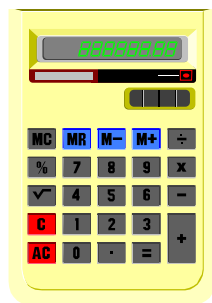


Chippewa Local Schools



# MATHEMATICS EXIT SKILLS K - 12

## **MATH EXIT SKILLS KINDERGARTEN**

- The student will count objects to 20.
- The student will rote count to 100.
- The student will extend and create patterns; groupings. The student will explain the groupings.
- The student will identify numbers and write numbers 0 - 2.
- The student will identify coin values.
- The student will create and interpret graphs.
- The student will add and subtract with concrete materials.

## **MATH EXIT SKILLS GRADE 1**

- The student will count forward to 100; backwards from 100. (Number line)
- The student will correctly add whole numbers to 12. (Addition facts)
- The student will correctly subtract whole numbers to 12. (Subtraction facts)
- The student will measure accurately to the nearest inch.
- The student will accurately tell time to the hour and half-hour.
- The student will identify coins and count groups of 2 different coins to 99 cents.
- The student will read and solve simple story problems and select the operation needed to solve the problem. The student will write a corresponding number sentence.
- The student will develop a system to group and count by 2s, 5s, and 10s.
- The student will identify, compare and sort two-dimensional shapes.
- The student will solve open sentences.
- The student will sort, classify and order objects by two or more attributes.
- The student will extend or create sequences of objects or numbers.
- The student will read and interpret charts, picture graphs and bar graphs.
- The student will identify fractions for halves, thirds and fourths.

## MATH EXIT SKILLS GRADE 2

**NUMBER SENSE AND OPERATIONS:** Using number sense and number skills, from basic counting to paper and pencil calculations, to age-appropriate use of calculators and computers.

The student will:

- Use place value concepts to read, write, compare and order numbers.
- Count money and make change using coins and a \$1 bill.
- Represent fractions using words, numerals, parts of a whole or a set of objects.
- Recognize and represent situations involving multiplication and division such as multiplication by combining equal groups of objects and division by sharing equally.
- Find sums and differences involving single-digit numbers quickly and accurately.
- Add and subtract multiples of 10.
- Estimate the answer to an addition or subtraction problem using front-end estimation.

**MEASUREMENT:** Making accurate measurements using the appropriate tools, terms and technology.

The student will:

- Identify appropriate units of measure for length, volume, weight and time.
- Explain how units of measure are related.
- Establish common references for units of measure.
- Tell time to the nearest minute on a digital clock and to the nearest 5 minutes on an analog clock.
- Use measurement tools such as a ruler to draw a line that is 3 inches long, a measuring cup to place 2 cups of rice in a bowl and a scale to find the weight of a potato in grams.

**GEOMETRY AND SPATIAL SENSE:** Identifying, classifying and analyzing one-, two- and three-dimensional objects, understanding their properties and using that knowledge to solve problems.

The student will:

- Identify and compare three-dimensional objects based on their characteristics such as shape of the faces or surfaces, number of edges or vertices.
- Predict what new shapes will be formed by putting together shapes or by taking apart or cutting a shape.
- Recognize and create shapes with line symmetry.
- Determine whether two-dimensional shapes are congruent or similar by copying or laying one on top of the other.

**MATH EXIT SKILLS**  
**GRADE 2 (continued)**

**PATTERNS, FUNCTIONS AND ALGEBRA:** Representing patterns and relationships using tables, graphs and symbols and using them to solve problems.

The student will:

- Extend simple number patterns.
- Describe the rule for a pattern and create patterns with consistent rules.
- Understand and use equivalence to identify values for symbols representing unknown quantities.
- Describe qualitative changes and quantitative changes, especially in addition and subtraction problems.

**DATA ANALYSIS AND PROBABILITY:** Organizing and interpreting results through data collection to answer questions, solve problems, show relationships and make predictions.

The student will:

- Collect data by asking questions, observing or taking a survey and put that data in a chart, picture, graph or bar graph.
- Write a few sentences to describe and answer questions about data represented in a chart or graph.
- Make a timeline to put events in order.
- Understand that data may vary from one population to another.
- List some possible outcomes of a simple experiment and predict whether possible outcomes are more, less or equally likely to occur.

