# Grade 8 Grade-Level Expanded Expectations

## NUMBER SENSE AND OPERATIONS: NS

| 8.NS.A | Know that there are numbers that are not rational, and approximate them by rational numbers. | |
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| 8.NS.A.1 | Explore the real number system. <br> 1. Know the differences between rational and irrational numbers. <br> 2. Understand that all rational numbers have a decimal expansion that terminates or repeats. <br> 3. Convert decimals which repeat into fractions and fractions into repeating decimals. <br> 4. Generate equivalent representations of rational numbers. | The expectation of the student is to explore the real number system. <br> a. Know the differences between rational and irrational numbers. <br> b. Understand that all rational numbers have a decimal expansion that terminates or repeats. <br> c. Convert decimals which repeat into fractions and fractions into repeating decimals. <br> d. Generate equivalent representations of rational numbers (fractions, decimals and percentages). |
| 8.NS.A.2 | Estimate the value and compare the size of irrational numbers and approximate their locations on a number line. | The expectation of the student is to estimate the value and compare the size of irrational numbers and approximate their locations on a number line. (e.g., $\pi$, $\sqrt{2}$, $\sqrt{3}$, etc.) |

## EXPRESSIONS, EQUATIONS AND INEQUALITIES: EEI

| 8.EEI.A | Work with radicals and integer exponents. | |
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| 8.EEI.A.1 | Know and apply the properties of integer exponents to generate equivalent expressions. | The expectation of the student is to know and apply the properties of integer exponents to generate equivalent numerical expressions including expressions with more than one operation. |

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| 8.EEI.A.2 | Investigate concepts of square and cube roots.<br>  a) Solve equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number.<br>  b) Evaluate square roots of perfect squares less than or equal to 625 and cube roots of perfect cubes less than or equal to 1000.<br>  c) Recognize that square roots of non-perfect squares are irrational. | The expectation of the student is to investigate concepts of square and cube roots.<br>  a. 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.<br>  b. Evaluate square roots of perfect squares less than or equal to 625 and cube roots of perfect cubes less than or equal to 1000.<br>  c. Recognize that square roots of non-perfect squares are irrational. (*e.g., explain why numbers are or are not perfect squares using area models*) |
| 8.EEI.A.3 | Express very large and very small quantities in scientific notation and approximate how many times larger one is than the other. | The expectation of the student is to express very large and very small quantities in scientific notation and approximate how many times larger one is than the other. |
| 8.EEI.A.4 | Use scientific notation to solve problems.<br>  a) Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.<br>  b) Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. | The expectation of the student is to use scientific notation to solve real-world and mathematical problems.<br>  a. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.<br>  b. 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 tectonic plate movement.*)<br>  c. Input and interpret scientific notation using technology. (e.g., different types of calculators) |
| **8.EEI.B** | **Understand the connections between proportional relationships, lines and linear equations.** | |
| 8.EEI.B.5 | Graph proportional relationships.<br>  a) Interpret the unit rate as the slope of the graph.<br>  b) Compare two different proportional relationships. | The expectation of the student is to graph proportional relationships<br>  a. Interpreting the unit rate as the slope of the graph.<br>  b. Compare two different proportional relationships given multiple representations including tables, graphs and equations. |

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| 8.EEI.B.6 | Apply concepts of slope and y-intercept to graphs, equations and proportional relationships.<br>   a)  Explain why the slope (m) is the same between any two distinct points on a non-vertical line in the Cartesian coordinate plane.<br>   b)  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. | The expectation of the student is to apply concepts of slope and $y$-intercept to graphs, equations and proportional relationships.<br>   a.  Explain why the slope m is the same between any two distinct points on a non-vertical line in the Cartesian coordinate plane.<br>   b.  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. |
| **8.EEI.C** | **Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations.** | |
| 8.EEI.C.7 | Solve linear equations and inequalities in one variable.<br>   a)  Create and identify linear equations with one solution, infinitely many solutions or no solutions.<br>   b)  Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and combining like terms. | The expectation of the student is to solve linear equations and inequalities in one variable.<br>   a.  Give examples of linear equations with one solution, infinitely many solutions or no solutions.<br>   b.  Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and combining like terms. |

