ECHS Integrated Math 1
per Illinois Model Curriculum

This year’s new Integrated Math 1 curriculum is the Illinois Model Curriculum which is aligned to the Illinois Common Core Learning Standards. You may reference the Learning Standards starting on page 57 at http://isbe.net/common_core/pls/level1/pdf/math-standards.pdf. A more condensed version can be found at http://isbe.net/common_core/pdf/math-models/high-school/1/1scope-sequence.pdf.

The Illinois Model Curriculum integrates concepts from algebra, geometry, and statistics with real-life critical thinking applications. The model has ten units which are:

**First Semester**
1. Expression, Equations and Inequalities
2. Geometry
3. Intro to Functions
4. Interpreting Functions
5. Linear Relations

**Second Semester**
6. Linear Modeling
7. Systems
8. Statistics
9. Representations of Exponential Functions
10. Comparing Models

Detailed descriptions of each of the ten units including the time frame, covered common core standards, key mathematical practices, focus of unit, skills to be learned, essential questions, and key vocabulary are provided below.

In order to evaluate your learning progress, you will be evaluated via the Partnership for Assessment of Readiness for College and Careers assessments - PARCC. The computerized PARCC assessments will include a rich set of performance-based tasks. Because of PARCC’s ability to better measure student performance through technology enhanced test items, they will look very different to students. The tasks on the assessments will resemble the classroom work you do during the school year and less like a conventional fill-in-the-bubble or short-answer test. You will be assessed with a PBA – Performance Based Assessment and an EOY - End of Year Assessment.

In addition, we will be utilizing the eight PARCC assessed Mathematical Practices throughout the school year which are:

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
Unit 1 - Expression, Equations and Inequalities (2-3 weeks)

Standards:
- Reason quantitatively and use units to solve problems.
  N.Q.1    N.Q.2    N.Q.3
- Interpret the structure of expressions.
  A.SSE.1
- Solve equations and inequalities in one variable.
  A.REI.3

Mathematical Practices Emphasized: 1, 4, 6, 7

Focus: Students understand that complex expressions are built of the basic operations; sums of terms and products of factors. Students understand that solving linear equations and inequalities in one variable is a process of reasoning, using steps that are reversible. Students will give precise attention to units when applying these skills to real world situations.

Skills: Students will be able to...
- identify the different parts of the expression and explain their meaning within context. (i.e. terms, factors, coefficients, constants, exponents).
- define, explain and describe the components of a complicated expression using decomposition.
- solve linear equations in one variable, including literal equations.
- solve linear inequalities in one variable, including literal inequalities.

Essential Questions:
How are equations and inequalities used to solve real world problems?
When is it advantageous to represent relationships between quantities symbolically? numerically? graphically?
Why are procedures and properties necessary when manipulating numeric or algebraic expressions?
How can the structure of expressions/equations/inequalities help determine a solution strategy?

Vocab: Literal equation    Expression    Equation    Inequality
Linear
Non-linear
Constant
Exponent
Term
Factor
Coefficient
Unit 2  – Geometry (4-6 weeks)

Standards:
Understand congruence in terms of rigid motions.
G.CO.6  G.CO.7  G.CO.8
Prove geometric theorems.
G.CO.9  G.CO.10  G.CO.11
Experiment with transformations in the plane.
G.CO.1  G.CO.2  G.CO.3  G.CO.4  G.CO.5

Mathematical Practices Emphasized: 1, 2, 3, 6, 7

Focus: Since concepts such as rotation, reflection, and translation were treated in the Grade 8 standards mostly in the context of hands-on activities, and with an emphasis on geometric intuition, one focus of this unit is to develop more precise definitions for these transformations. Precision and proof are critical elements of this unit. Students' understanding of what constitutes proof will be developed as students are introduced to the logical structure behind hypotheses and conclusions. Geometric objects will be more precisely defined using the basic building blocks of geometry, point, line, and distance. One very specific outcome of the unit is to develop a precise definition of congruence in terms of rigid motions, to use this definition to develop criteria for determining when two triangles are congruent, and finally, to develop triangle congruence theorems which follow from the definition of congruence in terms of rigid motions. In addition, attributes of geometric objects observed at an informal level in earlier grades will now be looked at more precisely through proof, and in many instances, these proofs will make use of triangle congruence and its consequences. Along with physical models, dynamic geometry environments will provide students with tools for investigating, experimenting with, conjecturing about, and modeling geometric phenomena.