**MATHEMATICAL PROCESSES:** Applying problem-solving and reasoning skills and communicating mathematical ideas.

The student will:

- Identify and restate in own words the question or problem and the information needed to solve the problem.
- Judge the reasonableness of predictions, estimates and solutions.
- Communicate thinking and solutions using everyday language and appropriate mathematical language and symbols.

**MATH EXIT SKILLS**  
**GRADE 3**

- The student will multiply whole numbers accurately to  $10 \times 10$ . (Multiplication facts)
- The student will add with regrouping.
- The student will subtract whole numbers with regrouping.
- The student will identify and list characteristics of geometric shapes.
- The student will accurately measure to the nearest  $\frac{1}{4}$  inch.

NOTE: Multiplication skills mastered at this point.

**MATH EXIT SKILLS**  
**GRADE 4**

- The student will use number sense and number skills from basic counting to paper and pencil calculations.
- The student will make accurate measurements and conversions using the appropriate tools, terms and technology.
- The student will identify, classify and analyze one-, two- and three-dimensional objects, understanding their properties and using that knowledge to solve problems.
- The student will represent patterns and relationships using tables, graphs and symbols and use them to solve problems.
- The student will organize and interpret results through data collection to answer questions, solve problems, show relationships and make predictions.
- The student will apply problem-solving and reasoning skills and communicate mathematical ideas.

## **MATH EXIT SKILLS GRADE 5**

- The student will identify, compare, order, add, subtract, and generate equivalent forms of fractions, decimals, whole numbers, and percents within same category.
- The student will identify and use relationships between operations to solve problems involving one or two steps.
- The student will describe and construct various lines, angles, and shapes and will find area, perimeter, and volume of various shapes.
- The student will accurately identify place values of whole numbers through billions and decimals to the thousandths place.
- The student will use data presented in graphs to read, interpret and predict results.
- The student will list and explain all possible outcomes in a given situation and make predictions based on experimental probabilities.
- The student will use rounding and estimation in order to find estimated answers to problems involving whole numbers, fractions, and decimals.
- The student will use appropriate units to measure different lengths and be able to convert within a measurement system.
- The student will describe, extend, and determine the rule for patterns and relationships occurring in numeric patterns.



## MATH EXIT SKILLS GRADE 6

- **NOTE: Master use of calculator at grade level.**

**NUMBER SENSE AND OPERATIONS:** Using number sense and number skills, from basic counting to paper and pencil calculations, to age-appropriate use of calculators and computers.

The student will:

- Use prime factorization to recognize the greatest common factor and least common multiple for composite numbers.
- Compute and model addition, subtraction, multiplication and division of fractions and decimals.
- Accurately convert between fractions, decimals and percents.
- Use models, pictures and real-life situations to relate the concepts of ratios.

**MEASUREMENT:** Making accurate measurements using the appropriate tools, terms and technology.

The student will:

- Estimate and calculate the perimeter and area of triangles and polygons and the surface area and volume of solid figures.
- Understand and describe the differences between perimeter, area, volume and surface area of a figure and determine which measure matches the context for a problem situation.

**GEOMETRY AND SPATIAL SENSE:** Identifying, classifying and analyzing one-, two- and three-dimensional objects, understanding their properties and using that knowledge to solve problems.

The student will:

- Classify, describe and sketch 2-dimensional figures and classify, describe and build 3-dimensional figures using geometric vocabulary and manipulatives.
- Sketch 2-dimensional figures after transformations and 3-dimensional figures from various perspectives.

**PATTERNS, FUNCTIONS AND ALGEBRA:** Representing patterns and relationships using tables, graphs and symbols and using them to solve problems.

The student will:

- Write and solve expressions and equations for a given situation.
- Determine patterns and relationships for equations and inequalities; will represent and analyze arithmetic and geometric patterns, rule and functions.

**DATA ANALYSIS AND PROBABILITY:** Organizing and interpreting results through data collection to answer questions, solve problems, show relationships and make predictions.

The student will:

- Analyze a set of data by calculating the range, mean, median, mode and identifying outliers.
- Read, construct and interpret line graphs, circle graphs and histograms.
- Choose an appropriate graphical representation for a given set of data and compare representations of the same data in different types of graphs.
- Conduct trials and calculate experimental probability to test theoretical probability.

