

## Green Township School District Gr. 8 Math Curriculum - July 2018

### *Unit 4: Linear Equations & Real Numbers* (Approximate Instructional Time: 10 weeks)

| NJ Student Learning Standards   | Suggested Standards for Mathematical Practice  | Critical Knowledge & Skills<br><i>(Learning goals are for the Unit but may not necessarily be in sequential order.)</i>   |
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| <p><b>Topic A</b><br/>8.EE.C.7. Solve linear equations in one variable.</p> <p>a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form <math>x = a</math>, <math>a = a</math>, or <math>a = b</math> results (where <math>a</math> and <math>b</math> are different numbers).</p> <p>b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.</p> | <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>  | <p>Concept(s):</p> <ul style="list-style-type: none"> <li>● <i>Linear equations may have an infinite number of solutions.</i></li> <li>● <i>Linear equations may have no solution or a single solution.</i></li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● Give examples of linear equations in one variable with one solution (<math>x = a</math>), infinitely many solutions (<math>a = a</math>), or no solutions (<math>a = b</math>.)</li> <li>● Transform a given equation, using the properties of equality, into simpler forms.</li> <li>● Transform a given equation until an equivalent equation of the form <math>x = a</math>, <math>a = a</math>, or <math>a = b</math> results (<math>a</math> and <math>b</math> are different numbers).</li> <li>● Solve linear equations that have fractional coefficients; include equations requiring use of the distributive property and collecting like terms.</li> </ul> <p><b>Learning Goal 1:</b> Apply the distributive property and collect like terms to solve linear equations in one variable that contain rational numbers as coefficients.</p> <p><b>Learning Goal 2:</b> Use an equivalent equation of the form <math>x = a</math>, <math>a = a</math>, or <math>a = b</math> (where <math>a</math> and <math>b</math> are different numbers) to describe the number of solutions.</p> |
| <p><b>Additional Topic</b><br/>8.NS.A.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., <math>\pi^2</math>). <i>For example, by truncating the decimal expansion of <math>\sqrt{2}</math>, show that <math>\sqrt{2}</math> is between 1 and 2, then between 1.4 and</i></p>  | <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> | <p>Concept(s): <i>Rational approximation of irrational numbers</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● Compare irrational numbers by replacing each with its rational approximation.</li> <li>● Locate rational approximations on a number line.</li> <li>● Estimate the value of expressions containing irrational numbers.</li> </ul> <p><b>Learning Goal 3:</b> Use rational numbers to approximate irrational numbers, locate</p>   |

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| <p>1.5, and explain how to continue on to get better approximations.</p>   |  | <p>irrational numbers on a number line, and estimate the value of expressions containing irrational numbers</p>   |
| <p>8.G.B.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.</p>  | <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.7 Look for and make use of structure.</p>  | <p>Concept(s): <i>Pythagorean Theorem and irrational numbers</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● Use the Pythagorean Theorem to find solutions that may contain irrational numbers.</li> </ul> <p><b>Learning Goal 4:</b> Apply the Pythagorean Theorem to mathematical and real world problems where irrational numbers are included in the situations.</p>  |
| <p>8.EE.A.2. Use square root and cube root symbols to represent solutions to equations of the form <math>x^2 = p</math> and <math>x^3 = p</math>, where <math>p</math> is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that <math>\sqrt{2}</math> is irrational.</p> | <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p> | <p>Concept(s):</p> <ul style="list-style-type: none"> <li>● <i>Square root and cube roots; perfect squares and perfect cubes</i></li> <li>● <i>Inverse relationship between powers and square roots</i></li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● Give the value of square roots of small perfect squares.</li> <li>● Solve equations of the form <math>x^2 = p</math>, where <math>p</math> is a positive rational number.</li> <li>● Use the square root symbol to represent solutions to equations of the form <math>x^2 = p</math>.</li> <li>● Give the value of cube roots of small perfect cubes.</li> <li>● Solve equations of the form <math>x^3 = p</math>, where <math>p</math> is a positive rational number.</li> <li>● Use the cube root symbol to represent solutions to equations of the form <math>x^3 = p</math>.</li> <li>● Show or explain that <math>\sqrt{2}</math> is an irrational number.</li> </ul> <p><b>Learning Goal 5:</b> Evaluate square roots and cubic roots of small perfect squares and cubes respectively and use square and cube root symbols to represent solutions to equations of the form <math>x^2 = p</math> and <math>x^3 = p</math> where <math>p</math> is a positive rational number; identify <math>\sqrt{2}</math> as irrational.</p> |
| <p>8.G.B.6. Explain a proof of the Pythagorean Theorem and its converse.</p>   | <p>MP.2 Reason abstractly and quantitatively.</p>  | <p>Concept(s): <i>Converse of the Pythagorean Theorem</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● Solve problems involving the converse of the Pythagorean Theorem.</li> </ul> <p><b>Learning Goal 6:</b> Solve problems involving the converse of the Pythagorean Theorem using irrational numbers.</p>  |

