*Unit 5: Functions and volume

Content Area: **Mathematics**
Course(s): **Math - Grade 8**
Time Period: **3rd Marking Period**
Length: **7 weeks**
Status: **Published**

Unit Overview

Invesitgate and understand linear functions.Understand what makes a function. Determine if a function is linear or non-linear. Students should have exposure to other types of functions so that they understand there are other types besides two categories of "linear" and "non-linear". Use and apply volume formulas for a cylinder, sphere and cone. Problem solve and compare volume of figures.

Transfer

Students will be able to independently use their learning to ...

Students will understand that functions describe relationships and will be able to compare and construct a function. The equation y=mx+b will be interpreted as a straight line, where m and b are constants. Students learn to recognize linearity in a table when constant differences between input values produce constant differences between output values, and they can use the constant rate of change and initial value appropriately in a verbal description of a context. Students will establish a routine of exploring functional relationships algebraically, graphically, and numerically in tables and verbal descriptions. When using functions to model a linear relationship between quantities, students learn to determine the rate of change of the function which is the slope of a graph.

Students will apply experience with coordinate planes and linear functions in the study of association between two variables related to a question of interest. The shape is a description of the cloud of points on a plane, the center is the line of best fit, and the spread is how far data points are from the line

Students extend their understanding of volume from right rectangular prisms to right cylinders, right cones, and spheres. They will apply information from word problems and use and apply the formulas necessary to find the unknowns. Stduent will indentify will use key information to help plug information into the variables within volume formulas.

Meaning

Understandings

Students will understand that

- A function is a specific topic of relationship in which each input has a unique output which can be represented in a table.
- A function can be represented graphically using ordered pairs that consist of the input and the output of the function in the form (input, output).
- A function can be represented with an algebraic rule.
- The equation is a straight line and that slope and y-intercept are critical to solving real problems involving linear relationships.
- Changes in varying quantities are often related by patterns which can be used to predict outcomes and solve problems.
- Linear functions may be used to represent and generalize real situations.

- Written descriptions, tables, graphs, and equations are useful in representing and investigating relationships between varying quantities.
- Different representations (written descriptions, tables, graphs, and equations) of the relationships between varying quantities may have different strengths and weaknesses.
- Linear functions may be used to represent and generalize real situations.
- Slope and -intercept are keys to solving real problems involving linear relationship models of data.
- Some data may be misleading based on representation.
- Volume is use with 3-dimensional figures
- Radius is half the diameter of a circle or sphere
- the volume of a sphere
- the volume of a cone
- the volume of a cylinder
- the different variables found in the volume formula

Essential Questions

Students will keep considering...

- How can you find and use patterns to model real-world situations?
- How can we model relationships between quantities?
- How do you estimate using data?
- How to identify the slope in a problem and what it means.
- What does the outlier tell you about the information?
- How do you find the volume of a figure?
- How do you determine a real world situation from a graph?

Application of Knowledge and Skill

Students will know...

Students will know...

- about what happens to inputs for each rule (Lesson 1)
- about dimensions of cylinders (Lesson 14)
- about the relationship between the volumes of cylinders and cones (Lesson 15)
- about dimensions of cones (Lesson 16)
- about volumes of spheres, cones, and cylinders as functions of their radii (Lesson 21)
- claims about what can be determined from given information (Lesson 2)
- claims about volumes of cubes and spheres based on graphs (Lesson 7)
- claims about approximately linear relationships (Lesson 10)
- reasoning about the volumes of spheres and cones (Lesson 21)
- different representations of functions (Lesson 3)
- features of graphs, equations, and situations (Lesson 4)
- features of a situation with features of a graph (Lesson 6)
- temperatures shown on a graph with different temperatures given in a table (Lesson 7)
- the volumes of cones with the volumes of cylinders (Lesson 16)
- methods for finding and approximating the volume of a sphere as function of its radius (Lesson 20)
- Interpret a respresentation of volume functions of cylinders, cone, and spheres
- Describe quantites in a situation
- describe volume measurements and features of 3 dimensional figures
- describe the effects of varying dimensions of rectangular prisms and cones on their voumes
- Descrive and represent approximately linear relationships
- Explain and represent how height and volume of cylinders are related
- Explain reasoning about finding the volume of a cylinder and about the relationship between volume of hemispheres and volume of boxes, cylinders and cones

Students will be skilled at...

