Orange Public Schools

Office of Curriculum & Instruction

2019-2020 Mathematics Curriculum Guide

8th Grade Mathematics

Illustrative Mathematics – Unit 5: Functions and Volume

January 16, 2020 – March 4, 2020

Board Approved: 1.14.2020

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From the New Jersey Student Learning Standards:

In **Grade 8**, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

1. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation.

Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

2. Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

3. Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

Yearlong Pacing Guide
Grade 8

Grade	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
5	Unit 1 5.NBT	Unit 2 5.NBT		Unit 3 5.NF	Unit 4 5.NF		Unit 5 5.MD		Unit 6 5.OA & 5.G	
6	Unit 1 6.G	Unit 2 6.RP	Unit 3 6.RP	Unit 4 6.NS		Unit 5 6.NS	Unit 6 6.EE	Unit 7 6.NS	Unit 8 6.SP	
7	Unit 1 7.G	Unit 2 7.RP	Unit 3 7.G	Unit 4 7.RP	Unit 5 7.NS	Unit 6 7.EE		Unit 7 7.G	Unit 8 7.SP	
8	**Unit 1 8.G**	**Unit 2 8.G**	**Unit 3 8.EE**	**Unit 4 8.EE**		**Unit 5 8.F**	**Unit 6 8.SP**	**Unit 7 8.EE**	**Unit 8 8.G**	

Unit 1	**Geometry:** Rigid Transformation & Congruence	Unit 2	**Geometry:** Dilations, Similarity, and Introducing Slope	Unit 3	**Expressions & Equations:** Linear Relationships	Unit 4	**Expressions & Equations:** Linear Equations & Linear Systems
Unit 5	**Functions:** Functions and Volume	Unit 6	**Statistics & Probability:** Associations in Data	Unit 7	**Expressions & Equations:** Exponents and Scientific Notation	Unit 8	**Geometry:** Pythagorean Theorem and Irrational Numbers

2019-2020 Grade 8 (iM)							
Quarter 1		**Quarter 2**		**Quarter 3**		**Quarter 4**	
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
8.G.1(M) 8.G.2(M) 8.G.5(M)	8.G.4(M) 8.G.3(M) 8.EE.6(M)	8.EE.5(M) 8.F.4(S) 8.EE.8(M)	8.EE.7(M) 8.EE.8(M)	8.F.1(M) 8.F.2(M) 8.F.3(M) 8.F.4(S) 8.F.5(S) 8.G.9(A)	8.SP.1(S) 8.SP.2(S) 8.SP.3(S) 8.SP.4(S)	8.EE.1(M) 8.EE.3(M) 8.EE.4(M)	8.NS.2(S) 8.EE.2(M) 8.G.6(M) 8.G.7(M) 8.G.8(M) 8.NS.1(S)
20 Days	15 Days	17 Days	18 Days	25 Days	13 Days	18 Days	17 Days
Oct. 8	Nov. 4	Dec. 6	Jan. 15	Mar. 4	Mar. 27	May 5	Jun. 3

Major Work Supporting Content Additional Content

Table of Contents

References

"Illustrative Mathematics" *Open Up Resources.* 2018 <https://auth.openupresources.org/register/complete>

I. Unit Overview

In this unit, students are introduced to the concept of a function as a relationship between "inputs" and "outputs" in which each allowable input determines exactly one output. In the first three sections of the unit, students work with relationships that are familiar from previous grades or units (perimeter formulas, proportional relationships, linear relationships), expressing them as functions. In the remaining three sections of the unit, students build on their knowledge of the formula for the volume of a right rectangular prism from grade 7, learning formulas for volumes of cylinders, cones, and spheres. Students express functional relationships described by these formulas as equations. They use these relationships to reason about how the volume of a figure changes as another of its measurements changes; transforming algebraic expressions to get the information they need (MP1).

