Accelerated Grade 7 – UNIT 2
Proportionality and Linear Relationships

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×A. 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.

CLUSTERS	COMMON CORE STATE STANDARDS
Analyze proportional relationships and use them to solve real-world and mathematical problems.	**7.RP.1** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.* **7.RP.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. **7.RP.3** Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*
Use properties of operations to generate equivalent expressions	**7.EE.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients **7.EE.2** Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that *"increase by 5%"* is the same as *"multiply by 1.05."*
Solve real-life and mathematical problems using numerical and algebraic expressions and equations	**7.EE.3.** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the*

	bar about 9 inches from each edge; this estimate can be used as a check on the exact computation. **7.EE.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 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? b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write* an inequality for the number of sales you need to make, and describe the solutions.
Understand the connections between proportional relationships, lines and linear equations.	**8.EE.5** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* **8.EE.6** Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.
Analyze and solve linear equations and pairs of simultaneous linear equations.	**8.EE.7** Solve linear equations in one variable. 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 $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). b. b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

MATHEMATICAL PRACTICES	LEARNING PROGRESSIONS
1. Make sense of problems and persevere in solving them. **2. Reason abstractly and quantitatively.** **3. Construct viable arguments and critique the arguments of others.** **4. Model with mathematics.** **5. Use appropriate tools strategically.** **6. Attend to precision.** **7. Look for and make use of structure.** 8. **Look for and express regularity in repeated reasoning.**	6-7, Ratios and Proportional Relationships http://commoncoretools.files.wordpress.com/2012/02/ccss_progression_rp_67_2011_11_12_corrected.pdf CDE Progress to Algebra continuum K-8 (P. Daro) - http://www.cde.ca.gov/be/cc/cd/documents/updateditem12catt3.doc UNIVERSITY OF ARIZONA - INSTITUTE FOR MATHEMATICS EDUCATION http://commoncoretools.files.wordpress.com/2011/04/ccss_progression_ee_2011_04_25.pdf http://ime.math.arizona.edu/progressions/#committee.

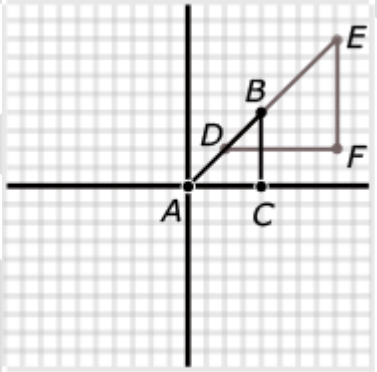
[1] **Major Clusters – area of intensive focus where students need fluent understanding and application of the core concepts.**

[2] **Supporting/Additional Clusters – designed to support and strengthen areas of major emphasis/expose students to other subjects.**

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
• Proportional reasoning is essential in problem solving • Understanding mathematical relationships allows us to make predictions, calculate and model unknown quantities. • Proportional relationships express how quantities change in relationship to each other. • Generating equivalent, linear expressions with rational coefficients using the properties of operations will lead to solving linear equation. • Discovering that rewriting expressions in different forms in a problem context leads to understanding that the values are equivalent. • Ability to solve and explain real life and mathematical problems involving rational numbers using numerical and algebraic expressions is important for preparation for HS Algebra. • Constructing simple equations and inequalities to solve real life word problems is a necessary concept. • Write and solve real- life and mathematical problems involving simple equations for an unknown angle in a figure would help students as the engage in higher Geometry concepts. • Students compare proportional relationships using a variety of representations of these relationships (graph, table, symbols). • Students understand and represent slope as a unit rate, and apply their knowledge of right triangles to represent slope. Students relate the slope with its concept as a rate and its visual representation as a set of right triangle that are similar for each line. • Students interpret slope and intercept using real world applications (e.g. bivariate data). • Students create equivalent equations to solve for an unknown. • Students employ graphical, tabular and symbolic representations to express linearity and determine the number of solutions. • Students interpret a linear equation in a real world application by deriving the equation.	• How can proportions be used to solve problems? • When is a relationship proportional? • How can proportions increase our understanding of the real world? • How does the mathematical use of the word *similar* differ from the everyday use? • How can similarity help us solve measurement problems? • What are the connections between similarity, geometry and algebra? • How can I apply the order of operations and the fundamentals of algebra to solve problems? • How can I justify that multiple representations in the context of a problem are equivalent expressions? • How do I assess the reasonableness of my answer? • How will I use the properties of equality to explain the order of the steps in solving equations and inequalities? • How do I interpret the solutions for equations and inequalities in the context of the problem? • How can I use and relate facts about special pairs of angles to write and solve simple equations involving unknown angles? • How can I determine, when analyzing the motion of two objects, which object has the greater speed? • What is the meaning of the slope and intercept of a line, in the context of the situation? • How may I use similar triangles to show that the slope is the same, given two distinct sets of points on a graph? • How will I explain how I know that a pair of linear equations has one solution, no solutions, or infinitely many solutions? • Is the slope between any two points on the same line the same? Explain your reasoning.	• algebraic • arithmetic • axis, x-axis, y-axis, • bivariate • coefficient • coefficient • constant • context • coordinate plane • cube Root • data • distributive property • equation • equivalence, equivalence • equivalent • estimate • expand • expression • factor • graph • horizontal • inequality • intercept/point of interception • linear • operations • origin • per • perfect Cube • perfect Square • point • properties • proportion

