High School Integrated Math III Blueprint

It is in Mathematics III that students pull together and apply the accumulation of learning that they have from their previous courses, with content grouped into four critical areas, organized into units. They apply methods from probability and statistics to draw inferences and conclusions from data. Students expand their repertoire of functions to include polynomial, rational, and radical functions. They expand their study of right triangle trigonometry to include general triangles. And, finally, students bring together all of their experience with functions and geometry to create models and solve contextual problems. The Mathematical Practice standards apply throughout Math III and together with the content standards prescribe that students experience math as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

*Additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, o r discrete mathematics is indicated by a (+).

Suggested Quarter/Time	Instructional Focus 1 (IM3IF1)	CCSS Mathematical Content	CCSS Mathematical Practice	Content
1st/35 days	Inferences and Conclusions from Data	**Summarize, represent, and interpret data on a single count or measurement variable.** **S.ID.4** - Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. *Build on understanding of data distributions to help them see how the normal distribution uses area to make estimates of frequencies (which can be expressed as probabilities). Emphasize that only some data are well described by a normal distribution.* **Understand and evaluate random processes underlying statistical experiments. count or measurement variable.** **S.IC.1** - Understand that statistics allows inferences to be made about population parameters based on a random sample from that population. **S.IC.2** - Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?	**Directly addressed practices are underlined** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	**myOER:** Coke vs Pepsi Taste Test: Experiments and Inference about Cause Making Sense of Percent Concentrations Lesson examples above address at least one (or more) of the Common Core State Standards included in this Instructional Focus. To find more lessons for this instructional focus, please use the **Advanced Search** and type the keyword – **IM3IF1**. **Teacher:**

		Make inferences and justify conclusions from sample surveys, experiments, and observational studies. **S.IC.3** - Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S.IC.4** - Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. **S.IC.5** - Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. **S.IC.6** - Evaluate reports based on data. *In earlier grades, students are introduced to different ways of collecting data and use graphical displays and summary statistics to make comparisons.,* *These ideas are revisited with a focus on how the way in which data is collected determines the scope and nature of the conclusions that can be drawn from that data.* *The concept of statistical significance is developed informally through simulation as meaning a result that is unlikely to have occurred solely as a result of random selection in sampling or random assignment in an experiment.* *For S.IC.4 and 5, focus on the variability of results from experiments—that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness.* **Use probability to evaluate outcomes of decisions.** **S.MD.6 (+)** - Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). **S.MD.7 (+)** - Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). *Extend to more complex probability models. Include situations such as those involving quality control or diagnostic tests that yields both false positive and false negative results.*		

Suggested Quarter/Time	Instructional Focus 2 (IM3IF2)	CCSS Mathematical Content	CCSS Mathematical Practice	Content
1st-2nd/55 days	**Polynomial, Rational, and Radical Relationships**	**Use polynomial identities to solve problems.** **A.APR.4** - Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples. **A.APR.5 (+)** - Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle. **Rewrite rational expressions** **A.APR.6** - Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system. **A.APR.7 (+)** - Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. **Understand solving equations as a process of reasoning and explain the reasoning.** **A.REI.2** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. **Represent and solve equations and inequalities graphically.** **A.REI.11 -** Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. *Include combinations of linear, polynomial, rational, radical, absolute value, and exponential functions.* **Analyze functions using different representations.** **F.IF.7 -** Graph functions expressed symbolically and	**Directly addressed practices are underlined** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	**myOER:** Manipulating Polynomials Radical Equations/Exponential and Logarithmic Functions Lesson examples above address at least one (or more) of the Common Core State Standards included in this Instructional Focus. To find more lessons for this instructional focus, please use the **Advanced Search** and type the keyword – **IM3IF2**. **Teacher:**

		show key features of the graph, by hand in simple cases and using technology for more complicated cases. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.		

