Numbers Up! Baggin’ the Dragon

Correlation with the NCTM Principles and Standards
**Algebra Standard**

*NCTM Level: Pre-K – 2*  
*Numbers Up! Levels 1-11 (Ages 4-7)*

In pre-kindergarten through grade 2 all students should:

**Understand patterns, relations, and functions**
- Sort, classify, and order objects by size, number, and other properties;
- Recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another;
- Analyze how both repeating and growing patterns are generated.

**Represent and analyze mathematical situations and structures using algebraic symbols**
- Use concrete and pictorial representations to develop an understanding of invented and conventional symbolic notations.

**Use mathematical models to represent and understand quantitative relationships**
- Model situations that involve the addition and subtraction of whole numbers, using objects, pictures and symbols;
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside mathematics.

**Connections**
- Recognize and use connections among mathematical ideas;
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside mathematics.

**Representations**
- Select, apply and translate among mathematical representations to solve problems.

*NCTM Level: Grades 3 – 5*  
*Numbers Up! Levels 12-17 (Ages 7-10)*

In grades 3 – 5 all students should:

**Understand patterns, relations, and functions**
- Describe, extend and make generalizations about geometric and numeric patterns;
- Represent and analyze patterns and functions, using words, tables, and graphs;
Represent and analyze mathematical situations and structures using algebraic symbols

- Identify such properties as commutativity, associativity, and distributivity and use them to compute with whole numbers;
- Represent the idea of a variable as an unknown quantity using a letter or a symbol;
- Express mathematical relationships using equations.

Use mathematical models to represent and understand quantitative relationships.

- Model problem situations with objects, and use representations such as graphs, tables, and equations to draw conclusions.

Analyze change in a variety of contexts

- Investigate how change in one variable relates to change in a second variable;
- Identify, describe, and compare situations with constant or varying rates of change.

Problem-solving

- Solve problems that arise in mathematics and other contexts;
- Apply and adapt a variety of appropriate strategies to solve problems.

Connections

- Recognize and use connections among mathematical ideas;
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside mathematics.

Representations

- Select, apply and translate among mathematical representations to solve problems.

**NCTM Level: Grades 6 – 8**

*Numbers Up! Levels 18-26 (Ages 10-14)*

In grades 6 – 8 all students should:

**Understand patterns, relationships, and functions**

- Represent, analyze, and generalize a variety of patterns with tables, graphs and words, and, when possible, symbolic rules;
- Relate and compare different forms of representation for a relationship;
- Identify functions as linear or non-linear and contrast their properties from tables, graphs, or equations.

**Represent and analyze mathematical situations and structures using algebraic symbols**

- Develop an initial conceptual understanding of different uses of variables;
- Explore relationships between symbolic expressions and graphs of lines, paying particular attention to the meaning of intercept and slope;
• Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships;  
• Recognize and generate equivalent forms for simple algebraic expressions and solve linear equations.

**Use mathematical models to represent and understand quantitative relationships**
• Model and solve contextualized problems using various representations, such as graphs, tables, and equations.

**Analyze change in various contexts**
• Use graphs to analyze the nature of changes in quantities in linear relationships.

**Problem-solving**
• Build new mathematical knowledge through problem-solving;  
• Solve problems that arise in mathematical and other contexts;  
• Apply and adapt a variety of appropriate strategies to solve problems;  
• Monitor and reflect on the process of mathematical problem solving.

**Connections**
• Recognize and use connections among mathematical ideas;  
• Understand how mathematical ideas interconnect and build upon one another to produce a coherent whole;  
• Recognize and apply mathematics in contexts outside of mathematics.

**Representation**
• Select, apply, and translate among mathematical representations to solve problems.

**NCTM Level: Grades 9 – 12**

In grades 9 – 12 all students should:

**Understand patterns, relations and functions**
• Generalize patterns using explicitly defined functions;  
• Understand relations and functions;  
• Understand and perform transformations such as arithmetically combining, composing and inverting commonly used functions;  
• Understand and compare the properties of classes of functions, including exponential, polynomial, rational and logarithmic functions.

**Represent and analyze mathematical situations and structures using algebraic symbols**
• Understand the meaning of equivalent forms of expressions, equations, inequalities, and relations;  
• Write equivalent forms of equations and solve them with fluency;
• Use symbolic algebra to represent and explain mathematical relationships;
• Use a variety of symbolic representations for functions and relations;
• Judge the meaning and reasonableness of the results of symbol manipulations.

