Indiana Department of Education

Grade 10 Math Content Connectors

Math 10
PROCESS STANDARDS FOR MATHEMATICS

The Process Standards demonstrate the ways in which students should develop conceptual understanding of mathematical content, and the ways in which students should synthesize and apply mathematical skills.

PROCESS STANDARDS FOR MATHEMATICS	
PS.1: Make sense of problems and persevere in solving them.	Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway, rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" and "Is my answer reasonable?" They understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
PS.2: Reason abstractly and quantitatively.	Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

PS.3: Construct viable arguments and critique the reasoning of others.	Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They analyze situations by breaking them into cases and recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions and communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is true always, sometimes, or never. Mathematically proficient students participate and collaborate in a mathematics community. They listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

PROCESS STANDARDS FOR MATHEMATICS

PS.4: Model with mathematics.	Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
PS.5: Use appropriate tools strategically.	Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Mathematically proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. Mathematically proficient students identify relevant external mathematical resources, such as digital content, and use them to pose or solve problems. They use technological tools to explore and deepen their understanding of concepts and to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication and problem solving.

PS.6: Attend to precision.	Mathematically proficient students communicate precisely to others. They use clear definitions, including correct mathematical language, in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They specify units of measure and label axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context.
PS.7: Look for and make use of structure.	Mathematically proficient students look closely to discern a pattern or structure. They step back for an overview and shift perspective. They recognize and use properties of operations and equality. They organize and classify geometric shapes based on their attributes. They see expressions, equations, and geometric figures as single objects or as being composed of several objects.
PS.8: Look for and express regularity in repeated reasoning.	Mathematically proficient students notice if calculations are repeated and look for general methods and shortcuts. They notice regularity in mathematical problems and their work to create a rule or formula. Mathematically proficient students maintain oversight of the process, while attending to the details as they solve a problem. They continually evaluate the reasonableness of their intermediate results.

MATHEMATICS: MATH 10

The Mathematics standards for Math 10 are supplemented by the Process Standards for Mathematics.

The Mathematics standards for Math 10 are made up of seven strands: Linear Equations and Inequalities; Functions; Data Analysis, Statistics, and Probability; Number Sense, Expressions, and Computation; Systems of Equations and Inequalities; Quadratic and Exponential Equations and Functions; and Geometry and Measurement. The skills listed in each strand indicate what students in grade 8 should know and be able to do in Mathematics.

LINEAR EQUATIONS AND INEQUALITIES

Indiana Academic Standards	Content Connectors
MA10.EI.1 Solve linear equations with rational number coefficients fluently, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear	**MA10.EI.1.a.1**: Solve linear equations with integer coefficients using one or two steps.

equations and inequalities in one variable and solve such problems. Explain and justify each step in solving an equation, starting from the assumption that the original equation has a solution. Justify the choice of a solution method.	**MA10.EI.1.a.2**: Translate a real-world problem into a one-variable linear equation.
MA10. EI.2 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 transforming a 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).	**MA10.EI.2.a.1**: Recognize when a linear equation has one solution, infinitely many solutions, or no solutions.
MA10.EI.3 Represent real-world problems using linear equations and inequalities in one variable and solve such problems. Interpret the solution and determine whether it is reasonable.	**MA10.EI.3.a.1**: Translate a real-world problem into a one-variable linear equation.
MA10.EI.4 Represent real-world and other mathematical problems using an algebraic proportion that leads to a linear equation and solve such problems.	**MA10.EI.4.a.1**: Represent a real-world situation using a proportion.
MA10.EI.5 Represent real-world problems using linear inequalities in two variables and solve such problems; interpret the solution set and determine whether it is reasonable. Solve other linear inequalities in two variables by graphing.	**MA10.EI.5.a.1**: Identify solutions from the graph of a linear inequality within a real-world problem.
MA10.EI.6 Solve compound linear inequalities in one variable, and represent and interpret the solution on a number line. Write a compound linear inequality given its number line representation.	**MA10.EI.6.a.1**: Find a solution of compound inequalities given a graph.
MA10.EI.7 Solve equations and formulas for a specified variable, including equations with coefficients represented by variables.	**MA10.EI.7.a.1**: Solve literal equations for a specified variable.
MA10.EI.8 Solve absolute value linear equations in one variable.	**MA10.EI.8.a.1**: Evaluate the absolute value of an expression.
MA10.EI.9 Graph absolute value linear equations in two variables.	**MA10.EI.9.a.1**: Identify an absolute value graph.

FUNCTIONS

Indiana Academic Standards	Content Connectors
MA10.F.1 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. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equations.	**MA10.F.1.a.1**: Given multiple representations, describe a function as linear and not linear.
MA10.F.2 Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem.	**MA10.F.2.a.1**: Identify the rate of change (slope) and initial value (y-intercept) from graphs.
MA10.F.3 Represent linear functions as graphs from equations (with and without technology), equations from graphs, and equations from tables and other given information (e.g., from a given point on a line and the slope of the line).	
MA10.F.4 Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.	**MA10.F.4.a.1**: Interpret the rate of change using graphical representations of a real-world situation.
MA10.F.5 Translate among equivalent forms of equations for linear functions, including slopeintercept, point-slope, and standard. Recognize that different forms reveal more or less information about a given situation.	**MA10.F.5.a.1**: Describe the attributes of an equation given various forms.
MA10.F.6 Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed).	**MA10.F.6.a.1**: Given a table or a graph, compare two linear functions to answer a question about rates.