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| <p>8.G.B.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.</p>  | <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.7 Look for and make use of structure.</p>  | <p>Concept(s): <i>Pythagorean Theorem &amp; irrational numbers</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>Determine side lengths of right triangles by applying the Pythagorean Theorem to solve real world and mathematical problems involving two dimensional spaces.</li> </ul> <p><b>Learning Goal 7:</b> Apply the Pythagorean Theorem to determine unknown side lengths of right triangles in two dimensional cases when solving real world and mathematical problems involving irrational and rational numbers.</p>  |
| <p>8.G.B.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system</p>   | <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.7 Look for and make use of structure.</p>  | <p>Concept(s): <i>Pythagorean Theorem and distance on coordinate plane.</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>Determine the distance between two points in a coordinate plane by drawing a right triangle and applying the Pythagorean Theorem.</li> </ul> <p><b>Learning Goal 8:</b> Use the Pythagorean Theorem to determine the distance between two points in the coordinate plane.</p>  |
| <p><b>Topic B</b><br/>8.EE.B.5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. <i>For example, compare a distance-time graph to a distance time equation to determine which of two moving objects has greater speed.</i></p>  | <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p> | <p>Concept(s): <i>Quantitative relationships can be represented in different ways.</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>Graph proportional relationships.</li> <li>Interpret unit rate as the slope of a graph.</li> <li>Compare two different proportional relationships that are represented in different ways (table of values, equation, graph, verbal description).</li> </ul> <p><b>Learning Goal 9:</b> Graph proportional relationships, interpreting slope as unit rate, and compare two proportional relationships, each represented in different</p> |
| <p>8.EE.B.6. Use similar triangles to explain why the slope <math>m</math> is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation <math>y = mx</math> for a line through the origin and the equation <math>y = mx + b</math> for a line intercepting the vertical axis at <math>b</math>.</p> | <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p>   | <p>Concept(s): <i>Using similar triangles to understand concepts of slope.</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>Show, using similar triangles, and explain why the slope, <math>m</math>, is the same between any two distinct points on a non-vertical line.</li> <li>Derive, from two points, the equation <math>y = mx</math> for a line through the origin.</li> <li>Derive, from two points, the equation <math>y = mx + b</math> for a line intercepting the</li> </ul>   |