Use mathematical models to represent and understand quantitative relationships
• Use symbolic expressions, including iterative and recursive forms, to represent relationships arising from various contexts;
• Draw reasonable conclusions about a situation being modelled.

Analyze change in various contexts
• Approximate and interpret rates of change from graphical and numerical data.

Problem-solving
• Build new mathematical knowledge through problem solving;
• Solve problems that arise in mathematics and in other contexts;
• Apply and adapt a variety of appropriate strategies to solve problems.

Reasoning and Proof
• Recognize reasoning and proof as fundamental aspects of mathematics;
• Make and investigate mathematical conjectures;
• Use and evaluate mathematical arguments and proofs;

Connections
• Recognize and use connections among mathematical ideas;
• Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
• Recognize and apply mathematics in contexts outside of mathematics.

Representations
• Complete and use representations that organize, record and communicate mathematical ideas;
• Apply mathematical representations to solve problems;
• Use representations to model and interpret physical, social and mathematical phenomena.
Geometry Standard

NCTM Level: Pre-K – 2

In pre-kindergarten through grade 2 all students should:

Analyze characteristics and properties of two- and three-dimensional geometric shapes, and develop mathematical arguments about geometric relationships

• Recognize, name, compare, and sort 2D and 3D shapes;
• Describe attributes and parts of 2D and 3D shapes;
• Investigate and predict the results of putting together and taking apart 2D and 3D shapes.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems

• Describe, name, and interpret relative positions in space, and apply ideas about relative position;
• Describe, name, and interpret direction and distance in navigating space and apply ideas about direction and distance;
• Find and name locations with simple relationships such as near to and in coordinate systems such as maps.

Apply transformations and use symmetry to analyze mathematical situations

• Recognize and apply slides, flips and turns;
• Recognize and create shapes that have symmetry.

Use visualization, spatial reasoning, and geometric modeling to solve problems

• Create mental images of geometric shapes using spatial memory and spatial visualization;
• Recognize and represent shapes from different perspectives;
• Relate ideas in geometry to ideas in number and measurement;
• Recognize geometric shapes and structures in the environment and specify their location.

Connections

• Recognize and use connections among mathematical ideas;
• Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
• Recognize and apply mathematics in contexts outside mathematics.

Representations

• Select, apply and translate among mathematical representations to solve problems.
In grades 3 – 5 all students should:

Analyze characteristics and properties of two- and three-dimensional geometric shapes, and develop mathematical arguments about geometric relationships.

- Identify, compare, and analyze attributes of 2D and 3D shapes and develop vocabulary to describe the attributes;
- Classify 2D and 3D shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids;
- Investigate, describe, and reason about the results of subdividing, combining, and transforming shapes;
- Explore congruence and similarity;
- Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems

- Describe location and movement using common language and geometric vocabulary;
- Make and use coordinate systems to specify locations and describe paths;
- Find the distance between points along horizontal and vertical lines of a coordinate system.

Apply transformations and use symmetry to analyze mathematical situations

- Predict and describe the results of sliding, flipping, and turning 2D shapes;
- Describe a motion or series of motions that will show that two shapes are congruent;
- Identify and describe line and rotational symmetry in 2D and 3D shapes and designs.

Use visualization, spatial reasoning, and geometric modeling to solve problems

- Build and draw geometric objects;
- Identify a 2D representation of a 3D object;
- Use geometric models to solve problems in other areas of mathematics such as number and measurement;
- Recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in everyday life.

Problem-solving

- Solve problems that arise in mathematics and other contexts;
- Apply and adapt a variety of appropriate strategies to solve problems.

Connections

- Recognize and use connections among mathematical ideas;
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside mathematics.
Representations

• Select, apply and translate among mathematical representations to solve problems.

NCTM Level: Grades 6 – 8

In grades 6 – 8 all students should:

Analyze characteristics and properties of two- and three-dimensional geometric shapes, and develop mathematical arguments about geometric relationships.

• Precisely describe, classify, and understand relationships among different types of 2D and 3D objects using their defining properties;
• Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems

• Use coordinate geometry to represent and examine the properties of geometric shapes;
• Use coordinate geometry to examine special geometric shapes, such as regular polygons, or those with parallel or perpendicular sides.