Students extend their understanding of volume from right rectangular prisms to right cylinders, right cones, and spheres. They begin by investigating the volume of water in a graduated cylinder as a function of the height of the water, and vice versa. They examine depictions of of a cylinder, prism, sphere, and cone, in order to develop their abilities to identify radii, bases, and heights of these objects. They estimate volumes of prisms, cylinders, cones, and spheres, in order to reinforce the idea that a measurement of volume indicates the amount of space within an object. Students use their abilities to identify radii, bases, and heights, together with the geometric abilities developed in earlier grades, to perceive similar structure (MP7) in formulas for the volume of a rectangular prism and the volume of a cylinder—both are the product of base and height. After gaining familiarity with a formula for the volume of a cylinder by using it to solve problems, students perceive similar structure (MP7) in a formula for the volume of a cone.

Essential Questions
• What are the key variables in this situation? • What is the pattern relating the variables? • What is a function? • How are functions represented? • What can a relationship between numbers tell about a problem? • Are properties of functions and graphs the same for all functions? • How do we use formulas to solve problems involving volumes of cones, cylinders, and spheres? • How do we select the correct formula for a given problem? • How do you make meaning of formulas, involving volumes of cones, cylinders?

Enduring Understanding

- Recognize linear and nonlinear patterns from verbal descriptions, tables, and graphs and describe those patterns using words and equations.
- Write equations to express linear patterns appearing in tables, graphs and verbal context.
- The definition of a function and what its graph represents.
- Properties of functions and their graphs are similar but not identical.
- Slope-intercept form is an easy way of graphing functions.
- Formulas for finding the areas of polygons, such as rectangles, squares, triangles as well as circles, can be used to find the surface areas of cylinders, cones and spheres.
- Finding the volume of a cylinder is an extension of finding the volume of a rectangular prism. The volume of a rectangular prism is the product of the area of it base and its height. Similarly, the volume of a cylinder is equal to the product of the area of its circular base and its height.
- The volume of a cone is $\frac{1}{3}$ the volume of the cylinder given that the bases have the same radius and the heights are the same. The formula for the volume of a cone is $v=\frac{1}{3}Bh$, where B is the area of its circular base and h is the height of the cone.

II. Pacing Guide

Activity	New Jersey State Learning Standards (NJSLS)	Estimated Time (Blocks)
Unit 5 Pre-Unit Assessment *Optional*	7.EE.B.4, 7.RP. A.2.a, 7.RP.A.2.c, 7.NS.A.1, 7.NS.A.2, 6.EE.A.2.c, 7.G.B.6, 7.G.B.4, 3.MD.C.7, 3.MD.D.8	½
Lesson 1: Inputs and Outputs	8.F.A.1	1
Lesson 2: Introduction to Functions	8.F.A.1	1
Lesson 3: Equations for Functions	8.F.A, 8.F.A.1	1
Lesson 4: Tables, Equations and Graphs of Functions	8.F.A.1, 8.F.A.3	1
Lesson 5: More Graphs of Functions	8.F.A.1, 8.F.B.5	1
Lesson 6: Even More Graphs of Functions	8.F.B.5	1
Lesson 7: Connecting Representations of Functions	8.F.A.2, 8.F.A.3	1
Lesson 8: Linear Functions	8.F.A.2, 8.F.A.3, 8.F.A.4	1
Lesson 9: Linear Models	8.F.B.4	1
Lesson 10: Piecewise Linear Functions	8.F.B, 8.F.B.4, 8.F.B.5	1
Unit 5 Mid-Unit Assessment *Optional*	8.F.A.1, 8.F.B.5, 8.F.B.4, 8.F.A.3, 8.EE.C, 8.F.A.2,	**1**
Lesson 11: Filling Containers	8.F.B, 8.F.B.4	1
Lesson 12: How Much Will Fit?	8.G.C	1
Lesson 13: The Volume of a Cylinder	8.G.C.9	1
Lesson 14: Finding Cylinder Dimensions	8.G.C.9	1
Lesson 15: Volume of a Cone	8.G.C.9	1
Lesson 16: Finding Cone Dimensions	8.G.C.9	1
Lesson 17: Scaling One Dimension	8.F.A.1, 8.F.B, 8.G.C, 8.G.C.9	1
Lesson 18: Scaling Two Dimensions	8.F.A.3, 8.F.B, 8.G.C.9	1
Lesson 19: Estimating a Hemisphere	8.G.C, 8.G.C.9	1
Lesson 20: The Volume of a Sphere	8.G.C, 8.G.C.9	1
Lesson 21: Cylinders, Cones, and Spheres	8.G.C.9	1
Lesson 22: Volume As a Function of… ***(Project Based Learning)***	8.F.A, 8.G.C.9	1
Performance Task	8.F.A.2	½
Unit 5 End of Unit Assessment *Optional*	8.G.C.9, 8.F.A.3, 8.F.A.1, 8.F.B.4	**1**
Total Time		**25 Blocks**

