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Belleville Public Schools

Curriculum Guide

MATH ESSENTIALS GRADES 11-12

UNIT 6 SLOPE & FUNCTIONS

Belleville Board of Education

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Unit Overview

Unit 6: Slope and Functions

In this unit, students should learn to find function values, find the slope given two points, find the slope of a linear equation, graph linear equations, find the rate of change in a table of values, determine if a function is linear or exponential, predict the missing values of linear/exponential functions.

Enduring Understanding

Unit Enduring Understandings: Students will understand that..

- Functions are a mathematical way to describe relationships between two quantities that vary.
- Functions can be represented in a variety of ways, including graphs, tables and equations.
- Ratios can be used to show slope, a relationship between vertical and horizontal change.
- The relationship between two lines can be determined by comparing their slopes and y-intercepts.
- Slope and y-intercept have meaning within the context of a situation.

- Linear functions have a constant rate of change.

Essential Questions

Unit Essential Questions: Students will keep considering..

- How can you represent and describe functions?
- How can functions describe real-world situations, model predictions and solve problems?
- What do the slope and y-intercept indicate about a line?
- What information does the equation of a line give you?
- How are equations, graphs and tables related?
- How do you find the slope of a line using a graph or two ordered pairs?
- How can a graph, table, ordered pair, or an algebraic rule help describe the relationship between two variables?
- How can we determine a gradual, steep or constant change between any two variables?
- How can we determine if a function is exponential or linear?

Exit Skills

By the end of Unit 6 Students will be able to:

- Evaluate a function given its formula and input value.
- Determine y-intercept of a line given its graph or table.
- Graph linear equations.
- Find the slope or rate of change given a graph or two ordered pairs.
- Distinguish between exponential and linear functions.
- Use patterns to find missing values of exponential or linear functions.
- Use functions to describe real-world situations and solve problems.

New Jersey Student Learning Standards (NJSLS-S)

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.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.
MA.K-12.4	Model with mathematics.
MA.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.
MA.K-12.6	Attend to precision.
MA.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.
MA.K-12.7	Look for and make use of structure.
MA.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.
MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.F-LE.A.1a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

Interdisciplinary Connections

LA.RL.11-12.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (e.g., Shakespeare as well as other authors.)
LA.W.11-12.2.D	Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