Apply transformations and use symmetry to analyze mathematical situations

• Describe sizes, positions, and orientations of shapes under informal transformations, such as flips, slides, and turns;
• Examine the congruence, similarity, and line or rotational symmetry of objects using transformations;

Use visualization, spatial reasoning, and geometric modeling to solve problems;

• Use 2D representations of 3D objects to visualize and solve problems such as those involving surface area and volume;
• Use visual tools such as networks to represent and solve problems;
• Use geometric models to represent and explain numerical and algebraic relationships.

Problem-solving

• Build new mathematical knowledge through problem-solving;
• Solve problems that arise in mathematical and other contexts;
• Apply and adapt a variety of appropriate strategies to solve problems;
• Monitor and reflect on the process of mathematical problem solving.

Connections

• Recognize and use connections among mathematical ideas;
• Understand how mathematical ideas interconnect and build upon one another to produce a coherent whole;
• Recognize and apply mathematics in contexts outside of mathematics.
**Representation**

- Select, apply, and translate among mathematical representations to solve problems.

**NCTM Level: Grades 9 – 12**

*Numbers Up! Levels 25-26 (Ages 14-15+)*

In grades 9 – 12 all students should:

**Analyze characteristics and properties of two- and three- dimensional geometric shapes.**

- Analyze properties and determine attributes of two- and three- dimensional objects;
- Explore relationships (including congruence and similarity) among classes of two- and three- dimensional objects, make and test conjectures about them, and solve problems involving them;
- Use trigonometric relationships to determine lengths and angle measures.

**Specify locations and describe spatial relationships using coordinate geometry and other representational systems.**

- Use Cartesian coordinates and other coordinate systems, such as navigational systems, to analyze geometric situations;
- Investigate conjectures and solve problems involving two-dimensional objects represented with Cartesian coordinates.

**Apply transformations and use symmetry to analyze mathematical situations**

- Understand and represent translations, reflections and rotations of objects in the plane by using images and coordinates.
- Use various representations to help understand the effects of simple transformations and their compositions.

**Use visualization, spatial reasoning, and geometric modelling to solve problems**

- Visualize three-dimensional objects and spaces from different perspectives and analyze their cross sections;
- Use geometric models to gain insights into, and answer questions in, other areas of mathematics;

**Problem-solving**

- Solve problems that arise in mathematics and in other contexts;
- Experience and reflect on the process of mathematical problem solving;
- Apply and adapt a variety of appropriate strategies to solve problems.

**Reasoning and Proof**

- Recognize reasoning and proof as fundamental aspects of mathematics;
- Make and investigate mathematical conjectures;
- Develop and evaluate mathematical arguments and proofs;
- Select and use various types of reasoning and methods of proof.
Connections

• Recognize and use connections among mathematical ideas;
• Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
• Recognize and apply mathematics in contexts outside of mathematics.

Representations

• Create and use representations that organize, record and communicate mathematical ideas;
• Apply mathematical representations to solve problems.
Measurement Standard

**NCTM Level: Pre-K – 2**

*Numbers Up! Levels 1-11 (Ages 4-7)*

In pre-kindergarten through grade 2 all students should:

**Understand measurable attributes of objects and the units, systems and processes of measurement**

- Recognize the attributes of length, volume, weight, area, and time;
- Compare and order objects according to these attributes;
- Understand how to measure using standard and non-standard units;
- Select an appropriate unit and tool for the attribute being measured;

**Apply appropriate techniques, tools, and formulas to determine measurements**

- Measure with multiple copies of units the same size;
- Develop common referents for measures to make comparisons and estimates.

**Connections**

- Recognize and use connections among mathematical ideas;
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside mathematics.

**Representations**

- Select, apply and translate among mathematical representations to solve problems.

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**NCTM Level: Grades 3 – 5**

*Numbers Up! Levels 12-17 (Ages 7-10)*

In grades 3 – 5 all students should:

**Understand measurable attributes of objects and the units, systems and processes of measurement**

- Understand such attributes as length, area weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute;
- Understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems;
- Carry out simple unit conversions, such as from centimeters to meters, within a system of measurement;
- Explore what happens to measurements of a 2D shape such as its perimeter and area when the shape is changed in some way.
Apply appropriate techniques, tools, and formulas to determine measurements
- Develop strategies for estimating the perimeters, areas, and volumes of irregular shapes;
- Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, and the sizes of angles;
- Select and use benchmarks to estimate measurements;
- Develop, understand, and use formulas to find the areas of rectangles and related triangles and parallelograms;
- Develop strategies to determine the surface areas and volumes of rectangular solids.

