Mathematics Transfer Goals

Students will independently be able to:

- Demonstrate **automaticity** in basic computation so that they can focus on the more **sophisticated** aspects of the problem
- Based on an understanding of *any* problem, initiate a plan (using a **variety of methods/strategies**), execute it, and evaluate the **reasonableness of the solution**
- Evaluate a **proposed solution** to determine accuracy, efficiency, and/or logic.
- **Articulate** how mathematical concepts relate to one another in the context of a problem or **abstract relationships**
- Communicate effectively based on purpose, task, and audience using appropriate vocabulary

Teacher notes on bolded words:

1. ***Automaticity****- fluent, immediate, and correct responses*
2. ***Sophisticated****- the complex, more "messy" part of the problem (not the straightforward computation)*
3. ***Variety of Methods/Strategies****- concretely, algebraically, pictorially, graphically, symbolically, orally, or in written form*
4. ***Reasonableness of the solution****- the validity of the solution matches the context of the problem (Is my answer a possible solution to the problem?)*
5. ***Proposed solution*** **-** *a different method/strategy to solving the same problem*
6. ***Articulate*** **-** *explain and/or show to reveal current understanding*
7. ***Abstract relationship*** *- broader concepts that lead to specific examples (i.e., addition leads to multiplication and then exponents).*

NUMBER SENSE (K-8)

Understandings	Essential Questions
1. (K+) Numbers can represent quantity, position, location, and /or relationships. 2. (K+) The same value can be represented in multiple ways. 3. (K+) A quantity can be presented in various ways depending on the context of the problem. 4. (1+) The value of a number is quantified by the placement of its digits. 5. (2+) Numbers are classified by their attributes (e.g., even/odd, prime/composite).	● (K-1) How do I show this number? How does this help me answer the problem? (2+) How do I determine the best way to represent this number/value/expression based on the problem in front of me? How does this help me become an efficient problem solver? (U 1, 2, 3) ● (K-1) How do I use numbers to make sense of things around me? (2+) How do I use numbers to make sense of the world? (U 1, 3) ● (K+) What strategy am I using to solve this problem? When does it work? When is a different strategy more appropriate/efficient? (U4) ● (2+) How do I classify this number? How does that help me solve the problem? How does that help me spot a strange answer or a common mistake? (U 5)

COMPUTATION

Understandings	Essential Questions
1. (K+) When objects/numbers/values are combined, mathematical rules guarantee the resulting quantity. 2. (K+) The relationships among the operations and their properties promote computational automaticity. 3. (2+) In certain situations, an estimate is as useful (if not more useful) than an exact answer.	● (K-1) How are addition (+) and subtraction (-) connected? How does that help me solve problems? (2+) How do mathematical operations relate to each other? (U1) ● (K-5) How do I know what operation to use? How do I know if I'm right? (6+) How do I know what operation/formula to use? How do I know if I'm right? (U 1, 2) ● (Gr. 2) When is estimation better than counting? (Gr. 3+)

	How do I make a reasonable estimation and how does it help me? (U 3)

MEASUREMENT AND GEOMETRY

Understandings	Essential Questions
1. (K +) Measurements with the same unit can be compared, combined, converted, and categorized to recognize patterns that describe the world. 2. (1 +) Every measurement has a unit in which it is expressed. 3. (2 +) There are many appropriate units that can be used to measure an object(s), but the precision is dependent on the situation. 4. (K +) Objects in the world can be described by their shape. 5. (K +) Every shape has properties that define it. 6. (K +) The properties of a shape do not change based on size or orientation. 7. (3 +) Any shape can be subdivided and/or combined to make new shapes. 8. (3 +) The construction of an accurate shape/object honors the appropriate attributes. 9. (4 +) Given a 2-D shape and the scale, mathematicians can compute its area and perimeter. 10. (2 +) The properties of a shape do not change when it is reflected, rotated, translated (on a coordinate plane beginning in Grade 7), or dilated (beginning in Grade 8). 11. (5 +) Shapes can be described synthetically (without coordinates) or analytically (with coordinates). 12. (6 +) Every geometric theorem or formula is an	● (K+) How can I compare objects based on their attributes? (U1) ● (1 +) How do I compare/combine measurements of objects? (combine with coins and compare time, temperature, shapes, solids, and liquids) (U 1) ● (1+) What measurements are best used to describe the properties of the object? (U 2, 3) How do I estimate/measure them? (U 3) ● (K+) What kind of shape is this? How do I know? (2+) What kinds of attributes/characteristics would I use to describe this shape/object? What category do they belong to? (U 4, 5, 6, 14) ● (K+) How do these shapes (categories of shapes) compare with one another? (U 4, 5, 6) ● (3+) How much space does this shape take up/enclose? (U 7) ● (3+) What shape(s) can I create? How do I show its attributes? (U 7, 8) ● (4 +) How do I use measurements about the shape to calculate additional information about it? (U 9) ● (2 +) What does an object's location in space tell me? (U 10, 11) ● (5 +) How do I analyze/justify my geometric argument? (U 11, 12) ● (4 +) What is the theorem/formula necessary to solve this

