinking and problem-solving skills	☐	☒	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st-century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☐	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with the teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☐	☒	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Math	Grade Level: 11-12	Unit Title: The Nature of Graphs
Created: 2024		Board Approved on:



Unit Overview Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Polynomial and Rational functions

Unit Summary: Students will use various methods, including technology, to locate and approximate the zeros of polynomial functions. They examine the relationship of locating zeros of a function to solving the roots of an equation. The strand of modeling real-world data is extended to include polynomial functions.

Primary Interdisciplinary Connections: *Science and Engineering*

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy

Unit Rationale: In this unit, students will learn various methods to analyze polynomial and rational functions.

Career Readiness (Standard 9):

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12.prof.CR2b, 2.2.12.LF.8).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Learning Targets

Standards: F.IF; F.LE; A.APR; A.REI; N.CN

Content Statements: Analyze functions using different representations; Construct and compare linear and exponential models and solve problems; Understand solving equations as a process of reasoning and explain the reasoning; Solve equations and inequalities in one variable; Use complex numbers in polynomial identities and equations.

CPI#:	Cumulative Progress Indicator (CPI):
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F.IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
F.IF.C.8a	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
F.LE.A.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
A.APR.B.2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x-a$ is $p(a)$, so $p(a)=0$ if and only if $(x-a)$ is a factor of $p(x)$.
A.APR.B.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
A.REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
A.REI.B.4a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x-p)^2=q$ that has the same solutions. Derive the quadratic formula from this form.
A.REI.B.4b	Solve quadratic equations by inspection (e.g., for $x^2=49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b .
N.CN.C.9	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
SEL.PK-12.2.2	Recognize the skills needed to establish and achieve personal and educational goals.
SEL.PK-12.4.1	Develop, implement and model effective problem-solving, and critical thinking skills.
SEL.PK-12.5.2	Utilize positive communication and social skills to interact effectively with others.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions:

- How are the roots of polynomial equations determined?
- What are the applications of the Fundamental Theorem of Algebra?
- What different methods can be used to analyze polynomial and rational functions?
- How can various methods be used to graph polynomial and rational functions?
- How are radical equations solved and extraneous solutions identified?

Unit Enduring Understandings:

- There are many methods which help analyze polynomial and rational functions
- Many real-world problems can be modeled using polynomial functions



Unit Learning Targets:

Students will....

- Determine roots of polynomial equation and apply the Fundamental Theorem of Algebra
- Solve quadratic equations and use the discriminant to describe the roots of quadratic equations
- Find the factors of polynomials using the Remainder and Factor Theorems
- Identify all possible rational roots of a polynomial equation by using the Rational Root Theorem
- Determine the number of positive and negative real roots a polynomial function has
- Approximate the real zeros of a polynomial function
- Solve rational equations and inequalities
- Decompose a fraction into partial fractions
- Solve radical equations and inequalities
- Write polynomial functions to model real-world data
- Use polynomial functions to interpret real-world data

Evidence of Learning

Summative Assessment: Two quizzes, one unit test

Equipment Needed: Teacher laptop, student laptops, graphing calculator

Teacher Resources: Textbook, Notes on Chapter 3, Workbook Worksheets, Online Student Text, Glencoe Test Generator

Formative Assessments:

- Students will be assessed on classwork assignments.
- Students will be assessed on group and individual projects.
- Students will be assessed on quizzes and tests.
- Students will be assessed on homework assignments.
- Students will be assessed on exit/entry tickets.



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Lesson Plans

Lesson	Time Frame
Lesson 1 Polynomial Functions	1 class period
Lesson 2 Quadratic Equations	1 class period
Lesson 3 The Remainder and Factor Theorems	1 class period

Teacher Notes: When deriving the quadratic formula with the students, have them discuss and suggest each next step with a partner.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<https://www.calc-medic.com/>

<https://tasks.illustrativemathematics.org/content-standards>

<https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx>



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Lesson Plan 1 Template

Content Area: Math Lesson Title: Polynomial Functions Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Be able to determine roots of polynomial equations - Be able to apply the Fundamental Theorem of Algebra	Lesson Sequence - Present students “investment problem.” - Show how to solve the problem and find the present value of the given college fund. - Use this problem as an example of a polynomial in one variable. - Give definitions of a polynomial function, leading coefficient, imaginary numbers, etc. - Have students develop the Fundamental Theorem of Algebra and its Corollary and show how to use them. - Students will be asked to work in pairs on the Desmos problems.	- Students respond to verbal prompts during initial discussion - Circle the room as students are working to check for understanding - Talk to each pair during the process or after they finish to assess understanding - Collect problem set to assess mastery



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7. Students then show their work to the partners and discuss the results.

Differentiation:

Students will work together in groups to sketch polynomial functions having a particular degree and number of real roots; for example, degree 3 and 3 roots or degree 3 and only 1 real root. Then students will experiment with coefficients in the general form of a polynomial in order to find functions whose graphs resemble student sketches

Resources Provided:

- Guided notes
- Exit Ticket
- Access to the online textbook for application problem access as well as textbook for student's preference.



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Lesson Plan 2 Template

Content Area: Math Lesson Title: Quadratic Equations Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☐ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Solve quadratic equations using factoring, and quadratic equation - Use the discriminants to describe the roots of quadratic equations	Lesson Sequence - Present the “Baseball” problem. - Ask students for an example of a quadratic equation. Ask students to recall from Algebra 2 different methods to solve it (e.g. factoring). - Have students develop how to solve it by graphing and completing the square. - Introduce the Quadratic Formula and show how to solve previous examples using it. Ask students first to develop the formula as a whole group using completing the square. - Discuss the discriminant and the importance of it	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to students during the process or after they finish to assess understanding. - Have students present solutions. - Collect application problems to assess student mastery.



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to determine the number of roots and their nature.

6. Ask students to solve the “baseball” problem using the Quadratic Formula and one of the other methods. Discuss the results.
7. As a conclusion of their work, ask a couple of students to share their solutions with the class.

Differentiation:

Students will research the root words that formed the words quadratic and discriminant. Students will be asked to explain how the meanings of the root words relate to the mathematical meanings that they know.

Resources Provided:

- Problem Set
- Access to online textbook
- Graphing Calculators



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Lesson Plan 3 Template

Content Area: Math Lesson Title: The Remainder and Factor Theorems Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Find the factors of polynomials using the Remainder and Factor Theorems - Determine if given numbers are roots of a polynomial - Generate a polynomial function given certain roots including imaginary roots	Lesson Sequence - Review with students how to divide two polynomials using long division. - Ask students to divide one particular polynomial $f(x)$ by, let's say, $(x - 3)$ and notice the remainder. Then ask them to find $f(3)$ and compare it with the remainder. - Ask students to give their conclusions. - As a conclusion, ask students to complete exit card problems. - Solve "skiing problem using two methods (long division and using the Remainder Theorem).	- Students respond to verbal prompts during initial discussion. - Circle the room to check for understanding. - Talk to each group during the process or after they finish to assess understanding - Have students present solutions to interesting problems - Collect exit cards to assess mastery



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6. Demonstrate Synthetic Division.
7. Introduce students to Factor Theorem
8. Ask students how to determine the binomial factors of a polynomial and how to generate a polynomial with given roots.
9. Ask students to work in groups to complete worksheet problems
10. As a conclusion, ask students to complete exit card problems.

