ACCRS: 8.1-.2

8.1: Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

8.2: 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.

Mastered:	**Present:**	**Going Forward:**
Students know that numbers that are not rational are called irrational, as well as understand informally that every number has a decimal expansion; for rational numbers. Students can show that the decimal expansion repeats eventually, and can convert a decimal expansion which repeats eventually, and can convert a decimal expansion which repeats eventually into a rational number. In addition, students can 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.	Students will apply their knowledge of rational and irrational numbers by forming a human number line.	Students will create their own set of cards to be used for individual exercise.

Present and Going Forward Vocabulary:
Rational, irrational

Career Connections:
Marketing

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

Rational vs. Irrational

Students will prepare 3x5 cards with an assortment of numbers, both rational and irrational. Students will trade cards with each other. They will arrange the cards in numerical order. (You may wish to allow students to use their calculators when determining the correct order.) As a second part to this activity, ask the students to separate the rational numbers from irrational numbers. This activity will help students strengthen their understanding of how numbers are related to one another. It is particularly valuable in allowing students to compare rational and irrational numbers.

Literature Connections/Resources:
http://regentsprep.org/Regents/math/ALGEBRA/AOP1/Tcards.htm

ACCRS: 8.3

Know and apply the properties of integer exponents to generate equivalent numerical expressions. Example: $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

Mastered:	**Present:**	**Going Forward:**
Students know and apply the properties of integer exponents to generate equivalent numerical expressions.	Students will apply the knowledge of properties of exponents via a student choice activity by creating games, writing poems, etc.	Students will evaluate each other's choices using student generated rubrics.

Present and Going Forward Vocabulary:
Exponents, base, power

Career Connections:
Scientist, Aerospace Engineer, Biomedical Engineer

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

Exponentially

Students may choose one or more of the following activities:

- Create a poem that explains what exponents are, how to use them, and when to use them. You may even use exponents in the poem to represent repeating words. Be creative.
- Research a career that uses exponents in real world problem solving. Present the career to the class using PowerPoint, Prezi, or another type of presentation tool. Be sure to include the following information in your presentation:
  - Career Name.
  - Availability of careers in this profession: In other words, how competitive is the job market to enter this career?
  - Educational Requirements.
  - Salary.
  - Description of Work.
  - Major locations of this profession: Are there certain areas around the world that more people from this profession live? For example, Silicon Valley, CA, has more computer program designers.
  - Why exponents are used in this profession.
  - An example exponent problem from this career.
  - Other interesting information.

Literature Connections/Resources:

- The Futures Channel: http://www.thefutureschannel.com/
- WeUseMath.org: http://weusemath.org/careers
- Careers that use Math: http://www.staff.olympia.org/external/classes/Staudenmeier/Careers/careers_that_require_mathematics.htm

ACCRS: 8.4

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 $\sqrt{2}$ is irrational.

Mastered:	**Present:**	**Going Forward:**
Students can 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 $\sqrt{2}$ is irrational.	Students will explore and determine relationships between square- and cube-roots.	Students will be asked to explore the relationship between three-dimensional objects in two-dimension.

Present and Going Forward Vocabulary:
Square root, cube root, geometric, numeric

Career Connections:
Artist, Architect

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

Using NCTM Illuminations: Stacking Squares

Students will download and complete the *Playing with Squares Activity Sheet*. Working independently, they will assemble a poster using markers, grid paper, rulers, etc. which illustrates guesses they have made about connections between geometric and numeric representations of squares and between whole numbers and their square-roots. Once completed, the students will have to explain their reasoning to the class and/or teacher. The activity sheet and directions can be found at http://illuminations.nctm.org/LessonDetail.aspx?id=L622

Literature Connections/Resources:

- http://illuminations.nctm.org/LessonDetail.aspx?id=L622
- Wagner, David. "We Have a Problem Here: 5 + 20 = 45?" *Mathematics Teacher* 96 (December 2003): 612-616.

ACCRS: 8.5-.6

8.5: 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.
Example: Estimate the population of the United 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.

8.6: 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.

Mastered:	**Present:**	**Going Forward:**
Students can 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. In addition, students can perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Students can 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) and interpret scientific notation that has been generated by technology.	Students will explore space by applying their knowledge of scientific notation to determine if another planet like earth exists.	Students will write a report summarizing the mathematical steps taken in order to determine the existence of another planet like Earth.