Compute fluently and make reasonable estimates.
- Develop fluency with basic number combinations for multiplication and division and use these combinations to mentally compute related problems, such as 30 x 50;
- Develop fluency in adding, subtracting, multiplying and dividing whole numbers;
- Develop and use strategies to estimate the results of whole-number computations and to judge the reasonableness of such results;
- Develop and use strategies to estimate computations involving fractions and decimals in situations relevant to the students’ experience;
- Use visual models, benchmarks and equivalent forms to add and subtract commonly used fractions and decimals.

Problem-solving
- Solve problems that arise in mathematics and other contexts;
- Apply and adapt a variety of appropriate strategies to solve problems.

Connections
- Recognize and use connections among mathematical ideas;
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside mathematics.

Representations
- Select, apply and translate among mathematical representations to solve problems.

NCTM Level: Grades 6 – 8

Numbers Up! Levels 18-26 (Ages 10-14)

In grades 6 – 8 all students should:

Understand measurable attributes of objects and the units, systems, and processes of measurement
- Understand both metric and customary systems of measurement;
- Understand relationships among units and convert from one unit to another within the same system;
- Understand, select, and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume;
Apply appropriate techniques, tools, and formulas to determine measurements

- Use common benchmarks to select appropriate methods for estimating measurements;
- Select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision;
- Develop and use formulas to determine the circumference of circles, and the area of triangles, parallelograms, trapezoids, and develop strategies to find the area of more complex shapes;
- Develop strategies to find the surface area and volume of selected prisms, pyramids and cylinders;
- Solve simple problems involving rates and derived measurements for such attributes as velocity and density.

Compute fluently and make reasonable estimates

- Select appropriate methods and tools for computing with fractions and decimals;
- Develop and analyze algorithms for computing with fractions, decimals and integers and develop fluency with their use;
- Develop and use strategies to estimate the results of rational-number computations and judge the reasonableness of the results;
- Develop methods for solving problems involving proportions, such as scaling and finding equivalent ratios.

Problem-solving

- Build new mathematical knowledge through problem-solving;
- Solve problems that arise in mathematical and other contexts;
- Apply and adapt a variety of appropriate strategies to solve problems;
- Monitor and reflect on the process of mathematical problem solving.

Connections

- Recognize and use connections among mathematical ideas;
- Understand how mathematical ideas interconnect and build upon one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside of mathematics.

Representation

- Select, apply, and translate among mathematical representations to solve problems.

**NCTM Level: Grades 9 – 12  Numbers Up! Levels 25-26 (Ages 14-15+)**

In grades 9 – 12 all students should:

Understand measurable attributes of objects and the units, systems, and processes of measurement

- Make decisions about units and scales that are appropriate for problem situations involving measurement.
Apply appropriate techniques, tools and formulas to determine measurements
  • Develop tools to express precision (significant figures and scientific notation)
  • Understand and use formulas for the area, surface area, and volume of geometric figures, including cones, spheres and cylinders.

Problem-solving
  • Apply and adapt a variety of appropriate strategies to solve problems;
  • Solve problems that arise in mathematics and in other contexts.

Reasoning
  • Make and investigate mathematical conjectures;
  • Select and use various types of reasoning.

Connections
  • Recognize and use connections among mathematical ideas;
  • Recognize and apply mathematics in contexts outside of mathematics.

Representation
  • Select, apply and translate among mathematical representations to solve problems.
Data Analysis and Probability Standard

**NCTM Level: Pre-K – 2**  
*Numbers Up! Levels 1-11 (Ages 4-7)*

In pre-kindergarten through grade 2 all students should:

**Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them**
- Sort and classify objects according to their attributes and organize data about the objects;
- Represent data using concrete objects, pictures, and graphs.

**Select and use appropriate statistical methods to analyze data**
- Describe parts of the data and the set of data as a whole to determine what the data show.

**Connections**
- Recognize and use connections among mathematical ideas;
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside mathematics.

