# The Number System

## Rational and Irrational Numbers

### Understanding Rational Numbers

1. Classify numbers as rational or irrational - Identify and classify numbers as rational or irrational, including single operation expressions. (8.NS.A.1 - AA1)
2. Understand decimal expansions of rational numbers - Understand that every number has a decimal expansion and that rational numbers have decimal expansions that repeat eventually. (8.NS.A.1 - AA2)
3. Convert fractions to repeating decimals - Convert fractions into their equivalent repeating decimal expansions. (8.NS.A.1 - AA3)
4. Convert repeating decimals to fractions - Convert repeating decimals (including multi-digit repeating decimals) into their equivalent rational number form (fractions). (8.NS.A.1 - AA4)

### Approximating and Comparing Irrational Numbers

1. Approximate square roots - Find the approximate value of square roots by thinking about perfect squares or by identifying the two whole number values between which a square root lies. (8.NS.A.2 - AB1)
2. Approximate cube roots - Approximate the value of cube roots and represent them as points on the number line. (8.NS.A.2 - AB2)
3. Locate irrational numbers on a number line - Locate irrational numbers approximately on a number line diagram using rational approximations. (8.NS.A.2 - AB3)
4. Compare and order irrational numbers (without calculator) - Compare and order irrational numbers without using a calculator, by using rational approximations and their relative positions on the number line. (8.NS.A.2 - AB4)
5. Compare and order irrational numbers (with calculator) - Compare and order irrational numbers using a calculator to find their approximate decimal values. (8.NS.A.2 - AB5)
6. Estimate values of expressions involving irrational numbers - Estimate the value of expressions involving irrational numbers (e.g., ) by using rational approximations. (8.NS.A.2 - AB6)

# Expressions and Equations

## Exponents and Scientific Notation

### Integer Exponents

1. Understand integer exponents - Comprehend that repeated division of a number is equivalent to repeated multiplication by its reciprocal, and understand the meaning of negative exponents. (8.EE.A.1 - AC1)
2. Evaluate powers with integer exponents - Compute numbers raised to positive and negative integer exponents, including bases that are fractions or decimals. (8.EE.A.1 - AC2)
3. Apply the product of powers property - Rewrite products of powers with the same base by adding their exponents (e.g., ). (8.EE.A.1 - AC3)
4. Apply the quotient of powers property - Rewrite quotients of powers with the same base by subtracting their exponents (e.g., ). (8.EE.A.1 - AC4)
5. Apply the power of a power property - Rewrite powers of powers by multiplying the exponents (e.g., ). (8.EE.A.1 - AC5)
6. Apply the power of a product and quotient properties - Rewrite powers of products and quotients, including expressions with negative exponents (e.g., ). (8.EE.A.1 - AC6)
7. Generate equivalent numerical expressions using exponent properties - Use properties of integer exponents to generate equivalent numerical expressions, including combining multiple properties. (8.EE.A.1 - AC7)

### Square and Cube Roots

1. Understand the concept of square roots - Comprehend that a square root is the inverse operation of squaring a number, and identify perfect squares. (8.EE.A.2 - AD1)
2. Evaluate positive and negative square roots of perfect square integers - Calculate both the principal (positive) and negative square roots of small perfect square integers. (8.EE.A.2 - AD2)
3. Evaluate square roots of perfect square fractions and decimals - Calculate square roots of perfect square fractions and decimals. (8.EE.A.2 - AD3)
4. Understand the concept of cube roots - Comprehend that a cube root is the inverse operation of cubing a number, and identify perfect cubes. (8.EE.A.2 - AD4)
5. Evaluate positive and negative cube roots of perfect cube integers - Calculate both the positive and negative cube roots of small perfect cube integers. (8.EE.A.2 - AD5)
6. Estimate non-perfect square and cube roots - Estimate the approximate numerical value of square roots and cube roots of non-perfect squares/cubes (e.g., where x is not a perfect square) to the nearest whole number or by identifying the two whole numbers it lies between. (8.EE.A.2 - AD6)
7. Represent solutions to using square root symbol - Express solutions to equations of the form (where is a positive rational number) using the notation. (8.EE.A.2 - AD7)
8. Solve equations of the form - Determine the numerical solutions to equations of the form , including cases where is a positive rational decimal or fraction. (8.EE.A.2 - AD8)
9. Represent solutions to using cube root symbol - Express solutions to equations of the form (where is a positive rational number) using the notation. (8.EE.A.2 - AD9)
10. Solve equations of the form - Determine the numerical solutions to equations of the form . (8.EE.A.2 - AE1)
11. Know that is irrational - State and understand that the square root of 2 is an irrational number. (8.EE.A.2 - AE2)
12. Solve varied problems involving square and cube roots - Apply knowledge of square and cube roots to solve various mathematical problems. (8.EE.A.2 - AE3)