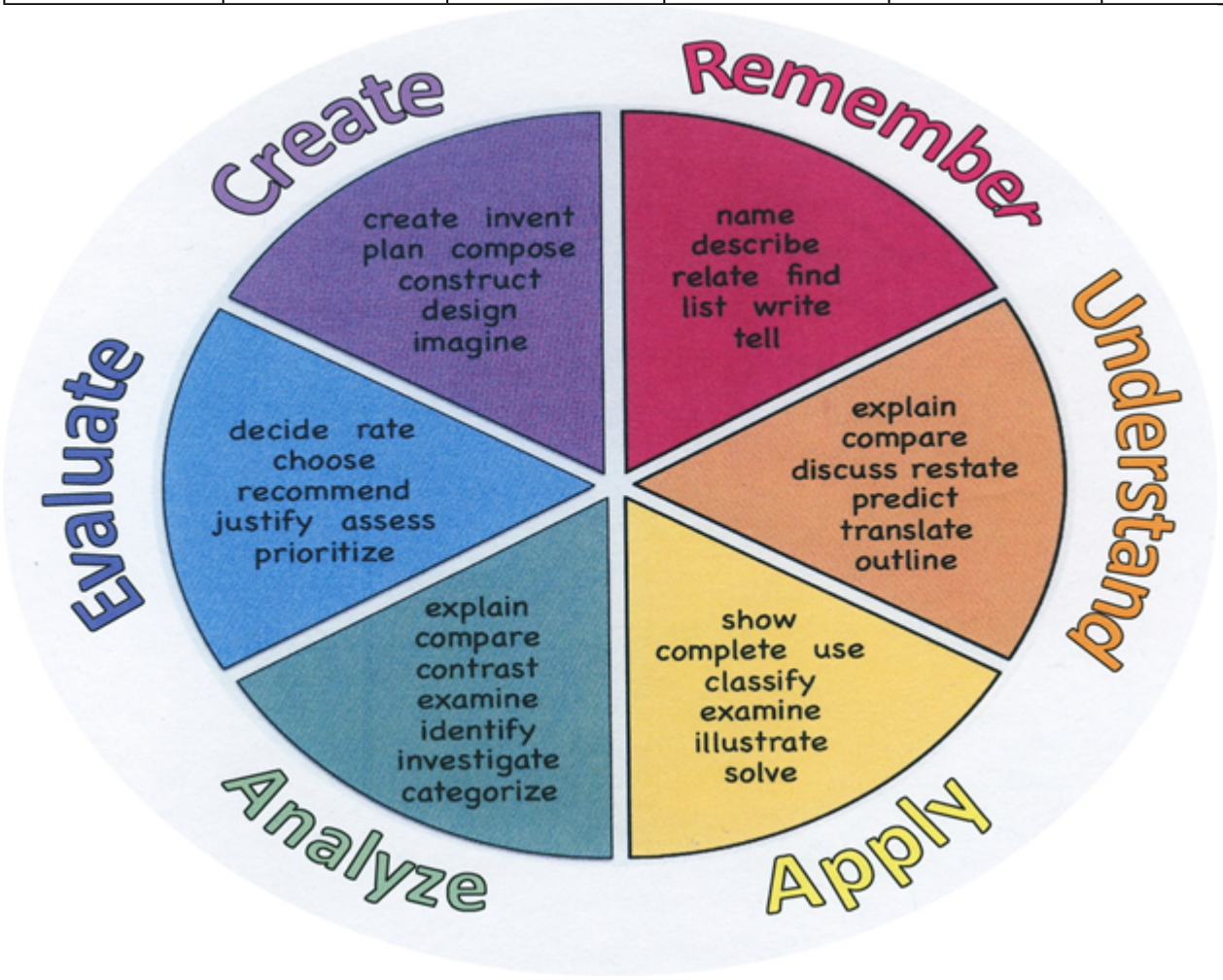
Learning Objectives

Students will be able to...

- Determine function values given its formula and input values.
- Identify the slope and y-intercept of a linear equation given its graph.
- Identify the slope and y-intercept of a linear equation given its table of values.
- Produce the graph of a linear function given its equation.
- Distinguish between linear and exponential functions given a graph or table of values.
- Predict the missing values in a linear or exponential function given its table of values.
- Create a linear function based on the information in a real-world situation or a word problem.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent

Name Omit Recite Select State Count Draw Outline Point Quote Recall Recognize Repeat Reproduce	Illustrate Indicate Interrelate Interpret Infer Match Paraphrase Represent Restate Rewrite Select Show Summarize Tell Translate Associate Compute Convert Discuss Estimate Extrapolate Generalize Predict	Produce Select Show Sketch Solve Use Add Calculate Change Classify Complete Compute Discover Divide Examine Graph Interpolate Manipulate Modify Operate Subtract	Select Subdivide Survey Arrange Breakdown Combine Detect Diagram Discriminate Illustrate Outline Point out Separate	Critique Determine Grade Justify Measure Rank Rate Support Test	Make Originate Organize Plan Produce Role Play Drive Devise Generate Integrate Prescribe Propose Reconstruct Revise Rewrite Transform



Suggested Activities & Best Practices

Supplemental Materials:

- khanacademy.com
- njctl.org
- coolmath.com
- mathbitsnotebook.com/
- https://parcc-assessment.org/released-items/
- https://accuplacer.collegeboard.org/student/practice
- https://collegereadiness.collegeboard.org

Assessment and Learning:

- aleks.com
- Google Forms
- edulastic.com
- Google Classroom
- https://kahoot.com/explore/collections/math-kahoot-algebra/ (has all levels of math in the collections)

Strategies:

- https://mashupmath.com
- virtualnerd.com
- https://ies.ed.gov/ncee/wwc/docs/practiceguide/wwc_algebra_040715.pdf

Assessment Evidence - Checking for Understanding (CFU)

Edulastic Formative Assessment (Formative)

Kahoots - Various Topics (Formative)

Glencoe McGraw-Hill EAssessment Test Generator (Summative)

Common benchmarks on OnCourse (Benchmark)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster

- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments

Primary Resources & Materials

- https://www.nj.gov/education/cccs/2016/math/standards.pdf
- aleks.com
- edulastic.com
- njctl.org
- Glencoe McGraw-Hill Algebra 1 2014
- https://accuplacer.collegeboard.org/student/practice
- https://collegereadiness.collegeboard.org

Ancillary Resources

- teacher-prepared worksheets, notes and slides

- ASVAB for Dummies
- CliffsTestPrep ASVAB
- collegeboard.org
- homeschoolmath.net
- Glencoe Math Accelerated 2017

Technology Infusion

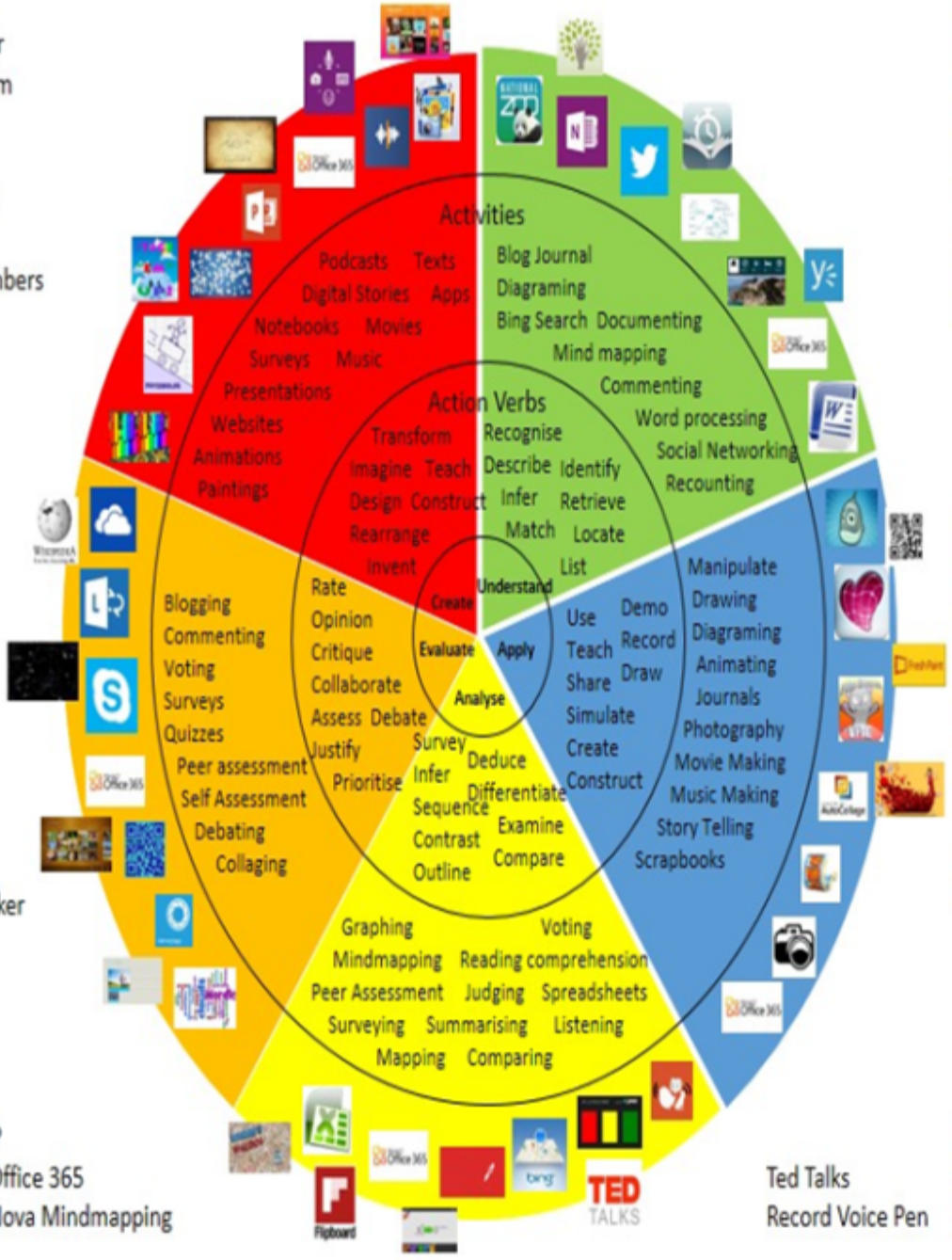
Create and assign exit tickets with Google Forms
Create and display slide presentations with Google Slides
Interactive activities with slope using Geogebra