Suggested Quarter/Time	Instructional Focus 3 (IM3IF3)	CCSS Mathematical Content	CCSS Mathematical Practice	Content
3rd/30 days	**Trigonometry of General Triangles and Trigonometric Functions**	**Apply trigonometry to general triangles.** **G.SRT.9 (+)** - Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. **G.SRT.10 (+)** - Prove the Laws of Sines and Cosines and use them to solve problems. **G.SRT.11 (+)** - Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). **Extend the domain of trigonometric functions using the unit circle.** **F.TF.1 -** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **F.TF.2** - Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. **Model periodic phenomena with trigonometric functions.** **F.TF.5 -** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	**Directly addressed practices are underlined** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. <u>Construct viable arguments and critique the reasoning of others.</u> 4. <u>Model with mathematics.</u> 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure<u>.</u> 8. <u>Look for and express regularity in repeated reasoning.</u>	**myOER:** Modeling Real World Weather Data Woody Sine Lesson examples above address at least one (or more) of the Common Core State Standards included in this Instructional Focus. To find more lessons for this instructional focus, please use the **Advanced Search** and type the keyword – **IM3IF3**. **Teacher:**

Suggested Quarter/Time	Instructional Focus 4 (IM3IF4)	CCSS Mathematical Content	CCSS Mathematical Practice	Content
4th/40 days	Mathematical Modeling	**Create equations that describe numbers or relationships.** **A.CED.1** - Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* **A.CED.2** - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **A.CED.3** - Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* **A.CED.4** - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R.* *For A.CED.1, use all available types of functions to create such equations, including root functions, but constrain to simple cases. While functions used in A.CED.2, 3, and 4 will often be linear, exponential, or quadratic the types of problems should draw from more complex situations than those addressed in Mathematics I. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line. Note that the example given for A.CED.4 applies to earlier instances of this standard, not to the current course.* **Interpret functions that arise in applications in terms of a context.** **F.IF.4** - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal	**Directly addressed practices are underlined** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. <u>Construct viable arguments and critique the reasoning of others.</u> 4. <u>Model with mathematics.</u> 5. <u>Use appropriate tools strategically.</u> 6. <u>Attend to precision.</u> 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	**myOER:** Quadrilaterals Analyzing the Data Lesson examples above address at least one (or more) of the Common Core State Standards included in this Instructional Focus. To find more lessons for this instructional focus, please use the **Advanced Search** and type the keyword – **IM3IF4**. **Teacher:**

| | | description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

F.IF.5 - Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

F.IF.6 - Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
Emphasize the selection of a model function based on behavior of data and context.

Analyze functions using different representations.

A.CED.1 - Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

A.CED.2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A.CED.3 - Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

A.CED.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*

F.IF.4 - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries;* | | |

end behavior; and periodicity.

F.IF.5 - Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

F.IF.6 - Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F.IF.7 - Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F.IF.8 - Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F.IF.9 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.*

Build a function that models a relationship between two quantities.

F.BF.1 - Write a function that describes a relationship between two quantities.

b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*

		Develop models for more complex or sophisticated situations than in previous courses. **Build new functions from existing functions.** **F.BF.3** - Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.* *Use transformations of functions to find more optimum models as students consider increasingly more complex situations.* *Note the effect of multiple transformations on a single function and the common effect of each transformation across function types. Include functions defined only by a graph.* **F.BF.4 -** Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) = 2 x^3 or f(x) = (x+1)/(x-1) for x ≠ 1. *Extend F.BF.4a to simple rational, simple radical, and simple exponential functions; connect F.BF.4a to F.LE.4.* **Construct and compare linear, quadratic, and exponential models and solve problems.** **F.LE.4** - For exponential models, express as a logarithm the solution to a bct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. *Consider extending this unit to include the relationship between properties of logarithms and properties of exponents, such as the connection between the properties of exponents and the basic logarithm property that log xy = log x+log y.* **Visualize relationships between two-dimensional and three-dimensional objects.** **G.GMD.4** - Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. **Apply geometric concepts in modeling situations.** **G.MG.1** - Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a		

		cylinder). **G.MG.2** - Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). **G.MG.3** - Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).		

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