Major Work Supporting Content Additional Content

III. Pacing Calendar

Please complete the pacing calendar based on the suggested pacing (*see Pacing Guide on page 2)*.

JANUARY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Please complete the pacing calendar based on the suggested pacing (*see Pacing Guide on page 2)*.

FEBRUARY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

Please complete the pacing calendar based on the suggested pacing (*see Pacing Guide on page 2)*.

MARCH

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	**2**	**3**	**4**	**5**	**6**	**7**
8	**9**	**10**	**11**	**12**	**13**	**14**
15	**16**	**17**	**18**	**19**	**20**	**21**
22	**23**	**24**	**25**	**23**	**27**	**28**
29	**30**	**31**				

IV. NJSLA Assessment Evidence Statements

Type I Type II Type III

NJSLS	Evidence Statement	Clarification	Math Practices	Calculator ?
8.F.1-1	Understand that a function is a rule that assigns to each input exactly one output.	i) Tasks do not involve the coordinate plane or the "vertical line test." ii) Some of functions in tasks are non-numerical. iii) Tasks should involve clearly defined inputs and outputs.	MP. 2	No
8.F.1-2	[Understand that] the graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	i) Functions are limited to those with inputs and outputs in the real numbers. ii) Most of the tasks require students to graph functions in the coordinate plane or read inputs and outputs from the graph of a function in the coordinate plane. iii) Some of the tasks require students to tell whether a set of points in the plane represents a function. iv) Tasks should involve clearly defined inputs and outputs.	MP. 2 MP. 5	No
8.F.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greatest rate of change.	i) Tasks have "thin context" 2 or no context. ii) Equations can be presented in forms other than y = mx + b, for example, 2x + 2y = 7.	MP. 2 MP. 5	Yes

8.F.3-1	Interpret the equation, y=mx + b as defining a linear function, whose graph is a straight line.	i) Tasks have "thin context" 2 or no context. ii) Equations can be presented in forms other than y = mx + b, for example, 2x + 2y =7.	MP. 2 MP. 7	No
8.F.3-2	Give examples of functions that are not linear and prove that they are not linear.	i) Tasks have "thin context" 2 or no context. ii) Tasks may require students to give examples of equations that are non-linear or pairs of points to show a function is non-linear. iii) Students are not required to produce a formal proof. For this aspect of 8.F.3, see 8.C.3.1.	MP. 7	No
8.F.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.	i) Tasks may or may not have a context.	MP. 2 MP. 4	Yes
8.F.5-1	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear).	i) Tasks may or may not have a context.	MP. 2 MP. 5	No
8.F.5-2	Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	i) Tasks may or may not have a context.	MP.2 MP.5 MP.7	No
8.G.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems	-	MP.1 MP.5	Yes

V. Differentiated Instruction

Supporting English Language Learners

The purpose of this document is to nudge the field forward by offering support to the next generation of mathematics learners and by challenging persistent assumptions about how to support and develop students' disciplinary language. The goal is to provide guidance to mathematics teachers for recognizing and supporting students' language development processes in the context of mathematical sense making. UL/SCALE provides a framework for organizing strategies and special considerations to support students in learning mathematics practices, content, and language. The framework is intended to help teachers address the specialized academic language demands in math when planning and delivering lessons, including the demands of reading, writing, speaking, listening, conversing, and representing in math (Aguirre & Bunch, 2012). Therefore, while the framework can and should be used to support all students learning mathematics, it is particularly well-suited to meet the needs of linguistically and culturally diverse students who are simultaneously learning mathematics while acquiring English.

