Work with radical and integer exponents (8.EE.1-4)
Standard 8.EE.1: Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$*
Concepts and Skills to Master
• Know the properties of integer exponents. (Rational exponents are in Secondary II Mathematics) • Apply the properties of integer exponents to simplify and evaluate numerical expressions.

Related Standards: Current Course	Related Standards: Future Courses
8.EE.3, 8.EE.4	I.A.REI.3, II.N.RN.1, II.N.RN.2

Support for Teachers

Critical Background Knowledge
• Understand exponents as repeated multiplication (6.EE.1) • Compute fluently with integers (add, subtract, and multiply) (7.NS.1, 7.NS.2)
Academic Vocabulary
exponent, base, power, integer
Resources
Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5180#71417

Work with radical and integer exponents (8.EE.1-4)
Standard 8.EE.2: Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.

Concepts and Skills to Master (This is student's first exposure to square roots and cube roots in the Utah Core)
- Evaluate the square roots of small perfect squares and cube roots of small perfect cubes.   - Represent the solutions to equations using square root and cube root symbols.

Related Standards: Current Course	Related Standards: Future Courses
8.NS.1, 8.NS.2, 8.G.6, 8.G.7, 8.G.8, 8.G.9	II.N.CN.1-2, II.A.REI.4, I.F.IF.8, II.F.IF.8, III.F.IF.8, III.F.BF.4a, II.F.TF.8

Support for Teachers

Critical Background Knowledge
- Understand and use inverse operations to solve equations (7.EE.4)   - Solving equations (6.EE.7)

Academic Vocabulary
square, square root, √, cube, cube root, $\sqrt[3]{}$, radical

Resources
Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5180#71417

Work with radical and integer exponents (8.EE.1-4)
Standard 8.EE.3: Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the Unites States as 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.*

Concepts and Skills to Master
• Write very large or very small numbers as the product of a single digit and a power of ten. • Estimate numbers as a product of a single digit and a power of ten. • Compare numbers expressed as a product of a single digit and a power of ten by expressing how many times one is bigger or smaller than the other.

Related Standards: Current Course	Related Standards: Future Courses
8.EE.1, 8.EE.4	I.F.LE.1, I.F.LE.5

Support for Teachers

Critical Background Knowledge
• Compare numbers using multiplicative comparison (4.OA.2) • Explain patterns in placement of the decimal point when a number is multiplied or divided by a power of ten (5.NBT.2) • Understand properties of integer exponents (8.EE.1) • Estimate and round numbers (5.NBT.4)

Academic Vocabulary
powers of ten, estimate

Resources
Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5180#71417

Work with radical and integer exponents (8.EE.1-4)
Standard 8.EE.4: Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
Concepts and Skills to Master
• Add, subtract, multiply and divide with numbers expressed in scientific notation and decimal notation.   • Represent very large and small quantities in scientific notation and use appropriate units.   • Convert between decimal notation and scientific notation.   • Interpret numbers expressed in scientific notation, including numbers generated by technology.

Related Standards: Current Course	Related Standards: Future Courses
8.EE.1, 8.EE.3	I.F.LE.1, I.F.LE.5

Support for Teachers

Critical Background Knowledge
• Use rules of exponents (8.EE.1)   • Understand powers of ten and place value (5.NBT.2)   • Multiplying decimals (5.NBT.7)
Academic Vocabulary
scientific notation, decimal notation, power of ten, units of measure
Resources
Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5180#71417

Understand the connections between proportional relationships, lines, and linear relationships (8.EE.5-6)
Standard 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 the two moving objects has greater speed.*

Concepts and Skills to Master
- Graph a proportional relationship given a table, equation or contextual situation.   - Recognize unit rate as slope and interpret the meaning of the slope in context.   - Compare different representations of two proportional relationships represented as contextual situations, graphs, tables, or equations.

Related Standards: Current Course	Related Standards: Future Courses
8.EE.6, 8.F.2, 8.F.3, 8.F.4, 8.SP.2, 8.SP.3	All function standards (functions are used throughout high school); I.A.REI.10, I.S.ID.7

Support for Teachers

Critical Background Knowledge (Access Background Knowledge)
- Recognize and represent proportional relationships between quantities: tables, graphs, equations (7.RP.2)   - Identify the constant of proportionality (unit rate) (7.RP.2b)   - Recognize that proportional relationships include the point (0,0) (7.RP.2d)   - Understand and calculate unit rates (6.RP.3)   - Graph points on a coordinate plane, mostly in Quadrant I (5.G.2, 6.NS.8, 6.RP.3a, 7.RP.2b)