### Powers of 10 and Scientific Notation

1. Understand powers of 10 - Recognize and work with positive and negative integer powers of 10. (8.EE.A.3 - AF1)
2. Express large numbers as a single digit times a power of 10 - Convert very large numbers into the form where is a single digit. (8.EE.A.3 - AF2)
3. Express small numbers as a single digit times a power of 10 - Convert very small numbers into the form where is a single digit and is a negative integer. (8.EE.A.3 - AF3)
4. Estimate very large quantities using powers of 10 - Approximate real-world very large quantities using a single digit times an integer power of 10. (8.EE.A.3 - AF4)
5. Estimate very small quantities using powers of 10 - Approximate real-world very small quantities using a single digit times an integer power of 10. (8.EE.A.3 - AF5)
6. Express how many times as much one quantity is than another using powers of 10 - Compare two quantities by determining how many times larger or smaller one is than the other, using powers of 10. (8.EE.A.3 - AF6)
7. Perform multiplication and division with powers of ten - Solve multiplication and division problems involving numbers expressed as powers of ten. (8.EE.A.3 - AF7)
8. Define scientific notation - Understand that scientific notation expresses numbers as a product of a number between 1 and 10 (inclusive of 1, exclusive of 10) and an integer power of 10. (8.EE.A.4 - AF8)
9. Convert between standard notation and scientific notation - Convert numbers from standard form to scientific notation and from scientific notation to standard form. (8.EE.A.4 - AF9)
10. Compare numbers written in scientific notation - Order and compare numbers given in scientific notation. (8.EE.A.4 - AG1)
11. Add and subtract numbers in scientific notation - Perform addition and subtraction operations on numbers expressed in scientific notation, including cases where adjustment of exponents is necessary. (8.EE.A.4 - AG2)
12. Multiply numbers in scientific notation - Perform multiplication operations on numbers expressed in scientific notation. (8.EE.A.4 - AG3)
13. Divide numbers in scientific notation - Perform division operations on numbers expressed in scientific notation. (8.EE.A.4 - AG4)
14. Solve word problems involving scientific notation - Apply operations with scientific notation to solve real-world problems, including those involving very large or very small quantities. (8.EE.A.4 - AG5)
15. Choose appropriate units for very large or very small quantities - Select and use appropriate units of measurement when working with very large or very small quantities, often expressed in scientific notation. (8.EE.A.4 - AG6)
16. Interpret scientific notation generated by technology - Understand and interpret scientific notation as it is displayed on calculators and other technological tools. (8.EE.A.4 - AG7)

## Solving Linear Equations

### Introduction to Equations

1. Identify solutions to one-variable equations - Determine whether a given value for the variable satisfies a one-variable equation. (8.EE.C.7 - AH1)
2. Write equations from word problems - Translate verbal descriptions into algebraic equations with one variable. (8.EE.C.7 - AH2)
3. Model and solve equations using algebra tiles - Represent and solve one-variable equations using algebra tiles to demonstrate balanced moves. (8.EE.C.7 - AH3)
4. Write and solve equations that represent diagrams - Formulate and solve equations based on visual diagrams like hanger diagrams. (8.EE.C.7 - AH4)
5. Understand properties of equality - Recognize and apply the properties of equality (addition, subtraction, multiplication, division) to transform equations. (8.EE.C.7 - AH5)
6. Identify equivalent equations - Determine if two equations are equivalent by applying properties of equality. (8.EE.C.7 - AH6)

### Solving One-Variable Linear Equations

1. Solve one-step linear equations - Solve linear equations that require one inverse operation. (8.EE.C.7 - AI1)
2. Solve two-step linear equations - Solve linear equations that require two inverse operations. (8.EE.C.7 - AI2)
3. Complete solutions to two-step equations - Fill in missing steps in the solution process of two-step linear equations. (8.EE.C.7 - AI3)
4. Solve one-step and two-step equations: word problems - Formulate and solve one-step and two-step linear equations from word problems. (8.EE.C.7 - AI4)
5. Solve equations involving like terms - Solve linear equations that require combining like terms on one or both sides of the equation. (8.EE.C.7 - AI5)
6. Equations with variables on both sides - Practice solving one-variable equations like 20 - 7x = 6x - 6, where the variable appears on both sides of the equals sign. (8.EE.C.7 - AI6)
7. Solve equations with variables on both sides - Solve linear equations where the variable appears on both sides of the equals sign. (8.EE.C.7 - AI7)
8. Equations with variables on both sides: decimals & fractions - Solve linear equations where the variable appears on both sides of the equation and the coefficients are decimals or fractions. (8.EE.C.7 - AI8)
9. Solve equations with variables on both sides: fractional coefficients - Solve linear equations with variables on both sides where the coefficients are fractions or decimals. (8.EE.C.7 - AI9)
10. Solve equations with variables on both sides: word problems - Formulate and solve linear equations with variables on both sides from word problems. (8.EE.C.7 - AJ1)
11. Equations with parentheses - Practice solving equations with parentheses using the distributive property. (8.EE.C.7 - AJ2)
12. Solve equations with the distributive property - Solve linear equations that require expanding expressions using the distributive property. (8.EE.C.7 - AJ3)
13. Equations with parentheses: decimals & fractions - Solve linear equations that contain expressions with parentheses and the coefficients are rational numbers. (8.EE.C.7 - AJ4)
14. Solve multi-step linear equations - Solve linear equations that require multiple steps, including combining like terms, using the distributive property, and variables on both sides. (8.EE.C.7 - AJ5)
15. Solve multi-step equations with fractional coefficients - Solve multi-step linear equations where coefficients are rational numbers (fractions or decimals). (8.EE.C.7 - AJ6)
16. Complete solutions to multi-step equations - Fill in missing steps in the solution process of multi-step linear equations. (8.EE.C.7 - AJ7)