**Representations**
- Select, apply and translate among mathematical representations to solve problems.

**NCTM Level: Grades 3 – 5**  
*Numbers Up! Levels 12-17 (Ages 7-10)*

In grades 3 – 5 all students should:

**Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them**
- Represent data using tables and graphs such as line plots, bar graphs, and line graphs;
- Recognize the difference between presenting categorical and numerical data.

**Select and use appropriate statistical methods to analyze data**
- Describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed;
- Use measures of center, focusing on the median, and understand what each does and does not indicate about the data set;
- Compare different representations of the same data and evaluate how well each representation shows important aspects of the data.
Understand and apply basic concepts of probability

• Understand that the measure of the likelihood of an event can be represented by a number from 0 to 1.

Compute fluently and make reasonable estimates.

• Develop fluency with basic number combinations for multiplication and division and use these combinations to mentally compute related problems, such as 30 x 50;
• Develop fluency in adding, subtracting, multiplying and dividing whole numbers;
• Develop and use strategies to estimate the results of whole-number computations and to judge the reasonableness of such results;
• Develop and use strategies to estimate computations involving fractions and decimals in situations relevant to the students’ experience;
• Use visual models, benchmarks and equivalent forms to add and subtract commonly used fractions and decimals.

Problem-solving

• Solve problems that arise in mathematics and other contexts;
• Apply and adapt a variety of appropriate strategies to solve problems.

Connections

• Recognize and use connections among mathematical ideas;
• Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
• Recognize and apply mathematics in contexts outside mathematics.

Representations

• Select, apply and translate among mathematical representations to solve problems.

**NCTM Level: Grades 6 – 8**

*Numbers Up! Levels 18-26 (Ages 10-14)*

In grades 6 – 8 all students should:

**Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them**

• Select, create and use appropriate graphical representations of data, including histograms, box plots, and scatterplots.

**Select and use appropriate statistical methods to analyze data**

• Find, use, and interpret measures of center and spread, including mean;
• Understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatterplots;
Develop and evaluate inferences and predictions that are based on data

• Use observations about differences between two or more samples to make conjectures about the populations from which the samples were taken.

Understand and apply basic concepts of probability

• Compute probabilities for simple compound events, using such methods as organized lists and tree diagrams.

Compute fluently and make reasonable estimates

• Select appropriate methods and tools for computing with fractions and decimals;
• Develop and analyze algorithms for computing with fractions, decimals and integers and develop fluency with their use;
• Develop and use strategies to estimate the results of rational-number computations and judge the reasonableness of the results;
• Develop methods for solving problems involving proportions, such as scaling and finding equivalent ratios.

Problem-solving

• Build new mathematical knowledge through problem-solving;
• Solve problems that arise in mathematical and other contexts;
• Apply and adapt a variety of appropriate strategies to solve problems;
• Monitor and reflect on the process of mathematical problem solving.

Connections

• Recognize and use connections among mathematical ideas;
• Understand how mathematical ideas interconnect and build upon one another to produce a coherent whole;
• Recognize and apply mathematics in contexts outside of mathematics.

Representation

• Select, apply, and translate among mathematical representations to solve problems.

**NCTM Level: Grades 9 – 12**  
*Numbers Up! Levels 25-26 (Ages 14-15+)*

In grades 9 – 12 all students should:

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them

• Understands the differences among and draws inferences from various kinds of studies;
• Understand the meaning of measurement, categorical and univariate data, and of the term variable;
• Understands histograms and scatter plots.
Select and use appropriate statistical methods to analyze data
  • For univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics.

Develop and evaluate inferences and predictions that are based on data
  • Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference.

Understand and apply basic concepts of probability
  • Understand the concepts of sample space and probability distribution in simple cases;
  • Compute and interpret the expected value of random variables in simple cases;
  • Understand how to compute the probability of a compound event.

Problem-solving
  • Apply and adapt a variety of appropriate strategies to solve problems.

Reasoning and Proof
  • Make and investigate mathematical conjectures;
  • Use and evaluate mathematical arguments.

Connections
  • Recognize and use connections among mathematical ideas;
  • Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
  • Recognize and apply mathematics in contexts outside of mathematics.

Representations
  • Create and use representations that organize, record and communicate mathematical ideas;
  • Apply mathematical representations to solve problems;
  • Use representations to model and interpret physical, social and mathematical phenomena.