Skills: Students will be able to ...
- develop definitions of rotations, reflections, and translations, in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- represent transformations in the plane.
- predict the effects of a given rigid motion on a given figure.
- use the definition of congruence in terms of rigid motions to decide if 2 given figures are congruent.
- describe transformations as functions that take points in the plane as inputs and give other points as outputs.
- compare transformations that preserve distance and angle and those that do not.
- given two geometric objects, recognize if and describe how one can be transformed to the other through a sequence of rigid motions.
- describe the necessary transformations to carry a figure onto itself.
- draw a figure that represents specific given information.
- construct a hypothesis and proof from a given conjecture.
- explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
- prove theorems about lines, angles, triangles and parallelograms.
Unit 2 – Geometry (continued)

Essential Questions:
In terms of rigid motions, when are two geometric figures congruent?
What are the undefined building blocks of geometry and how are they used?
What are possible conditions that are necessary to prove two triangles congruent?
What are the roles of hypothesis and conclusion in a proof?
What criteria are necessary in proving a theorem?

Vocab:

- Transformation
- Rigid motion
- Congruence
- Hypothesis
- Conclusion
- Proof
- Postulate
- Theorem
- Corresponding Rotation
- Reflection
- Translation
- Dilation
- Point
- Line
- Angle
Unit 3 – Introduction to Functions (2-3 weeks)

Standards:

Functions understand the concept of a function and use function notation.
F.IF.1  F.IF.2  F.IF.3

Interpret functions that arise in Applications in terms of the context.
F.IF.4  F.IF.5  F.IF.6

Mathematical Practices Emphasized:  2, 4, 7

Focus:  Students understand that functions have exactly one output for every input and that functions can be expressed and described in multiple ways. Students become fluent with function notation and will be able to evaluate functions (i.e. f(-3)) at various inputs. Students explore a variety of functions and representations and see function examples from algebra, geometry, and real world experiences.

Skills:  Students will be able to...
- use function notation and interpret statements that use function notation in terms of a context.
- identify functions from a variety of representations.
- evaluate f(x) for many functions.
- translate between symbolic representations of functions and tables or graphs.
- find outputs given inputs and inputs given outputs.
- relate the domain of a function to its graph and to the context.
- interpret key features of a function represented as a graph or a table.
- sketch graphs showing key features given a verbal description of the relationship.
- calculate and interpret the average rate of change of a function over a specified interval.
- estimate the rate of change from a graph.

Essential Questions:
What is function notation and how can it be used and interpreted?
What are functions and how can they be defined?
What are sequences and how are their domains defined?
How can you represent a function and what are the key features of each representation?

Vocab:  function  inputs  outputs  domain
range  representations  evaluate
dependent variable  independent variable
Unit 4 – Interpreting Functions (2-3 weeks)

Standards:
Interpret functions that arise in applications in terms of the context.
F.IF.4  F.IF.5  F.IF.6

Experiment with transformation in the plane.
G.CO.2

Mathematical Practices Emphasized: 2, 4, 7

Focus: Students use different function representations to analyze properties such as increasing, decreasing, end behavior, extreme values, symmetry, etc. For example, for the graph provided, students identify maximum and minimum values of a stock price or determine when that price was increasing or decreasing. They distinguish between the domain and context domain of this graph and find the average rate of change over a given interval. Students compare functions and understand the effect of basic transformations on the graphs of functions. By the completion of this unit and the previous units, students are familiar with piece-wise, absolute value, square root, and cube root functions. Students will use transformations to help solidify the concepts creating or interpreting a graph.

