Minnesota Mathematics

Grade 8

Data Analysis

1 Data Sciences: Identify, formulate and investigate statistical questions by collecting data considering cultural perspectives, analyzing and interpreting data and communicating the results.

1. Formulate statistical investigative questions, such as questions about variation, the differences between groups and associations between two numerical variables. (MP3) ✜ 8.1.1.1
2. 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. (MP5, MP8) 8.1.1.2
3. Identify when to use straight lines to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line and assess the model fit by judging the closeness of the data points to the line. (MP5, MP6) 8.1.1.3
4. Use the equation of a linear model to solve situations in the context of bivariate measurement data. Interpret the slope and intercepts in context of the variables. (MP4, MP6) $ # 8.1.1.4
5. Create data visualizations about a data set. Organize and present the data in appropriate ways, including in tables and scatter plots, and incorporate other relevant information that helps to tell a story and support a claim about the data. (MP1, MP6) $ # µ ✜ 8.1.1.5
6. Compare and communicate competing explanations for data trends observed, considering the reasonableness of the model's predictions and correlation versus causation. (MP3, MP6) # $ 8.1.1.6

Spatial Reasoning

3 Measurement: Investigate measurement using a variety of tools, units, systems, processes and techniques in various cultures. Explain and reason with attributes, estimations and formulas to communicate measurement(s) and relationships effectively. Justify decisions and consider the reasonableness of the measurement.

1. Informally justify the Pythagorean Theorem and its converse by using measurements, diagrams or computer software. (MP2, MP3) ✜ ☼ 8.2.3.1
2. Apply the Pythagorean Theorem to solve multi-step contextual situations by determining unknown side lengths in right triangles in both two- and three-dimensional shapes. (MP4) µ ☼ 8.2.3.2

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3 Determine the distance between two points on a horizontal or vertical line in a coordinate system. Use the Pythagorean Theorem to find the distance between any two points in a coordinate system. (MP7) ✜ ☼ 8.2.3.3

4 **Geometry: Analyze characteristics of geometric shapes to make mathematical arguments and justifications about geometric relationships. Use visualization and geometric modeling to compare, solve problems and communicate ideas.**

1 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 $yy = mmxx$ for a line through the origin and the equation $yy = mmxx + bb$ for a line intercepting the vertical axis at b. (MP8) 8.2.4.1

2 Given a line on a coordinate system and the coordinates of a point not on the line, find lines through that point that are parallel and perpendicular to the given line, using graphing technology or hand drawn graphs. (MP7) # ✜ 8.2.4.2

3 Identify the different types of solutions possible for a system of linear equations (no solution, one solution, infinitely many solutions). Using slope, compare the number of solutions to the graphical representation of pairs of lines that are intersecting, parallel or identical. (MP2) 8.2.4.3

Patterns and Relationships

5 **Number Relationships: Describe/Interpret and use quantities, relationships between and representations of quantities and number systems. Describe and relate operations. Use strategies and procedures accurately, efficiently and flexibly. Assess the reasonableness of the results.**

1 Classify real numbers as rational or irrational. Know that when a square root of a positive integer is not an integer, then it is irrational. (MP1, MP7) ☼ 8.3.5.1

2 Use rational approximations of irrational numbers to compare the size of irrational numbers and locate them approximately on a number line. Estimate the value of expressions involving irrational numbers. (MP2, MP6) 8.3.5.2

3 Know and apply the properties of positive and negative integer exponents to generate equivalent numerical expressions. (MP1) 8.3.5.3

4 Express approximations of very large and very small numbers using scientific notation. Understand how technology displays numbers in scientific notation. Compare numbers expressed in scientific notation using the symbols <, > , = , ≤ , ≥ . (MP4, MP5) $ ☼ 8.3.5.4

5 Multiply and divide numbers expressed in scientific notation. Express answers in scientific notation. (MP5) $ ☼ 8.3.5.5

6 Solve situations in various contexts involving calculating and comparing simple and compound interest. Compound interest situations are limited to compounded annually. (MP7, MP8) $ ☼ 8.3.5.6

7 Solve multi-step contextual situations comparing how interest rate and loan length affect the cost of credit. Calculate the total cost of repaying a loan under various rates of interest and over different periods of time. (MP4, MP5) ✜ $ μ ☼ 8.3.5.7

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8 Compare and contrast employment opportunities and their payment methods, including per hour, with or without tips, salary, per diem and piecework pay. Justify financial decisions with representations, including linear relationships. (MP1, MP4) ✜ $ µ ☼ 8.3.5.8

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6 Equivalence and Relational Thinking: Use concepts and properties of equivalence and relational thinking to represent and compare numerical expressions, proportional relationships, algebraic expressions and equations.

