

# *Numbers Up! Baggin' the Dragon*

Correlation with the  
NCTM Principles and Standards

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Mathematics

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

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**

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

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.

## **NCTM Level: Grades 3 – 5**

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

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***

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

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.

## ***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  $30 \times 50$ ;
- 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  $30 \times 50$ ;
- 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.