Present and Going Forward Vocabulary:

Base, power

Career Connections:

Engineer, Scientist, Astronaut

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

What Are the Odds?

Students will imagine they work for NASA. As employees of NASA they have been asked to determine if another planet like Earth exists in outer space. This project-based learning activity requires a student handout which can be found via the link, http://www.regentsprep.org/Regents/math/ALGEBRA/AO2/ScientificTeacher.htm.

Literature Connections/Resources:

http://www.regentsprep.org/Regents/math/ALGEBRA/AO2/ScientificTeacher.htm

ACCRS: 8.7-.8

8.7: Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
Example: Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

8.8: 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*.

Mastered:

Students can graph proportional relationships, interpreting the unit rate as the slope of the graph and compare two different proportional relationships represented in different ways. Students can also 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*.

Present:

Students will collect and analyzed data to determine the number of rubber bands needed for a Barbie doll to complete a secure bungee jump.

Going Forward:

Students will be asked to use different dolls with various weights and heights and decide if fewer or more rubber bands will be needed for a safe bungee jump.

Present and Going Forward Vocabulary:

Proportional, slope

Career Connections:

Engineer, Architect

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

NCTM Illuminations: Barbie Bungee

Students will conduct an experiment, collect data, and then use the data to predict the maximum number of rubber bands that should be used to give Barbie® a safe jump from a height of 400 cm. Materials needed include rubber bands (all the same size and type), yardsticks or measuring tapes, masking tape, Barbie® dolls (or similar), and a student activity sheet. The teacher or students will need to go to the NCTM Illuminations Web site, http://illuminations.nctm.org/LessonDetail.aspx?id=L646, to get a description of the activities, as well as location of videos about bungee jumping and student activity packets.

Literature Connections/Resources:
http://illuminations.nctm.org/LessonDetail.aspx?id=L646

ACCRS: 8.9-.10

8.9: 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. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions, using the distributive property and collecting like terms.

8.10: Analyze and solve pairs of simultaneous linear equations.

a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersections of their graphs because points of intersection satisfy both equations simultaneously.

b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
Example: $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.

c. Solve real-world and mathematical problems leading to two linear equations in two variables.
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.

Mastered:	**Present:**	**Going Forward:**
Students can solve linear equations in one variable as well as analyze and solve pairs of simultaneous linear equations.	Students will have the opportunity to construct graphs from tables and solve systems of linear equations in real-world applications.	Students will use graphing calculators to further explore the supply and demand functions.

Present and Going Forward Vocabulary:
Supply, demand, equilibrium

Career Connections:
Financial Advisor, Business Owner

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

NCTM Illuminations Web site: Supply and Demand

The project-based investigation directs the students to construct graphs, given specified data, and then examine the information to determine prices and equilibrium. This activity consists of three different real-life applications. The teacher will need to go to the NCTM Illuminations Web site, http://illuminations.nctm.org/LessonDetail.aspx?id=L382, to get a description of the activities. Materials needed include the student activity sheet and grid paper.

Literature Connections/Resources:

- http://illuminations.nctm.org/LessonDetail.aspx?id=L382
- Baker, Patricia Cooper, "Supply and Demand -- An Application of Linear Equations," *The Mathematics Teacher*, vol. 84, no. 7 (October 1991), p. 554.

ACCRS: 8.11-.13

8.11: Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.) [8-F1]

8.12: Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). [8-F2]

8.13: Interpret the equation y = mx + b as defining a linear function whose graph is a straight line; give examples of functions that are not linear. [8-F3]

Mastered:
Students can understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.) Students can compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Students can interpret the equation y = mx + b as defining a linear function whose graph is a straight line; give examples of functions that are not linear.

Present:
Students will compare properties of functions in order to discover relationships that will help the student match a graph with an equation, a table and a rule and explain the reason why the student matched the graph with its equation.

Going Forward:
Students will create their own equations. Draw a graph and make a table for each equation.