Differentiation:

Students will draw a flow chart demonstrating the process for synthetic division. Input should include the dividend and the divisor. The output should include the quotient and the remainder. Flow charts can be created by hand or by using computer software and can include color and three dimensional boxes.

Resources Provided:

- Laptops
- Graphing calculators
- Problem sets
- OnCourse Assignments



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Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson *Strongly, Moderately* or *Weakly* meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher-order thinking and problem-solving skills	☐	☒	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st-century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with the teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☐	☒	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Polynomial and Rational functions

Created: 2024

Board Approved on:



Unit Overview Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** The Trigonometric Functions

Unit Summary: Students will review angles and angle measurement in degrees and explore trigonometric functions. Students will examine trigonometric ratios defined using right triangles and investigate the trigonometric functions for an angle in standard position on the unit circle. Students then will solve right triangles. Students will also use the Law of Sines and the Law of Cosines to solve other triangles and to find the areas of triangles.

Primary Interdisciplinary Connections: *Science and Engineering*

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy

Unit Rationale: In this unit, students will learn how to convert decimal measures to degrees, minutes, and seconds and vice versa; how to solve triangles; how to find the values of trigonometric functions; how to find the area of triangles

Career Readiness (Standard 9):

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Learning Targets

Standards: G.SRT

Content Statements: Define trigonometric ratios and solve problems involving right triangles; Apply trigonometry to general triangles

CPI#:	Cumulative Progress Indicator (CPI):
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G.SRT.C.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
G.SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.
G.SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
G.SRT.D.9	Derive the formula $A = \frac{1}{2}ab\sin C$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
G.SRT.D.10	Prove the Laws of Sines and Cosines and use them to solve problems.
G.SRT.D.11	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).
SEL.PK-12.2.2	Recognize the skills needed to establish and achieve personal and educational goals.
SEL.PK-12.4.1	Develop, implement and model effective problem-solving, and critical thinking skills.
SEL.PK-12.5.2	Utilize positive communication and social skills to interact effectively with others.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions:

- How are decimal degree measures converted to degrees, minutes, and seconds and vice versa?
- How are coterminal angles found?
- How are reference angles found?
- How can the lengths of missing sides and the measurements of missing angles in a right triangle be found?
- How can the lengths of missing sides and the measurements of missing angles in any triangle be found?
- What are alternative methods to find the area of a triangle and how are they used?

Unit Enduring Understandings:

- There is a strong connection between the formulas we learned in geometry and trigonometry
- Sometimes you can use trigonometry to find the area of a regular polygon or a triangle

Unit Learning Targets:

Students will....

- Convert decimal degree measures to degrees, minutes, and seconds and vice versa.
- Find the number of degrees in a given number of rotations; identify angles that are coterminal with a given angle.
- Find the values of trigonometric ratios for acute angles of right triangles.
- Find the values of the six trigonometric functions using the unit circle.
- Use trigonometry to find the measures of the sides of a right triangle.



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- Evaluate inverse trigonometric functions; find missing angle measurements; solve right triangles.
- Solve triangles by using the Law of Sines; find the area of a triangle.
- Determine whether a triangle has zero, one, or two solutions.
- Solve triangles by using the Law of Cosines
- Find the area of triangles if the measures of three sides are given.



Evidence of Learning

Summative Assessment: Two quizzes, one unit test

Equipment Needed: Teacher laptop, student laptops, graphing calculator

Teacher Resources: Textbook, Notes on Chapter 3, Workbook Worksheets, Online Student Text, OnCourse Assignments

Formative Assessments:

- Students will be assessed on classwork assignments.
- Students will be assessed on group and individual projects.
- Students will be assessed on quizzes and tests.
- Students will be assessed on homework assignments.
- Students will be assessed on exit/entry tickets.



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Lesson Plans

Lesson	Time Frame
Lesson 1 Applying Trigonometric Functions	1 class period
Lesson 2 Solving Right Triangles	1 class period
Lesson 3 The Law of Sines	1 class period

Teacher Notes: Ask students to explain the triangle congruence shortcuts from Geometry to each other prior to solving right triangles.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<https://www.calc-medic.com/>

<https://tasks.illustrativemathematics.org/content-standards>

<https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx>



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Lesson Plan 1 Template

Content Area: Math Lesson Title: Applying Trigonometric Functions Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: Be able to use trigonometry to find the measures of the sides of right triangles	Lesson Sequence - Review sine, cosine, and tangent ratios students have learned in Geometry. - Ask students to work through examples where we can use these ratios to calculate the distance between two objects, the angle formed by two sides, etc. - In pairs, have students discover how to calculate the area of a regular polygon by finding its apothem and perimeter. - Students will be asked to work in pairs on the Desmos problems. - Students then show their work to the partners and discuss the results	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to each pair during the process or after they finish to assess understanding - Have students present solutions - Collect problem set to assess mastery



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6. The whole class comes back together to review.

Differentiation:

Students may be grouped so that they are working with partners at similar ability levels. Problem sets may be modified to address the needs of individual learners

Resources Provided:

- Guided notes
- Exit Ticket
- Access to the online textbook for application problem access as well as textbook for student's preference



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Lesson Plan 2 Template

Content Area: Math Lesson Title: Solving Right Triangles Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☐ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Evaluate inverse trigonometric functions - Find missing angle measurements - Solve right triangles	Lesson Sequence - Present “A security light installation” problem and discuss the importance of an angle it will be installed at. - Ask students to derive how to apply the inverse trigonometric functions to find angle measurements. - Ask students to analyze the possible solution set, then discuss the domain and range of the functions. - Show some examples where we need to find angle measurements in a right triangle. - Ask students to make a drawing of a parking lot light on the presented	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to students during the process or after they finish to assess understanding. - Have students present solutions. - Collect application problems to assess student mastery.



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problem and think of an idea how to solve it.

6. Ask students to give some examples of similar problems from “real life” where they will need to use inverse trigonometric functions
7. As a conclusion of their work, ask a couple of students to share their examples with the class and show their solutions.

Differentiation:

Enrichment: solving triangles, as it requires an organized approach to piecing together given information to find missing parts. Students will be asked to solve a triangle in more than one way.

Resources Provided:

- Problem Set
- Access to online textbook
- Graphing Calculators
- OnCourse Assignments



Lesson Plan 3 Template

Content Area: Math Lesson Title: The Law of Sines Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☐ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Be able to solve triangles by using the Law of Sines if the measures of two angles and a side are given - Be able to find the area of a triangle if the measures of two sides and the included angle or the measures of two angles and a side are given	Lesson Sequence - Have students derive the Law of Sines using Desmos. Ask when the Law of Sines can be applied (AAS and ASA). - Have students work out solutions. - As a class, work out an activity problem with 3 objects on the floor which form large triangles. Use a ruler and a protractor to determine a side and two angles of the triangles. Then solve the triangles using the Law of Sines. - Measure the other sides and angles to verify the solution. - Ask students to work in groups to solve similar	- Students respond to verbal prompts during initial discussion. - Circle the room to check for understanding - Talk to each group during the process or after they finish to assess understanding - Have students present solutions to interesting problems - Collect exit cards to assess mastery



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problems. Share the results.