established relationship that can be applied to a specific set of figures. 13. (8 +) Given a 3-D shape and the scale, mathematicians can compute its volume and surface area. 14. (8 +) 3-D shapes can be categorized by the number and nature of their surfaces. 15. (Geometry) Circles encompass all the relationships of geometry: points make lines, triangles make polygons, and polygons make circles.	problem? (U9, 12, 13) ● (Geometry) What geometric relationship(s) can be observed within a circle? (U15)

PROBABILITY AND STATISTICS

Understandings	Essential Questions
● (K+) The organization and the display of data makes it possible to recognize patterns, trends, and relationships. ● (2+) Analyze and interpret data and its properties to predict future outcomes. ● (3+) The probability of an event's occurrences and outcomes can be predicted, found, analyzed, and interpreted with varying degrees of confidence.	● (K+) Why am I collecting this data and how can I use it? ● (2+) How do I effectively organize and display data? And what does the data/graph tell me? U 1) ● (2+) How can I predict future outcomes from a data set? (6+) What is the relationship between data sets? What predictions can be made based on the patterns I see? (U 1, 2) ● (2+) How can I use probability to make wise/informed decisions in my life? (U3)

PATTERNS, FUNCTIONS, ALGEBRA

Understandings	Essential Questions
1. (K +) Numbers, objects, or elements may repeat in predictable ways (patterns). 2. (K+) Objects may be sorted or classified by one or more attributes. 3. (1+) The same value/relationship can be represented in multiple ways. 4. (2+) Mathematical symbols (e.g. period, line) represent quantities and operations in agreed upon ways (e.g. decimal place holders, line to separate numerator from denominator). 5. (3+) Expressions, equations, inequalities, and functions use symbols to represent quantities, operations, and their relationships. 6. (5+) A problem can be created using a variable(s) to establish a mathematical relationship. 7. (5+) Applications of specific properties/operations can simplify expressions and solve equations. 8. (6+) Substituting a correct value(s) for an unknown makes the mathematical statement/relationship true. 9. (6+) Certain mathematical manipulations preserve the relationship in an expression or equation, even though they change the representation. 10. (6+) A function can represent how quantities in the real world relate to one another. 11. (6+) Recognition of predictable mathematical patterns supports the analysis of functional relationships and the prediction of data. 12. (6+) Equations and inequalities can be solved and graphed.	● (K +) How can patterns be used to make predictions? (U1) ● (K +) Where are patterns found in the world? (U1) ● (K +) What rule or pattern can help me simplify the expression or solve this problem? (U1) ● (K +) How do I describe this object, or set of objects and/or numbers? (U2, 3) ● (1 +) What is the relationship between/among these values? (U3, 9) ● (2 +) How can I represent this information in symbols/equations/models? (U4) ● (3 +) What is the value of this number/relationship and how can I represent it in different ways? (U5, 6, 7, 8) ● (1+) What does equality mean? (U 3) ● (5+) How do I manipulate both sides to create a true relationship? (U7, 8) ● (5+) When does a pattern or rule no longer hold true? Is this a new set of rules or an exception to an already existing rule? (U7) ● (6 +) What function best models this data? How do its characteristics help me make predictions? (U10, 11, 13) ● (6 +) How are tables, graphs, and equations useful for representing relationships? (U12) ● (Algebra 1+) How do I classify, interpret, and compare functions or equations? (U13)

(This includes linear and inequality systems). 13. (Algebra 1+) Algebraic relationships can be represented by analytical geometry.	