Present and Going Forward Vocabulary:
Function, linear, non-linear

Career Connections:
Financial Manager, Computer and Information Systems Managers, Human Resources Assistant and Manager, Engineer

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

Sorting Functions

This problem gives the student a chance to:

- Find relationships between graphs, equations, tables and rules
- Explain his/her reasons for four graphs, four equations, four tables, and four rules

The teacher or students will need to go to the following Web site and print out the first two pages, which will contain the information that the student needs to complete this assignment. This Web site contains an explanation of the lesson and a variety of student responses following the two page activity sheets.
http://www.insidemathematics.org/pdfs/algebra/sorting-functions/packet.pdf?phpMyAdmin=NqJS1x3gaJqDM-1-8LXtX3WJ4e8

Literature Connections/Resources

Insidemathematics.org http://www.insidemathematics.org/pdfs/algebra/sorting-functions/packet.pdf?phpMyAdmin=NqJS1x3gaJqDM-1-8LXtX3WJ4e8

ACCRS: 8.14-.15

8.14: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x,y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of linear function in terms of the situation it models and in terms of its graph or a table of values. [8-F4]

8.15: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. [8-F5]

Mastered:	Present:	Going Forward:
Students can construct a function to model a linear relationship between two quantities and determine the rate of change and initial value of the function from a description of a relationship or from two (x,y) values, including reading these from a table or from a graph. Students can nterpret the rate of change and initial value of linear function in terms of the situation it models and in terms of its graph or a table of values. Students can describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	Students will use an activity called Amazing Profit to determine a linear equation for selling price of and profit from "new" technology on eBay. Students will interpret a graph of the constructed equations and analyze relationships and trends from multiple representations of data.	Students will find a line of fit for a set of data and make a prediction.

Present and Going Forward Vocabulary:
Function, rate of change, linear, nonlinear

Career Connections:
Nursing, Nursing Aide, Psychiatric Aide, Home Health Care Aide, Medical Assistant, Stock Clerk, Purchasing Manager, Computer Programmer

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)
NCTM Illuminations Web site: Amazing Profit
http://illuminations.nctm.org/LessonDetail.aspx?id=L799
Students will complete the activity sheets using equations to determine profit for eBay on new technology. Students will determine relationships and trends as they complete the work through the lessons.

Literature Connections/Resources
NCTM Illuminations Web site: http://illuminations.nctm.org/LessonDetail.aspx?id=L799

ACCRS: 8.16-.19

8.16: Verify experimentally the properties of rotations, reflections, and translations:
a. Lines are taken to lines, and line segments are taken to line segments of the same length.
b. Angles are taken to angles of the same measure.
c. Parallel lines are taken to parallel lines.

8.17: Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

8.18: Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.19: Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

Mastered:	Present:	Going Forward:
Students can verify experimentally the properties of rotations, reflections, and translations; understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them; describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates; and understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	Students will be create two equivalent transformations.	Students will be given two congruent shapes and asked to identify a transformation or composition of transformations that will map one to the other.

Present and Going Forward Vocabulary:
Translation, dilation, rotation, reflection, composition

Career Connections:
Artist, Designer

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)
NCTM Illuminations Web site: Understanding Congruence, Similarity, and Symmetry Using Transformations and Interactive Figures http://illuminations.nctm.org/LessonDetail.aspx?ID=L447
Students will use a computer and internet connection to manipulate interactive figures and examine the actions, deepening their understanding of congruence, similarity, and reflection. Students will need to write a response to the discussion question under the stand-alone applet tool. The teacher will need to go to the NCTM Illuminations Web site listed below to get a more detailed description of the activities.

Literature Connections/Resources:
http://illuminations.nctm.org/LessonDetail.aspx?ID=L447

ACCRS: 8.20
Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. Example: Arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give argument in terms of transversals why this is so.

Mastered:	Present:	Going Forward:
Students can use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the	Students will explore the relationships between interior and exterior angles of a triangle.	Students can create a piece of art in which vividly illustrates the use of interior, exterior, adjacent, supplementary, and

angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.		remote interior angles.

Present and Going Forward Vocabulary:
Interior, exterior, adjacent, supplementary, and remote interior angles

Career Connections:
Architecture, Artist

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A).

Triangle Exploration

Students will download and complete the Explorations Activity 4 from the Web site, http://www.math.unl.edu/~sdunbar1/ExperimentationCR/Lessons/TI84Lessons/ExploringTriangles.pdf. Through technology, the students will explore and construct interior and exterior angles of a triangle. In addition, students will collect and analyze data that will be used to form conjectures about the interior and exterior angles of a triangle as well as explain their rationale.