## **MATH EXIT SKILLS GRADE 7**

The student will:

- demonstrate an understanding of place value using powers of 10 and write large numbers in scientific notation.
- explain the meaning of exponents that are negative or 0.
- describe the differences between rational and irrational numbers: e.g., use technology to show that some numbers (rational) can be expressed as terminating or repeating decimals and others (irrational) as non-terminating and non-repeating decimals.
- use order of operations and properties to simplify numerical expressions involving integers, fractions and decimals.
- explain the meaning and effect of adding, subtracting, multiplying and dividing integers; e.g., how adding two integers can result in a lesser value.
- simplify numerical expressions involving integers and use integers to solve real-life problems.
- solve problems using the appropriate form of a rational number (fraction, decimal or percent).
- develop and analyze algorithms for computing with percents and integers and demonstrate fluency in their use.
- represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents and square roots (for perfect squares).
- select appropriate units for measuring derived measurements; e.g., miles per hour.
- convert units of area and volume within the same measurement system using proportional reasoning and a reference table when appropriate; e.g., square feet to square yards.
- estimate a measurement to a greater degree of precision than the tool provides.
- solve problems involving proportional relationships and scale factors; e.g., scale models that require unit conversions within the same measurement system.
- analyze problem situations involving measurement concepts, select appropriate strategies and use an organized approach to solve narrative and increasingly complex problems.
- use strategies to develop formulas for finding area of trapezoids and volume of cylinders and prisms.

- develop strategies to find the area of composite shapes using the areas of triangles, parallelograms, circles and sectors.
- understand the difference between surface area and volume and demonstrate that two objects may have the same surface area but different volumes or may have the same volume but different surface areas.
- describe what happens to the surface area and volume of three-dimensional objects when the measurements of the objects are changed; e.g., length of sides are doubled.
- use proportional reasoning to describe and express relationships between parts and attributes of similar and congruent figures.
- determine sufficient (not necessarily minimal) properties that define a specific two-dimensional figure or three-dimensional object. For example:
  - a. determine when one set of figures is a subset of another; e.g., all squares are rectangles.
  - b. develop a set of properties that eliminates all but the desired figure; e.g., only squares are quadrilaterals with all sides congruent and all angles congruent.
- use and demonstrate understanding of the properties of triangles. For example:
  - a. use Pythagorean Theorem to solve problems involving right triangles.
  - b. use triangle angle sum relationships to solve problems.
- determine necessary conditions for congruence of triangles.
- apply properties of congruent or similar triangles to solve problems involving missing lengths and angle measures.
- determine and use scale factors for similar figures to solve problems using proportional reasoning.
- identify the line and rotation symmetries of two-dimensional figures to solve problems.
- perform translations, reflections, rotations and dilations of two-dimensional figures using a variety of methods (paper folding, tracing, graph paper).
- draw representations of three-dimensional geometric objects from different views.
- represent and analyze patterns, rules and functions with words, tables, graphs and simple variable expressions.
- generalize patterns by describing in words how to find the next term.

- recognize and explain when numerical patterns are linear or nonlinear progressions; e.g., 1,3,5,7... is linear and 1,3,4,8,16... is nonlinear.
- create visual representations of equation-solving processes that model the use of inverse operations.
- represent linear equations by plotting points in the coordinate plane.
- represent inequalities on a number line or a coordinate plane.
- justify that two forms of an algebraic expression are equivalent and recognize when an expression is simplified.
- use formulas in problem-solving situations.
- recognize a variety of uses for variables; e.g., placeholder for an unknown quantity in an equation, generalization for a pattern, formula.
- analyze linear and simple non-linear relationships to explain how a change in one variable results in the change of another.
- use graphing calculators or computers to analyze change; e.g., distance-time relationships.