6. Ask students to derive two formulas to calculate the area of a triangle.
7. Review some examples.
8. As a conclusion, ask students to complete exit card problems.

Differentiation:

We will place 3 objects on the floor so that they form a large triangle. We will use a ruler and a protractor to determine a side and two angles of the triangles. Then we will solve the triangles using the Law of Sines. We will measure the other sides and angle to verify the solution.

Resources Provided:

- Laptops
- Graphing calculators
- Problem sets



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Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson *Strongly, Moderately* or *Weakly* meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher order thinking and problem solving skills	☐	☒	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☐	☐	☐
Provide opportunities for student reflection and self- assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☐	☐	☐

Curriculum Design Template

Content Area: Math	Grade Level: 11-12	Unit Title: The Trigonometric Functions
Created: 2024	Board Approved on:	



Unit Overview Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Graphs of Trigonometric Functions

Unit Summary: Students will review graphs of trigonometric functions and their inverses using radian measure. Students will learn about amplitude, period, phase shift, and vertical shift. Applications include finding linear and angular velocity and writing trigonometric equations to model real-life situations.

Primary Interdisciplinary Connections: *Science and Engineering*

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy

Unit Rationale: In this unit, students will learn how to convert from degrees to radians and vice versa; how to draw the graph of different trigonometric functions; how to find amplitude, period, phase shift, and vertical shift of the given trigonometric function.

Career Readiness (Standard 9):

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12.prof.CR2b, 2.2.12.LF.8).

9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Learning Targets

Standards: F.TF; F.IF; N.Q

Content Statements: Extend the domain of trigonometric functions using the unit circle; Model periodic phenomena with trigonometric functions; Analyze functions using different representations; Reason quantitatively and use units to solve problems

CPI#:

Cumulative Progress Indicator (CPI):



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F.TF.A.1	(+) Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
F.TF.A.2	(+) Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
F.TF.A.3	Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for πx , $\pi+x$, and $2\pi-x$ in terms of their values for x , where x is any real number.
F.TF.A.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
F.IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior.
F.TF.B.5	(+) Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★
F.TF.B.6	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
F.TF.B.7	Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
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.
SEL.PK-12.2.2	Recognize the skills needed to establish and achieve personal and educational goals.
SEL.PK-12.4.1	Develop, implement and model effective problem-solving, and critical thinking skills.
SEL.PK-12.5.2	Utilize positive communication and social skills to interact effectively with others.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions:

- How are degree measurements converted to radian measurements and vice versa?
- How can the length of an arc or the area of a sector be found given the measure of the central angle?
- How are linear and angular velocity calculated?
- How are graphs of sine, cosine, tangent, cotangent, secant, and cosecant functions produced?
- How are equations of trigonometric functions written?

Unit Enduring Understandings:

- There is a strong connection between the formulas we learned in geometry and trigonometry



- We can use trigonometric functions to model real- life data such as sound waves, seasonal temperature change, etc.

Unit Learning Targets:

Students will....

- Find the amplitude, period, phase shift, vertical shift for sine, cosine, tangent, cotangent, secant, and cosecant functions.
- Write equations of trigonometric functions given the amplitude, period, phase shift, vertical shift.
- Model real-life data using sine and cosine functions.
- Graph inverse trigonometric functions.
- Find principal values of inverse trigonometric functions.
- 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.



Evidence of Learning

Summative Assessment: Two quizzes, one unit test

Equipment Needed: Teacher laptop, student laptops, graphing calculator

Teacher Resources: Textbook, Notes on Chapter 6, Workbook Worksheets, Online Student Text, Glencoe Test Generator

Formative Assessments:

- Students will be assessed on classwork assignments.
- Students will be assessed on group and individual projects.
- Students will be assessed on quizzes and tests.
- Students will be assessed on homework assignments.
- Students will be assessed on exit/entry tickets.



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Lesson Plans

Lesson	Time Frame
Lesson 1 Angles and Radian Measures	1 class period
Lesson 2 Linear and Angular Velocity	1 class period
Lesson 3 Graphing Sine and Cosine Functions	1 class period

Teacher Notes: Ask students to plot the hourly temperature in Hawaii for 2 days from weather.com. Notice the shape.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<https://www.calc-medic.com/>

<https://tasks.illustrativemathematics.org/content-standards>

<https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx>



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Lesson Plan 1 Template

Content Area: Math Lesson Title: Angles and Radian Measures Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Be able to change from radian measure to degree measure, and vice versa - Find the length of an arc given the measure of the central angle. - Find the area of a sector	Lesson Sequence - Define the radian (use string cut to the length of the circle radius). - Have students derive the connection between radian and degree measures using Desmos. - Show an example how to convert from degree measure to radian measure and vice versa - Review how to find reference angles. - Show how to determine values of trigonometric functions using reference angles. - Discuss the Length of an Arc and the Area of a Circular Sector Formulas.	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to each pair during the process or after they finish to assess understanding - Collect problem set to assess mastery



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| | <ol style="list-style-type: none">7. Students will be asked to work in pairs on Desmos problems8. Students then show their work to the partners and discuss the results. | |
|--|---|--|

Differentiation:

Students may be grouped so that they are working with partners at similar ability levels. Problem sets may be modified to address needs of individual learners.

Resources Provided:

- Guided notes
- Exit Ticket
- Access to the online textbook for application problem access as well as textbook for student's preference.



Lesson Plan 2 Template		
Content Area: Math	Lesson Title: Linear and Angular Velocities	Time Frame: 1 class period
Lesson Components		
<u>21st Century Themes</u>		
☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy ☐ Civic Literacy ☐ Health Literacy		
<u>21st Century Skills</u>		
☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy		
Interdisciplinary Connections: Science and Engineering		
Integration of Technology: Graphing Calculators, Desmos		
Equipment Needed: Laptops, graphing calculators		

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Find linear and angular velocities - Determine angular displacement	Lesson Sequence - Present “The Children’s Museum carousel” problem - Ask students to derive how to calculate angular displacement - Discuss definitions of Angular Velocity and Linear Velocity and show some examples on Desmos. - Ask students to work in pairs and determine the angular and linear velocities of someone riding an animal in the inner circle and someone riding an animal in the same row in the outer circle (“Carousel Problem”).	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to students during the process or after they finish to assess understanding. - Have students present solutions. - Collect application problems to assess student mastery.



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| | 5. Ask students to present their conclusions. | |
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Differentiation:

Extension problem:

Joe is running one lap on the outside of a circular track with a diameter of 1000 ft. His constant rate of speed is 12 mph. Sunil is running one lap on the outside of a nearby circular track with a diameter of 1125 ft. He too is running at 12 mph. Find the time in minutes for each of the two runners, and compare their times with the radius of each other circle.