Skills: Students will be able to ...
- create a table and a graph given the equation of a function.
- identify the context domain and corresponding range of a function model.
- use and interpret a table, graph, or equation to determine critical features of a function and to relate these back to the real context.
- explain the features of a function in relation to its context and to its mathematical structure.
- calculate average rate of change as represented in equations, tables, or graphs.
- compare functions represented in various ways.
- relate values of a function back to the original context.
- graph a function using basic transformations.
- compare transformations that preserve distance and angle to those that do not.

Essential Questions:
What are various representations of a function, and how can they be interpreted?
How do you identify and explain the key features of a function in relation to the context?
How do you compare functions and their properties including maxima, minima, domain, range, intercepts, symmetry, end behavior, and average rate of change?
What are transformations, and how can they be used symbolically and graphically?

Vocab: maximum  minimum  symmetry  increasing
decreasing  rate of change  end behavior  x-intercept
y-intercept
Unit 5 – Representations of Linear Relations (3-5 weeks)

Standards:

- Understand the concept of a function and use function notation. F.IF.3
- Build a function that models a relationship between two quantities. F.BF.2
- Represent and solve equations and inequalities graphically. A.REI.10
- Create equations that describe numbers or relationship. A.CED.1, A.CED.2, A.CED.4
- Interpret functions that arise in applications in terms of the context. F.IF.4, F.IF.5, F.IF.6
- Analyze functions using different representations. F.IF.7

Mathematical Practices Emphasized: 3, 4, 7, 8

Focus: Students will understand that ...

- Linear relationships have a constant rate of change.
- The graph of a linear equation in two variables is the set of all its solutions plotted in the coordinate plane, which are points that either lie along a line (discrete) or form a line continuous.
- Arithmetic sequences are functions with a domain that is a subset of the integers and can be identified by the constant difference between consecutive terms.
- Arithmetic sequences follow a discrete linear pattern, and the common difference is the slope of the line.
- Linear functions can be represented by a table, graph, verbal description or equation and that each representation can be transferred to another representation.

Skills: Students will be able to ...

- Determine the slope of a linear relationship using two points (table or graph).
- Determine the slope of a linear relationship using its equation.
- Complete a table of linear data.
- Create linear equations and inequalities in one variable and use them to solve problems.
- Create equations in two or more variables to represent relationships between quantities.
- Graph an equation on coordinate axes with labels and scales.
- Rearrange formulas to highlight a quantity of interest, using the same reason as in solving equations.
- Determine the common difference in an arithmetic sequence.
- Write both recursive and explicit equations of arithmetic sequences.
- Translate among representations of linear functions including tables, graphs, equations and real-life situations.
- For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities.
- Sketch graphs showing key features given a verbal description of the relationship.
- Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- 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.
Unit 5 – Representations of Linear Relations (continued)

**Essential Questions:**
- What are the characteristics of a linear function?
- What is an arithmetic sequence and how does it relate to linear functions?
- What is the relationship between recursive and explicit equations and how are they represented symbolically?
- How can we represent a linear function?

**Vocab:**
- Domain
- Term
- Arithmetic sequence
- Recursive formula
  - Continuous
  - Discrete
- Rate of change
- Slope
- Common difference
- Linear relation/function
- Integers
- y-intercept
- Function
Unit 6 – Linear Modeling (3-4 weeks)

Standards:
- Interpret the structure of expressions.
  A.SSE.1
- Create equations that describe numbers or relationships.
  A.CED.1  A.CED.2  A.CED.3  A.CED.4
- Interpret functions that arise in Applications in terms of the context
  F.IF.4  F.IF.5  F.IF.6
- Build a function that models a relationship between two quantities.
  F.BF.1
- Represent and solve equations and inequalities graphically.
  A.REI.12
- Analyze functions using different representations.
  F-IF.7  N.Q.1  N.Q.2  N.Q.3

Mathematical Practices Emphasized: 2, 3, 6

Focus: Students generate and interpret linear equations and inequalities to model data in real-world contexts. Students interpret key features, such as intercepts, slope, correlation, causation, and linear fit.