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|  | <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>  | <p style="text-align: center;">vertical axis at b.</p> <p><b>Learning Goal 10:</b> Derive the equation of a line (<math>y = mx</math> for a line through the origin and the equation <math>y = mx + b</math> for a line intercepting the vertical axis at b).</p> <p><b>Learning Goal 11:</b> use similar triangles to explain why the slope (<math>m</math>) is the same between any two points on a non-vertical line in the coordinate plane.</p>  |
| <p>8.EE.C.8. Analyze and solve pairs of simultaneous linear equations.</p> <p>a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.</p> <p>b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, <math>3x + 2y = 5</math> and <math>3x + 2y = 6</math> have no solution because <math>3x</math></p> <p>c. Solve real-world and mathematical problems leading to two linear equations in two variables. <i>For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.</i></p> | <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p>   | <p>Concept(s):</p> <ul style="list-style-type: none"> <li>● <i>Simultaneous linear equations may have an infinite number of solutions.</i></li> <li>● <i>Simultaneous linear equations may have no solution or a single solution.</i></li> <li>● <i>Solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs.</i></li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● Solve systems of two linear equations in two variables algebraically.</li> <li>● Estimate solutions of a linear system of two equations by graphing.</li> <li>● Solve simple cases of a linear system of two equations by inspection.</li> <li>● Solve real-world and mathematical problems leading to two linear equations in two variables.</li> </ul> <p><b>Learning Goal 12:</b> Solve systems of linear equations in two variables algebraically and by inspection.</p> <p><b>Learning Goal 13:</b> Estimate solutions by graphing, explain that points of intersection satisfy both equations simultaneously, and interpret solutions in context.</p> |
| <p><b><u>Interdisciplinary Connections:</u></b></p> <p><b><u><a href="#">NGSS Appendix for Alignment</a></u></b></p>   | <p><b><u>Science:</u></b></p> <p><b>MS-PS2 Motion and Stability: Forces and Interactions</b><br/> <i>Expressions and Equations (6–8.EE). Science example: Interpret an expression in terms of a physical context, e.g., interpret the expression <math>F_1 + F_2</math> in a diagram as representing the net force on an object.</i></p> <p><b>MS-LS2 Ecosystems: Interactions, Energy, and Dynamics: As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, write and solve equations, and use basic statistics:</b><br/> <i>Expressions and Equations (6–8.EE). Science examples: (1) Write a number sentence that expresses the conservation of total matter or energy in a system as matter or energy flows into, out of, and within it. Assign values to the arrows in a diagram to show flows</i></p> |   |

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quantitatively. (2) *Infer an unknown matter or energy flow in a system by using the concept of conservation to write and solve an equation with a variable.*

### English-Language Arts:

**RI.8.4.** Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.

**RI.8.5.** Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to develop and to refine a key concept.

**RI.8.6.** Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.

**RI.8.7.** Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.

**W.8.2.** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

A. Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia).

B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.

D. Use precise language and domain-specific vocabulary to inform about or explain the topic.

E. Establish and maintain a formal style/academic style, approach, and form.

F. Provide a concluding statement or section that follows from and supports the information or explanation presented.

**W.8.4.** Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

**W.8.5.** With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

**W.8.6.** Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.

**W.8.7.** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

**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.

A. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

B. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.

C. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.

D. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.

**SL.8.2.** Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate

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|  | <p>the motives (e.g., social, commercial, political) behind its presentation.</p> <p><b>SL.8.3.</b> Delineate a speaker’s argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.</p> <p><b>SL.8.5.</b> Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p>   |
| <p><a href="#"><u>21st Century Skills/ Career Ready Practices:</u></a></p> | <p><b>CRP1. Act as a responsible and contributing citizen and employee.</b></p> <ul style="list-style-type: none"> <li>● Students will learn to work respectfully in groups within the classroom.</li> </ul> <p><b>CRP2. Apply appropriate academic and technical skills.</b></p> <ul style="list-style-type: none"> <li>● Students will use technology to collect and compare data to understand concepts with linear equations as applied to real world situations such as in astronomy, biology, physics, finance, video games and population.</li> </ul> <p><b>CRP4. Communicate clearly and effectively and with reason.</b></p> <ul style="list-style-type: none"> <li>● In line with the mathematical practices, students will explain and defend their reasoning when working on tasks in class and support this reasoning with evidence either verbally or in writing.</li> </ul> <p><b>CRP5. Consider the environmental, social and economic impacts of decisions.</b></p> <ul style="list-style-type: none"> <li>● Through the course of real world applications and use of linear equations and systems of equations, students will have the opportunity to discuss issues related to the environment (astronomy, bacteria), society (population) and economics (population, finance).</li> </ul> <p><b>CRP6. Demonstrate creativity and innovation.</b></p> <ul style="list-style-type: none"> <li>● Students are encouraged to look at more than one way to solve a problem. This is evident through tasks that require the mathematical practice: modeling with mathematics.</li> </ul> <p><b>CRP7. Employ valid and reliable research strategies.</b></p> <ul style="list-style-type: none"> <li>● Students will have the opportunity when exploring real world applications and resources through the Internet to question the validity of the data presented, and to use the information gathered to make decisions.</li> </ul> <p><b>CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.</b></p> <ul style="list-style-type: none"> <li>● Students will be prompted to explore and determine the meaning of each term of a linear equation written in slope-intercept form.</li> <li>● Students will need to make sense of problems and persevere in solving linear equations and systems of linear equations.</li> </ul> <p><b>CRP9. Model integrity, ethical leadership and effective management.</b></p> <ul style="list-style-type: none"> <li>● Students will learn time management skills when given both short-term and long-term tasks to complete.</li> <li>● Students will learn leadership skills when working with groups.</li> <li>● Students model integrity when completing assignments independently.</li> </ul> <p><b>CRP10. Plan education and career paths aligned to personal goals.</b></p> <ul style="list-style-type: none"> <li>● In this unit, various real world applications are explored which may lead to a student’s interest in a particular career field.</li> </ul> <p><b>CRP11. Use technology to enhance productivity.</b></p> <ul style="list-style-type: none"> <li>● Students will use technology (calculator, online resources) to understand slope and to graph the relationship between two variables.</li> </ul> <p><b>CRP12. Work productively in teams while using cultural global competence.</b></p> <ul style="list-style-type: none"> <li>● When working in groups, students will be encouraged to include all members and to encourage the contribution of all members.</li> </ul> |
| <p><a href="#"><u>2014 NJ Technology Standards:</u></a></p>                | <p><b>8.1 Educational Technology</b> (<a href="#">Word</a>   <a href="#">PDF</a>)</p>   |