Resources Provided:

- Problem Set
- Access to online textbook
- Graphing Calculators



Lesson Plan 3 Template

Content Area: Math Lesson Title: Graphing Sine and Cosine Functions Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science, Computer Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Generate the graphs of the sine and cosine functions • Be to identify the amplitude, phase shift, vertical shift and period of a sine or cosine function • Generate the graph of a sine or cosine function from a graph • Use sine functions to model naturally occurring phenomena	Lesson Sequence 1. Discuss the “Meteorology” problem. 2. Have students access climate data for two US cities: Baltimore, Maryland, and Asheville, North Carolina 3. Explain what a periodic function is. 4. Discuss with the class what makes these functions periodic, then find the period. 5. Ask students to give examples of periodic functions in real life. 6. Show students a graph of sine and its connection with the unit circle. 7. Review properties of the sine functions.	• Students respond to verbal prompts during initial discussion. • Circle the room to check for understanding. • Talk to each group during the process or after they finish to assess understanding • Have students present solutions to interesting problems • Collect exit cards to assess mastery



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- | | | |
|--|---|--|
| | <ol style="list-style-type: none">8. Show students a graph of cosine and its connection with the unit circle.9. Review properties of the cosine functions. | |
|--|---|--|

Differentiation:

Students will research and observe what the graph of the sound pattern of a person's live voice, a song recorded by Frank Sinatra, a rock concert, and a healthy and unhealthy heart would look like.

Students will be asked to decide whether these patterns are periodic functions.

Resources Provided:

- Laptops
- Graphing calculators
- Problem sets



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Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson *Strongly*, *Moderately* or *Weakly* meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher-order thinking and problem-solving skills	☐	☒	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st-century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with the teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☐	☒	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Math	Grade Level: 11-12	Unit Title: Graphs of Trigonometric Functions
Created: 2024	Board Approved on:	



Unit Overview Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Trigonometric Identities and Equations

Unit Summary: Students will review the basic trigonometric identities, use sum and difference identities, and use double- and half-angle identities. Students will also solve trigonometric equations.

Primary Interdisciplinary Connections: *Science and Engineering*

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy

Unit Rationale: In this unit, students will learn how to use different trigonometric identities and solve trigonometric equations.

Career Readiness (Standard 9):

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Learning Targets

Standards: F.TF; A.REI

Content Statements: Prove and apply trigonometric identities; Represent and solve equations and inequalities graphically

CPI#:	Cumulative Progress Indicator (CPI):
F.TF.C.8	(+) Prove the Pythagorean identity $\sin^2(\theta) + \cos^2 \theta = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$ or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$ or $\tan(\theta)$ and the quadrant of the angle.
F.TF.C.9	Prove the addition and subtraction formulas for sine, cosine and tangent and use them to solve problems.



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A.REI.D.11	Explain why the x-coordinates of the points where the graphs of the equations of $y=f(x)$ and $y=g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations.
SEL.PK-12.2.2	Recognize the skills needed to establish and achieve personal and educational goals.
SEL.PK-12.4.1	Develop, implement and model effective problem-solving, and critical thinking skills.
SEL.PK-12.5.2	Utilize positive communication and social skills to interact effectively with others.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions:

- What does it mean to verify a trigonometric identity and what are some methods for simplifying the process?
- How are trigonometric equations solved?

Unit Enduring Understandings:

- There is a strong connection between the formulas we learned in geometry and trigonometry.
- We can use trigonometric functions to model real- life data such as sound waves, seasonal temperature change, etc.

Unit Learning Targets:

Students will....

- Identify and use reciprocal, quotient, Pythagorean, symmetry, and opposite-angle identities
- Use the basic trigonometric identities to verify other identities
- Find numerical values of trigonometric functions
- Use the sum and difference identities for the sine, cosine, and tangent functions
- Identify equivalent values for trigonometric functions involving quadrantal angles
- Use the double- and half-angle identities for the sine, cosine, and tangent functions
- Solve trigonometric equations and inequalities



Evidence of Learning

Summative Assessment: Two quizzes, one unit test

Equipment Needed: Teacher laptop, student laptops, graphing calculator

Teacher Resources: Textbook, Notes on Chapter 7, Workbook Worksheets, Online Student Text, Glencoe Test Generator

Formative Assessments:

- Students will be assessed on classwork assignments.
- Students will be assessed on group and individual projects.
- Students will be assessed on quizzes and tests.
- Students will be assessed on homework assignments.
- Students will be assessed on exit/entry tickets.



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Lesson Plans

Lesson	Time Frame
Lesson 1 Basic Trigonometric Identities	2 class periods
Lesson 2 Verifying Trigonometric Identities	1 class period
Lesson 3 Solving Trigonometric Equations	2 class periods

Teacher Notes: When solving trigonometric proofs, utilize a two column proof to help students see which identify is being applied.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<https://www.calc-medic.com/>

<https://tasks.illustrativemathematics.org/content-standards>

<https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx>



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Lesson Plan 1 Template

Content Area: Math Lesson Title: Basic Trigonometric Identities Time Frame: 2 class periods

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☐ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: Be able to identify and use reciprocal, quotient, Pythagorean, symmetry, and opposite-angle identities	Lesson Sequence - Introduce students to the “polarized lenses” problem. - Explain what an identity is and give some examples from Algebra 2, then ask students to get in pairs and derive a trigonometric identity. Work through other identities as a whole class. - Have pairs of students prove that a given statement is not an identity. - Introduce students to Reciprocal, Quotient, and Pythagorean Identities. - Use the Unit Circle to present Symmetry and	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to each pair during the process or after they finish to assess understanding - Collect problem set to assess mastery



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Opposite-Angle
Identities.

6. Ask students to use these basic identities and give information to find the exact value of other trigonometric functions.
7. Students then show their work to the partners and discuss the results.

Differentiation:

Students may be grouped so that they are working with partners at similar ability levels. Problem sets may be modified to address the needs of individual learners.

Resources Provided:

- Guided notes
- Exit Ticket
- Access to the online textbook for application problem access as well as textbook for student's preference.



Lesson Plan 2 Template

Content Area: Math Lesson Title: Verifying Trigonometric Identities Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Use the basic trigonometric identities to verify other identities • Find numerical value of trigonometric functions	Lesson Sequence 1. Introduce the students to the “ladder problem.” 2. Students will work in groups to derive an expression for the length of a ladder. 3. Choose two different (correct) formulas and show students that they are equivalent. 4. Give students some problems to verify. 5. Ask students to present work in pairs and work on their proofs. They could use “identity cards.”	• Students respond to verbal prompts during initial discussion. • Circle the room as students are working to check for understanding • Talk to students during the process or after they finish to assess understanding. • Have students present solutions. • Collect application problems to assess student mastery.
Differentiation: Kinesthetic: Students will work in groups to model signs of trigonometric functions. Each group should use masking tape or rope on the ground to model the x- and y-axis. One student will place a		



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meter stick on the coordinate plane with one end on the origin. Other students will state the signs of the six trigonometric functions for the angle formed.