## MATH EXIT SKILLS

## GRADE 8

- The student will estimate and compute accurately with real numbers: rationals, decimals, fractions, percents, integers, exponential numbers, and absolute values: irrationals, square roots and pi.
- The student will accurately use calculators in problem solving; solving multi-step problems.
- The student will set up and solve problems that require rates, ratios, proportions, and percents.
- The student will use scientific notation to express large numbers and numbers less than one; identify subsets of the real number system and apply properties of operation and explain the effects.
- The student will generalize and explain patterns and sequences in order to find the next term or the  $n$ th term; identify and classify as linear or nonlinear and contrast their properties; analyze, compare, solve and graph linear equations and inequalities. The student will solve linear equations and inequalities.
- The student will solve quadratic equations with real roots by graphing, formula and factoring; solve systems of linear equations involving two variations; model and solve direct and indirect variation; describe rates of change.
- The student will solve increasingly complex non-routine measurement problems and check reasonableness of results; will use formulas and indirect measurement techniques and will demonstrate understanding of the geometry of lines and angles to include vocabulary terms, shape names up to ten-sided figures, or parallel lines cut by a transversal.
- The student will apply concepts of congruency and similarity to solve geometric problems.
- The student will accurately convert within the English system and within the metric system.
- The student will write, interpret, simplify, evaluate, and/or use algebraic expressions and formulas which include:  $r+prt$ ,  $l=prt$ ,  $w^1d^1=w^2d^2$
- The student will create, interpret, use, and evaluate graphical displays and statistical measures to sort, present and use data; compare the characteristics of mean, median, mode for the data; will compute probabilities, make predictions, draw conclusions from data.

## **MATH EXIT SKILLS INTEGRATED I**

- The student will identify subsets of real numbers and apply properties of operation and the real number system and justify when they hold for a set of numbers.
- The student will estimate, compute and solve problems involving real numbers using verbal, physical, and symbolic representation, including problems about ratio, proportion, percent, and scientific notation.
- The student will use definitions and properties of similar figures, congruent figures, and situations involving angles formed by intersecting lines, parallel and perpendicular lines to justify conjectures; the student will explain thinking processes involved.
- The student will use measures of central tendency and measures of spread to interpret and create graphical displays and draw/explain conclusions about sets of data.
- The student will gather data using various sampling methods and predict the reliability of the process.
- The student will compute experimental and theoretical probabilities using counting techniques for compound, independent, and simple dependent events.

## **MATH EXIT SKILLS INTEGRATED II**

- The student will apply indirect measurement techniques, tools, and formulas to find perimeter, area, and volume of two- and three-dimensional figures, accurate to a specified level of precision.
- The student will use the Pythagorean Theorem and right triangle trigonometry to solve real world problems.
- The student will work with linear equations to:
  - graph using tables and slope intercepts
  - write equations of specified lines
  - solve problems using linear equations / inequalities.
- The student will add, subtract, multiply, divide, and factor polynomials.
- The student will solve:
  - quadratic equations (with factoring + quadratic form + graphics)
  - systems equations with 2 variables (graphically, substitution, elimination)
  - systems of inequalities with 2 variables
  - problem-solving,,, direct or inverse variation.

## **MATH EXIT SKILLS ALGEBRA I**

- The student will identify subsets of real numbers and apply properties of operations and the real number system and justify when they hold for a set of numbers.
- The student will use the Pythagorean Theorem, right triangle trigonometry and scale drawings to solve real world problems.
- The student will define and work with linear equations/inequalities and will:
  - graph using table and slope intercept
  - write equations of specified lines
  - solve problems using linear equations
  - understand and explain characteristics of linear equations.
- The student will add, subtract, multiply, divide, and factor polynomials.
- The student will solve:
  - quadratic equations (with factoring + quadratic form + graphics)
  - systems equations with 2 variables (graphically, substitution, elimination)
  - systems of inequalities with 2 variables
  - problem-solving,,, direct or inverse variation.
- The student will use measures of central tendency and measures of spread to interpret and create graphical displays and draw conclusions about sets of data.
- The student will gather data using various sampling methods and predict the reliability of the process.
- The student will compute experimental and theoretical probabilities using contrary techniques for compound, independent, and simple dependent events.



## **MATH EXIT SKILLS GEOMETRY**

- The student will identify properties of polygons and circles.
- The student will solve problems involving similar and congruent polygons.
- The student will develop two column and paragraph proofs about:
  - line and angle relationships
  - triangles
  - coordinate geometry.
- The student will demonstrate understanding of three-dimensional figures including:
  - drawing figures and cross-sections of figures
  - finding volumes
  - finding surface areas.
- The student will represent and model transformations.
- The student will solve problems of logic utilizing laws of logic.
- The student will draw and construct two- and three-dimensional geometric objects using various geometric tools.