	• How can I create an equation with given information from a table, graph, or problem situation	• proportional relationship • rate • ratio • rational • scale • scale drawing • slope • Solution • solution Set • solve • square Root • symbol • triangle • unit rate • variable • vertical

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
LAUSD Adopted Textbook: Glencoe – California Mathematics Grade 7, Chapter 4 – lessons 4.1-10 McDougal Holt – California Mathematics, Course 2, Chapter 3 –Lessons 3.6, 3.7, 3.8, Chapter 5 - 5.6. **Engage New York:** Grade 8 Module 4 - Linear Equations **National Library of Virtual Manipulatives -** http://nlvm.usu.edu/en/nav/grade_g_3.html **NCTM Tools Activities** – http://www.nctm.org/resources/content.aspx?id=32702 **TI Math**– http://education.ti.com/calculators/timathnspired/US/Activities/Subject?sa= **Geometer's Sketchpad -**	• Real-world connections (e.g. Use grocery store ads to find unit rates for various products) • Structured instructional conversations (Think-Pair-Share) • Peer Tutoring • Use visuals to illustrate multiple representations of rate of change • Real-world connections (Use equations to set up a home budget, e.g. % of take-home pay for rent, utilities, food, savings, etc.) • Structured instructional conversations (Think-Pair-Share) • Journal writing prompts - http://futureofmath.misterteacher.com/Writing%20Prompts.pdf • Questioning Strategies - http://www.utdanacenter.org/mathtoolk	SBAC - http://www.smarterbalanced.org/ 7 RP 3 - Item #'s 42933, 42961 7G1 - Item # 43057 7EE – Item # 2959, 43022, 43023, 43026, 43047, 43053 PARCC - http://parcconline.org/samples/mathematics/grade-7-speed http://parcconline.org/samples/mathematics/grade-6-slider-ruler SBAC - http://www.smarterbalanced.org/ , http://sampleitems.smarterbalanced.org/itempreview/sbac/index.htm ITEM #'S 42906 8 NS1-2, 8 EE 1-2, 43056 8 EE 7 "Expressions and Equations 3" SAMPLE ITEMS:

http://dynamicgeometry.com/ **Illustrative Mathematics** 7.RP.1 Molly's Run http://illustrativemathematics.org/illustrations/828 7.RP.2 Music Companies, Variations 1 - http://illustrativemathematics.org/illustrations/95 **LAUSD Adopted Textbook**: Glencoe – California Mathematics Grade 7 Chapter 1 – lessons 1.2, 1.4, 1.5,1.7, 1.8, 1.9, 1.10; Chapter 6 – Lessons 6.1, 6.3 Chapter 8– lessons 1-8 Holt McDougal – California Mathematics, Course 2, Chapter 5–Lessons 1,2,3,4,5,6,7,8,9 **National Library of Virtual Manipulatives** - http://nlvm.usu.edu/en/nav/grade_g_3.html **NCTM Tools and Activities** – http://www.nctm.org/resources/content.aspx?id **TI Math Tools**– http://education.ti.com/calculators/timathnspired/US/Activities/Subject?sa **Geometer's Sketchpad** - http://dynamicgeometry.com/ **California Draft Mathematics Framework Chapters** http://www.cde.ca.gov/be/cc/cd/draftmathfwchapters.asp . **Illustrative Mathematics** 7.EE.1– Equivalent Expressions - http://illustrativemathematics.org/illustrations/543 7.EE.1 and 7.EE.4a – Guess My Number - http://illustrativemathematics.org/illustrations/712 8.EE.7, Inside Mathematics, Performance Tasks, Squares and Circles, http://insidemathematics.org/common-core-math-tasks/8th-grade/8-2006%20Squares%20and%20Circles.pdf 8.EE.7: MAP Center, Concept Lesson, "Solving Linear Equations in One Variable,"	it/support/questioning.php • Identify cases in which a system of two equations in two unknowns has no solution, an infinite number of solutions. • Solve a system of two equations (linear) in two unknowns algebraically. • Estimate the point(s) of intersection for a system of two equations in two unknowns by graphing the equations. • Use graphs of experiences that are familiar to students to increase accessibility and supports understanding and interpretation of proportional relationship. Students are expected to both sketch and interpret graphs. • For 8.EE.6 use this example to introduce it: Explain why ACB □ is similar to DFE, and deduce that AB has the same slope as BE. Express each line as an equation.  	8 EE 7: MAT.08.SR.1.000EE.D.201 8 EE 8: MAT.08.TE.1.000EE.C.200 MAT.08.TE.1.000EE.D.147 SBAC Content Specs: http://www.smarterbalanced.org/wordpress/wpcontent/uploads/2011/12/Math-Content-Specifications.pdf 8 EE 8: CR 8: Taxi Cabs

http://map.mathshell.org/materials/lessons.php?taskid=4 42&subpage=concept Other Resources http://www.arcademicskillbuilders.com/games/ratio-blaster/ratio-blaster.html http://www.azed.gov/azcommoncore/files/2012/11/7th_flipbookedited21.pdf http://schools.nyc.gov/NR/rdonlyres/41C0F04C-0BD6-491F-9BF0-16485EC080BE/0/NYCDOEG7MathProportionalReasoning_Final.pdf		

LANGUAGE GOALS
Reading Students will evaluate the argument and specific claims in a word problem, including the validity of the reasoning, making explicit reference to words in the problem and using reporting language (According to the problem, …; the problem states that…; the main points are…' *argues, In my opinion, the way to solve this problem is…; What is most important in this problem is…;* Students will read ratios, proportions, and percent's aloud fluently, without hesitating Students will summarize the steps in setting up and solving a proportion as described in their textbooks using the words *first*, *second*, *third*, *etc*. Students will identify words, or phrases, in word problems that help them solve them using a causative structure such as: *The following words* **"**unit " *and* "rate" *help me solve the problem* Students will read equations, expressions, and inequalities aloud fluently, without hesitating **Writing** Students will write definitions of key vocabulary using complete, well-formed sentences. Students will write a constructed response to a word problem using logically ordered reasons that are supported by facts and details and using the appropriate mathematic vocabulary. Students will list possible reasons for their conclusions, using verbs such as *explain, demonstrate, justify* and *because*). Students will explain how they use a specific mathematical concept in their lives, using the following specific set of words: *miles per gallon*, miles per hour, feet per second, *cents/pound*, "*the ratio of a to b." variable*, *distribute*, Students will write definitions of key vocabulary using complete, well-formed sentences. **Listening and Speaking** Students will explain how to set up and solve a proportion to a partner using the words *first*, *second*, *third*, *etc.* Students will describe the relationship between fraction, ratio, proportion, using the words comparison, part to whole , part to part Students will explain how to set up and solve/evaluate equations, expressions, and inequalities to a partner using the words *first*, *second*, *third*, *etc.* Students will describe the difference between an equation, an expression, and an inequality using the words solution, simplify, solution set Students will compare two angles (complementary, supplementary, and straight) using comparative words such as less than, greater than, equal to,

etc.
Students will agree or disagree with mathematical answers to specific word problems using expressions of agreement or disagreement (I agree/disagree because)

Students will compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
Example: The difference between a distance-time graph and a distance-time equation in terms of speed is _____.
Students will explain in writing how to derive the equation y = mx for a line through the origin.
Example: The *m* in the equation *y = mx + b* for a line intercepting the vertical axis at *b* is_____.
Students will identify the solution(s) to a system of two linear equations in two variables as the point(s) of intersection of their graphs.
Example: To identify the solution(s) of a system of two linear equations in two variables, I will _____.
Students will describe the point(s) of intersection between two lines as points that satisfy both equations simultaneously.
Example: 3x + 2y = 5 and 3x + 2y = 6 have no solution because _____ be ___ and 6.