1 Justify steps in generating equivalent algebraic expressions and identify the properties used. Properties include the associative, commutative, distributive, identity and inverse laws. (MP1, MP3) 8.3.6.1

2 Evaluate algebraic expressions, including expressions containing radicals and absolute values, by applying computational hierarchy of operations at specified values of their variables. (MP7) 8.3.6.2

3 Solve multi-step equations in one variable, including equivalent linear expressions. Solve for one variable in a multivariable equation in terms of the other variables. Justify the steps by identifying the properties of the equality used. (MP3, MP4) 8.3.6.3

4 Use the relationship between square roots and squares of a number to solve situations. (MP2, MP6) 8.3.6.4

5 Represent linear relationships in point-slope and standard form and convert to slope-intercept form. (MP7) 8.3.6.5

6 Reason abstractly, involving variables as a point, slope or intercept, to compare general forms of linear relationships, including point-point, point- slope, standard form and slope-intercept form. (MP7) µ 8.3.6.6

7 Represent relationships in various contexts using multi-step linear inequalities. Solve linear inequalities using properties of inequalities. Graph the solutions on a number line and interpret the solutions in context. (MP4) $ ☼ 8.3.6.7

8 Represent relationships in various contexts with equations and inequalities involving the absolute value of a linear expression. Solve such equations and inequalities and graph the solutions on a number line. (MP4) $ ☼ 8.3.6.8

9 Represent relationships in various contextual situations using systems of linear equations. Solve systems of linear equations in two variables, symbolically and graphically, understanding that the solution corresponds to the point of intersection of their graphs. (MP4, MP5) $ # ☼ 8.3.6.9

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7 Patterns and Relationships: Represent and connect mathematical patterns and relationships using verbal descriptions, generalizations, tables and graphs. Use representations to generate questions, make predictions and solve mathematical problems.

1 Compare graphical properties of proportional and non-proportional linear relationships, including slope. (MP7) $ ☼ 8.3.7.1

Analyze visual patterns to distinguish between linear and non-linear patterns. For linear patterns, describe how a pattern is changing, name the nth term and write an equation to generalize the nth term. (MP1, MP7) ✜ # ☼ 8.3.7.2

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3 Recognize that a function is a rule that assigns each input to exactly one output. Use the function to represent the relationship in which changing the input (independent) variable, by an amount, leads to a change in the output (dependent) variable; a constant multiplied by that amount. Recognize that the graph of a function is the set of ordered pairs consisting of an input and the corresponding output. Use functional notation, such as $ff(xx)$, to represent such relationships. (MP4, MP7) µ 8.3.7.3

4 Represent linear functions with tables, verbal descriptions, symbols, equations and graphs. Translate from one representation to another. (MP5) $ ☼ 8.3.7.4

5 Explain how changes to the values m or b in the linear function $ff(xx) = mmxx + bb$ affect the graph of the function. Use graphing technology to examine these effects. Recognize that the graph of the linear equation $yy = mmxx + bb$ comes from b units translation of $yy = mmxx$ graph. (MP1, MP5) µ # ☼ 8.3.7.5

6 Identify graphical properties of linear functions in the form $ff(xx) = mmxx + bb$, including slope, y- intercept and x-intercept. Know that the graph is a straight line, the slope (m) equals the rate of change, the y-intercept (b) is the value of the function at $xx = 0$ and the x-intercept is the value of the function at $ff(xx) = 0$. (MP1, MP5) $ ☼ 8.3.7.6

7 Recognize that an arithmetic sequence is a linear function that can be expressed in the form where $ff(xx) = mmxx + bb$, where $xx = 0, 1, 2, 3, \ldots$ (MP1, MP8) 8.3.7.7

8 Recognize that a geometric sequence is a non- linear function that can be expressed in the form $ff(xx) = aa(bb)xx$, where $xx = 0, 1, 2, 3, \ldots$ (MP1, MP8) 8.3.7.8

9 Represent arithmetic and geometric sequences using equations, tables, graphs and verbal descriptions and use them to solve situations. (MP4) 8.3.7.9