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

- **8.1.8.A.1:** Students will use technology (calculator, online resources) to understand slope and to graph the relationship between two variables.
- **8.1.8.F.1:** Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.

### **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming**

([Word](#) | [PDF](#))

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.

Please see relevant projects for technology standards [8.1](#) and [8.2](#):

| District/School Primary and Supplementary Resources  |   |
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| <p><b>Primary Resource:</b></p> <p><a href="#"><u><b>Eureka Math (Unbound Ed - Module 4)</b></u></a></p> | <p><b>Supplementary Resources:</b></p> <p><i>Algebra I</i> (Glencoe 2018)</p> <p><i>Larsen Pre-Algebra</i> (Houghton Mifflin Harcourt 2012) <i>Chapter 8: Lessons 8.2-8.6; 8.8</i></p> <p><i>NJ Progress for Grade 8</i> (William H. Sadlier) Unit 2: Lessons 10-15</p> <p><i>Understanding Algebra I</i> (The Critical Thinking Company)</p> <p><a href="#">Open Up Resources Online Curriculum</a></p> <p><b>Khan Academy</b></p> <p><a href="#">eMath : Unit 4 from Alg 1</a></p> <p><a href="#">eMath : Unit 5 from Alg 1</a></p> <p><a href="#">Desmos: Which is the Steepest?</a></p> <p>In this activity, students explore the idea of "steepness" of line segments. This activity serves as a prelude to formal conversations about vertical change, horizontal change, and slope.</p> <p><a href="#">Desmos: Investigate Rate of Change</a></p> <p>In this activity students will compare slopes of lines with a y-intercept of zero. They'll use their comparisons to learn how to write the equations of lines of the form <math>y=ax</math>.</p> <p><a href="#">Desmos: Land the Plane</a></p> <p>In this activity, students practice finding equations of lines in order to land a plane on a runway. Most of the challenges are well-suited to slope-intercept form, but depending on the goals of an</p> |