PERFORMANCE TASKS

MATHEMATICS ASSESSMENT PROJECT
7.RP.1 and 7.RP.2 Proportion and Non-proportion Situations http://map.mathshell.org/materials/lessons.php?taskid=483#task483
7.RP.1 and 7.G.1 Developing a Sense of Scale http://map.mathshell.org/materials/lessons.php?taskid=456#task45
7.RP.3Increasing and Decreasing Quantities by a Percent http://map.mathshell.org/materials/lessons.php?taskid=210#task210
7.EE.1 and 7.EE.4 Steps to Solving Equations http://map.mathshell.org/materials/lessons.php?taskid=431#task431
LAUSD CONCEPT LESSONS
RATIOS AND PERCENT LESSON - http://www.lausd.net/lausd/offices/iss/Math/MS/RATIO_AND_PERCENTS.pdf
SHRINKING AND ENLARGING - http://www.lausd.net/lausd/offices/iss/Math/MS/SHRINKING_AND_ENLARGING.pdf
GAUGING GAS MILEAGE - http://www.lausd.net/lausd/offices/iss/Math/MS/GAUGING_GAS_MILEAGE.pdf
Planning a Bowling Party– http://math.lausd.net/sites/math.lausd.net/files/18.%20Planning%20a%20Bowling%20Party.pdf
7.EE.4 a Calling Plans– http://math.lausd.net/sites/math.lausd.net/files/17.%20Calling%20Plans.pdf
ILLUSTRATIVE MATHEMATICS
7.RP.1 Cooking with Whole Cup - http://illustrativemathematics.org/illustrations/470
7.RP.1 Track Practice - http://illustrativemathematics.org/illustrations/82
7 RP.2 Art Class, Variations 1&2 - http://illustrativemathematics.org/illustrations/100 ; http://illustrativemathematics.org/illustrations/101
- Buying Coffee - http://illustrativemathematics.org/illustrations/104
7.RP.2d Robot Races - http://illustrativemathematics.org/illustrations/181
7.RP.2 Sore Throats – Variation 1 - http://illustrativemathematics.org/illustrations/180
7.EE.1 – Miles to Kilometers - http://illustrativemathematics.org/illustrations/433
7 EE.3 – Discounted Books - http://illustrativemathematics.org/illustrations/478
7.EE.4 and 4b. – Fishing Adventures 2 - http://illustrativemathematics.org/illustrations/643
7 EE.4b – Sport Equipment Set - http://www.illustrativemathematics.org/illustrations/986

INSIDE MATHEMATICS

7.RP.1, 7.RP.3 – Mixing Paint - http://insidemathematics.org/common-core-math-tasks/7th-grade/7-2003%20Mixing%20Paints.pdf
- Cereal – http://insidemathematics.org/common-core-math-tasks/7th-grade/7-2004%20Cereal.pdf
- Lawn Mowing- http://insidemathematics.org/common-core-math-tasks/7th-grade/7-2005%20Lawn%20Mowing.pdf
7.RP.2 - Cat Food- http://insidemathematics.org/common-core-math-tasks/7th-grade/7-2009%20Cat%20Food.pdf
7.EE.2&4 - The Wheel Shop http://insidemathematics.org/problems-of-the-month/pom-thewheelshop.pdf
7.EE.3 - The Toy Train http://insidemathematics.org/common-core-math-tasks/7th-grade/7-2009%20Toy%20Trains.pdf

NCTM ILLUMINATIONS

7.PR.2b Golden Ratio- http://illuminations.nctm.org/LessonDetail.aspx?ID=L510
7.RP.1 What's Your Rate- http://illuminations.nctm.org/LessonDetail.aspx?ID=L511
7.EE.1 The Mango Problem http://illuminations.nctm.org/LessonDetail.aspx?id=L264
7.EE.1 The Sailor and Cocoanut Problem http://illuminations.nctm.org/lessons/6-8/mangoes/Classic-AS-Sailor.pdf
7.EE.1 and 7.EE.2 Pan Balance - Expressions - http://illuminations.nctm.org/LessonDetail.aspx?id=L755