MA10.F.7 Understand that a function from one set (called the domain or independent variable) to another set (called the range or dependent variable) assigns to each element of the domain exactly one element of the range. Understand that if f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. Understand the graph off is the graph of the equation y = f(x).	**MA10.F.7.a.1**: Distinguish between functions and non-functions within graphs or tables.
MA10.F.8 Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.	**MA10.F.8.a.1**: Identify the domain and range from a table or graph.
MA10.F.9 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.	**MA10.F.9.a.1**: Given the qualitative features, sketch a graph.
	MA10.F.9.a.2: Given a sketch, describe and make predictions about the relationship between the variables.
	MA10.F.9.a.3: Given a graph, describe the defining features of a function.
	MA10.F.9.a.4: Given a verbal description, create or identify a graph to model the situation.
MA10.F.10 Understand and interpret statements that use function notation in terms of a context; relate the domain of the function to its graph and to the quantitative relationship it describes.	**MA10.F.10.a.1**: Interpret statements that use function notation in terms of a context.

DATA ANALYSIS, STATISTICS, AND PROBABILITY

Indiana Academic Standards	Content Connectors
MA10.DASP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantitative variables. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	**MA10.DASP.1.a.1**: Graph bivariate data using scatter plots and identify possible associations between the variables.
	MA10.DASP.1.a.2: Using scatter plots, identify data points that appear to be outliers.
MA10.DASP.2 Represent sample spaces and find probabilities of compound events (independent and	**MA10.DASP.2.a.1**: Determine the theoretical probability of multi-stage probability experiments (2 coins, 2 dice).

dependent) using methods, such as organized lists, tables, and tree diagrams.	**MA10.DASP.2.a.2**: Collect data from multi-stage probability experiments (2 coins, 2 dice).
MA10.DASP.3 For events with a large number of outcomes, understand the use of the multiplication counting principle. Develop the multiplication counting principle and apply it to situations with a large number of outcomes.	**MA10.DASP.3.a.1**: Use the multiplication counting principle to determine the total number of outcomes.
MA10.DASP.4 Distinguish between random and non-random sampling methods, identify possible sources of bias in sampling, describe how such bias can be controlled and reduced, evaluate the characteristics of a good survey and well-designed experiment, design simple experiments or investigations to collect data to answer questions of interest, and make inferences from sample results.	**MA10.DASP.4.a.1**: Determine whether a sampling method was random or nonrandom.
MA10.DASP.5 Understand that statistics and data are non-neutral and designed to serve a particular interest. Analyze the possibilities for whose interest might be served and how the representations might be misleading.	
MA10.DASP.6 Find a linear function that models a relationship (with and without technology) for a bivariate data set to make predictions; interpret the slope and y-intercept, and compute (with and without technology) and interpret the correlation coefficient.	**MA10.DASP.6.a.1**: Use the line of best fit to find a point that answers a question about the data.
MA10.DASP.7 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 (including joint, marginal, and conditional relative frequencies) to describe possible associations and trends in the data.	**MA10.DASP.7.a.1**: Interpret a two-way table summarizing data on two categorical variables collected from the same subjects using relative frequencies calculated for rows or columns.
MA10.DASP.8 Distinguish between correlation and causation.	

NUMBER SENSE, EXPRESSIONS, AND COMPUTATION

Indiana Academic Standards	Content Connectors
MA10.NSEC.1 Give examples of rational and irrational numbers and explain the difference between them. Understand that every number has a decimal expansion; for rational numbers, show that the decimal expansion terminates or repeats, and convert a decimal expansion that repeats into a rational number.	**MA10.NSEC.1.a.1**: Identify rational and irrational numbers. **MA10.NSEC.1.a.2**: Round irrational numbers to the hundredths place
MA10.NSEC.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, plot them approximately on a number line, and estimate the value of expressions involving irrational numbers.	**MA10.NSEC.2.a.1**: Use the estimate of irrational numbers to locate them on a number line.
MA10.NSEC.3 Given a numeric expression with common rational number bases and integer exponents, apply the properties of exponents to generate equivalent expressions.	**MA10.NSEC.3.a.1**: Use properties of integer exponents to produce equivalent expressions.
MA10.NSEC.4 Rewrite and evaluate numeric expressions with positive rational exponents using the properties of exponents.	
MA10.NSEC.5 Simplify square roots of non-perfect square integers and algebraic monomials.	
MA10.NSEC.6 Solve real-world problems with rational numbers by using multiple operations.	**MA10.NSEC.6.a.1**: Solve real-world problems with rational numbers by using two operations.
MA10.NSEC.7 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	
MA10.NSEC.8 Simplify algebraic rational expressions, with numerators and denominators containing monomial bases with integer exponents, to equivalent forms.	**MA10.NSEC.8.a.1**: Simplify numeric exponential expressions in rational form.
MA10.NSEC.9 Factor common terms from polynomials and factor polynomials completely. Factor the difference of two squares, perfect square trinomials, and other quadratic expressions.	**MA10.NSEC.9.a.1**: Use factoring to find equivalent expressions.

