Math Foundations II 3131

Course Description:

Students will use problem situations, physical models, and appropriate technology to investigate concepts and topics that prepare them for higher level mathematics. Problem-solving situations will provide an environment that promotes communication and fosters connections within mathematics, to other disciplines, and to the real world. Students will use physical models to represent, explore, and develop abstract concepts. The use of appropriate technology will help students apply mathematics in an increasingly technological world.

Content Standard 1.0: Number and Operations

Students will recognize, represent, model, and apply real numbers and operations verbally, physically, symbolically, and graphically and will compute fluently and make reasonable estimates in problem solving.

Learning Expectations:

The student will:

1.1 demonstrate an understanding of the subsets, elements, properties, and operations of the real number system;

1.2 demonstrate an understanding of the relative size of rational and irrational numbers;

1.3 connect physical, graphical, verbal, and symbolic representations of real numbers;

1.4 informally describe and model the concept of inverse (e.g., opposites, reciprocals, and squares and square roots);

1.5 demonstrate an understanding of division involving zero;

1.6 describe, model, and apply inverse operations;

1.7 apply number theory concepts (e.g., primes, factors, divisibility and multiples) in mathematical problem situations;

1.8 connect physical, graphical, verbal, and symbolic representations of absolute value;

1.9 use real numbers to represent real-world applications (e.g., rate of change, probability, and proportionality);

1.10 select and apply an appropriate method (i.e., mental arithmetic, paper and pencil, or technology) for computing with real numbers, and evaluate the reasonableness of results;

1.11 communicate the concepts and strategies being used in estimation and computation;

1.12 perform operations on simple algebraic expressions, and informally justify the procedures chosen;

1.13 use estimation to make predictions and determine reasonableness of computational results;

1.14 use mathematical notations appropriately.

Performance Indicators State:

As documented through state assessment ,

At Level 1, the student is able to

choose the prime factorization of a two-digit composite whole number;
compare a fraction to a decimal using less than, greater than, and equals symbols;
multiply a fraction by a multiple of its denominator (denominator less than or equal to 25);
apply order of operations to evaluate numerical expressions (whole numbers only; no exponents or grouping symbols).

At Level 2, the student is able to

identify the opposite of any rational number;
select the best estimate for the coordinate of a given point on a number line (rationals);
choose an equivalent exponential form of a one-variable monomial given in factored form (only first- degree variables with positive integral coefficients);
multiply an integer by a one-variable binomial;
select a reasonable solution for a real-world division problem in which the remainder must be considered;
apply order of operations to evaluate numerical expressions containing whole numbers, exponents (1 and/or 2), and no more than two sets of grouping symbols;

At Level 3, the student is able to

select ratios and proportions to represent real-world problems such as scale drawings and samplings (all ratios are positive integers to positive integers).

Performance Indicators Teacher:

As documented through teacher observation,

At Level 1, the student is able to

classify numbers less than 100 as prime or composite;
model rational numbers using manipulatives;
classify a number as a whole number, an integer, a rational number, and/or a real number;
select and apply the appropriate method for computing with real numbers (i.e., mental arithmetic, paper and pencil, or technology).

At Level 2, the student is able to

compare a quotient when zero is the divisor to a quotient when zero is the dividend;
relate sets of numbers using Venn diagrams;
arrange a given set of rational numbers in ascending order;
use concrete and pictorial representations to model the Distributive Property;
connect a variety of real-world situations to integers;

At Level 3, the student is able to

connect physical, graphical, verbal, and symbolic representations of absolute value;
model inverse operations;
explore various representations and equivalent forms of real numbers;
justify, using models, operations on simple algebraic expressions (i.e., collecting like terms).

Sample Tasks: Search the newspapers for various uses of numbers and, in writing, justify the representations chosen (i.e., percent, fraction, and decimal). Investigate the applications of numbers and computations in the workplace.

Linkages: Mathematics - Estimation, Measurement, and Computation. Make connections to social studies through the study of latitude/longitude in mapping skills. Make connections to business/economics by tracking the stock market. Make connections to number representations and computations (e.g., interest) used in the workplace.

Standard 2.0: Algebra

Students will describe, extend, analyze, and create a wide variety of patterns and solve real-world problems using appropriate materials and representations.