### Solutions to Linear Equations

1. Number of solutions to equations - Practice telling whether an equation has one, zero, or infinite solutions. For example, how many solutions does the equation 8(3x+10)=28x-14-4x have? (8.EE.C.7.a - AK1)
2. Find the number of solutions - Analyze linear equations to determine if they have one solution, no solutions, or infinitely many solutions. (8.EE.C.7.a - AK2)
3. Number of solutions to equations challenge - Given a linear equation with missing values, determine appropriate values in order to have one, zero, or infinite solutions. For example, complete the equation -11x + 4 = \_\_x + \_\_ so that it has no solutions. (8.EE.C.7.a - AK3)
4. Create equations with no solutions or infinitely many solutions - Construct linear equations that result in no solution or infinitely many solutions by manipulating coefficients and constants. (8.EE.C.7.a - AK4)
5. Equation practice with angle addition - Given the sum of a pair of angle measures and the algebraic expressions that represent them, form and solve an equation. Includes complementary, supplementary, and other adjacent angles. (8.EE.C.7.b - AK5)
6. Equation practice with midpoints - Given information about the distance of a segment’s midpoint from its endpoints, form and solve an equation in order to find the length of the segment. (8.EE.C.7.b - AK6)
7. Equation practice with segment addition - Given an information about the lengths of line segments, form and solve an equation in order to find the lengths of the segments. (8.EE.C.7.b - AK7)
8. Equation practice with vertical angles - Given algebraic expressions that represent a pair of two vertical angles, form and solve an equation. (8.EE.C.7.b - AK8)
9. Intercepts from an equation - Solve linear equations for the x-intercept and y-intercept (8.EE.C.7.b - AK9)
10. Slope-intercept from two points - Practice finding the equation of a line passing through two points. (8.EE.C.7.b - AL1)
11. Sums of consecutive integers - Practice finding the nth number in a sequence of consecutive numbers based on the sum. (8.EE.C.7.b - AL2)

## Systems of Linear Equations

### Understanding Systems Graphically

1. Verify solutions to systems of equations - Verify whether a given pair of values for x and y is a solution to a system of equations. (8.EE.C.8.a - AM1)
2. Solve systems of equations with graphing - Graph a system of equations in slope-intercept or standard form, and find their solution using the graphs. (8.EE.C.8.a - AM2)
3. Number of solutions to a system graphically - Determine the number of solutions of a given system of equations by considering its graph. (8.EE.C.8.a - AM3)
4. Interpret points relative to a system - Practice interpreting what different points mean in context in a system of linear equations. (8.EE.C.8.a - AM4)
5. Understand solution as point of intersection - Comprehend that the solution to a system of two linear equations is the point where their graphs intersect, as this point satisfies both equations simultaneously. (8.EE.C.8.a - AM5)
6. Estimate solutions by graphing - Graph linear equations and estimate the point of intersection to approximate the solution to a system. (8.EE.C.8.b - AM6)

### Solving Systems Algebraically

1. Solve systems using substitution - Solve systems of linear equations by solving one equation for a variable and substituting that expression into the other equation. (8.EE.C.8.b - AN1)
2. Solve systems using elimination - Solve systems of linear equations by adding or subtracting equations to eliminate one variable. (8.EE.C.8.b - AN2)
3. Solve systems algebraically - Solve systems of two linear equations in two variables using algebraic methods (substitution or elimination). (8.EE.C.8.b - AN3)
4. Solve simple cases by inspection - Identify solutions to systems of equations in simple cases by visually examining the equations or their graphs without complex calculations. (8.EE.C.8.b - AN4)
5. Number of solutions to a system algebraically - Determine the number of solutions of a given system of equations by considering its algebraic solution process. (8.EE.C.8.a - AN5)

### Applications of Systems

1. Solve systems using any method - Choose and apply the most appropriate method (graphing, substitution, or elimination) to solve a system of linear equations. (8.EE.C.8 - AO1)
2. Solve systems using any method: word problems - Solve word problems by modeling them into a system of equations and solving them using any method. (8.EE.C.8 - AO2)
3. Classify a system of equations by graphing - Classify systems of equations as consistent/inconsistent and dependent/independent based on their graphs. (8.EE.C.8 - AO3)
4. Classify a system of equations - Classify systems of equations as consistent/inconsistent and dependent/independent using algebraic analysis. (8.EE.C.8 - AO4)
5. Solve age word problems with systems - Solve word problems specifically involving ages by setting up and solving a system of equations. (8.EE.C.8.c - AO5)
6. Solve systems of equations word problems - Solve word problems by modeling them into a system of equations and solving it. (8.EE.C.8.c - AO6)
7. Write systems of equations from word problems - Translate real-world problems into a system of two linear equations in two variables. (8.EE.C.8.c - AO7)
8. Solve systems by substitution: word problems - Solve word problems by setting up a system of linear equations and solving it using the substitution method. (8.EE.C.8.c - AO8)
9. Solve systems by elimination: word problems - Solve word problems by setting up a system of linear equations and solving it using the elimination method. (8.EE.C.8.c - AO9)
10. Solve systems by graphing: word problems - Graphically solve systems of linear equations derived from real-world word problems. (8.EE.C.8.c - AP1)