MA10.NSEC.10 Understand polynomials are closed under the operations of addition, subtraction, and multiplication with integers; add, subtract, and multiply polynomials and divide polynomials by monomials.	MA10.NSEC.10.a.1: Add and subtract polynomials.
	MA10.NSEC.10.a.2: Multiply polynomials.
	MA10.NSEC.10.a.3: Divide a polynomial by a monomial.

SYSTEMS OF EQUATIONS AND INEQUALITIES

Indiana Academic Standards	Content Connectors
MA10.SEI.1 Understand the relationship between a solution of a pair of linear equations in two variables and the graphs of the corresponding lines. Solve pairs of linear equations in two variables by graphing; approximate solutions when the coordinates of the solution are non-integer numbers.	MA10.SEI.1.a.1: Identify the solution to a system of linear equations given a graph.
MA10.SEI.2 Understand that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. Solve pairs of linear equations in two variables using substitution and elimination.	MA10.SEI.2.a.1: Solve a system of linear equations.
MA10.SEI.3 Write a system of two linear equations in two variables that represents a real-world problem and solve the problem with and without technology. Interpret the solution and determine whether the solution is reasonable.	MA10.SEI.3.a.1: Choose a system of linear equations that represents a given real-world problem.
MA10.SEI.4 Represent real-world problems using a system of two linear inequalities in two variables and solve such problems; interpret the solution set and determine whether it is reasonable. Solve other pairs of linear inequalities by graphing with and without technology.	MA10.SEI.4.a.1: Identify the solution set to a system of inequalities.

QUADRACTIC AND EXPONENTIAL EQUATIONS AND FUNCTIONS

Indiana Academic Standards	Content Connectors

MA10.QEEF.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. Understand that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Compare linear functions and exponential functions that model realworld situations using tables, graphs, and equations.	**MA10.QEEF.1.a.1:** Given multiple graphs, describe the function as linear or not linear.
MA10.QEEF.2 Graph exponential and quadratic equations in two variables with and without technology.	**MA10.QEEF.2.a.1**: Determine if points lie on a graph of an exponential or quadratic function.
MA10.QEEF.3 Solve quadratic equations in one variable by inspection (e.g., for $x^2 = 49$), finding square roots, using the quadratic formula, and factoring, as appropriate to the initial form of the equation.	**MA10.QEEF.3.a.1**: Solve equations using square roots.
MA10.QEEF.4 Represent real-world problems using quadratic equations in one or two variables and solve such problems with and without technology. Interpret the solution and determine whether it is reasonable.	**MA10.QEEF.4.a.1**: Determine if points lie on a graph of a quadratic function of a real-world situation.
MA10.QEEF.5 Use and apply the process of factoring to determine zeros (x-intercepts and solutions), lines of symmetry, and extreme values in real-world and other mathematical problems involving quadratic functions; interpret the results in the real-world contexts.	**MA10.QEEF.5.a.1**: Describe attributes of a quadratic function in a real-world problem.
MA10.QEEF.6 Represent real-world and other mathematical problems that can be modeled with exponential functions using tables, graphs, and equations of the form $y = ab^x$ (for integer values of $x > 1$, rational values of $b > 0$ and $b \neq 1$); translate fluently among these representations and interpret the values of a and b.	**MA10.QEEF.6.a.1**: With a model, answer questions about exponential functions.

GEOMETRY AND MEASUREMENT

Indiana Academic Standards	Content Connectors

MA10.GM.1 Identify, define and describe attributes of three-dimensional geometric objects (right rectangular prisms, cylinders, cones, spheres, and pyramids). Explore the effects of slicing these objects using appropriate technology and describe the two-dimensional figure that results.	**MA10.GM.1.a.1**: Identify and describe attributes of three-dimensional geometric objects.
MA10.GM.2 Solve real-world and other mathematical problems involving volume of cones, spheres, and pyramids and surface area of spheres.	**MA10.GM.2.a.1**: Apply the formula to find the volume of three-dimensional shapes (e.g., cubes, spheres, and cylinders).
MA10.GM.3 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. Describe a sequence that exhibits the congruence between two given congruent figures.	**MA10.GM.3.a.1**: Describe a sequence of transformations between two congruent figures.
MA10.GM.4 Describe the effect of dilations, translations, rotations, and reflections on twodimensional figures using coordinates.	**MA10.GM.4.a.1**: Describe the effects of transformations on the coordinates of a figure.
MA10.GM.5 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions.	**MA10.GM.5.a.1**: Apply the Pythagorean Theorem to determine lengths/distances in real-world situations. MA10.GM.5.a.2: Find the hypotenuse of a twodimensional right triangle (Pythagorean Theorem).
MA10.GM.6 Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane.	**MA10.GM.6.a.1**: Apply the Pythagorean Theorem to determine lengths/distances on a coordinate plane.