6.EE: EXPRESSIONS & EQUATIONS

Cluster Statement: C: Represent and analyze quantitative relationships between dependent and independent variables.

Major Cluster (Students should spend the large majority of their time (65-85%) on the major work of the grade/course. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.)

Standard Text	Standard for Mathematical Practices	Students who demonstrate understanding can:
6.EE.C.9: Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.*	SMP 1: Students will make sense of problems and persevere in solving them by using algebraic reasoning to understand real-world and mathematical problems. They will interpret the unknown variable and what it represents in context. They identify an appropriate strategy to apply when solving the problem. Students will build upon their prior experiences and background knowledge with numerical expressions to make sense of the problem. They may ask themselves questions such as: "What are you trying to find?" "What do you know from the problem?" "What is the unknown?" "What is the relationship between the known and unknown numbers?" SMP 2: Students reason abstractly and quantitatively by representing a wide variety of real-world contexts through the use of real numbers and variables in mathematical terms. Students consider the context contained in the problem to understand the meaning of the number or variable. They use algebraic and mathematical reasoning when writing an expression. SMP 4**:** Students will model with mathematics by using numerical and algebraic expressions and symbols such as variables, numbers, parentheses, operators,	• Use variables to represent unknowns in a real-world problem and write an equation to show the relationship between two changing quantities. • Describe the variables in context of dependent and independent • Analyze the relationship between the dependent and independent variables using tables, graphs and equations.
		Webb's Depth of Knowledge: 1-3
		Bloom's Taxonomy: Apply, Analyze

etc. to represent a mathematical or real-world problem.

SMP 6: Students will attend to precision when communicating their solutions using precise and accurate mathematical language. They will calculate the solution to the expression accurately. They will correctly label any numbers in a real-world problem, and they will correctly label any visual models they use to support or defend their answers.

SMP 7: Students will look for and make use of structure when interpreting a real-world problem using their understanding of the word meanings and the structure of mathematical and algebraic expressions.

Previous Learning Connections	**Current Learning Connections**	**Future Learning Connections**
• In Grade 5, learners are taught how to generate patterns from rules that are given to them. This will connect when students are analyzing the relationship between the dependent and independent variables in this cluster.	• The students will expand their knowledge of 6.EE.7 in this cluster by continuing practice of writing equations in real-world situations. The students will expand their knowledge of 6.RP.3 by continuing to find relationships with numbers through rate reasoning.	• The students will continue using dependent and independent variables and noticing patterns throughout the rest of their mathematical career, showing up mainly in the RP clusters and as they dive in to linear and non-linear relationships. In high school, they will be using this knowledge as they construct and compare linear, quadratic, and exponential models.

Clarification Statement:

The focus for this cluster is using variables to represent two quantities in a real-world problem that change in relationship to one another. Students write an equation and analyze the relationship between the dependent and independent variables using graphs and tables.

Common Misconceptions
- Students may confuse what the graph represents in context. For example, that moving up or down on a graph does not necessarily mean that a person is moving up or down.
- Students may reverse the independent and dependent variable in an equation, graph or table.

Multi-Layered System of Supports (MLSS)/Suggested Instructional Strategies

       Pre-Teach

Pre-teach (targeted): *What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*

- For example, some learners may benefit from targeted pre-teaching that previews new contexts for tasks within the unit when studying relationships between dependent and independent variables because this standard introduces new information i.e., to understand the relationship between dependent and independent variables. The dependent variable is the variable that can be changed; one that is affected by the change in the independent variable.

Pre-teach (intensive): *What critical understandings will prepare students to access the mathematics for this cluster?*

- 5.O.A.B.3. This standard provides a foundation for work with summarizing and analyzing relationships between dependent and independent variables because representing two quantities in a real-world problem can be generated from a pattern using given rules. Students represent quantitative relationships in different ways. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

Core Instruction

Access

Interest: *How will the learning for students provide multiple options for recruiting student interest?*

- For example, learners engaging with quantitative relationships between dependent and independent variables benefit when learning experiences include ways to recruit interest such as providing choices in their learning, for example, given a problem set of 15 different situations, students will choose at least three items based on their interest to identify the dependent variable and the independent variable because students engage themselves in learning when they are interested in the topic and have student choice.

Build

Effort and Persistence: *How will the learning for students provide options for sustaining effort and persistence?*

- For example, learners engaging with relationships between dependent and independent variables benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as providing alternatives in the mathematics representations and scaffolds because students need to understand how the expressions or equations relate to situations presented, as well as the process of solving them by exposing them to different representations.

Language and Symbols: *How will the learning for students provide alternative representations to ensure accessibility, clarity and comprehensibility for all learners? (e.g., a graph illustrating the relationship between two variables may be informative to one learner and inaccessible or puzzling to another; picture or image may carry very different meanings for learners from differing cultural or familial backgrounds).*

- For example, learners engaging with quantitative relationships between dependent and independent variables benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity and comprehensibility for all learners such as highlighting how complex terms, expressions, or equations are composed of simpler words or symbols by attending to the structure because the purpose of this cluster is for students to understand the

relationship between two variables, which begins with the distinction between dependent and independent variables. The independent variable is the variable that can be changed and is graphed on the x-axis; the dependent variable is the variable that is affected by the change in the independent variable and is graphed on the y-axis. Students are expected to recognize and explain the effect on the dependent variable when the independent variable changes.