# Functions

## Understanding Functions

### Function Basics

1. Identify functions from relations (tables, graphs, and sets of ordered pairs) - Determine whether a given relation (represented as a table of values, a graph, or a set of ordered pairs) represents a function by checking if each input has exactly one output. (8.F.A.1 - AQ1)
2. Identify independent and dependent variables - Identify the independent and dependent variables in a given relationship or function. (8.F.A.1 - AQ2)
3. Evaluate functions from equations - Evaluate functions for specific inputs given the formula of the function, written using function notation. (8.F.A.1 - AQ3)
4. Evaluate functions from graphs - Evaluate functions for specific inputs given the graph of the function. (8.F.A.1 - AQ4)
5. Find inputs for a given function output from equations - Find all the inputs that correspond to a given function output, using the function’s formula. (8.F.A.1 - AQ5)
6. Complete tables for a function graph - Given the graph of a function, complete a table of values that represent points on the function. (8.F.A.1 - AQ6)
7. Determine the domain and range of a function from a graph - Given the graph of a function, determine its domain or range. (8.F.A.1 - AQ7)
8. Determine the domain of a function from a word problem - Use information about a situation to figure out the domain of the function which models it. (8.F.A.1 - AQ8)
9. Determine if an ordered pair is a solution to a two-variable equation - Determine which ordered pairs are solutions to two-variable equations. (8.F.A.1 - AQ9)
10. Complete solutions to two-variable equations - Given the x or y value of a two-variable equation solution, find the value for the other variable in the solution. (8.F.A.1 - AR1)
11. Create function rules from two-variable equations - Create functions that match one variable to the other in a two-variable equation. (8.F.A.1 - AR2)

### Classifying and Representing Functions

1. Identify linear and nonlinear functions from equations - Determine if a relationship represented by an equation is linear or nonlinear. (8.F.A.3 - AS1)
2. Identify linear and nonlinear functions from tables - Determine if a relationship represented by a table of values is linear or nonlinear. (8.F.A.3 - AS2)
3. Identify linear and nonlinear functions from graphs - Determine if a relationship represented by a graph is linear or nonlinear. (8.F.A.3 - AS3)
4. Understand slope-intercept form () - Practice basic understanding of slope-intercept form for linear equations, including identifying the slope and y-intercept from the equation. (8.F.A.3 - AS4)
5. Graph a line from an equation in slope-intercept form - Practice drawing the graph of a line given in slope-intercept form (e.g., graph ). (8.F.A.3 - AS5)
6. Graph a line from an equation in standard form - Find the graph of a linear equation given in standard form. (8.F.A.3 - AS6)
7. Graph a line from an equation in point-slope form - Graph a line from an equation in point-slope form. (8.F.A.3 - AS7)
8. Graph horizontal and vertical lines - Graph horizontal and vertical lines given their equations. (8.F.A.3 - AS8)
9. Write equations of horizontal and vertical lines - Write the equations of horizontal and vertical lines given their graphs or descriptions. (8.F.A.3 - AS9)
10. Find intercepts from a graph - Look at the graph of an equation to find x-intercepts and y-intercepts. (8.F.A.3 - AT1)
11. Find intercepts from a table - Find the intercepts of a line given a table of values. (8.F.A.3 - AT2)
12. Find intercepts from an equation - Solve linear equations for the x-intercept and y-intercept. (8.F.A.3 - AT3)
13. Solve problems involving linear equations in various forms - Apply understanding of different forms of linear equations (slope-intercept, standard, point-slope) to solve problems. (8.F.A.3 - AT4)

## Analyzing Linear Functions

### Proportional Relationships as Functions

1. Identify proportional relationships from tables - Determine if a relationship represented in a table is proportional. (8.EE.B.5 - AU1)
2. Identify proportional relationships from graphs - Determine if a relationship represented on a graph is proportional by checking if it’s a straight line through the origin. (8.EE.B.5 - AU2)
3. Identify proportional relationships from graphs and equations - Determine if a relationship is proportional given its graph or equation. (8.EE.B.5 - AU3)
4. Identify proportional relationships: word problems - Determine if a real-world situation describes a proportional relationship. (8.EE.B.5 - AU4)
5. Find the constant of proportionality from a table - Calculate the constant of proportionality from data presented in a table. (8.EE.B.5 - AU5)
6. Find the constant of proportionality from a graph - Determine the constant of proportionality from the graph of a proportional relationship. (8.EE.B.5 - AU6)
7. Write equations for proportional relationships from tables - Formulate an equation that represents a proportional relationship given in a table. (8.EE.B.5 - AU7)
8. Write equations for proportional relationships from graphs - Formulate an equation that represents a proportional relationship given its graph. (8.EE.B.5 - AU8)
9. Graph proportional relationships - Graph a line that represents a proportional relationship given an equation, table, or verbal description. (8.EE.B.5 - AU9)
10. Interpret graphs of proportional relationships - Understand what points and sections of a graph of a proportional relationship represent in context, including the unit rate as slope. (8.EE.B.5 - AV1)
11. Graph proportional relationships and find the slope - Graph a proportional relationship and identify its slope, understanding that the slope represents the unit rate. (8.EE.B.5 - AV2)
12. Write and solve equations for proportional relationships - Write and solve equations of the form to represent and solve problems involving proportional relationships. (8.EE.B.5 - AV3)
13. Compare proportional relationships represented in different ways - Compare unit rates and other features of two different proportional relationships presented as graphs, tables, equations, or verbal descriptions. (8.EE.B.5 - AV4)
14. Understand direct variation - Recognize that direct variation is a type of proportional relationship and identify the constant of variation. (8.EE.B.5 - AV5)
15. Find the constant of direct variation - Calculate the constant of variation in a direct variation relationship. (8.EE.B.5 - AV6)
16. Write direct variation equations - Write an equation that represents a direct variation relationship. (8.EE.B.5 - AV7)
17. Solve problems using direct variation equations - Use direct variation equations to solve real-world and mathematical problems. (8.EE.B.5 - AV8)