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| 8.EEI.C.8 | Analyze and solve systems of linear equations.<br>a) Graph systems of linear equations and recognize the intersection as the solution to the system.<br>b) Explain why solution(s) to a system of two linear equations in two variables correspond to point(s) of intersection of the graphs.<br>c) Explain why systems of linear equations can have one solution, no solution or infinitely many solutions.<br>d) Solve systems of two linear equations. | The expectation of the student is to analyze and solve systems of linear equations.<br>a. Graph systems of linear equations and recognize the approximation of their intersection as the solution to the system.<br>b. Explain why solution(s) to a system of two linear equations in two variables correspond to point(s) of intersection of their graphs.<br>c. Explain why systems of linear equations can have one solution, no solution or infinitely many solutions.<br>d. Solve systems of two linear equations in two variables algebraically, including methods of substitution and elimination or through inspection.<br>e. Solve real-world and mathematical problems leading to two linear equations in two variables. |

## GEOMETRY AND MEASUREMENT: GM

| 8.GM.A | **Understand congruence and similarity using physical models, transparencies or geometry software.** | |
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| 8.GM.A.1 | Verify experimentally the congruence properties of rigid transformations.<br>a) Verify that angle measure, betweenness, collinearity and distance are preserved under rigid transformations.<br>b) Investigate if orientation is preserved under rigid transformations. | The expectation of the student is to verify experimentally the congruence properties of rigid transformations (rotations, reflections and translations).<br>a. Verify that betweenness, collinearity and distance are preserved under rigid transformations.<br>b. Verify that lines are mapped to lines, including parallel lines.<br>c. Verify that corresponding angles are congruent.<br>d. Verify that corresponding line segments are congruent.<br>e. Investigate if orientation is preserved under rigid transformations. |

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| 8.GM.A.2 | Understand that two-dimensional figures are congruent if a series of rigid transformations can be performed to map the pre-image to the image.<br>    a) Describe a possible sequence of rigid transformations between two congruent figures. | The expectation of the student is to understand that two-dimensional figures are congruent if a series of rigid transformations (rotations, reflections, translations) can be performed to map the pre-image to the image. Given two congruent figures, describe the sequence of transformations that justifies the congruence between them. |
| 8.GM.A.3 | Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates. | The expectation of the student is to describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates. (limit the center of rotation to a vertex of the figure or the origin) |
| 8.GM.A.4 | Understand that two-dimensional figures are similar if a series of transformations (rotations, reflections, translations and dilations) can be performed to map the pre-image to the image.<br>    a) Describe a possible sequence of transformations between two similar figures. | The expectation of the student is to understand that two-dimensional figures can be similar if a series of transformations (rotations, reflections, translations and dilations) can be performed to map the pre-image to the image. Given two similar figures, describe a sequence of transformations that justifies the similarity between them. |
| 8.GM.A.5 | Explore angle relationships and establish informal arguments.<br>    a) Derive the sum of the interior angles of a triangle.<br>    b) Explore the relationship between the interior and exterior angles of a triangle.<br>    c) Construct and explore the angles created when parallel lines are cut by a transversal.<br>    d) Use the properties of similar figures to solve problems. | The expectation of the student is to explore angle relationships and establish informal arguments for the following:<br>    a. The sum of the angles in a triangle.<br>    b. The relationship between the interior and exterior angles of a triangle.<br>    c. The angles created when parallel lines are cut by a transversal.<br>    d. Congruent corresponding angles in similar figures. |
| **8.GM.B** | **Understand and apply the Pythagorean Theorem.** | |
| 8.GM.B.6 | Use models to demonstrate a proof of the Pythagorean Theorem and its converse. | The expectation of the student is to use models to demonstrate a proof of the Pythagorean Theorem and its converse. |

| 8.GM.B.7 | Use the Pythagorean Theorem to determine unknown side lengths in right triangles in problems in two- and three-dimensional contexts. | The expectation of the student is to use the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensional contexts. |
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| 8.GM.B.8 | Use the Pythagorean Theorem to find the distance between points in a Cartesian coordinate system. | The expectation of the student is to use the Pythagorean Theorem to find the distance between two points in a coordinate system. |

| **8.GM.C** | **Solve problems involving volume of cones, pyramids and spheres.** | |
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| 8.GM.C.9 | Solve problems involving surface area and volume.<br>  a) Understand the concept of surface area and find surface area of pyramids.<br>  b) Understand the concepts of volume and find the volume of pyramids, cones and spheres. | The expectation of the student is to solve real-world and mathematical problems involving surface area and volume.<br>  a. Understand the concept of surface area and find surface area of pyramids (triangular and rectangular).<br>  b. Understand the concepts of volume and find the relationships among pyramids (triangular and rectangular), cones and spheres. |