For more information, click the link below:

Supporting ELL Learners

Supporting Students with Disabilities

The philosophical stance that guided the creation of these materials is the belief that with proper structures, accommodations, and supports, all children can learn mathematics. Lessons are designed to maximize access for all students and include additional suggested supports to meet the varying needs of individual students. While the suggested supports are designed for students with disabilities, they are also appropriate for many children who struggle to access rigorous, grade-level content. Teachers should use their professional judgment about which supports to use and when, based on their knowledge of the individual needs of students in their classroom.

For more information, click the link below:

Supporting Students with Disabilities

VI. Vocabulary

Dependent Variable:	A variable representing the output of a function.
Function:	A function is a rule that assigns to each allowable input exactly one output.
Independent Variable:	A variable representing the input of a function.

VII. Assessment Framework

Unit 5 Assessment Framework				
Assessment	**NJSLS**	**Estimated Time**	**Format**	**Graded ?**
Pre-Unit Diagnostic Assessment (Beginning of Unit – Optional) *Illustrative Mathematics*	7.EE.B.4, 7.RP.A.2.a, 7.RP.A.2.c, 7.NS.A.1, 7.NS.A.2, 6.EE.A.2.c, 7.G.B.6, 7.G.B.4, 3.MD.C.7, 3.MD.D.8	½ Block	Individual	Yes (No Weight)
Mid-Unit Assessment (After Lesson 10 - Optional) *Illustrative Mathematics*	8.F.A.1, 8.F.B.5, 8.F.B.4, 8.F.A.3, 8.EE.C, 8.F.A.2,	1 Block	Individual	Yes
End-of-Unit Assessment (End of Unit – Optional) *Illustrative Mathematics*	8.G.C.9, 8.F.A.3, 8.F.A.1, 8.F.B.4	1 Block	Individual	Yes

Unit 5 Performance Assessment Framework				
Assessment	**NJSLS**	**Estimated Time**	**Format**	**Graded ?**
Unit 5 Performance Task (Mid-March) *Battery Charging*	8.F.A.2	½ Block	Individual	Yes; Rubric
Unit 5 Performance Task Option 1 (Optional) *Introduction to Linear Function*	8.F.A.3	Teacher Discretion	Teacher Discretion	Yes, if administered
Extended Constructed Response (ECR)* (click here for access)	Dependent on unit of study & month of administration	Up to 30 minutes	Individual	Yes; Rubric

* Use the following links to access ECR protocol and district assessment scoring documents:

- *Assessment & Data in Mathematics Bulletin*
- *Extended Constructed Response Protocol*

Name _____ Block _____ Date _____

Battery Charging (8.F.A.2)

Sam wants to take his MP3 player and his video game player on a car trip. An hour before they plan to leave, he realized that he forgot to charge the batteries last night. At that point, he plugged in both devices so they can charge as long as possible before they leave.

Sam knows that his MP3 player has 40% of its battery life left and that the battery charges by an additional 12 percentage points every 15 minutes.

His video game player is new, so Sam doesn't know how fast it is charging but he recorded the battery charge for the first 30 minutes after he plugged it in.

time charging (minutes)	0	10	20	30
video game player battery charge (%)	20	32	44	56

a. If Sam's family leaves as planned, what percent of the battery will be charged for each of the two devices when they leave?

b. How much time would Sam need to charge the battery 100% on both devices?