Learning Expectations:

The student will:

2.1 recognize, extend, and create geometric, spatial, and numerical patterns;

2.2 analyze mathematical patterns related to algebra and geometry in real-world problem solving;

2.3 solve problems in number theory, geometry, probability and statistics, and measurement and estimation using algebraic thinking and symbolism (attention given to solving linear equations);

2.4 communicate the meaning of variables in algebraic expressions, equations, and inequalities;

2.5 interpret the results of algebraic procedures;

2.6 apply the concept of variable in simplifying algebraic expressions, solving equations, and solving inequalities;

2.7 interpret graphs that depict real-world phenomena;

2.8 model real-world phenomena using graphs.

Performance Indicators State:

As documented through state assessment,

At Level 1, the student is able to

extend a pattern of geometric figures;

extend a numerical pattern using only whole numbers.

At Level 2, the student is able to

solve a one-step linear equation with a variable on only one side of the equation (integral coefficients and constants);

solve a two-step linear equation with a variable on only one side of the equation (integral coefficients and constants);

translate a one-variable verbal expression into an algebraic expression (no more than two operations);

evaluate a first-degree algebraic expression given the values for the variables (up to three variables);

select the appropriate linear graph that models a real-world situation or vice versa.

At Level 3, the student is able to

select the number line graph that models a given one-step linear inequality (variables may not have negative coefficients);

simplify a first-degree algebraic expression without parenthesis by combining like terms (integral coefficients and constants).

Performance Indicators Teacher:

As documented through teacher observation ,

At Level 1, the student is able to

complete a function table given the function rule.

At Level 2, the student is able to

construct linear and non-linear graphs that model given real-world situations;

solve a two-step linear equation using models and justify each step.

At Level 3, the student is able to

use the Distributive Property to solve a one-variable linear equation (variable on both sides of the equation);

solve and graph linear inequalities with integral coefficients.

Sample Tasks: Use the internet or daily newspaper to find information regarding the stock results of one to five companies. Graphically demonstrate the histories of the companies for five to thirty days. Using the information found, predict the status of the company five to thirty days from now. Develop a range of the companies' stock values for the last five to thirty days, using inequalities. Write a scenario explaining why a company's stock changed drastically.

Linkages: Statistics and Probability. Trends in finance and in the business world. Science - numerical patterns in human anatomy (golden ratio)

Standard 3.0: Geometry

Students will investigate, model, and apply geometric properties and relationships.

Learning Expectations:

The student will:

3.1 analyze relationships among corresponding parts of similar or congruent geometric figures;

3.2 apply geometric properties, formulas, and relationships to solve real-world problems;

3.3 use inductive reasoning to make conjectures;

3.4 communicate position using spatial sense with two-dimensional coordinate system;

3.5 demonstrate an understanding of transformations of geometric figures;

3.6 apply the Pythagorean Theorem in problem solving;

3.7 name, analyze, and describe the properties of various polygons.

Performance Indicators State:

As documented through state assessment,

At Level 1, the student is able to

determine the perimeter of any geometric figure.

At Level 2, the student is able to

identify the coordinates for a given point;

find the missing length of a side given two similar triangles.

At Level 3, the student is able to

use the Pythagorean Theorem to determine the length of a missing side of a right triangle (no radicals).

Performance Indicators Teacher:

As documented through teacher observation,

At Level 1, the student is able to

identify corresponding parts of congruent triangles;

classify a quadrilateral, given its properties, as a square, a rectangle, a rhombus, a parallelogram, and/or a trapezoid.

At Level 2, the student is able to

model a variety of triangles (i.e., acute, obtuse, scalene, isosceles, and equilateral);

determine if given lengths could form a triangle;

calculate the area of a circle, a triangle, a parallelogram, a rhombus, or a trapezoid given the appropriate formula.

At Level 3, the student is able to

classify a variety of polygons then justify the classification;

determine and justify the missing angle measures, given the measure of one angle, when two parallel lines are cut by a transversal.

Sample Tasks: Students choose tessellating polygon shapes to design a quilt pattern. Students use the properties of similar triangles to investigate the height of trees, flagpoles, and other structures.