Students will be skilled at...

- Verify that a relationship is a function or not. (8.F.1)
- Reason from a context, graph, or table after knowing which quantity is the input and which is the output. (8.F.1)

- Represent and compare functions numerically, graphically, verbally and algebraically. (8.F.2)
- Interpret equations in form as a linear function. (8.F.3)
- Determine whether a function is linear or non-linear. (8.F.3)
- Identify and contextualize the rate of change and the initial value from tables, graphs, equations, or verbal descriptions. (8.F.4)
- Construct a model for a linear function. (8.F.4)
- Describe the qualities of a function using a graph (e.g., where the function is increasing or decreasing). (8.F.5)
- Sketch a graph when given a verbal description of a situation. (8.F.5)
- Use similar triangles to explain why the slope is the same between any two distinct points on a non-vertical line in the coordinate plane. (8.EE.6)
- Derive the equation for a line through the origin. (8.EE.6)
- Use the equation of a linear model to solve problems in the context of bivariate measurement data. (8.SP.3)
- Show that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. (8.SP.4)
- Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. (8.SP.4)
- Use relative frequencies calculated for rows or columns to describe possible association between the two variables. (8.SP.4)
- Determining the volume of a sphere, cone, and cylinder
- Applying the volume formulas to real world problems

Academic Vocabulary

Function, Graph of a function, Domain, Range, Input/output, Ordered pairs/coordinate plane, Slope, Rate of change, Unit rate, Linear/non-linear functions

Bivariate data, Clustering, Outlier, Positive/negative association, continuous data, dependent variable, independent variable, relation, range, linear equation, discrete data, quadratic function, qualitative graphs,function table, hemisphere, cone, volume, approximate range, radius, base (of a cylinder or cone), cylinder, three-dimensional, piecewise linear function, constant rate, mathematical model, cube, sphere

Learning Goal 1

Define, evaluate, compare functions

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP11	Use technology to enhance productivity.

CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Target 1.1-- (Level of Difficulty: Comprehension (symbolizing), DOK: 2- Skill/Concept)

SWBAT:

Represent relations using tables and graphs. **(Chapter 7, Lesson 1-5)**

MA.8.F.A.1	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.

Target 1.2--(Level of Difficulty: Retrieval(recognizing), DOK: 2- Skill/concept)

SWBAT:

Determine whether a relation is a function. **(Chapter 7, Lesson 3)**

Find function values and complete function. **(Chapter 7, Lesson 4-5)**

MA.8.F.A.1	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

Target 1.3--(Level of Difficulty: Comprehension, DOK: 2- Skill/Concept)

SWBAT: Represent linear functions using tables and graphs. **(Chapter 7, Lesson 7-8)**

MA.8.F.A.3	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.

Target 1.4--(Level of Difficulty: Comprehension(symbolizing), DOK: 3- Strategic Thinking)

SWBAT: Compare properties of functions represented in different ways. **(Chapter 7, Lesson 7)**

MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

Target 1.5 -- (Level of Difficulty: Comprehension(integrating), DOK: 3- Strategic Thinking)

Find and interpret the rate of change and initial value of a function. **(Chapter 7, Lesson 9)**

MA.8.F.B.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

Target 1.6-- (Level of Difficulty: Analysis, DOK: 3- Strategic Thinking)

Determine whether a function is linear or non-linear. **(Chapter 7, Lesson 6)**

MA.8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.

Target 1.7--(Level of Difficulty: Comprehension (symbolizing), DOK: 2- Skill/Concept)

Graph families of non-linear functions. **(Chapter 7, Lesson 6)**
Sketch and describe qualitative graphs.

MA.8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.

Learning Goal 2

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.

