

## Mathematics Benchmarks for Grade 8

<b>Mathematical Content</b>
<b>Strand: <i>The Number System (NS)</i></b>
<b>Know that there are numbers that are not rational, and approximate them by rational numbers.</b>
Show that numbers that are not rational are irrational
Show that every number has a decimal expansion
Show that for rational numbers the decimal expansion repeats eventually
Convert a decimal expansion which repeats eventually into a rational number
Compare rational approximations of irrational numbers to the size of irrational numbers
Locate rational approximations of irrational numbers on a number line diagram
Estimate the value of expressions by using rational approximations of irrational numbers
<b>Strand: <i>Expressions and Equations (EE)</i></b>
<b>Work with radicals and integer exponents.</b>
Show that the properties of integer exponents generate equivalent numerical expressions
Apply the properties of integer exponents to generate equivalent numerical expressions
Use square root symbols to represent solutions to equations of the form $x^2 = p$ , where $p$ is a positive rational number
Use cube root symbols to represent solutions to equations of the form $x^3 = p$ , where $p$ is a positive rational number
Evaluate square roots of small perfect squares
Evaluate cube roots of small perfect cubes
Estimate large or small quantities using numbers expressed in the form of a single digit times a whole-number power of 10
Compare large quantities to small quantities expressed in the form of a single digit times a whole-number power of 10
Perform operations with numbers expressed in scientific notation
Choose units of appropriate size for measurements of large or small quantities using scientific notation
Interpret numbers that have been expressed in scientific notation which have been generated by technology

<b>Understand the connections between proportional relationships, lines, and linear equations.</b>
Graph proportional relationships
Interpret the unit rate as the slope of a graph showing a proportional relationship
Compare two different proportional relationships represented in different ways
Use similar triangles to show that 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
Derive the equation $y = mx + b$ for a line intercepting the vertical axis at $b$
<b>Analyze and solve linear equations and pairs of simultaneous linear equations.</b>
Create linear equations in one variable with one solution
Create linear equations in one variable with infinitely many solutions
Create linear equations in one variable with no solutions
Solve linear equations with rational number coefficients
Show how solutions to a system of two linear equations in two variables correspond to points of intersection of their graph
Solve systems of two linear equations in two variables algebraically
Estimate solutions of two linear equations by graphing the equations
Solve simple cases of systems of two linear equations by inspection
Solve real world and mathematical problems leading to two linear equations in two variables
<b>Strand: <i>Functions (F)</i></b>
<b>Define, evaluate, and compare functions.</b>
Recognize that a function is a rule that assigns to each input exactly one output
Relate the graph of a function to the set of ordered pairs consisting of an input and the corresponding output
Compare properties of two functions each represented in a different way
Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line
Construct examples of functions that are not linear
<b>Use functions to model relationships between quantities.</b>

## Mathematics Benchmarks for Grade 8

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
Determine the rate of change and initial value of the function from two (x, y) values
Interpret the rate of change and initial value of a linear function in terms of the situation it models
Interpret the rate of change and initial value of a linear function in terms of its graph
Interpret the rate of change and initial value of a linear function in terms of a table of values
Describe qualitatively the functional relationship between two quantities by analyzing a graph
Graph the qualitative features of a function that has been described verbally
<b>Strand: Geometry (G)</b>
<b>Understand congruence and similarity using physical models, transparencies, or geometry software.</b>
Verify experimentally the properties of rotations, reflections, and translations, when lines are taken to lines
Verify experimentally the properties of rotations, reflections, and translations, when line segments are taken to line segments of the same length
Verify experimentally the properties of rotations, reflections, and translations, when angles are taken to angles of the same measure
Verify experimentally the properties of rotations, reflections, and translations, when parallel lines are taken to parallel lines
Show 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
Describe a sequence that exhibits the congruence between two congruent figures
Describe the effect of dilations on two-dimensional figures using coordinates
Describe the effect of translations on two-dimensional figures using coordinates
Describe the effect of rotations on two-dimensional figures using coordinates

Describe the effect of reflections on two-dimensional figures using coordinates
Relate one two-dimensional figure as similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations
Describe a sequence that exhibits the similarity between two similar two-dimensional figures
State informal arguments to establish facts about the angle sum of triangles
State informal arguments to establish facts about the exterior angle of triangles
State informal arguments to establish facts about the angles created when parallel lines are cut by a transversal
State informal arguments to establish facts about the angle-angle criterion for similarity of triangles
<b>Understand and apply the Pythagorean Theorem.</b>
Explain a proof of the Pythagorean Theorem
Explain a proof of the converse of the Pythagorean Theorem
Solve real world and mathematical problems in two dimensions using the Pythagorean Theorem to determine unknown side lengths in right triangles
Solve real world and mathematical problems in three dimensions using the Pythagorean Theorem to determine unknown side lengths in right triangles
Find the distance between two points in a coordinate system using the Pythagorean Theorem
<b>Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.</b>
Solve real world and mathematical problems using the formula for the volume of cones
Solve real world and mathematical problems using the formula for the volume of cylinders
Solve real world and mathematical problems using the formula for the volume of spheres
<b>Strand: Statistics and Probability (SP)</b>
<b>Investigate patterns of association in bivariate data.</b>
Construct scatter plots for bivariate measurement data
Analyze patterns of association between two quantities on a scatter plot of bivariate measurement data

## Mathematics Benchmarks for Grade 8

Assess the proximity of data points to a line on a scatter plot in order to determine its linear association
Assess the model fit to a line on a scatter plot by judging the closeness of the data points to a line
Solve problems by interpreting the slope and intercept of bivariate measurement data by using the equation of a linear model
Analyze patterns of association of categorical data displayed in a two-way frequency and relative frequency table
Construct a two-way table summarizing data on two categorical variables collected from the same subjects
Analyze summary data from a two-way frequency table to describe the association between two categorical variables
<b>Mathematical Practice</b>
<b>Strand: <i>Solve Problems (MP1)</i></b>
<b>1. Make sense of problems and persevere in solving them.</b>
Make sense of problems and persevere in solving them
<b>Strand: <i>Reason (MP2)</i></b>
<b>2. Reason abstractly and quantitatively.</b>
Reason abstractly and quantitatively
<b>Strand: <i>Construct Arguments (MP3)</i></b>
<b>3. Construct viable arguments and critique the reasoning of others.</b>
Construct viable arguments and critique the reasoning of others
<b>Strand: <i>Model (MP4)</i></b>
<b>4. Model with mathematics.</b>
Model with mathematics
<b>Strand: <i>Use Tools (MP5)</i></b>
<b>5. Use appropriate tools strategically.</b>
Use appropriate tools strategically
<b>Strand: <i>Attend to Precision (MP6)</i></b>
<b>6. Attend to precision.</b>
Attend to precision
<b>Strand: <i>Use Structure (MP7)</i></b>
<b>7. Look for and make use of structure.</b>

Look for and make use of structure
<b>Strand: <i>Express Regularity (MP8)</i></b>
<b>8. Look for and express regularity in repeated reasoning.</b>
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