Skills: Students will be able to ...
- interpret parts of expressions, such as terms, factors, and coefficients.
- determine for what range of values a linear model might be appropriate (restrictions on domain/range) for a given situation.
- estimate the rate of change over a specified interval.
- 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.
- relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- define appropriate quantities for the purpose of descriptive modeling.
- choose a level of accuracy appropriate to limitations of measurement when reporting quantities.
- graph linear and quadratic functions and show intercepts, maxima, and minima.

Essential Questions:
What real world situations can be modeled by a linear relationship?
How can technology help to determine whether a linear model is appropriate in a given situation?

Vocab: Linear regression  Terms  Factors  Coefficients
Interpolate  Extrapolate  Significant digits  Outlier
Unit 7 – Systems (2-3 weeks)

Standards:

Create equations that describe numbers or relationships.
A.CED.3

Represent and solve equations and inequalities graphically.
A.REI.11 A.REI.12

Solve equations and in equalities in one variable.
A.REI.5 A.REI.6

Mathematical Practices Emphasized: 3, 4, 5

Focus: Students become fluent in writing equations, interpreting variables, and verifying solutions as viable in the context of a problem. They explore systems of equations and inequalities, find and interpret solutions.

Skills: Students will be able to...

- write a system of linear equations in two variables to model a situation.
- determine if an ordered pair is a solution to a system and interpret the viability of solutions.
- 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.
- 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.
- solve a system of two equations or inequalities graphically, using tables, algebraically or with technology.
- prove 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.
- graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Essential Questions:

- How can systems of linear equations or inequalities be used to model real world situations?
- How can the solution(s) of a system be represented and interpreted?
- What processes may be used to solve a system of equations or inequalities?

Vocab:

- System of linear equations
- System of linear inequalities
- Solution set
- No solution
- Infinite solutions
- Region
- Constraints
- Ordered pair
Unit 8 – Statistics (1-2 weeks)

Standards:

Summarize, represent, and interpret data on a single count of measurement variable.

S.ID.1       S.ID.2       S.ID.3       S.ID.5

Summarize, represent, and interpret data on two categorical and quantitative variables.

S.ID.6

Interpret linear model.

S.ID.7       S.ID.8       S.ID.9

Mathematical Practices Emphasized: 1, 4, 6

Focus: Students use statistics to compare center and spread of two or more different data sets, including the use of scatter plots, histograms, box plots, and standard deviation. Students will interpret outliers and recognize associations and trends in the data. They use technology to examine data sets and potential models, as well as support the appropriate choice of model. They will be using scatter plots in 2 variables and finding line of best fit. Then they use the line of best fit to be able to determine if the two variables are correlations.

Skills Students will be able to...

• use and convert (as necessary) the appropriate unit when solving a multi-step real-world problem.
• interpret units used in formulas and real-world problems.
• choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
• choose and interpret the scale and origin in graphs and data displays.
• define the appropriate quantities to describe the characteristics of interest for a population.
• determine and interpret the appropriate quantities when communicating and using visual representations.
• define variables in the context of a situation.
• use and justify units to evaluate the appropriateness of a solution.
• use correct numerical value based on context and tools used in measurement.
• represent data visually in scatter plots, histograms, or box plots.
• compute the measures of central tendencies of a data set (mean, median, and mode).
• compute the range, max/min, quartiles and standard deviation of multiple data sets.
• compare measures of center (mean, median) and spread (range, maximum, minimum, quartiles) from multiple data sets.
• identify and describe possible outliers in a data set.
• use measures of central tendencies, range, max/min, quartiles, and standard deviation to interpret differences between data sets.
• create two-way frequency tables for categorical data.
• identify joint, marginal, and conditional relative frequencies within two-way tables.
• interpret relative frequencies in the context of the data.
• recognize possible associations and trends in data represented in two-way tables.
Skills  Students will be able to...
  ▪ create a scatter plot of data, including axes labels and appropriate ranges and scales, both by hand and with technology.
  ▪ estimate the rate of change over a specified interval from a scatter plot.
  ▪ interpret the slope and y-intercept of a best fit line in the context of the data.
  ▪ interpret the meaning of the correlation coefficient for a line of best fit.