Resources Provided:

- Problem Set
- Access to online textbook
- Graphing Calculators



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Lesson Plan 3 Template

Content Area: Math Lesson Title: Solving Trigonometric Equations Time Frame: 2 class periods

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Solve trigonometric equations - Solutions using a graphing calculator	Lesson Sequence - Have students conduct internet searches to find size and period for a famous Ferris wheel such as the London Eye. - Ask students how to solve an equation for the principal values of x. - Ask students how to solve an equation for x between 0 and 360 degrees. - Ask students how to solve an equation for all real values of x. - Discuss the difference and also show that the answer can be presented either in degrees or radians. - Students will be working in pairs to complete a Desmos activity. - Students will check answers using graphing calculators. - Ask some students to show their solutions on the board.	- Students respond to verbal prompts during initial discussion. - Circle the room to check for understanding. - Talk to each group during the process or after they finish to assess understanding - Have students present solutions to interesting problems - Collect exit cards to assess mastery



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9. Give students Exit Cards to complete.

Differentiation:

Students will create a set of trigonometric equations and inequalities and provide solutions for each.

Resources Provided:

- Laptops
- Graphing calculators
- Problem sets

Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson *Strongly*, *Moderately* or *Weakly* meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher-order thinking and problem-solving skills	☐	☐	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☐	☐	☐
Integrate 21st-century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☐	☒	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Math

Grade Level: 11-12

Unit Title: Trigonometric Identities and Equations

Created: 2024

Board Approved on:



Unit Overview Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Exponential and Logarithmic Functions

Unit Summary: This unit introduces exponential and logarithmic functions. Students will simplify and evaluate exponential expressions with rational and irrational exponents and graph exponential functions and inequalities. In addition, they model real-world situations using common and natural logarithms.

Primary Interdisciplinary Connections: *Science and Engineering*

21st Century Themes ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☒ Information Literacy ☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy

Unit Rationale: In this unit, students will learn various methods to analyze exponential and logarithmic functions.

Career Readiness (Standard 9):

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12.prof.CR2b, 2.2.12.LF.8).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Learning Targets

Standards: N.RN; N.Q; A.SSE; F.IF; F.BF; F.LE

Content Statements: Extend the properties of exponents to rational exponents; Use properties of rational and irrational numbers; Reason quantitatively and use units to solve problems; Interpret the structure of expressions; Write expressions in equivalent forms to solve problems; Interpret functions that arise in applications in terms of the context; Analyze functions using different representations; Build new functions from existing functions; Construct and compare linear and exponential models and solve problems

CPI#:

Cumulative Progress Indicator (CPI):



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N.RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.
N.RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
N.RN.A.3	Simplify radicals, including algebraic radicals (e.g. $\sqrt[3]{54} = 3\sqrt[3]{2}$, simplify $\sqrt{32x^2}$).
N.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
N.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
A.SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
A.SSE.B.3b	Use the properties of exponents to transform expressions for exponential functions.
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.
F.IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior.
F.IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
F.BF.B.5	Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
F.LE.A.1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
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 (including reading these from a table).
F.LE.A.4	Understand the inverse relationship between exponents and logarithms. 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.
SEL.PK-12.2.2	Recognize the skills needed to establish and achieve personal and educational goals.
SEL.PK-12.4.1	Develop, implement and model effective problem-solving, and critical thinking skills.
SEL.PK-12.5.2	Utilize positive communication and social skills to interact effectively with others.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions:



- How are expressions containing rational and irrational exponents simplified and evaluated?
- How are exponential functions and inequalities graphed?
- How are logarithmic expressions evaluated?
- How are logarithmic equations graphed and solved?
- How can real-world situations be modeled and solved using common and natural logarithms?

Unit Enduring Understandings:

- There are many methods which help analyze exponential and logarithmic functions
- Many real-world problems can be modeled using exponential and logarithmic functions

Unit Learning Targets:

Students will....

- Use the properties of exponents
- Evaluate and simplify expressions containing rational exponents
- Solve equations containing rational exponents
- Graph exponential functions and inequalities
- Solve problems involving exponential growth and decay
- Use the exponential function $y = e^x$
- Evaluate expressions involving logarithms
- Solve equations and inequalities involving logarithms
- Graph logarithmic functions and inequalities
- Find common logarithms and antilogarithms of numbers
- Solve equations and inequalities using common logarithms
- Solve real-world applications with common logarithmic functions
- Find natural logarithms of numbers
- Solve equations and inequalities using natural logarithms
- Solve real-world applications with natural logarithmic functions
- Find the doubling time of exponential quantity
- Find exponential and logarithmic functions to model real-world data
- Linearize data
- 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.
- Climate Change Example: Students may, when reporting quantities related to how variations in the flow of energy into and out of the Earth's systems result in climate change, choose a level of accuracy appropriate to limitations on how quantities were measured.



Evidence of Learning

Summative Assessment: Two quizzes, one unit test

Equipment Needed: Teacher laptop, student laptops, graphing calculator

Teacher Resources: Textbook, Notes on Chapter 11, Workbook Worksheets, Online Student Text, Glencoe Test Generator

Formative Assessments:

- Students will be assessed on classwork assignments.
- Students will be assessed on group and individual projects.
- Students will be assessed on quizzes and tests.
- Students will be assessed on homework assignments.
- Students will be assessed on exit/entry tickets.



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Lesson Plans

Lesson	Time Frame
Lesson 1 Real Exponents	1 class period
Lesson 2 Exponential Functions	1 class period
Lesson 3 The Number e	1 class period

Teacher Notes: As an extension, ask students to look up different ways that e has been calculated historically.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<https://www.calc-medic.com/>

<https://tasks.illustrativemathematics.org/content-standards>

<https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx>



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Lesson Plan 1 Template

Content Area: Math Lesson Title: Real Exponents Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☒ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Be able to use properties of exponents • Be able to evaluate and simplify expressions containing rational exponents • Be able to solve equations containing rational exponents	Lesson Sequence 1. Present students the “aerospace” problem. 2. Show some power definitions. 3. Use the “aerospace” problem to discuss scientific notation. 4. Ask students to review the properties of exponents. 5. Students will be asked to work in pairs on Desmos problems applying exponents. 6. Students then show their work to the partners and discuss the results	• Students respond to verbal prompts during initial discussion. • Circle the room as students are working to check for understanding • Talk to each pair during the process or after they finish to assess understanding • Collect problem set to assess mastery
Differentiation: Students will explain to others in class how to change a number written in scientific notation to standard notation.		



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Resources Provided:

- Guided notes
- Exit Ticket
- Access to the online textbook for application problem access as well as textbook for student's preference.



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Lesson Plan 2 Template

Content Area: Math Lesson Title: Exponential Functions Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Graph exponential functions and inequalities - Solve problems involving exponential growth and decay	Lesson Sequence - Ask students to graph a series of exponential functions. Compare and contrast the graphs. - Discuss real-world problems of exponential functions. Use the graphing calculators to help visualize. - Ask students to work in groups and complete the Desmon activity applying exponential functions. - As a conclusion of their work, ask volunteers to share their solutions with the class.	- Students respond to verbal prompts during initial discussion. - Circle the room as students are working to check for understanding - Talk to students during the process or after they finish to assess understanding. - Have students present solutions. - Collect application problems to assess student mastery.

Differentiation:

Students will be asked to find out whether some factories' accountants use exponential functions to calculate the depreciation of their machines and other assets used in production. Students will write and present short reports to the class on their findings.