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|  | <p>individual class or student they are easily adapted to other forms of linear equations.<br/> <a href="#">Desmos: Linear Systems: Gym Membership</a><br/>                     In this activity, students analyze several gym membership plans in order to make a recommendation to a friend.<br/>                     The activity assumes some familiarity with linear equations, particularly how slope and intercept appear in equations and how they affect the graph.<br/>                     If your students need a quick refresher on these concepts, consider offering a brief review prior to starting this activity.<br/> <a href="#">Desmos: 400 Meter Modeling</a><br/>                     In this linear modeling activity, students make predictions about record times for the women's 400 meter dash. They also reflect on the contextual meaning of the slope and intercept, and consider shortcomings of the model over the long run.</p> <p><b>Performance Tasks are available for use from the following sites:</b><br/> <a href="#">Illustrative Mathematics</a><br/> <a href="#">Coherence Map</a><br/> <a href="#">Inside Mathematics Problems of the Month</a><br/> <a href="#">YouCubed Tasks</a><br/> <a href="#">PARCC Released test items- Grade 8</a></p> |
| <p><b>Materials:</b></p>   | <p><b>Suggested Workstations &amp; Activities for Use During Unit</b></p>   |
| <ul style="list-style-type: none"> <li><input type="checkbox"/> <i>Scientific calculator</i></li> <li><input type="checkbox"/> <i>Online graphing calculator (e.g., <a href="https://www.desmos.com/calculator">https://www.desmos.com/calculator</a>)</i></li> <li><input type="checkbox"/> <i>Graph paper</i></li> <li><input type="checkbox"/> <i>Straightedge</i></li> </ul> | <p><b>TBD and updated as lesson planning commences</b></p>  |
| <p><b>District/School Formative Assessment Plan</b></p>  | <p><b>District/School Summative Assessment Plan</b></p>   |
| <ul style="list-style-type: none"> <li>● Teacher observation of students engaged in group and independent activities.</li> <li>● Individual and small group conferences/interviews to assess understanding with rubric</li> <li>● Self-assessment by students with guidance from teacher.</li> </ul>   | <ul style="list-style-type: none"> <li>● Teacher created assessments and projects</li> <li>● <i>Eureka Math</i> Mid- and End- Module Assessments (Constructed response item with rubric)</li> <li>● Teacher/District created Quarterly Assessments</li> <li>● <b>Project on the use of water bottles</b></li> </ul>   |

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| <ul style="list-style-type: none"> <li>● Eureka Math Sprints</li> <li>● Exit tickets</li> </ul>  | <p>Students should investigate how many water bottles are purchased versus recycled and use scientific notation to demonstrate understanding of the magnitude of numbers; extend to explore the impact on the environment and solutions to lessen the impact on the environment in our community.</p>  |
| <b>Instructional Best Practices and Exemplars</b>  | <b>Mathematical Terms/Vocabulary</b>   |
| <ul style="list-style-type: none"> <li>● <i>Facilitate partner and group collaborations</i></li> <li>● <i>Inquiry based tasks introduced before direct teaching</i></li> <li>● <i>Small and large group discussions</i></li> <li>● <i>Have students use a variety of representations or methods to show and explain their understanding.</i></li> <li>● <i>Build fluency over time.</i></li> </ul> | <ul style="list-style-type: none"> <li>● <b>Coefficient</b></li> <li>● <b>Equation</b></li> <li>● <b>Like terms</b></li> <li>● <b>Linear Expression</b></li> <li>● <b>Solution</b></li> <li>● <b>Term</b></li> <li>● <b>Unit rate</b></li> <li>● <b>Variable</b></li> <li>● <b>Average Speed</b> Let a time interval of <math>t</math> hours be given. Suppose that an object travels a total distance of <math>d</math> miles during this time interval. The average speed of the object in the given time interval is <math>\frac{d}{t}</math> miles per hour.</li> <li>● <b>Constant Speed</b> For any positive real number <math>t</math>, an object travels at a constant speed of <math>s</math> mph over a fixed time interval if the average speed is always equal to <math>s</math> mph for any smaller time interval of the given time interval.</li> <li>● <b>Horizontal Line</b> In a Cartesian plane, a horizontal line is either the <math>x</math>-axis or any other line parallel to the <math>x</math>-axis. For example, the graph of the equation <math>y = -5</math> is a horizontal line.</li> <li>● <b>Linear Equation</b> A linear equation is an equation in which both expressions are linear expressions.</li> <li>● <b>Point-Slope Equation of a Line</b> The point-slope equation of a non-vertical line in the Cartesian plane that passes through point <math>(x_1, y_1)</math> and has slope <math>m</math> is             <ul style="list-style-type: none"> <li>○ <math>y - y_1 = m(x - x_1)</math>.</li> <li>○ It can be shown that every non-vertical line is the graph of its point-slope equation, and that every graph of a point-slope equation is a line.</li> </ul> </li> <li>● <b>Slope:</b> Slope is a number that describes the “steepness” or “slant” of a line. It is the constant rate of change. Example: The slope, <math>m</math>, of the graph of line <math>l</math> to the right is <math>m = \frac{3}{7}</math>.</li> <li>● <b>Slope of a Line in a Cartesian Plane</b> The slope of a non-vertical line in a Cartesian plane that passes through two different points is the number given by the change in <math>y</math>-</li> </ul> |

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coordinates divided by the corresponding change in the  $x$ -coordinates. For two points  $(x_1, y_1)$  and  $(x_2, y_2)$  on the line where  $x_1 \neq x_2$ , the slope of the line can be computed by the formula  $m = (y_2 - y_1)/(x_2 - x_1)$ . The slope of a vertical line is not defined. The definition of slope is well-defined after one uses similar triangles to show that expression  $(y_2 - y_1)/(x_2 - x_1)$  is always the same number for any two distinct points  $(x_1, y_1)$  and  $(x_2, y_2)$  on the line.