Essential Questions:
  How do various representations of data lead to different interpretations of the data?
  When and how can extreme data points impact interpretation of data?
  Why are multiple sets of data used?
  How are center and spread of data sets described and compared?
  How is a data set represented in a two-way frequency table summarized?
  When is it appropriate to use causation or correlation?
  How can technology help to determine whether a linear model is appropriate in a given situation?
  What information is appropriate to interpret from a data-based linear model?

Vocab:  Joint relative frequency  Marginal relative frequency
  Conditional relative frequency  Outlier
  Skewed Distribution  Correlation Coefficient
  Two-Way Frequency Table  Standard deviation
  Interquartile Range  Line of best fit
  Linear regression  Correlation coefficient
  Correlation  Causation
  Association  Trend
  Dot plot  Histogram
  Box Plot  Scatter Plot
  Measure of Center  Normal Distribution
  Categorical Data  Accuracy
  Scale  Quantity
Unit 9 – Representations of Exponential Functions (4-5 weeks)

Standards:
- Interpret the structure of expressions. A.SSE.1
- Represent and solve equations and inequalities graphically. A.REI.10
- Functions understand the concept of a function and use function notation. F.IF.3
- Analyze functions using different representation. F.IF.9
- Build a function that models relationship between two quantities. F.BF.2
- Construct and compare linear, quadratic, and exponential models and solve problems. F.LE.1 F.LE.2

Mathematical Practices Emphasized: 7, 8

Focus: Using the understanding of arithmetic sequences, students see how the recursive and explicit formulas are different for geometric sequences. Students compare what happens when the growth of a sequence is a common ratio rather than a common difference. Students contrast exponential and linear functions as they explore exponential models using tables, graphs and symbols. In Math 1, exponential functions are limited to a domain of the integers, providing a connection between geometric sequences and exponential functions in multiple representations.

Skills: Students will be able to ...
- write recursive and explicit equations for arithmetic and geometric functions.
- create tables or other representations given recursive or explicit equations for sequences.
- recognize patterns in exponential functions and geometric sequences.
- model situations using explicit and recursive equations. Translate among representations of exponential functions including tables, graphs, equations and real-life situations.
- distinguish between linear and exponential functions from multiple representations.

Essential Questions:
- How can you decide what type of sequence or function is represented?
- What are the different ways you can represent an exponential function?
- How do you create an appropriate function to model data or situations given within context?
- What new information will be revealed if this equation is written in a different but equivalent form?

Vocab: Geometric sequence Recursive formula
Explicit formula Exponential function
Equal factor Equal interval
Domain Continuous
Discrete Arithmetic sequence
Linear equation Term
Initial value Common difference
Constant ratio
Unit 10 – Comparing Mathematical Models (3-4 weeks)

Standards:
- Interpret functions that arise in applications in terms of the context.
  F.IF.4    F.IF.5    F.IF.6
- Create equations that describe numbers or relationships.
  A.CED.1
- Build a function that models a relationship between two quantities.
  F.BF.1
- Summarize, represent, and interpret data on two categorical and quantitative variables.
  S.ID.6
- Interpret expressions for functions in terms of the situation they model.
  F.LE.3    F.LE.5
- Seeing Structure in Expressions.
  A.SSE.3

Mathematical Practices Emphasized: 1, 2, 4

Focus: Students apply the knowledge of geometric sequences to modeling with exponential relations. Students compare and make decisions about linear and exponential functions.

Skills: Students will be able to...
- translate between representations of exponential functions including tables, graphs, equations and real-life situations.
- distinguish between linear and exponential functions from multiple representations.
- rewrite exponential functions to reveal new information.
- use functions fitted to data to solve problems in the context of the data.
- interpret the parameters in a linear or exponential function in terms of a context.
- relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- 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.
- observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly

Essential Questions:
What do the key features of an exponential or linear function represent in a modeling situation?
How do you determine if a situation is best modeled by an exponential or linear function?
How do you choose units, scale, data displays and levels of accuracy to appropriately represent a situation?
How do you find a function that best fits data from a scatter plot?

Vocab: Tables    Graphs    Real-life situations
Equations    Exponential functions    Domain
Rate    Percent increase or decrease    Interval
Scale