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Resources Provided:

- Problem Set
- Access to online textbook
- Graphing Calculators



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Lesson Plan 3 Template

Content Area: Math Lesson Title: The Number e Time Frame: 1 class period

Lesson Components

21st Century Themes

- ☐ Global Awareness ☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☐ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☐ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Science and Engineering

Integration of Technology:

Graphing Calculators, Desmos

Equipment Needed:

Laptops, graphing calculators

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Use the exponential function $y=e^x$ • Solve problems involving population growth • Solve problems involving continuously compounded interest	Lesson Sequence 1. Discuss the “medicine” problem. 2. Ask students to pair together to determine example formulas for exponential growth and exponential decay. 3. As a group, work out the Continuously Compounded Interest problems. 4. Ask students to work in groups to complete Desmos problems. 5. As a conclusion, ask students to complete exit card problems.	• Students respond to verbal prompts during initial discussion. • Circle the room to check for understanding. • Talk to each group during the process or after they finish to assess understanding • Have students present solutions to interesting problems • Collect exit cards to assess mastery

Differentiation:

Present the formula for compound interest and have groups of students calculate the value of an account with a principal of \$1000 after 3 years at 6% interest when compounded annually, quarterly, monthly, daily, and hourly.



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Resources Provided:

- Laptops
- Graphing calculators
- Problem sets



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Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson *Strongly, Moderately* or *Weakly* meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher-order thinking and problem-solving skills	☐	☒	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☒	☐	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☐	☒	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Math **Grade Level:** 11-12 **Unit Title:** Exponential and Logarithmic Functions

Created: 2024

Board Approved on:



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GLOBAL SKILLS

IEP AND 504 ACCOMMODATIONS AND MODIFICATIONS FOR EARLY CHILDHOOD AND ELEMENTARY SCHOOL STUDENTS:

Large print textbooks
Textbooks for at-home use
Additional time for assignments
Review of directions
Use of mnemonics
Have student restate information
Concrete examples
Adaptive writing utensils
Support auditory presentations with visuals
Use of a study carrel
Assistance in maintaining uncluttered space
Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
Space for movement or breaks
Study sheets and teacher outlines
Extra visual and verbal cues and prompts
Math sheets with highlighted instructions
Graph paper to assist in organizing or lining up math problems
Use of computers and calculators
Books on tape
Graphic organizers
Quiet corner or room to calm down and relax when anxious
Preferential seating
Alteration of the classroom arrangement
Reduction of distractions
Answers to be dictated
Hands-on activities
Use of manipulatives
No penalty for spelling errors or sloppy handwriting
Follow a routine/schedule
Alternate quiet and active time
Teach time management skills
Rest breaks
Verbal and visual cues regarding directions and staying on task
Agenda book and checklists
Adjusted assignment timelines
Visual daily schedule



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**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Varied reinforcement procedures
Immediate feedback
Work-in-progress check
Personalized examples

TESTING AND ASSESSMENT ACCOMMODATIONS AND MODIFICATIONS:

Answers to be dictated
Frequent rest breaks
Additional time
Oral testing
Untimed tests
Choice of test format (multiple-choice, essay, true-false)
Alternate ways to evaluate (projects or oral presentations instead of written tests)
Accept short answers
Open-book tests
Read test and directions to student
Provide study outline prior to tests
Highlight key directions
Test in alternative site
Use of calculator
Extra credit option
Preview test procedures
Simplified test wording; rephrased test questions and/or directions

GENERAL ACCOMMODATIONS AND MODIFICATIONS:

Use of alternative books or materials on the topic being studied
Computerized spell-check support
Word bank of choices for answers to test questions
Provision of calculator and/or number line for math tests
Reworded questions in simpler language
Projects instead of written reports
Highlighting important words or phrases in reading assignments
Modified workload or length of assignments/tests
Modified time demands
Modified grades based on IEP

BEHAVIOR ACCOMMODATIONS MODIFICATIONS:



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**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Breaks between tasks
Cue expected behavior
Daily feedback to student
Have contingency plans
Use de-escalating strategies
Use positive reinforcement
Use proximity/touch control
Use peer supports and mentoring
Model expected behavior by adults
Have parent sign homework
Have parent sign behavior chart
Set and post class rules
Chart progress and maintain data



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ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS

IEP AND 504 ACCOMODATIONS AND MODIFICATIONS FOR MIDDLE AND HIGH SCHOOL STUDENTS:

- Large print textbooks
- Textbooks for at-home use
- Additional time for assignments
- A locker with adapted lock
- Review of directions
- Review sessions
- Use of mnemonics
- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Adaptive writing utensils
- Support auditory presentations with visuals
- Weekly or bi-weekly home-school communication
- Space for movement or breaks
- Study sheets and teacher outlines
- Extra visual and verbal cues and prompts
- Lab and math sheets with highlighted instructions
- Graph paper to assist in organizing or lining up math problems
- Use of tape recorder for lectures
- Use of Interactive notebook
- Use of a scribe
- Use of computers and calculators
- Books on tape
- Graphic organizers
- Quiet corner or room to calm down and relax when anxious
- Preferential seating
- Alteration of the classroom arrangement
- Reduction of distractions
- Answers to be dictated
- Hands-on activities
- Ability to type all assignments
- Follow a routine/schedule
- Teach time management and organizational skills
- Rest breaks
- Verbal and visual cues regarding directions and staying on task
- Agenda book and checklists
- Daily check-in with case manager or special education teacher
- Adjusted assignment timelines
- Visual daily schedule



SPRINGFIELD PUBLIC SCHOOLS

**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Varied reinforcement procedures
Immediate feedback
Work-in-progress check
Personalized examples

TESTING AND ASSESSMENT ACCOMMODATIONS AND MODIFICATIONS:

Answers to be dictated
Frequent rest breaks
Additional time
Oral testing
Choice of test format (multiple-choice, essay, true-false)
Alternate ways to evaluate (projects or oral presentations instead of written tests)
Accept short answers
Open-book or open-note tests
Read test and directions to student
Provide study guides prior to tests
Highlight key directions
Test in alternative site
Use of calculator
Extra credit option
Pace long-term projects
Preview test procedures
Simplified test wording; rephrased test questions and/or directions

GENERAL ACCOMMODATIONS AND MODIFICATIONS:

Allow outlining, instead of writing for an essay or major project
Use of alternative books or materials on the topic being studied
Computerized spell-check support
Word bank of choices for answers to test questions
Provision of calculator for math tests
Film or video supplements in place of reading text
Reworded questions in simpler language
Projects instead of written reports
Highlighting important words or phrases in reading assignments
Modified workload or length of assignments/tests
Modified time demands



SPRINGFIELD PUBLIC SCHOOLS

**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Pass/no pass option
Modified grades based on IEP

BEHAVIOR ACCOMMODATIONS FOR STUDENTS:

- Breaks between tasks
- Cue expected behavior
- Daily feedback to student
- Have contingency plans
- Use de-escalating strategies
- Use positive reinforcement
- Use proximity/touch control
- Use peer supports and mentoring
- Model expected behavior by adults
- Have parent sign homework
- Set and post class rules
- Chart progress and maintain data