8th Grade Battery Charging Name: _____ Date: _____

NJSLS: 8F.A.2 Type:_____ Teacher: _____

SOLUTION

a. **Student indicates that After 60 minutes Battery charge for the video game will be 92 percent and explains either with a table, equation or graph.**
b. **Students indicates that if Sam's family needs to wait just 15 more minutes then he can charge both of the devices 100% and explains the reason**

Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**	**Level 1: No Command**
Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical approach based on a conjecture and/or stated assumptions • a logical and complete progression of steps • complete justification of a conclusion with minor computational error	Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical approach based on a conjecture and/or stated assumptions • a logical and complete progression of steps • complete justification of a conclusion with minor conceptual error	Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical, but incomplete, progression of steps • minor calculation errors • partial justification of a conclusion • a logical, but incomplete, progression of steps	Constructs and communicates an incomplete response based on concrete referents provided in the prompt such as: diagrams, number line diagrams or coordinate plane diagrams, which may include: • a faulty approach based on a conjecture and/or stated assumptions • An illogical and Incomplete progression of steps • major calculation errors • partial justification of a conclusion	The student shows no work or justification.

8th Grade Battery Charging - Scoring Guide

Solution: Using equations

a. The battery charge of both devices can be modeled with linear functions. The wording describing the MP3 player suggests a linear function since it uses a constant rate of change. The table of values for the video game player shows a constant rate of change for the first 30 minutes. It is a reasonable assumption that the battery will continue to charge at the same rate. However, it is an assumption on our part. (Another possibility would be that as the battery charge approaches 100%, the rate of change decreases, but that would be much harder to model.)

The MP3 player charges at a rate of 12 percentage points every 15 minutes, which is equal to 0.8 percentage points per minute. If we let y be battery charge of the device (in percentage points) we have:

$$y=0.8t+40,$$

where t is measured in minutes.

We know that the video game player is initially 20% charged and from the table we see that the charge increases by an additional 12 percentage points every 10 minutes, or 1.2 percentage points per minute. So for this function we get:

$$y=1.2t+20.$$

Sam's family is planning to leave the house 60 minutes after Sam started charging his devices. We are looking for the charge when $t=60$:

MP3 player: $y=0.8\cdot 60+40=88$ % charged

video game player: $y=1.2\cdot 60+20=92$ % charged

b. To answer this question, we need to find the values of t for which each function has output value 100.

MP3 player: Solving $100=0.8t+40$ for t we have, $t=75$ minutes.

Video game player: Solving $100=1.2t+20$ for t we have $t=67$minutes.

So if Sam's family could wait just 15 more minutes, Sam could have both devices fully charged for the car trip.

Solution: Using tables

a. Since the video game player's battery charge is given in a table, we can extend the table and see what value it will give after 60 minutes. Note that the rate of change of the data in the table is constant: For every 10 minutes the charge increases by 12 percentage points. Assuming that this pattern continues, we have:

time charging (minutes)	0	10	20	30	40	50	60
Video game player battery charge (%)	20	32	44	56	68	80	92

b. We can make a similar table for the MP3 player:

time charging (minutes)	0	15	30	45	60
MP3 player battery charge (%)	40	52	64	76	88

c. So after 60 minutes, the MP3 player's battery would be 88% charged and the video game player will be 92% charged.

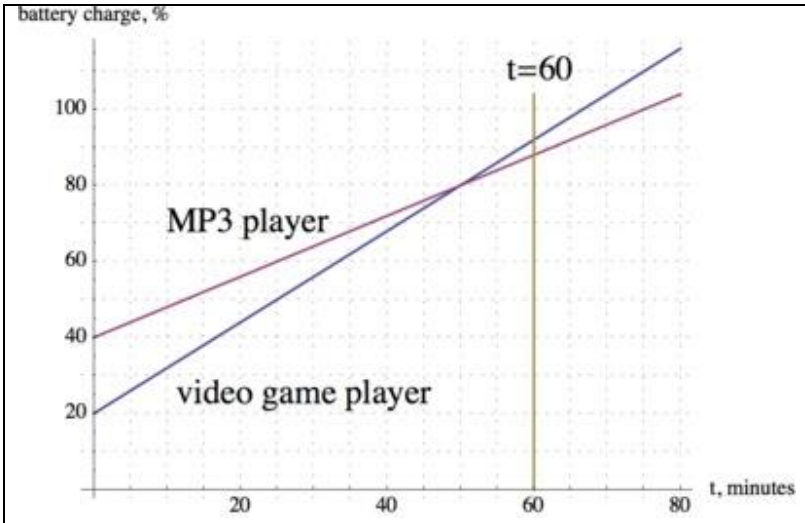
d. We can see from the table above that the MP3 player would be fully charged in another 15 minutes; we just have to add one more column to the table to find that answer.