### Slope and Intercepts of Linear Functions

1. Find the slope from a graph - Find the slope of a line on the coordinate plane. (8.F.B.4 - AW1)
2. Find the slope from two points - Find the slope of the line that goes through the two points that are given. (8.F.B.4 - AW2)
3. Find the slope from a table - Practice finding the slope for a linear relationship in a table of values. (8.F.B.4 - AW3)
4. Find the slope from an equation - Find the slopes of lines whose equations are given in various forms (e.g., find the slope of ). (8.F.B.4 - AW4)
5. Find a missing coordinate using slope - Find a missing coordinate of a point on a line given the slope and another point. (8.F.B.4 - AW5)
6. Graph a line using slope and a point - Graph a line using its slope and a given point. (8.F.B.4 - AW6)
7. Write a linear equation from a graph - Practice finding the slope-intercept equation of a line from its graph. (8.F.B.4 - AW7)
8. Write a linear equation from two points - Practice finding the equation of a line passing through two points. (8.F.B.4 - AW8)
9. Write a linear equation from a slope and y-intercept - Write a linear equation given its slope and y-intercept. (8.F.B.4 - AW9)
10. Write a linear equation from a slope and a point - Write a linear equation given its slope and a point it passes through. (8.F.B.4 - AX1)
11. Convert a linear equation in standard form to slope-intercept form - Convert a linear equation from standard form to slope-intercept form. (8.F.B.4 - AX2)

### Interpreting and Applying Linear Functions

1. Interpret the slope and y-intercept of a linear function in context - Interpret the meaning of the slope (rate of change) and y-intercept (initial value) of a linear function in terms of the situation it models. (8.F.B.4 - AY1)
2. Write linear functions from word problems - Find a linear function that represents a real-world relationship that is given verbally. (8.F.B.4 - AY2)
3. Evaluate linear functions from word problems - Evaluate linear functions for specific inputs in the context of real-world word problems. (8.F.B.4 - AY3)
4. Interpret graphs of functions (increasing/decreasing, linear/nonlinear) - Interpret the graphs of both linear and nonlinear functions, describing where the function is increasing, decreasing, constant, or identifying if it’s linear or nonlinear. (8.F.B.5 - AY4)
5. Identify relative maxima and minima from graphs - Given the graph of a function, find all of its relative maximum and minimum points. (8.F.B.5 - AY5)
6. Sketch a graph from a verbal description of a function - Sketch a graph that exhibits the qualitative features of a function that has been described verbally. (8.F.B.5 - AY6)

# Geometry

## Transformations and Congruence

### Introduction to Transformations

1. Identify transformations - Identify a given transformation as a rotation, reflection, or translation. (8.G.A.1 - AZ1)
2. Describe transformations informally - Describe a translation or rotation of a shape using informal language, such as ‘slide’ and ‘turn’. (8.G.A.1 - AZ2)
3. Draw images of figures under translations on a grid - Draw the image of a figure that results from a translation on a grid. (8.G.A.1 - AZ3)
4. Draw images of figures under rotations on a grid - Draw the image of a figure that results from a rotation on a grid. (8.G.A.1 - AZ4)
5. Draw images of figures under reflections on a grid - Draw the image of a figure that results from a reflection on a grid. (8.G.A.1 - AZ5)
6. Describe translations using coordinates - Given a point and a definition of a translation, identify the coordinates of the translated point or graph it on a coordinate plane. (8.G.A.1 - AZ6)
7. Describe reflections using coordinates - Given a point and a definition of a reflection (horizontal or vertical), plot the reflection on a coordinate plane or identify the coordinates of the reflected point. (8.G.A.1 - AZ7)
8. Describe rotations using coordinates (general) - Given a point and a definition of a rotation, plot the rotation on a coordinate plane or identify the coordinates of the rotated point. (8.G.A.1 - AZ8)
9. Determine the rule for a translation - Given two figures on the coordinate plane, find the formal definition of the translation that takes one figure to another. (8.G.A.1 - AZ9)
10. Determine the line of reflection - Given a shape and its image under a horizontal or vertical reflection, determine the line of reflection. (8.G.A.1 - BA1)
11. Determine the angle and center of rotation (general) - Given a figure on the coordinate plane and a center of a rotation, find the angle for the rotation that maps one figure to the other. (8.G.A.1 - BA2)
12. Determine the rule for reflections and rotations - Given a figure and its image, write the rule for the reflection or rotation. (8.G.A.1 - BA3)
13. Apply a sequence of transformations - Apply a sequence of transformations to points on a coordinate plane and determine whether the order of transformations affects the image. (8.G.A.1 - BA4)
14. Graph the image of a figure after a translation - Given a figure and a definition of a translation, manually draw the image on a coordinate plane. (8.G.A.3 - BA5)
15. Graph the image of a figure after a reflection over an axis - Given a figure and a definition of a reflection over the x- or y-axis, graph the image on a coordinate plane. (8.G.A.3 - BA6)
16. Graph the image of a figure after a reflection - Given a figure and a definition of a reflection, manually draw the image on a coordinate plane. (8.G.A.3 - BA7)
17. Rotate points (basic) - Given a point and a definition of a rotation, plot the rotation on a coordinate plane or identify the coordinates of the rotated point. Rotations are about the origin and multiples of 90°. (8.G.A.3 - BA8)
18. Rotate points - Given a point and a definition of a rotation, plot the rotation on a coordinate plane or identify the coordinates of the rotated point. (8.G.A.3 - BA9)
19. Determine rotations (basic) - Given a figure on the coordinate plane and a center of a rotation, find the angle for the rotation that maps one figure to the other. Rotations are around the origin and a multiple of 90°. (8.G.A.3 - BB1)