Expression and Communication: *How will the learning provide multiple modalities for students to easily express knowledge, ideas, and concepts in the learning environment?*
- For example, learners engaging with quantitative relationships between dependent variable and independent variable benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing sentence starters or sentence strips, for example, "the ___ variable depends of ___ variable" or " as the number of ___variable increases, the number of ___variable increases/decreases" because this strategy provides opportunities for students to explain their thinking and respond to the mathematical thinking of others.

Internalize

Comprehension: *How will the learning for students support transforming accessible information into usable knowledge, knowledge that is accessible for future learning and decision-making?*
- For example, learners engaging with quantitative relationships between dependent and independent variables benefit when learning experiences attend to students by intentionally building connections to prior understandings and experiences; relating important information to the learning goals; providing a process for meaning making of new learning; and, applying learning to new contexts such as provide tasks with multiple entry points and optional pathways because students connect the pieces together, students use multiple representations for the mathematical relationship. Students translate freely among the words, models, tables, graphs and equations. Students start with any of the representations and understand or explain the relationship to others.

Re-teach

Re-teach (targeted): *What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?*
- For example, students may benefit from re-engaging with content during a unit on relationships of dependent and independent variables by critiquing student approaches/solutions to make connections through a short mini lesson because it allows students to receive immediate feedback of their work. It may even make sense for a student's critique of their peer's work to be part of making connections. It is important that it doesn't simply focus on the right or wrong solutions but presents a balanced view that allows improvement and redirection of students' learning.

Re-teach (intensive): *What assessment data will help identify content needing to be revisited for intensive interventions?*
- For example, some students may benefit from intensive extra time during and after a unit on summarizing and analyzing dependent and independent variables by offering opportunities to understand and explore different strategies because quantitative relationships can be presented in different forms. Students mastery of identifying the dependent variable and the independent variable from real-world problems leads to a deeper understanding of the connections between the equation to a graph, table or written description that show the same relationship.

Extension

4

> *What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?*
> - For example, some learners may benefit from an extension such as open ended tasks linking multiple disciplines when studying relationships between the dependent and independent variables because providing multiple situations for the student to analyze and determine what unknown is dependent on the other components allows students' thinking and creativity to happen. One example is the use of technology, including computer apps and other hand-held technology that allows the collection of real-time data to create tables and charts. It is important for students to realize that although real-world data often is not linear, a line sometimes can model the data.

Culturally and Linguistically Responsive Instruction:

Validate/Affirm: How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?

Build/Bridge: How can you create connections between the cultural and linguistic behaviors of your students' home culture and language the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?

Using and Connecting Mathematical Representations: The standard for mathematical practice, use appropriate tools strategically, provides a strong foundation to validate and bridge for students. Mathematical representations are mathematical tools. The linguistic and cultural experiences of students provide different and varied types of representations for solving mathematical problems. By explicitly encouraging students to use multiple mathematical representations students can draw on their "mathematical, social, and cultural competence". By valuing these representations and discussing them we can connect student representations to the representations of school mathematics and build a bridge for students to position them as competent and capable mathematicians. For example, when studying how to represent and analyze quantitative relationships between dependent and independent variables the use of mathematical representations within the classroom is critical because students can use many forms to represent relationships between quantities. Multiple representations include describing the relationship using language, a table, an equation, or a graph. Translating between multiple representations helps students understand that each form represents the same relationship and provides a different perspective.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: Cognia Testlet for Grade 6: Expressions & Equations-Represent and analyze quantitative relationships

A zoo has two young alligators named Scales and Claw. This table compares the lengths of the two alligators at different times in their lives.

Length of Scales in inches (s)	Length of Claw in inches (c)
12	18
16	24
20	30

a. Based on the information in the table, write an equation that can be used to find s, the length in inches of Scales when Claw is c inches long.

b. Scales is now 32 inches long. How long is Claw?

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involving motion at constant speed, list and graph ordered pairs of distances and times and write the equation d = 65t to represent the relationship between distance and time.

- Learning Target: I can write an equation to represent a relationship and use the equation to find a value.
- Webb's Depth of Knowledge: 2
- This type of assessment question requires students to analyze a table and write an equation that represents the relationship between the length of scales and the length of inches and then to use the equation to calculate a variable that isn't represented on the table. The teacher can evaluate a student's ability to first analyze a relationship between the columns on the table, which variable is dependent, and which is independent. Then, the teacher can determine if a student can take the information to create an equation that fits the data reflected on the table but also data points beyond. A task like this allows students to enter the problem by first just noticing and wondering about the table but then parts A and B require elements of the standard and allow the teacher to evaluate a student's understanding based on completion.

Relevance to families and communities:	**Cross-Curricular Connections**
During a unit focused on representing and analyzing quantitative relationships between dependent and independent variables, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, the cost of making one Navajo ceremonial basket is $150. Students create an equation, a table of values and graphical representations of the situation. From the context, equation, or graph, students determine which variable is in a dependent relationship and independent relationship.	Science: Students can create expressions to anticipate the real-world events that happen. Students must understand that events that occur at one scale, may not occur at a larger/smaller scale. Students will be able to create expressions about the scale of cells and molecules as well as create a visual representation of the phenomena that occur within these smaller structures. They will analyze the independent and dependent variables in these situations. https://www.nextgenscience.org/pe/ms-ls1-1-molecules-organisms-structures-and-processes

Cross-curricular English continued:

English:
- RST.6.8.3- following precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.6.8.4- demonstrating the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grade 6-8 texts and topics.
- RST.6.8.7- distinguish among facts, reasoned judgment based on research findings, and speculations in a text.
- SL.6.1- engage effectively in a range of collaborative discussions (one-on-one, in groups and teacher-led) with diverse partners on grade 6 topics, texts, and issues building on other's ideas and expressing their own clearly.