UTAH

7.RP.1 and 7.RP.2 Ratios, Rates, and Proportions – http://www.uen.org/Lessonplan/preview.cgi?LPid=23491

DIFFERENTIATION 🕮

FRONT LOADING	ACCELERATION	INTERVENTION
• Skills of arithmetic for fractions, decimals and percents • Understanding of coordinate plane and graphing of linear functions • Generate and solve linear equations Understand solving formulas for different variables (*t=pn; y=kx; i=prt*) • Reason about and solve 1-variable equations and inequalities • Apply and extend previous understandings of arithmetic to algebraic expressions Apply and extend understandings of numbers to the number system of rational numbers • Have students analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. Use square tiles to construct different patterns that are	• How is rate of change related to the slope? • Multiple discounts • Limits of change • Rates of Change for Acceleration and Deceleration • Explain that the connection between the unit rate in a proportional relationships and the slope of its graph depends on a connection with the geometry of similar triangles. • Explain to the students that the fact that a line has a well-defined slope—that the ratio between the rise and run for any two points on the line is always the same—depends on similar triangles. • Have students use equations in two variables to express relationships between two quantities that vary together. • When they construct an expression like 10 - *p* to represent a quantity, students can choose a variable such as *C* to represent the calculated quantity and write *C*=10 - *p* to represent the	☐ ALEKS – www.aleks.com ☐ Small group re-teach ☐ Using kinesthetic activities and manipulatives Use blocks or virtual manipulative to build patterns. Have the students work in groups to construct a table based on the growing pattern. Then have them explain how the patterns translate to the numbers they have on the table of values and subsequently have then graph the values.

growing with constant amount to introduce proportional relationship. • Explain that the connection between the unit rate in a proportional relationships and the slope of its graph depends on a connection with the geometry of similar triangles. Explain to the students that the fact that a line has a well-defined slope—that the ratio between the rise and run for any two points on the line is always the same—depends on similar triangles.	relationship. This prepares • Use the following activities for acceleration: First Rate (LEVEL D) http://insidemathematics.org/problems-of-the-month/pom-firstrate.pdf 7.RP.2 Bagel Algebra http://illuminations.nctm.org/LessonDetail.aspx?id=L662 Building bridges http://illuminations.nctm.org/LessonDetail.aspx?id=L247	

References:

1. National Governors Association Center for Best Practices, Council of Chief State School Officers. (2010). *Common Core State Standards (Mathematics)*. Washington D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.
2. McCallum, W., Zimba, J., Daro, P. (2011, December 26 Draft). *Progressions for the Common Core State Standards in Mathematics*. Cathy Kessel (Ed.). Retrieved from http://ime.math.arizona.edu/progressions/#committee.
3. Engage NY. (2012). New York Common Core Mathematics Curriculum. Retrieved from http://engageny.org/sites/default/files/resource/attachments/a-story-of-ratios-a-curriculum-overview-for-grades-6-8.pdf.
4. Mathematics Assessment Resource Service, University of Nottingham. (2007 - 2012). Mathematics Assessment Project. Retrieved from http://map.mathshell.org/materials/index.php.
5. Smarter Balanced Assessment Consortium. (2012). Smarter Balanced Assessments. Retrieved from http://www.smarterbalanced.org/.
6. Partnership for Assessment of Readiness for College and Career. (2012). PARCC Assessments. Retrieved from http://www.parcconline.org/parcc-assessment.
7. Institute for Mathematics & Education (2013). Illustrative Mathematics. Retrieved from http://www.illustrativemathematics.org/
8. California Department of Education. (2013). Draft Mathematics Framework Chapters. Retrieved from http://www.cde.ca.gov/be/cc/cd/draftmathfwchapters.asp.
9. National Council of Teachers of Mathematics (NCTM) Illuminations. (2013). Retrieved from http://illuminations.nctm.org/Weblinks.aspx.
10. The University of Arizona. (2011-12). Progressions Documents for the Common Core Math Standards. Retrieved from http://ime.math.arizona.edu/progressions.