Linkages: Construction, Design, Architecture, and Art

Standard 4.0: Measurement

Students will become familiar with the units and processes of measurement in order to use various tools, techniques, and formulas to determine and estimate measurements in problem solving.

Learning Expectations:

The student will:

4.1 communicate the concepts and strategies used to measure and to estimate measurements;

4.2 use concepts of length and area, including surface area and volume, to estimate and solve real-world problems (e.g., parallelograms, triangles, right rectangular prisms, circles, right cylinders, spheres, and pyramids);

4.3 apply measurement concepts and relationships in algebraic and geometric problem-solving situations;

4.4 choose appropriate techniques and tools to measure quantities in order to meet specifications for precision and accuracy;

4.5 demonstrate an understanding of rates and other derived and indirect measurements (e.g., velocity, miles per hr, rpm, and cost per unit).

Performance Indicators State:

As documented through state assessment ,

At Level 1, the student is able to

apply the given formula to determine the area of a rectangular figure with rational dimensions.

At Level 2, the student is able to

calculate the cost per unit to determine the best buy (no more than four samples).

At Level 3, the student is able to

choose the correct area representation of the product of an integer and a one-variable first-degree binomial.

Performance Indicators Teacher:

As documented through teacher observation,

At Level 1, the student is able to

measure a line segment using appropriate metric or customary units;

choose an appropriate unit of measure in a real-world situation (e.g., length of a car, length of a pencil, or weight of a person).

At Level 2, the student is able to

apply the concept of rate such as mph, cost per unit, and rpm.

At Level 3, the student is able to

model and compare the area and dimensions of similar polygons (i.e., triangles, squares, and rectangles).

Sample Tasks: Provide students a scale drawing of a room and have them calculate the amount and cost of various floor-covering. Give students a blow pop and have them measure the circumference. Have students rotate the blow pop in their mouths for two minutes. Measure the circumference again. Repeat this process five times. Plot time versus circumference and explain the change.

Linkages: Mathematics – Geometry and Science. Connect to careers such as auto mechanic, construction, travel, etc.

Standard 5.0: Data Analysis and Probability

Students will interpret a given set of data, including analyzing the use, misuse, and abuse of data; choose, construct, and analyze appropriate graphical representations for a data set; use technology in data collection and analysis; and apply theoretical and experimental probability to analyze the likelihood of an event.

Learning Expectations:

The student will:

5.1 interpret a set of data using the appropriate measure of central tendency (mean, median, mode) and the appropriate measure of dispersion (e.g., quartiles, range);

5.2 choose, construct, and analyze appropriate graphical representations for a data set including pie charts, histograms, stem-and-leaf plots, scatterplots, and box plots;

5.3 apply appropriate technology in data collection and analysis;

5.4 apply theoretical and experimental probability to analyze the likelihood of an event;

5.5 use simulations to estimate probability;

5.6 analyze the validity of statistical conclusions and the use, misuse, and abuse of data;

5.7 apply counting principles of permutations and combinations using appropriate technology.

Performance Indicators State:

As documented through state assessment,

At Level 1, the student is able to

determine the mean of a given set of data (no more than five one- or two-digit numbers);

determine the number of possible outcomes for a simple experiment using a list, tree diagram, or the multiplication counting principle;

determine the probability of a single event (e.g., rolling a die or using a spinner).

At Level 2, the student is able to

interpret bar graphs representing real-world data;
interpret circle graphs (pie charts) representing real-world data;
determine the median from a given stem-and-leaf plot.

At Level 3, the student is able to

determine the median of a given set of real-world data (even number of data);

Performance Indicators Teacher:

As documented through teacher observation ,

At Level 1, the student is able to

construct a bar graph using real-world data;
construct a circle graph using real-world data;
construct a line graph using real-world data.

At Level 2, the student is able to

construct a stem-and-leaf plot using real-world data.

At Level 3, the student is able to

use simulations to estimate probability;
select the measure of central tendency that best describes the given real-world situation.

Sample Tasks: Survey 100 people on political candidates, favorite shows, etc. Create a frequency table and display the data. Randomly sample the school population and survey those students to predict the opinions of other students on certain topics.

Linkages: Technology - Students create spreadsheets and graphs on the computer and then decide which type of graph best displays their data. Social Studies - Census Bureau, Neilson Ratings, National Polls.