### Properties of Rigid Transformations

1. Identify properties preserved under rigid transformations (length) - Identify that line segments maintain the same length after a rigid transformation (reflection, rotation, translation). (8.G.A.1.a - BC1)
2. Solve problems involving lengths after rigid transformations - Use knowledge about the effects of rigid transformations to solve problems about figures and their images, specifically focusing on lengths. (8.G.A.1.a - BC2)
3. Identify properties preserved under rigid transformations (angle measure) - Identify that angles maintain the same measure after a rigid transformation (reflection, rotation, translation). (8.G.A.1.b - BC3)
4. Solve problems involving angle measures after rigid transformations - Use knowledge about the effects of rigid transformations to solve problems about figures and their images, specifically focusing on angle measures. (8.G.A.1.b - BC4)
5. Identify properties preserved under rigid transformations (parallelism) - Identify that parallel lines remain parallel after a rigid transformation (reflection, rotation, translation). (8.G.A.1.c - BC5)
6. Solve problems involving parallelism after rigid transformations - Use knowledge about the effects of rigid transformations to solve problems about figures and their images, specifically focusing on parallelism. (8.G.A.1.c - BC6)

### Congruence

1. Understand congruence through rigid transformations - Understand that two-dimensional figures are congruent if one can be obtained from the other by a sequence of rotations, reflections, and translations. (8.G.A.2 - BD1)
2. Describe sequences of rigid transformations to show congruence - Given two congruent figures, describe a sequence of rigid transformations (translations, rotations, and/or reflections) that will map one shape onto the other. (8.G.A.2 - BD2)
3. Identify congruent figures - Determine whether two shapes are congruent using visual inspection and understanding of rigid transformations. (8.G.A.2 - BD3)
4. Justify congruence of figures - Determine if two figures are congruent and justify the answer based on rigid transformations. (8.G.A.2 - BD4)
5. Identify corresponding parts of congruent figures - Given two congruent figures, identify corresponding sides and angles. (8.G.A.2 - BD5)
6. Find side lengths and angle measures of congruent figures - Use the properties of congruent figures to find missing side lengths and angle measures. (8.G.A.2 - BD6)
7. Verify congruence by measuring distances - Determine whether shapes are congruent by measuring the distances between corresponding points. (8.G.A.2 - BD7)

## Similarity and Dilations

### Dilations

1. Dilate points on a coordinate plane - Given a point and a definition of a dilation, plot the dilation on a coordinate plane or identify the coordinates of the dilated point. (8.G.A.3 - BE1)
2. Graph the image of a figure after a dilation - Given a figure and a definition of a dilation, select or manually draw the image on a coordinate plane. (8.G.A.3 - BE2)
3. Describe transformations using coordinates - Describe the effect of translations, rotations, reflections, and dilations on two-dimensional figures using coordinates. (8.G.A.3 - BE3)
4. Determine the center and scale factor of a dilation - Find both the center and the scale factor of a dilation that maps a given figure to another one. (8.G.A.3 - BE4)
5. Analyze properties preserved and changed under dilations - Given a shape and the dilation that is performed on it, determine which properties the shape and its image share. (8.G.A.3 - BE5)

### Similarity

1. Understand similarity through transformations - Understand that two-dimensional figures are similar if one can be obtained from the other by a sequence of rotations, reflections, translations, and dilations. (8.G.A.4 - BF1)
2. Describe sequences of transformations to show similarity - Given two similar two-dimensional figures, describe a sequence of rotations, reflections, translations, and dilations that exhibits the similarity between them. (8.G.A.4 - BF2)
3. Identify similar triangles - Determine if two triangles are similar. (8.G.A.4 - BF3)
4. Justify similarity of figures - Determine if two figures are similar and justify the answer based on transformations. (8.G.A.4 - BF4)
5. Identify corresponding angles and proportional side lengths in similar polygons - Understand that similar polygons have congruent corresponding angles and proportional side lengths. (8.G.A.4 - BF5)
6. Find side lengths and angle measures of similar triangles - Use the properties of similar triangles to find missing side lengths and angle measures. (8.G.A.4 - BF6)
7. Find side lengths and angle measures of similar figures - Use the properties of similar figures to find missing side lengths and angle measures. (8.G.A.4 - BF7)