Kindergarten

calendar
day
week
month
count
data
set
collect
organize
sort
classify
Identify
extend
describe
create
Transfer

circle
square
triangle
rectangle
attribute
Repeated pattern
pattern
dime
nickel
penny
quarter
equal share
objects

table
graph (*object, picture*)
sum
add
subtract
difference
part
whole
compare and order (*after, before, more,fewer, same shorter, longer, taller, heavier, lighter, hotter, colder, larger, smaller, greatest, least, backward, forward*)

1st Grade

skip count
numeral
digit
number
ordinal/ordered position
fraction
tens (*place value*)
magnitude
corresponding (fact family)
growing pattern
measure
weight
mass
volume
greater than
less than
equal to
region
Equal
Equality
hour, half hour
Clock
Concrete

2nd Grade

odd
even
hundreds *(place value*)
round
estimate
regroup
inequality
units of measurement: (*pound, inches, cents, dollars $, minutes)*
symmetry
Thermometer
Celsius and Fahrenheit
ruler
Scale
Not equal to

sphere
cube
rectangular prism
edges
faces
graph (*picture, bar*)
impossible
unlikely
as likely as
equally likely
likely
Certain
experiment/probability

3rd Grade

addends
equivalent
Outcomes
tables

points
rays
line

4th Grade

tenths
hundredths
thousandths
millions

parallel lines
perpendicular
intersecting

5th Grade

composite
prime
Verbal expression
Quantitative expression

acute

equilateral
isosceles

thousands (*place value up to 100,000*) fraction (*mixed numbers, numerator, denominator, proper, improper*) multiply divide area perimeter units of measurement:*(centimeter, foot, yard, elapsed time, meter, cup, pint, quart, gallon, liter)* *polygon*	line segment Equation equivalent figures (*congruent, non-congruent*) (*trapezoid, rhombus, parallelogram, quadrilateral, pentagon, polygon, hexagon, heptagon, octagon, nonagon, decagon*) Subdivide Combine	decimal multiple quotient product remainder factor (*greatest common, least common multiple*) Quadrilateral: (Parallelogram, rhombus, and trapezoid).	pyramid cone cylinder units of measurement : *(gram, kilogram, mile, ton)* inclusive graph (line)	variable evaluate mean median mode range Graph (*line plot, stem-and-leaf plot)* transformation translation rotation Reflection vertices sides Obtuse Acute Right straight interior exterior	obtuse scalene chord circumference diameter radius Order of operations Distributive property Associative property Identity property Commutative property

Grade 6	Grade 7	Grade 8

Percent Ratio Integer (positive, negative) Rational Absolute value Exponent Perfect square Simplify Pi Coordinates Coordinate plane Ordered pair graph (circle) balance point Constant Proportionality Proportional relationship Verbal descriptions One-step linear equations solution		Scientific notation Square root Unit rate Slope Rate of change Ordered pairs Direct variation Two-step linear equations Table of values Proportions Corresponding sides Corresponding angles Probability (*theoretical, experimental*) Graph (*histogram*)	Real number Subsets Natural/Counting Whole Numbers Irrational consecutive Vertical angles Adjacent angles Supplementary angles Complementary angles Reflex angles Three dimensional Pythagorean Theorem Cones Square-based pyramids Composite Relation Function Domain Range Y-intercept Non-proportional situations Linear functions Linear inequalities Probability (*independent, dependent events*) Graph (*box plots, scatter plots*) Line of best fit	

High School

GEOMETRY	ALGEBRA+
Deductive reasoning	Polynomial (mono- bi- tri-)
Validity	Quadratic
Logical argument	Literal Equation
Converse	System of Equations
Inverse	Zeros/Roots/x-intercepts
Contrapositive	Inverse Variation
Conditional statement	Curve of Best-Fit
Prove/Proof	Exponential Functions
Transversal	Logarithmic Functions
Corresponding angles	Maxima
Alternate interior angles	Minima
Alternate exterior angles	Asymptote
Consecutive interior angles	Mutually exclusive events
Distance	Permutations
Mid-point	Combinations
Construction	Normal Distribution
Angle bisector	Z-scores
Perpendicular bisector	Standard Deviation
Similar	Radical Expression
Sine	Complex Numbers
Cosine	Arithmetic Sequences/Series
Tangent	Geometric Sequences/Series
Secant	Continuous/Discontinuous
Cosecant	Inverse Function
Cotangent	Joint Variation
Convex	
Concave	
Sector	
Arc Length	

Grade 1: Addition and Subtraction

SOLs: 1.7b demonstrate fluency with addition facts for sums to 10 or less and the corresponding subtraction facts.	Transfer Goals Based on an understanding of *any* problem, initiate a plan (using a **variety of methods/strategies**), execute it, and evaluate the **reasonableness of the solution**
Understandings: When objects/numbers are combined, mathematical rules guarantee the resulting quantity.	Essential Questions(K-1) How are addition (+) and subtraction (-) connected? How does that help me solve problems?
Critical Vocabulary: equal	Skills: combine numbers to 10, subtract numbers from 10, use part - part whole to write addition and subtraction facts to 10

Grade 3:

SOLs: 3.3 (b) create and solve single step practical problems involving sums and differences of two whole numbers	Transfer Goals: Based on an understanding of *any* problem, students will independently be able to initiate a plan (using a **variety of methods/strategies**), execute it, and evaluate the **reasonableness of the solution**
Understandings:When objects/numbers are combined, mathematical rules guarantee the resulting quantity.	Essential Questions: How do I know which operation to use? How do I know if I'm right?
Critical Vocabulary: N/A	Skills: Students will be skilled at place value to thousands, regrouping, and knowing which operation to use according to the word problem. Students will confirm using addition.