SPRINGFIELD PUBLIC SCHOOLS

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS

Accommodations and Modifications for ESL Students

- Give tests orally
- Give instructions/directions in writing and orally
- Assign a peer tutor, same language or English speaking
- Allow use of bilingual/translation dictionary
- Provide summaries of text or study guides of particular chapters
- Allow errors in speaking
- Allow errors in writing
- Accept writing in first language
- Highlight key vocabulary
- Reduce amount of work required
- Assess comprehension through demonstration or other alternative means (gestures, drawings)
- Rephrase questions, directions, and explanations
- Reduce multiple choices on assessments
- Provide study guides and/ or outlines
- Shorten reading assignments
- Allow extended time for test/project completion
- Use of audio books
- Use of graphic organizers
- Use reduced text, so that print is not dense
- Use visuals/pictures throughout lesson/unit/assignment
- Adapt homework to reflect language proficiency/home support
- Adapt homework to reflect home support
- Provide hands-on activities and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Use of translation dictionaries to locate words in the native language
- Use anecdotal records and portfolio of work as forms of assessment
- Use story retellings to assess comprehension

What Does the Gifted and Talented Experience Look Like? *Springfield Public Schools*

Mission Statement

The Gifted and Talented Program of the Springfield Public Schools aims to provide a meaningful and rigorous education that instills the value of lifelong learning and empowers all students to reach their full potential and become self-fulfilled creative leaders in accordance with the comprehensive standards of our state. We accomplish this by offering challenging, real-world experiences in a student-centered environment.

We recognize that students come from diverse socioeconomic, cultural, and ethnic backgrounds, and the mission of the gifted and talented program is to provide opportunities for students to explore their intellectual, creative, and artistic gifts and talents within the classroom and with beyond-the-classroom experiences. It is essential to provide diverse, appropriate, and ongoing learning experiences and environments that incorporate students' academic, psychological, and social needs. Our responsibility is to provide students with educational alternatives that teach, challenge, and expand their knowledge, while simultaneously stressing the development of independent and self-directed learners who continuously generate questions, analyze, synthesize, and evaluate information and ideas.

New Jersey Administrative Code 6A:8-3.1 defines students who are gifted and talented as those students who possess or demonstrate high levels of ability in one or more content areas when compared to their chronological peers in the local district and who require modification of their educational program if they are to achieve in accordance with their capabilities.

Goals:

To support our mission, we have established the following goals to guide our work:

- To infuse into the general education program a broad range of activities for high-level learning that will challenge all students to perform at advanced levels, and provide extended opportunities, resources, and support in particular areas where student interest or talent is demonstrated.
- To provide a continuum of gifted education services that will strengthen the total school program, offer enriching and challenging learning opportunities for all students, and provide specialized learning experiences
- To promote achievement of students' best potentials and increased ability.

Through a productive and collaborative relationship among the building principals, classroom teachers, and the Gifted and Talented teacher, our schools can create programming that will enhance the learning experience for every student and serve the unique and specialized needs of students currently demonstrating gifted behaviors.

Elements of the Schoolwide Enrichment Model, W.I.N (What I Need), differentiated instruction, advanced classes, or individual programs into a student's regular instruction program are integral to this overarching framework for gifted education in the Springfield School District.

Reference Board Policy and Regulation 2464 – Gifted and Talented Pupils (M)

Early Childhood Center **Edward V. Walton**

Schoolwide Virtual Enrichment

All first and second grade students have access to the [Gifted and Talented Virtual Classroom](#). This virtual classroom is a space for students to complete various challenges and enrichment opportunities at their own pace. Students can receive feedback and additional adaptable resources to meet their individual learning needs. The virtual classroom design expands accessibility to enrichment resources and allows students to choose learning activities according to their unique interests and abilities. The purpose of the activities is to encourage problem-solving, develop critical thinking

skills, and expand curiosity and imagination. Activities are aligned to the New Jersey Student Learning Standards.

Gifted and Talented Teacher as a Resource

The Gifted and Talented teacher serves as a resource to all teachers within Edward V. Walton School. Teachers seeking resources for their high-ability learners will receive additional support from the Gifted and Talented teacher in various ways. This support may include additional units of study, challenging resources, and student projects.

Elementary Schools **James Caldwell** **Thelma L. Sandmeier**

The goal is to engage small groups of students in intensive learning experiences through standards-based, rigorous, and relevant units of study that supplement, not supplant, the grade-level curriculum and support students' unique learning needs.

Enrichment Experience Grade 3

Beginning in third grade, the G&T teacher will cycle through all classrooms to work on problem-solving and enrichment tasks with students. Driven by assessment data, academic performance, student interest, and teacher observation, small groups of students will meet with the G&T teacher during W.I.N. (What I Need) periods throughout the week that the teacher is assigned to their classroom teacher. Groupings will be flexible and monitored to best meet each student's needs throughout the school year. Activities will include brain teasers, puzzles, strategic thinking, problem-solving, and STEM challenges.

Targeted Gifted and Talented Programing Grades 4-5

Students may become identified as Gifted and Talented in fourth grade. Students that are identified may receive support from the G&T Teacher for up to five periods (200 minutes) a week during W.I.N. (What I Need) periods. Identified students will meet to explore grade-level content while incorporating depth and complexity in a student-centered, problem-based environment. The Gifted and Talented Program aims to provide students with various advanced and challenging learning experiences across content areas to promote independent thinking skills, refine critical thinking and communication skills, cultivate joy in learning, and expand student interests through problem-solving. The instruction that students receive incorporates 21st Century Skills and advanced content that is challenging, hands-on, and relevant to the real world.

Strategies and Practices that Support Gifted and Talented Students

- Adjusted Pace of Lessons
- Inquiry-Based Instruction
- Higher-Order Thinking Activities
- Interest-Based Content
- Real World Problem Solving/Problem Based Learning
- Independent Study/Passion Projects
- Units of Study with Like-Minded Peers

Schoolwide Virtual Enrichment

All JCS and TLS students have access to grade level-specific [Gifted and Talented Virtual Classrooms](#). These virtual classrooms are a space for students to complete various challenges and enrichment opportunities at their own pace. Students are able to receive feedback and additional opportunities based on their needs. The virtual classrooms have expanded the accessibility of enrichment resources directly to the students and allows for students to choose opportunities according to their interests and abilities. The purpose of the activities is to encourage problem solving, develop critical thinking skills, and expand curiosity and imagination in conjunction with the New Jersey Student Learning Standards.

Gifted and Talented Teacher as a Resource

In addition to classroom support, the Gifted and Talented teacher also serves as a resource to all teachers in the building. Teachers that are seeking resources for their high ability learners will receive additional support from the Gifted and Talented teacher in various ways. This may include additional units of study, challenging resources, student projects, and meeting with the G&T teacher as needed.

Additional Enrichment Opportunities

Across all grade levels 3-5, as recommended by the classroom teacher, students exhibiting a need for additional enrichment may have the opportunity to meet with the G&T teacher as the schedule allows. Groupings will be flexible and monitored to best meet the students' needs throughout the school year. Activities will include, brain teasers, puzzles, strategic thinking activities, problem-solving challenges, and STEM challenges. Students engage in an extended process of asking questions, using resources, and developing answers that lead to thinking about what and how they are learning. Students are held accountable for how they work and use their time by demonstrating their learning through products or presentations.