### Angle Relationships and Similar Triangles

1. Identify angle relationships with parallel lines and transversals - Identify alternate interior, alternate exterior, corresponding, and consecutive interior angles formed by parallel lines cut by a transversal. (8.G.A.5 - BG1)
2. Find missing angles with parallel lines and transversals - Find missing angle measures given two parallel lines and a transversal. (8.G.A.5 - BG2)
3. Solve equations involving angles formed by parallel lines and transversals - Solve for angle measures on angles formed by parallel lines and a transversal, where the angle measures are given as linear expressions. (8.G.A.5 - BG3)
4. Calculate angle measures using alternate interior angles - Calculate angle measures using alternate interior angles when parallel lines are cut by a transversal. (8.G.A.5 - BG4)
5. Calculate angle measures using vertical and supplementary angles - Calculate angle measures using vertical and supplementary angles. (8.G.A.5 - BG5)
6. Solve equations using angle relationships (complementary, supplementary, vertical, adjacent) - Given the sum of a pair of angle measures and the algebraic expressions that represent them, form and solve an equation for complementary, supplementary, vertical, and other adjacent angles. (8.G.A.5 - BG6)
7. Prove the angle sum theorem of triangles - Use the measure of a straight angle and properties of parallel lines to prove the sum of angles in a triangle is 180 degrees. (8.G.A.5 - BG7)
8. Find missing angles in triangles using the angle sum theorem - Find missing angle measures in triangles using the property that the sum of angles in a triangle is 180 degrees. (8.G.A.5 - BG8)
9. Find missing angles in isosceles triangles - Find missing angles in isosceles triangles given just one angle. (8.G.A.5 - BG9)
10. Apply the Exterior Angle Theorem - Apply the Exterior Angle Theorem to find missing angle measures in triangles. (8.G.A.5 - BH1)
11. Understand the angle-angle criterion for similar triangles - Understand that two triangles are similar if two pairs of corresponding angles are congruent (AA similarity criterion). (8.G.A.5 - BH2)
12. Determine similarity of triangles using AA criterion - Determine that two triangles are similar by finding a sequence of transformations that takes one triangle to the other or by checking that two pairs of corresponding angles are congruent. (8.G.A.5 - BH3)
13. Calculate unknown side lengths in similar triangles using scale factor - Calculate unknown side lengths in similar triangles using the scale factor between similar triangles and understand that the quotients of pairs of side lengths in similar triangles are equal. (8.G.A.5 - BH4)
14. Solve real-world problems using similar triangles (indirect measurement) - Use the properties of similar triangles in a real-world context to find the height of an unknown object. (8.G.A.5 - BH5)

## Pythagorean Theorem and Volume

### Pythagorean Theorem

1. Understand the Pythagorean Theorem visually - Visualize the Pythagorean theorem and its converse using the area of squares. (8.G.B.7 - BI1)
2. Prove the Pythagorean Theorem - Explain and apply a proof of the Pythagorean Theorem. (8.G.B.7 - BI2)
3. Find the length of the hypotenuse using the Pythagorean Theorem - Find the length of the hypotenuse of a right triangle using the Pythagorean theorem. (8.G.B.7 - BI3)
4. Find the missing leg length using the Pythagorean Theorem - Find the length of a leg of a right triangle using the Pythagorean theorem. (8.G.B.7 - BI4)
5. Find missing side lengths in right triangles using the Pythagorean Theorem - Find the length of the hypotenuse or a leg of a right triangle using the Pythagorean theorem. (8.G.B.7 - BI5)
6. Determine if a triangle is a right triangle using the converse of the Pythagorean Theorem - Determine if a triangle with given side lengths is a right triangle using the converse of the Pythagorean Theorem. (8.G.B.7 - BI6)
7. Solve word problems using the Pythagorean Theorem - Use the Pythagorean theorem to solve word problems in two dimensions. (8.G.B.7 - BI7)
8. Find perimeter using the Pythagorean Theorem - Find the perimeter of triangles and quadrilaterals by first using the Pythagorean Theorem to find missing side lengths. (8.G.B.7 - BI8)
9. Find area using the Pythagorean Theorem - Find the area of triangles and quadrilaterals by first using the Pythagorean Theorem to find missing side lengths. (8.G.B.7 - BI9)
10. Find missing side lengths in isosceles triangles using the Pythagorean Theorem - Find a missing side length on an acute isosceles triangle by using the Pythagorean theorem. (8.G.B.7 - BJ1)
11. Apply the Pythagorean Theorem in 3D problems - Apply the Pythagorean theorem to find lengths in prisms and pyramids (three dimensions). (8.G.B.7 - BJ2)
12. Find the distance between two points on the coordinate plane - Use the Pythagorean theorem to find the distance between two points on the coordinate plane. (8.G.B.8 - BJ3)