- Youtube
- Khan academy
- MS Word
- Google Slides
- Google Classroom
- Google Forms
- Edulastic
- ALEKS
- Desmos.com
- Geogebra.org
- Smart Exchange
- McGraw-Hill Education

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
TECH.8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

21st Century Skills/Interdisciplinary Themes

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness

Differentiation

GENERAL EXAMPLES INCLUDE:

Use of Glencoe virtual manipulatives: http://www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html
Study Guides provided prior to tests and quizzes
Use of ALEKS for differentiated practice or extension of skills

Differentiations:

- Small group instruction
- Small group assignments

- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw

- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Flash cards for vocabulary and new concepts
One-on-one questioning during testing to elicit responses
Use of Glencoe personal tutor or The Video Math Tutor for additional instruction

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Use of multilingual mathematics glossary including definitions in English and its translations to other languages:
https://my.hrw.com/math06_07/nsmedia/tools/glossary/msm/glossary.html

Use of Spanish instructional videos of concepts:
https://www.youtube.com/user/KhanAcademyEspanol/videos
https://www.mathtv.com/
Peer partners for assignments with students that can verbally translate material and meanings of concepts

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Printed or video copy of material missed during excessive absences
Retests or test corrections of incorrect work on tests
Working contract to ensure completion of prioritized tasks

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes

- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Glencoe Enrichment Activities and Chapter Projects

Complete higher level learning problems in textbook

Complete math league sample contest problems:

https://www.mathleague.com/index.php/annualcontestinformation/samplecontests

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a plan to solve an issue presented in the class or in a text
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: Exponential and Linear Functions

NJSLS: MA.9-12.F-LE.A.1a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

InterdisciplinaryConnection: Real-Life example: the relationship between the time traveled and the distance of a car is linear at a constant speed.

Statement of Objective: SWDT Distinguish between exponential and linear functions; Find missing values in a table representing an exponential or linear function.

Anticipatory Set/Do Now: Admit ticket: Find the rate of change of each linear function.

Learning Activity: Notes: Exponential and Linear Functions, Students practice examples, Students place solutions on whiteboard, Other students justify work as summary.

Student Assessment/CFU's: questioning, admit ticket, explaining, compare & contrast

Materials: use of Smart TV, Google Forms (Chromebooks), Google Slides, WS Notes & Practice - Exponential and Linear Functions, use of whiteboard, calculators

21st Century Themes and Skills: critical thinking, communication, information literacy

Differentiation: study guides, team work with peer tutoring, classroom discussions, board work

Integration of Technology: calculators, use of Google Forms (Chromebooks), Google Slides