Students self-select to participate in individual and/or group projects based on interest and commitment. The classroom teacher and/or the enrichment teacher will help guide and monitor student exploration of chosen topics, facilitating their learning with resources and teaching of needed skills.

Secondary Schools
Florence M. Gaudineer Middle School
Jonathan Dayton High School

Grades 6-12: Access to specific content programs with higher levels of academic challenges (i.e. Pre-Algebra, Accelerated Communication Arts, and Advanced Placement Classes)

Dual Credit Courses provide students the opportunity to obtain high school credit, and college credit, simultaneously through partnerships with several institutions.

Project Lead the Way (PLTW) students become builders of technology by engaging in real world activities. Students are empowered as design thinkers collaborating on real world projects.

Gifted and Talented Identification Criteria

The Springfield Schools Gifted and Talented Program recognizes that students require differentiated learning experiences beyond the core curriculum being taught because of their advanced abilities in one or more content areas. These students may also have other cognitive qualities such as curiosity, creativity, motivation, leadership, and passion that require modifications to their academic experience.

Multiple Measures of Eligibility

Kindergarten through grade twelve identification process for gifted and talented students includes multiple measures. Multiple measures may include but are not limited to: achievement test scores; grades; student performance or products; intelligence testing; parent, student, and/or teacher recommendation; and other appropriate measures. The identification methodology is developmentally appropriate, non-discriminatory, and related to the programs and services offered by the Springfield School District. The identification procedures are reviewed annually.

According to N.J.A.C. 6A:8-3.1, all public school districts must have a board-approved gifted and talented identification process and provide services for identified students enrolled in the grades of that school district. The regulations require that identification and services be made available to students in grades K-12.

When students are recommended for the Gifted and Talented Program there are multiple measures that are considered to determine if services are necessary and appropriate. The assessments used are as follows:

- Cognitive Abilities Test (CogAT)
- Classroom Performance/Student Portfolios
- DRA2 Level
- iReady Diagnostic Scores
- Gifted Indicators Checklist
- Start Strong/NJSLA Assessment Data

The N.J.A.C. requires that students be compared to their chronological peers in the local school district. The New Jersey Department of Education has not established state-level criteria for identifying students who are gifted, such as mandated tests or assessments, grade point averages, or IQ scores. Local school districts must use multiple measures to identify students.

Procedures

<https://www.straussesmay.com/seportal/Public/DistrictPolicy.aspx?policyid=2464&id=b8a33a9f505e4998a6db3fb8e1de778b>

Gifted and Talented Program Identification Matrix

Minimum Score Required for Consideration: 14 Points

1 Point	2 Points	3 Points
Cogat Assessment Overall Stanine Score of a 7	Cogat Assessment Overall Stanine Score of an 8	Cogat Assessment Overall Stanine Score of a 9
iReady Math Assessment Just Below Current Grade Level	iReady Math Assessment On Grade Level	iReady Math Assessment ½ Year + Above Current Level
iReady ELA On Grade Level	iReady ELA ½ Year Above Current Level	iReady ELA One Full Grade Level + Above Current Level
NJSLA Math Approaching Expectations	NJSLA Math Met Expectations	NJSLA Math Exceed Expectations
NJSLA ELA Approaching Expectations	NJSLA ELA Met Expectations	NJSLA ELA Exceed Expectations
HOPE Teacher Rating Scale Raw Score: 11 - 29	HOPE Teacher Rating Scale Raw Score: 30 - 49	HOPE Teacher Rating Scale Raw Score: 50-66

Team meetings present the opportunity to review data and assess the educational needs of all students. Teacher provides examples of student work exhibiting above and beyond grade level expectations, creativity, leadership, critical and abstract thinking. Programs for gifted and talented students will be periodically evaluated for their continuing efficacy and adjusted accordingly. The parent of any student identified as gifted or talented shall be consulted regarding any program designed to address the student's particular needs.

Resource Links

https://riversideinsights.com/cognitive_abilities_test

<https://www.curriculumassociates.com/programs/i-ready-learning>

<https://www.nj.gov/education/assessment/resources/>

<https://www.routledge.com/HOPE-Teacher-Rating-Scale-Involving-Teachers-in-Equitable-Identification/Gentry-Pereira-Peters-McIntosh-Fugate/p/book/9781618214522#:~:text=The%20HOPE%20Teacher%20Rating%20Scale,making%20it%20easy%20to%20use.>

Gifted and talented student: The “*[Strengthening Gifted and Talented Education Act](#)*” defines a gifted and talented student as a “student who possesses or demonstrates a high level of ability in one or more content areas when compared to their chronological peers in the school district and who require modifications of their educational program if they are to achieve in accordance with their capabilities.”

Twice-exceptional (2E) students: A twice-exceptional (2E) student is defined as “a student who is both gifted and a student with a disability. These students may also be referred to as having dual exceptionalities or as being gifted with learning disabilities (GT/LD). This also applies to students who are gifted with ADHD or gifted with autism” (New Jersey Association for Gifted Children, www.nagc.org).

Instructional adaptation: An adjustment or modification to instruction enabling a student who is gifted and talented to participate in, benefit from, and demonstrate knowledge and application of the New Jersey Student Learning Standards in one or more content areas at the instructional level of the student, not just the student's grade level.

Identifying gifted and talented students: The focus of identification is to provide programming and services in which students' specific learning needs and potential are appropriately addressed and met. In every New Jersey school district, there are students who require modifications to the general education curriculum if they are to achieve in accordance with their abilities. By identifying a student's general intellectual ability, creativity, or specific academic area aptitudes, we are acknowledging that they need programming and services outside of the general education/grade level curriculum to advance their learning.

NJDOE Fast Facts

<https://www.nj.gov/education/standards/gifted/>

<https://www.nj.gov/education/standards/gifted/legislation.shtml>

Supplemental Resources/Programming for Gifted Students

Edward V. Walton

- PETS Program – Primary Education Thinking Skills
- Group Solutions/Group Solutions 2 – Cooperative Logic Activities
- Lollipop Logic
- Beginning Thinking Skills
- AIMS Education Programming

James Caldwell and Thelma L. Sandmeier

Math/ELA

- Project M3: Mentoring Mathematical Minds
- Junior Great Books
- AIMS Education Programming
- Borenson Hands on Equations
- BizWorld
- Perplexors
- Advanced Math Explorations grade 3-5
- Challenging Units for Gifted Learners (ELA and Math)
- Creative Curriculum Extenders
- Differentiated Lessons & Projects
- Challenge Math Grades 4+
- Differentiating Instruction with Menus (All Content Areas)
- Jacob's Ladder
- Genius Hour/Passion Project
- Spatial Reasoning
- Logic Puzzles, Brain Games, Analogies

STEM

- Engineering is Elementary
- Engineer Throughout the Year
- PBS Design Squad
- DefinedSTEM
- Project Lead the Way (PLTW)

Enrichment Events

Experience for all students to be enriched through events related to the curricular or extracurricular activities. Examples include after school clubs, PTA-sponsored events, leadership opportunities, visual and performing arts, and community service opportunities.