The video game player will need less than 10 minutes to fully charge, since we are only missing 8 percentage points after 60 minutes. To be exact, using the rate of increase, we will need 2/3 of 10 minutes, which is just under 7 minutes.

Solution: Using graphs

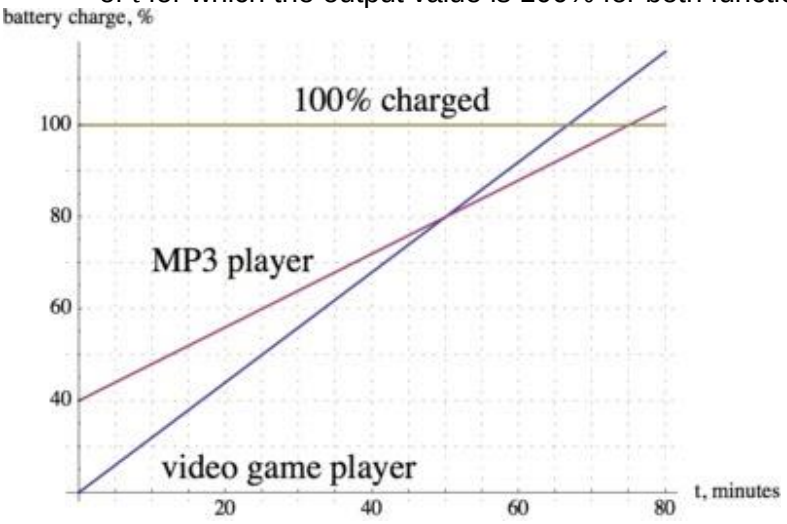
a. With the given information, it is quite straight-forward to graph the functions for both devices. For the MP3 player we have a starting value (i.e. vertical intercept) of 40% and a rate of change (i.e. slope) of 12/15 = 0.8 percentage points per minute.

For the video game player we have a starting value of 20% and the rate of change for the data in the table is constant at 12/10 = 1.2 percentage points per minute. Below are the two graphs.



We can estimate from the graph that after 60 minutes the MP3 player has a battery charge of just under 90% and the video game player has a battery charge of just over 90%. Zooming in on a graphing calculator or other graphing device would give us better estimates.

b. To find out how long it will take until both batteries are fully charged, we need to find values of t for which the output value is 100% for both functions.



From the graph we see that the MP3 player will take the longest to charge and it will take about 75 minutes total. So if Sam's family can wait an extra 15 minutes before they leave, Sam would have both devices fully charged.

Name _____ Block _____ Date _____

Introduction to Linear Function (8.F.A.3)

a. Decide which of the following points are on the graph of the function $y=2x+1$:
   - $(0,1),(2,5),(12,2),(2,-1),(-1,-1),(0.5,1)$.
   - Find 3 more points on the graph of the function.

b. Find several points that are on the graph of the function $y=2x^2+1$.
   - Plot the points in the coordinate plane. Is this a linear function?
   - Support your conclusion.

c. Graph both functions and list as many differences between the two functions as you can.