- **Slope-Intercept Equation of a Line** The slope-intercept equation of a non-vertical line in the Cartesian plane with slope  $m$  and  $y$ -intercept  $b$  is  $y = mx + b$ . It can be shown that every non-vertical line is the graph of its slope-intercept equation, and that every graph of a slope-intercept equation is a line.
- **Solution to a System of Linear Equations** The solution to a system of linear equations is a pair of numbers from the domain of the variables that, when each number from the pair is substituted into all instances of its corresponding variable, makes the equation a true number sentence. Example: The solution to the system of linear equations  $x + y = 15$  and  $3x - 7y = -2$  is the ordered pair  $(103/10, 47/10)$  because the ordered pair is a solution to each linear equation of the system, and it is the point on the plane where the graphs of the two equations intersect.
- **Standard Form of a Linear Equation** A linear equation in two variables  $x$  and  $y$  is in standard form if it is of the form  $ax + by = c$  for real numbers  $a$ ,  $b$ , and  $c$ , where  $a$  and  $b$  are both not zero. The numbers  $a$ ,  $b$ , and  $c$  are called constants.
- **System of Linear Equations** A system of linear equations is a set of two or more linear equations. For example,  $\{x + y = 15 \text{ and } 3x - 7y = -2\}$  is a system of linear equations.
- **Vertical Line** In a Cartesian plane, a vertical line is either the  $y$ -axis or any other line parallel to the  $y$ -axis. For example, the graph of the equation  $x = 3$  is a vertical line.
- **X-Intercept** An  $x$ -intercept of a graph is the  $x$ -coordinate of a point where the graph intersects the  $x$ -axis. An  $x$ -intercept point is the coordinate point where the graph intersects the  $x$ -axis. The  $x$ -intercept of a graph of a linear equation can be found by setting  $y = 0$  in the equation. Many times the term “ $x$ -intercept point” is shortened to just “ $x$ -intercept” if it is clear from the context that the term is referring to a point and not a number.
- **Y-Intercept** A  $y$ -intercept of a graph is the  $y$ -coordinate of a point where the graph intersects the  $y$ -axis. A  $y$ -intercept point is the coordinate point where the graph intersects the  $y$ -axis. The  $y$ -intercept of a graph of a linear equation can be found by setting  $x = 0$  in the equation. Many times the term “ $y$ -intercept point” is shortened to

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just “ $\square$ -intercept” if it is clear from the context that the term is referring to a point and not a number.

### Focus Mathematical Concepts

#### **Grade Level Fluency Requirement:**

❖ *Concepts related to linear algebra and linear functions*

#### **Mathematical Practices Applied to this Unit**

**MP1: Make sense of problems and persevere in solving them.** Students analyze given constraints to make conjectures about the form and meaning of a solution to a given situation in one-variable and two-variable linear equations, as well as in simultaneous linear equations. Students are systematically guided to understand the meaning of a linear equation in one variable, the natural occurrence of linear equations in two variables with respect to proportional relationships, and the natural emergence of a system of two linear equations when looking at related, continuous proportional relationships.

**MP 2: Reason abstractly and quantitatively.** Students decontextualize and contextualize throughout the module as they represent situations symbolically and make sense of solutions within a context. Students use facts learned about rational numbers in previous grade levels to solve linear equations and systems of linear equations.

**MP 3: Construct viable arguments and critique the reasoning of others.** Students use assumptions, definitions, and previously established facts throughout the module as they solve linear equations. Students make conjectures about the graph of a linear equation being a line, then proceed to prove this claim. While solving linear equations, they learn that they must first assume that a solution exists, then proceed to solve the equation using properties of equality based on the assumption. Once a solution is found, students justify that it is in fact a solution to the given equation, thereby verifying their initial assumption. This process is repeated for systems of linear equations.