# DATA ANALYSIS, STATISTICS AND PROBABILITY: DSP

| **8.DSP.A** | **Investigate patterns of association in bivariate data.** | |
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| 8.DSP.A.1 | Construct and interpret scatter plots of bivariate measurement data to investigate patterns of association between two quantities. | The expectation of the student is to 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 correlation, linear association and nonlinear association. |
| 8.DSP.A.2 | Generate and use a trend line for bivariate data, and informally assess the fit of the line. | The expectation of the student is to know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally find a line of best fit and informally assess the fit of the line by evaluating the closeness of the data points to the line.<br>  a. Understand that not all trend lines start at the origin.<br>  b. Know that not all trend lines pass through the data points. |

| 8.DSP.A.3 | Interpret the parameters of a linear model of bivariate measurement data to solve problems. | The expectation of the student is to use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. (*e.g., In a linear model for a biology experiment, interpret a slope of 1.5 mm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 mm in mature plant height.*) |
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| 8.DSP.A.4 | Understand the patterns of association in bivariate categorical data displayed in a two-way table.<br>a) Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.<br>b) Use relative frequencies calculated for rows or columns to describe possible association between the two variables. | The expectation of the student is to understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.<br>a. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.<br>b. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. (*e.g., Collect data from students in your class on whether or not they ride a bus to school and whether or not they have assigned chores at home. Is there evidence that those who ride a bus also tend to have chores?*) |

## FUNCTIONS: F

| **8.F.A** | **Define, evaluate and compare functions.** | |
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| 8.F.A.1 | Explore the concept of functions. (The use of function notation is not required.)<br>a) Understand that a function assigns to each input exactly one output.<br>b) Determine if a relation is a function.<br>c) Graph a function. | The expectation of the student is to explore the concept of functions. (The use of function notation is not required.)<br>a. Understand that a function assigns to each input exactly one output.<br>b. Determine if a relation is a function using multiple representations including mappings, tables and graphs.<br>c. Graph a function from a table of values. |
| 8.F.A.2 | Compare characteristics of two functions each represented in a different way. | The expectation of the student is to compare characteristics of two functions each represented in a different way. (*e.g., algebraically, graphically, numerically in tables or by verbal description*) |

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| 8.F.A.3 | Investigate the differences between linear and nonlinear functions.<br>a) Interpret the equation y = mx + b as defining a linear function, whose parameters are the slope (m) and the y-intercept (b).<br>b) Recognize that the graph of a linear function has a constant rate of change<br>c) Give examples of nonlinear functions. | The expectation of the student is to investigate the differences between linear and nonlinear functions.<br>a. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line.<br>b. Recognize that the graph of a linear function has a constant rate of change.<br>c. Give examples of nonlinear functions. |
| **8.F.B** | **Use functions to model relationships between quantities.** | |
| 8.F.B.4 | Use functions to model linear relationships between quantities.<br>a) Explain the parameters of a linear function based on the context of a problem.<br>b) Determine the parameters of a linear function.<br>c) Determine the x-intercept of a linear function. | The expectation of the student is to use functions to model linear relationships between quantities.<br>a. Understand that the slope is the constant rate of change and the initial value is the $y$-intercept. Describe their meanings in the context of a given situation.<br>b. Determine the slope and the $y$-intercept of a linear function given a description of the relationship or from two points, tables or graphs.<br>c. Determine the $x$-intercept, if it exists. Describe its meaning in the context of a given situation. |
| 8.F.B.5 | Describe the functional relationship between two quantities from a graph or a verbal description. | The expectation of the student is to describe the functional relationship between two quantities from a graph (*e.g., constant, increasing/decreasing, linear/nonlinear and continuous/discontinuous*) and be able to sketch a graph given a verbal description. |