IX. Modifications

Special Education/ 504:	English Language Learners:
-Adhere to all modifications and health concerns stated in each IEP. -Give students a MENU options, allowing students to pick assignments from different levels based on difficulty. -Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time -Allow students to demonstrate understanding of a problem by drawing the picture of the answer and then explaining the reasoning orally and/or writing , such as Read-Draw-Write -Provide breaks between tasks, use positive reinforcement, use proximity -Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum by using manipulatives -Implement supports for students with disabilities (click here) - Make use of strategies imbedded within lessons -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 17-18) - Strategies for students with 504 plans	- Use manipulatives to promote conceptual understanding and enhance vocabulary usage - Provide graphic representations, gestures, drawings, equations, realia, and pictures during all segments of instruction - During i-Ready lessons, click on “Español” to hear specific words in Spanish - Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information - Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve word problems - Utilize program translations (if available) for L1/ L2 students - Reword questions in simpler language - Make use of the ELL Mathematical Language Routines (click here for additional information) -Scaffolding instruction for ELL Learners -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 16-17)
Gifted and Talented:	**Students at Risk for Failure:**
- Elevated contextual complexity - Inquiry based or open ended assignments and projects - More time to study concepts with greater depth - Promote the synthesis of concepts and making real world connections - Provide students with enrichment practice that are imbedded in the curriculum such as: ● Application / Conceptual Development ● Are you ready for more? - Provide opportunities for math competitions - Alternative instruction pathways available - Common Core Approach to Differentiate Instruction: Students with Disabilities (pg. 20)	- Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum - Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Peer Support - Constant parental/ guardian contact - Provide academic contracts to students & guardians - Create an interactive notebook with samples, key vocabulary words, student goals/ objectives. - Plan to address students at risk in your learning tasks, instructions, and directions. Anticipate where the needs will be, then address them prior to lessons. -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 19)

21st Century Life and Career Skills:

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2**. Apply appropriate academic and technical skills.
- **CRP3**. Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5**. Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7**. Employ valid and reliable research strategies.
- **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9**. Model integrity, ethical leadership and effective management.
- **CRP10**. Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

Students are given an opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are encouraged to reason through experiences that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, calculators, and educational websites.

Technology Standards:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.
https://www.state.nj.us/education/cccs/2014/tech/

8.1 Educational Technology:

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

A. **Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations.
B. **Creativity and Innovation:** Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
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.
D. **Digital Citizenship:** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
E. **Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use of information.
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.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

A. **The Nature of Technology: Creativity and Innovation-** Technology systems impact every aspect of the world in which we live.
B. **Technology and Society:** Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society.
C. **Design:** The design process is a systematic approach to solving problems.
D. **Abilities in a Technological World:** The designed world in a product of a design process that provides the means to convert resources into products and systems.
E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Interdisciplinary Connections:	
English Language Arts:	
L.8.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
W.8.1	Write arguments to support claims with clear reasons and relevant evidence.

X. Core Instruction & Supplemental Resources

Core Instruction

ILLUSTRATIVE MATHEMATICS V. 2019
(OPEN UP RESOURCES)

GRADE	TEACHER RESOURCES	STUDENT RESOURCES
6	• **Teacher Edition: Unit 1-9** • Online Course Guide	• Student Workbook Set: Unit 1-9 • Online Student Access (Digital Applets)
7	• **Teacher Edition: Unit 1-9** • Online Course Guide	• Student Workbook Set: Unit 1-9 • Online Student Access (Digital Applets)
8	• **Teacher Edition: Unit 1-9** • Online Course Guide	• Student Workbook Set: Unit 1-9 • Online Student Access (Digital Applets)

5 Practices for Orchestrating Productive Mathematics Discussions

Anticipate

Consider how students might mathematically interpret a problem, the array of strategies—both correct and incorrect—that they might use to tackle it, and how those strategies and interpretations might relate to the mathematical concepts, representations, procedures, and practices that you would like the students to learn.

- Solve the problem yourself first. If possible work with colleagues.
- Ask yourself the following questions:
  - What strategies have students used in the past?
  - What representations are students most likely to use?
  - What incorrect or unproductive strategies are students likely to try?
  - What things might get in the way of students being able to engage with the problem? How can you remove those barriers?
  - What questions will you ask those who struggle?

Monitor

Pay close attention to students' mathematical thinking and solution strategies as they work on the task.

- Create a list of strategies the students may produce.
- Circulate the room. Watch and listen to students as they work.
- If any students use strategies you anticipated, write their name or group number on your list.
- Ask questions that will help students make their thinking visible.
- Ask questions that will help students clarify their thinking.
- Press students to consider aspects of the task to which they need to attend.