**MP 4: Model with mathematics.** Throughout the module, students represent real-world situations symbolically. Students identify important quantities from a context and represent the relationship in the form of an equation, a table, and a graph. Students analyze the various representations and draw conclusions and/or make predictions. Once a solution or prediction has been made, students reflect on whether the solution makes sense in the context presented. One example of this is when students determine how many buses are needed for a field trip. Students must interpret their fractional solution and make sense of it as it applies to the real world.

**MP 7: Look for and make use of structure.** Look for and make use of structure. Students use the structure of an equation to make sense of the information in the equation. For example, students write equations that represent the constant rate of motion for a person walking. In doing so, they interpret an equation such as  $\square = (3/5) \square$  as the total distance a person walks,  $\square$ , in  $\square$  amount of time, at a rate of  $3/5$ . Students look for patterns or structure in tables and show that a rate is constant.

#### **Prerequisite skills & Foundational Standards**

*Refer to Achieve the Core Coherence Map for full detail on vertical and horizontal alignment to prerequisite skills & future skills.*

[Coherence Map](#)

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### Understand ratio concepts and use ratio reasoning to solve problems.

**6.RP.A.2** Understand the concept of a unit rate  $a/b$  associated with a ratio  $a:b$  with  $b \neq 0$ , and use rate language in the context of a ratio relationship. For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is  $3/4$  cup of flour for each cup of sugar.” “We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger.” (Unit rates in are not limited to non-complex fractions in Grade 8.)

**6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

b. Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

### Apply and extend previous understandings of arithmetic to algebraic expressions.

**6.EE.A.2** Write, read, and evaluate expressions in which letters stand for numbers.

a. Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation “Subtract  $y$  from 5” as  $5 - y$ .

b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression  $2(8 + 7)$  as a product of two factors; view  $(8 + 7)$  as both a single entity and a sum of two terms.

c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas  $V = s^3$  and  $A = 6s^2$  to find the volume and surface area of a cube with sides of length  $s = 1/2$ .

### Analyze proportional relationships and use them to solve real-world and mathematical problems.

**7.RP.A.2** Recognize and represent proportional relationships between quantities.

a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

c. Represent proportional relationships by equations. For example, if total cost  $t$  is proportional to the number  $n$  of items purchased at a constant price  $p$ , the relationship between the total cost and the number of items can be expressed as  $t = pn$ .

d. Explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate.

### Use properties of operations to generate equivalent expressions.

**7.EE.A.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

### Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

**7.EE.B.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the

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quantities.

- a. Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*

### Differentiation/Accommodations/Modifications

#### Gifted and Talented

(content, process, product and learning environment)

#### **Extension Activities**

- Conduct research and provide presentation of various topics.
- Design surveys to generate and analyze data to be used in discussion.
- Debate topics of interest / cultural importance.
- Authentic listening and reading sources that provide data and support for speaking and writing prompts.
- Implement RAFT Activities as they pertain to the types / modes of communication (role, audience, format, topic).
- Activities defined as “Gold” require more advanced logic and reasoning skills and will be provided as additional or replacement work on a weekly basis.
- Coordination with the G&T teacher in order to supplement the math curriculum as needed.

#### **Anchor Activities**

- Use of Higher Level Questioning Techniques
- Provide assessments at a higher level of thinking

#### English Language Learners

#### **Modifications for Classroom**

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.

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- Repetition and practice.
- Model skills/techniques that need to be mastered.
- Extended time to complete class work
- Visual dictionaries to help build vocabulary
- Provide copy of class notes
- Pair with a peer for assistance during class

### **Modifications for Homework/Assignments**

- Modified Assignments
- Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary)
- Extended time for assignment completion as needed
- Highlight key vocabulary
- Use graphic organizers

### Students with Disabilities

**(possible appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team)**

### **Modifications for Classroom**

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of class notes
- Preferential seating to be mutually determined by the student and teacher
- Establish expectations for correct spelling on assignments.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests and check Google classroom for updates and assignments
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily

### **Modifications for Homework and Assignments**

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

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### Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

### Students at Risk of School Failure

### Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily

### Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

### Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.