### Volume of 3D Figures

1. Know the formula for the volume of a cylinder - Recall and understand the formula for the volume of a cylinder (). (8.G.C.9 - BK1)
2. Calculate the volume of a cylinder - Practice applying the volume formula for cylinders to find their volumes. (8.G.C.9 - BK2)
3. Calculate unknown dimensions of a cylinder given its volume - Calculate the value of one dimension (radius or height) of a cylinder, given its volume and other dimension. (8.G.C.9 - BK3)
4. Know the formula for the volume of a cone - Recall and understand the formula for the volume of a cone (). (8.G.C.9 - BK4)
5. Calculate the volume of a cone - Practice applying the volume formula for cones to find their volumes. (8.G.C.9 - BK5)
6. Calculate unknown dimensions of a cone given its volume - Calculate the value of one dimension (radius or height) of a cone, given its volume and other dimension. (8.G.C.9 - BK6)
7. Know the formula for the volume of a sphere - Recall and understand the formula for the volume of a sphere (). (8.G.C.9 - BK7)
8. Calculate the volume of a sphere - Practice applying the volume formula for spheres to find their volumes. (8.G.C.9 - BK8)
9. Estimate the volume of a hemisphere - Estimate the volume of a hemisphere. (8.G.C.9 - BK9)
10. Compare volumes of cylinders, cones, and spheres - Explain the relationship between the volumes of a sphere, cone, and cylinder with the same radius and height. (8.G.C.9 - BL1)
11. Solve word problems involving volumes of cylinders, spheres, and cones - Solve real-world problems involving volume of cylinders, spheres, and cones. (8.G.C.9 - BL2)
12. Find volume and surface area of cylinders - Find volumes and surface areas of cylinders. (8.G.C.9 - BL3)
13. Find volumes of various 3D figures - Find the volumes of cylinders, cones, spheres, and rectangular prisms. (8.G.C.9 - BL4)
14. Interpret and compare volume functions - Interpret and compare functions that represent the volume of a sphere, cone, and cylinder using different representations. (8.G.C.9 - BL5)
15. Analyze effects of scaling dimensions on volume - Determine how scaling one or two dimensions of a figure affects its volume. (8.G.C.9 - BL6)

# Statistics and Probability

## Scatter Plots and Data Analysis

### Constructing and Interpreting Scatter Plots

1. Construct scatter plots by plotting points - Practice plotting points to construct a scatter plot. (8.SP.A.1 - BM1)
2. Make appropriate scatter plots (axes and scale) - Create scatter plots with the independent variable on the x-axis and the dependent variable on the y-axis, using a reasonable scale for both axes to make the data easy to read. (8.SP.A.1 - BM2)
3. Interpret points in a scatter plot - Interpret the meaning of individual points on a scatter plot in terms of the real-world quantities they represent. (8.SP.A.1 - BM3)
4. Describe trends in scatter plots (real-world context) - Explain what trends in scatter plots mean in terms of real-world quantities. (8.SP.A.1 - BM4)
5. Identify patterns of association from scatter plots (positive, negative, nonlinear, no association) - Identify various patterns of association in scatter plots, including positive linear, negative linear, nonlinear, and no association. (8.SP.A.1 - BM5)
6. Identify clustering in scatter plots - Describe instances of data clustering in scatter plots, where data points group together. (8.SP.A.1 - BM6)
7. Identify outliers in scatter plots - Identify data points that are outliers in scatter plots, appearing far away from the other data points. (8.SP.A.1 - BM7)
8. Make predictions with scatter plots (general) - Use scatter plots to make predictions based on observed trends. (8.SP.A.1 - BM8)

### Lines of Best Fit

1. Informally fit a straight line to scatter plot data (Eyeballing the line of best fit) - Given a random assortment of points, draw a line of best fit through them informally. (8.SP.A.2 - BN1)
2. Identify lines of best fit - Given a scatter plot with several lines, identify the line that best fits the data. (8.SP.A.2 - BN2)
3. Assess the model fit by judging closeness of data points to the line - Informally assess how well a straight line models the relationship in a scatter plot by judging how close the data points are to the line. (8.SP.A.2 - BN3)
4. Estimate equations of lines of best fit - Practice estimating the equation of a line of best fit through data points in a scatter plot. (8.SP.A.3 - BN4)
5. Use equations of lines of best fit to make predictions - Use the estimated equation of a line of best fit to make predictions based on the scatter plot data. (8.SP.A.3 - BN5)
6. Estimate slope of line of best fit - Given a scatter plot, estimate the slope of the line of best fit that goes through the data points. (8.SP.A.3 - BN6)
7. Interpret slope for linear models in context - Explain the meaning of the slope for lines of best fit on scatter plots in the context of the real-world situation. (8.SP.A.3 - BN7)
8. Interpret y-intercept for linear models in context - Explain the meaning of the y-intercept for lines of best fit on scatter plots in the context of the real-world situation. (8.SP.A.3 - BN8)
9. Write equations for lines of best fit - Given a scatter plot and a line of best fit, write the equation of that line. (8.SP.A.3 - BN9)
10. Interpret lines of best fit: word problems - Interpret and apply information from lines of best fit in word problems related to real-world scenarios. (8.SP.A.3 - BO1)

### Two-Way Tables

1. Create two-way frequency tables from descriptions/Venn diagrams - Given a Venn diagram or other information about a relationship between two categorical variables, create a two-way frequency table. (8.SP.A.4 - BP1)
2. Read two-way frequency tables - Practice interpreting and extracting specific information from cells within two-way frequency tables. (8.SP.A.4 - BP2)
3. Analyze two-way frequency tables - Practice analyzing two-way frequency tables to understand the joint and marginal frequencies. (8.SP.A.4 - BP3)
4. Interpret two-way tables (general understanding) - Demonstrate a general understanding of how two-way tables organize and display bivariate categorical data. (8.SP.A.4 - BP4)
5. Create two-way relative frequency tables - Practice creating two-way relative frequency tables from a two-way frequency table. (8.SP.A.4 - BP5)