## **MATH EXIT SKILLS ALGEBRA II**

- The student will work with matrices including:
  - addition and subtraction
  - scalar and matrix multiplication
  - find values of  $2 \times 2$  and  $3 \times 3$  determinants
  - solve systems of equations using a matrix equation and graphing calculator.
  
- The student will write an equation for a line using:
  - point slope form
  - slope intercept form
  - standard form
  - properties of parallel and perpendicular lines.
  
- The student will use function notation and
  - evaluate a function at a point
  - perform operations on functions
  - give the definition and domain and range of a function.
  
- The student will perform operation on all complex numbers including irrational numbers.
  
- The student will simplify and perform operations on rational expressions.
  
- The student will be solve quadratic equations with complex roots.
  
- The student will use logarithms including:
  - use the definition and laws of logs to simplify expressions
  - solve logarithmic and exponential equations.

## **MATH EXIT SKILLS**

### **ALGEBRA II WITH TRIGONOMETRY**

- The student will work with matrices including:
  - addition and subtraction
  - scalar and matrix multiplication
  - find values of  $2 \times 2$  and  $3 \times 3$  determinants
  - solve systems of equations using a matrix equation and graphing calculator.
  
- The student will write an equation for a line using:
  - point slope form
  - slope intercept form
  - standard form
  - properties of parallel and perpendicular lines.
  
- The student will use function notation and
  - evaluate a function at a point
  - perform operations on functions
  - give the definition and domain and range of a function.
- The student will perform operation on all complex numbers including irrational numbers.
  
- The student will simplify and perform operations on rational expressions.
  
- The student will be solve quadratic equations with complex roots.
  
- The student will use logarithms including:
  - use the definition and laws of logs to simplify expressions
  - solve logarithmic and exponential equations.
  
- The student will use trigonometry to:
  - solve right triangles
  - solve triangles using the Law of Sines and the Law of Cosines
  - find values of trigonometric functions without a calculator
  - graph trigonometric functions without a calculator.

**MATH EXIT SKILLS**  
**FUNCTIONS, STATISTICS, and TRIGONOMETRY (F.S.T.)**

- The student will use trigonometry to:
  - o Solve right triangles
  - o Solve triangles using the Law of Sines and Cosines
  - o Find values of trigonometry functions without a calculator
  - o Graph trigonometry functions without a calculator.
- The student will apply factorials and exponents, including fractional exponents.
- The student will use descriptive statistics to analyze and summarize data, including measures of center and spread.
- The student will design and perform a statistical experiment and make predictions about the conclusions.
- The student will find theoretical probability using counting methods.
- The student will interpret algebraic notation for sequences and series.
- The student will compare and contrast characteristics of different binomial and normal distributions.
- The student will convert from polar to rectangular coordinates and vice versa.

## **MATH EXIT SKILLS PRECALCULUS**

- The student will solve trigonometric equation and simplify expressions using identities.
- The student will find terms and sums of arithmetic and geometric sequences, use sigma notation, and use mathematical induction to prove results.
- The student will be able to write equations for and graph conic sections.
- The student will be able to do operations on polynomials including:
  - synthetic division
  - factoring with negative and rational exponents.
- The student will work with functions by:
  - composing functions
  - finding the inverse of a function
  - graphing periodic, logarithmic, algebraic and exponential functions without a calculator
  - finding the domain, range, and zeros of logarithmic, algebraic, and exponential functions without a calculator.

## **CALCULUS EXIT SKILLS**

- The student will calculate limits analytically and graphically.
- The student will demonstrate understanding of derivatives by:
  - using rules to find derivatives algebraically
  - using the definition to calculate the derivative
  - analyzing curves
  - modeling rate of change, including related rates problems
  - solving optimization problems.
- The student will demonstrate an understanding of integrals by:
  - computing Riemann sums and using the trapezoid rule to approximate definite integrals
  - using rules to find integrals algebraically
  - finding area and volumes
  - solving separable differential equations.