Academic Vocabulary
slope, rate of change

Resources
Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5180#71417

Understand the connections between proportional relationships, lines, and linear relationships (8.EE.5-6)	
Standard 8.EE.6: Use similar triangles to explain why the slope 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.	
Concepts and Skills to Master	
- Determine the slope of a line as the ratio of the leg lengths of similar right triangles. - Explain why the slope is the same between any two distinct points on a line using similar right triangles. - Derive an equation in the form $y = mx + b$ from a graph of a line on the coordinate plane.	
Related Standards: Current Course	Related Standards: Future Courses
8.EE.5, 8.EE.8, 8.F.2, 8.F.3, 8.F.4, 8.G.5 (AA criterion), 8.SP.3	I.A.CED.2, I.F.IF.4, I.F.IF.6, II.F.IF.6, III.F.IF.6, I.F.BF.3, I.F.LE.1, I.F.LE.2, I.S.ID.7, II.G.SRT.2

Support for Teachers

Critical Background Knowledge
- Recognize similar triangles and know that they have proportional sides (7.G.1)   - Use ratio reasoning and plot points on the coordinate plane (6.RP.3a)   - Recognize and represent proportional relationships graphically (7.RP.2d)   - Identify the constant of proportionality (unit rate) (7.RP.2b)   - Graph points on a coordinate plane, mostly in Quadrant I (5.G.2, 6.NS.8, 6.RP.3a, 7.RP.2b)   - Similarity of triangles 8.G.5 (AA criterion)
Academic Vocabulary
similar triangles, m (slope), b (y-intercept), linear, right triangle, origin
Resources
Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5180#71417

Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations (8.EE.7-8)

Standard 8.EE.7: Solve linear equations and inequalities 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. Solve single-variable linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and collecting like terms.

c. Solve single-variable absolute value equations.

Concepts and Skills to Master

- Understand that the simplified form of an equation ($x=a, a=a, or a=b)$ indicates the number of solutions (one, zero, or infinitely many solutions).
- Solve multistep linear equations and inequalities with rational coefficients and variables on both sides.
- Solve absolute value equations (not inequalities) and understand why there are either zero, one, or two solutions.

Related Standards: Current Course	Related Standards: Future Courses
8.EE.8, 8.G.7, 8.G.8, 8.G.9, 8.SP.3	All algebra standards (algebra and function is used throughout high school mathematics courses), all F.BF standards

Support for Teachers

Critical Background Knowledge

- Solve one- step equations (6.EE.7) and inequalities (6.EE.8)
- Solve two-step equations and inequalities (7.EE.4)
- Understand absolute value (6.NS.7)
- Reason about and solve equations and inequalities (6.EE.5-6)
- Use properties of algebra to simplify algebraic expressions (7.EE.1-2)

Academic Vocabulary
solve, variable, order of operations, solution, like terms, distributive property

Resources
Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5180#71417

Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations (8.EE.7-8)
Standard 8.EE.8: Analyze and solve pairs of simultaneous linear equations.
d. 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.
e. Solve systems of two linear equations in two variables graphically, approximating when solutions are not integers and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example,* 3x + 2y = 5 *and* 3x + 2y = 6 *have no solution because* 3x + 2y *cannot simultaneously be 5 and 6.*
f. Solve real-world and mathematical problems leading to two linear equations in two variables graphically. *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.*

Concepts and Skills to Master
• Understand that solutions to a system of two linear equations is where the lines intersect.
• Solve systems of two linear equations graphically and identify the number of solutions (one solution, infinitely many solutions or no solutions).
• Interpret the solution to graphs of systems of linear equations, estimating when solutions are not integers.

Related Standards: Current Course	Related Standards: Future Courses
8.EE.7, 8.F.1 - 5	I.A.CED.2, II.A.CED.2, III.A.CED.2, I.A.CED.3, III.CED.3, I.A.REI.5, I.A.REI.6, I.A.REI.10, I.A.REI.11, I.A.REI.12, II.A.REI.7, III.A.REI.11, IIH.A.REI.8, IIH.A.REI.9

Support for Teachers

Critical Background Knowledge
• Reason about solutions (6.EE.5)
• Graphing points in all four quadrants (6.NS.8) and represent proportional relationships graphically (7.RP.2d)
• Graph proportional relationships and linear functions linear (8.EE.5, 8.EE.6, and 8.F.3)

Academic Vocabulary
elimination, substitution, solution, intersection, solve, system of linear equations

Resources
Curriculum Resources: http://www.uen.org/core/core.do?courseNum=5180#71417