

# PRE-Unit: Linear Equations & Properties of Exponents Summer Packet Review

Content Area: **Mathematics**  
Course(s): **Algebra II Honors, Algebra II**  
Time Period: **September**  
Length: **2 Weeks**  
Status: **Published**

## Unit Overview

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During this unit, students will...

- Reason quantitatively and use units to solve problems.
- Build functions that model a relationship between two quantities.
- Build new functions from existing functions.
- Analyze functions using different representations.

**\*OPTIONAL\***By the end of September, administer the Algebra II Link It! NJSLS Form A.

## Transfer

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

- Write and solve algebraic models and functions to describe real-world situations.
- Use patterns of transformation to sketch graphs of simple functions, or to write equations of simple functions based on their graphs.
- Compare important attributes of given functions.
- Perform operations on functions.
- Give the domain of simple polynomial, rational, and square root functions.

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For more information, read the following article by Grant Wiggins.

[http://www.authenticeducation.org/ae\\_bigideas/article.lasso?artid=60](http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60)

## Meaning

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## **Understandings**

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Students will understand that...

- Algebraic models are useful in describing real-life situations.
- Functions can be represented in a variety of different formats.
- Input values are sometimes restricted due to the nature of the function.
- Introducing a constant into the equation of a function causes the graph of the function to shift, stretch, or reflect in the coordinate plane.
- The concept of a function and function notation.

## **Essential Questions**

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Students will keep considering...

- How can mathematical models be used as tools to describe and help explain real-life situations?
- How can various mathematical expressions be simplified both effectively and efficiently?
- How can you sketch accurate graphs of functions? How can translations and reflections be used when doing so?
- What does it mean for functions to be inverses of one another? How can you define the inverse of a given function?
- How can algebraic concepts and their properties be described by careful use of mathematical language?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?

## **Application of Knowledge and Skill**

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### **Students will know...**

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Students will know...

- Functions can be combined through addition, subtraction, multiplication, division, and function composition.
- Introducing a constant to the equation of a function has the effect of shifting, stretching, or reflecting the graph of the function in the coordinate plane.

## **Students will be skilled at...**

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Students will be skilled at...

- Writing and using algebraic expressions and functions to model real-world situations.
- Performing operations with functions, including function composition.
- Using patterns of transformations to graph and write equations for functions.
- Analyzing the relationships among functions represented as tables of values, algebraic formulas, written statements, and graphs.
- Writing equations for the inverses of functions.

## **Academic Vocabulary**

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- Addition
- Average Rate of Change
- constant
- coordinate points
- Dependent Variable
- Distributive Property
- Division
- Equation
- Independent Variable
- Linear Equation
- Model
- Multiplication
- Order of Operations
- Slope
- Slope-intercept Form
- Subtraction
- unit
- Variable
- x-intercept
- y-intercept

## **Learning Goal P.1**

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Use, write & solve linear equations and graphs in context.

### Target P.1.1

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SWBAT:

- Explain each step in solving a multi-step equation with variables on both sides utilizing order of operations when simplifying on each side. **(DOK 1)**
- *For example, solve  $-3(1+4r)=5+8(1-2r)$  for  $r$ .* **(DOK 1)**

MA.A-REI.A.1

Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

MA.A-REI.B.3

Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using

concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

## Target P.1.2

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SWBAT:

- Create a multi-step equation to model a situation in context, and use the model to solve the problem. **(DOK 4)**
- Select appropriate quantities when using descriptive modeling, and verify that the quantities make sense in relation to the problem. **(DOK 3)**

MA.N-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

MA.N-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling.

MA.A-CED.A.1

Create equations and inequalities in one variable and use them to solve problems.

MA.A-REI.B.3

Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints,

relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

### Target P.1.3

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SWBAT explain each step in re-writing a linear equation given in any form in slope-intercept form. **(DOK 3)**

MA.A-CED.A.4

Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

MA.A-REI.A.1

Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

### Target P.1.4

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SWBAT:

- Define slope as a rate of change. **(DOK 1)**
- Find the slope of an equation given two points in context, and describe the graph of the equation in terms of slope. **(DOK 2)**
- Give the slope of a line given a graph. **(DOK 1)**
- Recognize when given points represent points on a horizontal or vertical line, and the corresponding slopes of those lines. **(DOK 2)**
- Explain the implication of slope in real-world context in terms of average rate of change and use the correct quantities when reporting average rate of change. **(DOK 3)**

MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

## Target P.1.5

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SWBAT:

- Graph a line using an equation in slope-intercept form. **(DOK 1)**
- Explain the steps in graphing a line using slope-intercept form. **(DOK 3)**
- Write an equation of a line given a linear graph. **(DOK 2)**

MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

## Target P.1.6

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SWBAT:

- Write an equation of a line given: the slope and a point on the line, two points on a line. **(DOK 2)**
- Create a linear algebraic model given data points in a real-world situation, and use the linear model to solve for quantities of interest. **(DOK 4)**
- Use the correct quantities when reasoning, and verify that the quantities make sense in the context of the problem. **(DOK 2)**

MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

## Formative Assessment and Performance Opportunities

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- academic games
- Class discussions
- Classwork
- Do nows
- Exit tickets
- Homework

- Problem based learning
- student interviews
- Teacher observation
- whiteboard/communicator opportunities

## **Summative Assessment**

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- Link-It Exams
- Projects
- Quizzes
- student interviews
- Tests
- Unit Exam

## **21st Century Life and Careers**

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CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

## **Technology**

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TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.12.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.

## **Accommodations and Modifications**

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- 504 Accommodations
- centers/stations
- challenge questions
- IEP Modifications
- manipulatives
- Pre-Unit Review for Test
- projects



- scaffolding questions
- small group instruction
- Summer Packet with guided notes and answer key
- use of technology

## **Unit Resources**

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- Desmos
- Explorations in Core Math for Common Core: Algebra 2 (Holt McDougal)
- Geometer sketchpad
- Kuta software
- NCTM website
- online textbook materials
- PARCC/NJSLA Released Questions
- SJMAP Resources
- Text

## **Interdisciplinary Connections**

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Real world applications involving rate of change and systems of equations helps students compare/contrast to help make educated financial decisions. (MA.9-12.ACED.A.3)

PFL.9.1.12.E.2

Analyze and apply multiple sources of financial information when prioritizing financial decisions.