Literature Connections/Resources:

- http://www.math.unl.edu/~sdunbar1/ExperimentationCR/Lessons/TI84Lessons/ ExploringTriangles.pdf
- http://education.ti.com/educationportal/sites/US/productDetail/us_cabrijr_83_84.html
- http://mathbits.com/mathbits/tisection/GEOMETRY/CabriIntro.htm
- http://www.mathwarehouse.com/geometry/triangles/interactive-triangle.htm

ACCRS: 8.21-.23

8.21: Explain a proof of the Pythagorean Theorem and its converse.
8.22: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
8.23: Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Mastered:	**Present:**	**Going Forward:**
Students can explain a proof of the Pythagorean Theorem and its converse, apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions, as well as apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	Students will replicate the Global Positioning System (GPS) by using triangulation to locate a target.	After completing the GPS activity, students will compare and contrast between the activity and an actual "smart" bomb using the GPS to strike its target.

Present and Going Forward Vocabulary:
Pythagorean Theorem, triangulation, global positioning system

Career Connections:
Engineer, Aerospace Engineer, Military Computer Technician

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

The Third Side by PBS Teachers

Students will conduct an experiment in triangulation by setting up mock satellites on the ceiling and point towards selected targets inside the classroom. This trial should simulate the guidance systems used in some rockets and other war devices. A diagram is on the student handout sheet. Details of this activity, along with the student handout are located at http://www.pbs.org/teachers/connect/resources/4315/preview/

Literature Connections/Resources:
http://www.pbs.org/teachers/connect/resources/4315/preview/

ACCRS: 8.24
Know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real-world and mathematical problems.

Mastered:	Present:	Going Forward:
Students know the formulas for the volumes of cones, cylinders, and spheres, and can use them to solve real-world and mathematical problems.	Students will perform an experiment to deepen their understanding of relationships between dimension and volume.	Students will compare cylinders to understand the concept of calculating radius.

Present and Going Forward Vocabulary:
Cylinder, circumference, radius

Career Connections:
Marketing, Engineering

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)
NCTM Illuminations Activity
Students will construct objects and determine the resulting volume. They will substitute values into formulas in an experiment based on their own conjectures. This activity uses two shapes, rectangles and cylinders. The entire lesson and all materials needed can be found on the NCTM Illuminations Web site at:
http://illuminations.nctm.org/LessonDetail.aspx?id=L797

Literature Connections/Resources:
http://illuminations.nctm.org/LessonDetail.aspx?id=L797

ACCRS: 8.25-28

8.25: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. [8-SP1]

8.26: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. [8-SP2]

8.27: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. [8-SP3]

8.28: Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. [8-SP4]

Mastered:	Present:	Going Forward:
Students can construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities, and describe patterns such as clustering, outliers,	Students will plot data, identify lines of best fit, and detect outliers using an activity from NCTM Illuminations Web site.	Students will combine the data for the Lakers and the Pistons and consider the complete set. Are either Kobe Bryant or Ben Wallace outliers in this set? Are both of them still outliers? How do you know?

positive or negative association, linear association, and nonlinear association. Students can know that straight lines are widely used to model relationships between two quantitative variables, and for scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. Students can use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. Students can understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Students can construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Students can use relative frequencies calculated for rows or columns to describe possible association between the two variables.		

Present and Going Forward Vocabulary:
Bivariate, clustering, outliers, positive and negative association, linear and nonlinear association

Career Connections:
Nurse, Nursing Aide, Psychiatric Aide, Home Health Care Aide, Medical Assistant, Stock Clerk, Purchasing Manager, Computer Programmer, Forest Ranger , Conservation Manager

Advanced Understanding & Activity (Alternate activity): (Student activity page is located in Appendix A.)

NCTM Illuminations Activity
http://illuminations.nctm.org/LessonDetail.aspx?id=L673
Students will complete two activities to determine outliers within a set of data. Teacher or student will need to download the two activity sheets, *Illuminations Line of Best Fit Activity* and *Impact of a Superstar Activity Sheet.* A detailed lesson description and activity explanations can be found at the NCTM Web site.

Literature Connections/Resources

- **NCTM Illuminations Web site:**
  http://illuminations.nctm.org/LessonDetail.aspx?id=L673
- **Line of Best Fit:**
  http://illuminations.nctm.org/ActivityDetail.aspx?id=146