Target 2.1 --(Level of Difficulty: Comprehension, DOK: 2- Skills/concept) INQUIRY LAB

SWBAT: Determine how some 3-D figures are related to circles. **(Chapter 8, Lesson 7-8)**

MA.8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.

Target 2.2 -- (Level of Difficulty: Retrieval(executing), DOK: 2- Skill/Concept)

SWBAT: Find the volume of cylinders. **(Chapter 8, Lesson** 1)

MA.8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.

Target 2.3 --(Level of Difficulty: Retrieval(executing), DOK: 2- Skill/Concept)

SWBAT: Find the volume of cones **(Chapter 8, lesson 3)**

MA.8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

Target 2.4 -- (Level of Difficulty: Retrieval(executing), DOK: 2- Skill/Concept)

SWBAT: Find the volume of spheres. **(Chapter 8, Lesson 6)**

MA.8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

Target 2.5 -- (Level of Difficulty: Analysis, DOK: 3- Strategic thinking) INQUIRY LAB

SWBAT: Determine how changes in dimensions affect area and volume. **(Chapter 8) Area not discussed just volume**

MA.8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
MA.K-12.1	Make sense of problems and persevere in solving them. Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use

	counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Target 2.6 -- (Level of Difficulty: Analysis, DOK: 3- Strategic thinking)

SWBAT: Solve problems involving similar solids. **(Chapter 8, Lesson 7-8)**

MA.8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

21st Century Life and Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
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.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

Technology

TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.8.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

TECH.8.1.8.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.

Formative Assessment and Performance Opportunities

Am I Ready Assessments

Mid chapter check ups
Tests
Quizzes
Informal Assessments
Graded Classwork
Surveys
WhiteBoard Activities
Exit tickets
Group activities
Projects
Teacher Observations
Student Interviews
Aleks Assessments
Linkit Assessments

Summative Assessment

Unit Test-Found on Linkit
Aleks-Based off percentage
Unit Project
Performance based assessment

Accommodations & Modifications

See Unit Resources below for specific targeted resources

- Centers
- Desmos-use of the graphing options and activities provided
- Extra time
- Function Friday Pattern discussions-Each week a new pattern and discovering the expression that match the drawings
- Graphing Calculator for graphing options
- interactive math notebooks
- Interactive Notebook-Demonstrate what a function what is not a function with Mapping
- Labeled coordinate graph to help support graphing

- Modifications as per IEP/504
- Review and Practice
- Small Group Instruction
- Smartboard/Document Camera for visual examples and demonstration
- Translate the text
- Visuals to demonstrate Functions
- www.quizlet.com

Unit Resources

Additional resources found in unit folder

- http://schools.nyc.gov/Academics/CommonCoreLibrary/TasksUnitsStudentWork/default.htm
- Aleks online supplement
- ck12.org
- http://blog.mrmeyer.com/?p=213
- http://illuminations.nctm.org/LessonDetail.aspx?id=L298
- http://illuminations.nctm.org/LessonDetail.aspx?id=L646
- http://illuminations.nctm.org/LessonDetail.aspx?ID=L673
- http://illuminations.nctm.org/LessonsList.aspx?grade=3&standard=all
- http://insidemathematics.org/index.php/8th-grade
- http://www.education.ucsb.edu/ucsbpt3/afield/teacher_projects/jimsfinal/Jimstudent.htm
- http://www.illustrativemathematics.org/
- http://www.pbs.org/teachers/connect/resources/4384/preview/
- http://www.pbs.org/teachers/connect/resources/4442/preview/
- https://www.khanacademy.org/
- Inquiry labs
- ttp;//achievethecore.org/coherencemap
- Unit project
- www.desmos.com
- www.geogebra.org
- www.quizlet.com

Interdisciplinary Connections

Walk the line with TI84-Allow students to make predictions on function graphs by walking the line and/or hearing a situation and attempting to draw it. (8.F.B.5)

6-8.MS-PS2-2	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
6-8.MS-PS1-2.4.1	Analyze and interpret data to determine similarities and differences in findings.