Select

Select particular students to share their work with the rest of the class to get specific mathematics into the open for discussion. The selection of particular students and their solutions is guided by the previously anticipated strategies and your assessment of how each approach will contribute to that goal.

- Based on the previously anticipated strategies and the mathematical goal of the activity, decide which student strategies to highlight.
- Select students who will share their work with the class.

Sequence

Make purposeful choices about the order in which students' work is shared to maximize the chances of achieving the mathematical goals for the discussion.

- Based on the mathematical goal, decide on the purpose for the sequence of work. For example: least efficient to most efficient, concrete to abstract, misconceptions to conceptions, or building representations.
- Decide in which order students will present their work.

Connect

Help students draw connections between their solutions and other students' solutions as well as the key mathematical ideas in the lesson. Help students to make judgments about the consequences of different approaches for the range of problems that can be solved, one's likely accuracy and efficiency in solving them, and the kinds of mathematical patterns that can be most easily discerned. Know where you want the discussion to "land" and make choices that are likely to get you there. If necessary, you may have to demonstrate an approach that students didn't come up with themselves.

- As students share, ask questions to elicit and clarify student thinking.
- After each student shares, ask questions to connect it to previously shared work or ask a student to summarize what another student said in their own words.
- Ask students to compare and contrast strategies or representations during the discussion.
- If students did not come up with an approach that you need them to see in order for the discussion to "land," demonstrate this approach and connect it to the work that students did.

IDEAL MATH BLOCK

Whole Group Instruction	55min	INSTRUCTION (Grades 3 – 8) Daily Routine: Mathematical Content or Language Routine (7 – 10 min) Anchor Task: Anticipate, Monitor, Select, Sequence, Connect Tech Integration: Digital applets embedded within lessons designed to enhance student learning Collaborative Work* Guided Learning/Guided Practice Independent Work (Demonstration of Student Thinking) Additional Activities / Let's Practice		
Rotation Stations (Student Notebooks & Chromebooks Needed)	1-2X 30 min	STATION 1: Focus on current Grade Level Content STUDENT EXPLORATION* Independent or groups of 2-3 Emphasis on MP's 3, 6 (Reasoning and Precision) And MP's 1 & 4 (Problem Solving and Application) TOOLS/RESOURCES Practice Problems Extra Practice/Enrichment Are you ready for more? Put Your Thinking Cap On	STATION 2: Focus on Student Needs TECH STATION Independent TECH INTEGRATION iReady - *i-Ready* delivers online lessons driven by student data to provide tailored instruction that meets students where they are in their learning trajectory. Dreambox (ELL) – Adaptive online learning platform.	TEACHER STATION: Focus on Grade Level Content; heavily scaffolded to connect deficiencies TARGETED INSTRUCTION 4 – 5 Students TOOLS/ RESOURCES Homework Manipulatives Reteach Workbook Transition Guide *all students seen in 2 weeks
Closure	5 min	INSTRUCTION Exit Ticket (Demonstration of Student Thinking) TOOLS/RESOURCES Notebooks or Exit Ticket Slips		

* Promotes discourse and collaboration

Supplemental Resources

Achieve the Core

Tasks - https://achievethecore.org/category/416/mathematics-tasks

Coherence Map - https://achievethecore.org/page/1118/coherence-map

Embarc

https://embarc.online/

Engage NY

https://www.engageny.org/ccss-library/?f%5B0%5D=field_subject%253Aparents_all%3A13601

iReady Digital Platform

https://login.i-ready.com/

Illustrative Mathematics

Content Standard Tasks - https://tasks.illustrativemathematics.org/content-standards

Practice Standard Tasks - https://tasks.illustrativemathematics.org/practice-standards

Open Up Resources - https://access.openupresources.org/sign_in

iM Additional Resources - https://bit.ly/imshare

Khan Academy

https://www.khanacademy.org/math/illustrative-math

NJDOE Digital Item Library

https://nj.digitalitemlibrary.com/home?subject=Math

Ready Teacher Toolbox

https://teacher-toolbox.com/