Grade 4:

SOLs: 4.4d The student will create and solve single-step practical problems involving addition and subtraction with whole numbers.	Transfer Goals: Based on an understanding of *any* problem, students will independently be able to initiate a plan (using a **variety of methods/strategies**), execute it, and evaluate the **reasonableness of the solution**.
Understandings: (K+) When objects/numbers are combined, mathematical rules guarantee the resulting quantity.	Essential Questions: (K-5) How do I know what operation to use? How do I know if I'm right?
Critical Vocabulary: N/A	Skills: Students will be skilled at... ● Knowing their place value to millions ● Regrouping ● Choosing the correct operation for the problem ● Solving single-step practical problems using addition and subtraction

Grade 6: One-Step Equations (including Practical Problems)

SOLs: 6.14 (Old SOL 6.18)	Transfer Goals: Based on an understanding of *any* problem, initiate a plan (using a **variety of methods/strategies**), execute it, and evaluate the **reasonableness of the solution**
Understandings: 6. (5+) A problem can be created using a variable(s) to establish a mathematical relationship. 8. (6+) Substituting a correct value(s) for an unknown makes the mathematical statement/relationship true. 9. (6+) Certain mathematical manipulations preserve the	Essential Questions ● (3 +) What is the value of this number/relationship and how can I represent it in different ways? (U5, 6, 7, 8) ● (5+) How do I manipulate both sides to create a true relationship? (U7, 8) ● (1 +) What is the relationship between/among these values?

relationship in an expression or equation, even though they change the representation.	(U3, 9)
Critical Vocabulary: linear equation, variable, equal, solution	Skills: ● Represent and solve a one-step equation, using a variety of concrete materials such as colored chips, algebra tiles, or weights on a balance scale. ● Solve a one-step equation by demonstrating the steps algebraically.

Grade 6:

SOLs: 6.4 (old 6.5)	Transfer Goals: Demonstrate **automaticity** in basic computation so that they can focus on the more **sophisticated** aspects of the problem
Understandings: (K+) Numbers can represent quantity, position, location, and /or relationships. (K+) The same value can be represented in multiple ways.	Essential Questions ● (K-1) How do I show this number? How does this help me answer the problem? (2+) How do I determine the best way to represent this number/value/expression based on the problem in front of me? How does this help me become an efficient problem solver? (U 1, 2, 3) ● (K-1) How do I use numbers to make sense of things around me? (2+) How do I use numbers to make sense of the world? (U 1, 3)
Critical Vocabulary: exponents, perfect squares	Skills: ● Recognize and describe patterns with exponents that

	are natural numbers, by using a calculator. ● Recognize and describe patterns of perfect squares not to exceed 20 2 , by using grid paper, square tiles, tables, and calculators. ● Recognize powers of ten by examining patterns in a place value chart: 104 = 10,000, 103 = 1000, 102 = 100, 101 = 10, 10 0 =1.

Grade 7: two-step equations

SOLs: 7.12 a & b (old SOL is 7.14)	Transfer Goals: Based on an understanding of *any* problem, initiate a plan (using a **variety of methods/strategies**), execute it, and evaluate the **reasonableness of the solution**
Understandings: (5+) A problem can be created using a variable(s) to establish a mathematical relationship. (6+) Substituting a correct value(s) for an unknown makes the mathematical statement/relationship true. (6+) Certain mathematical manipulations preserve the relationship in an expression or equation, even though they change the representation.	Essential Questions: ● (3 +) What is the value of this number/relationship and how can I represent it in different ways? (U5, 6, 7, 8) ● (5+) How do I manipulate both sides to create a true relationship? (U7, 8) ● (1 +) What is the relationship between/among these values? (U3, 9)
Critical Vocabulary: linear equation, variable, equal, solution	Skills: ● Represent and demonstrate steps for solving two-step equations in one variable using concrete materials, pictorial representations and algebraic sentences. ● Solve two-step linear equations in one variable.

	• Solve practical problems that require the solution of a two-step linear equation.

Grade 7: Perfect Squares

SOLs: 7.1d	Transfer Goals: Demonstrate **automaticity** in basic computation so that they can focus on the more **sophisticated** aspects of the problem
Understandings: (K+) Numbers can represent quantity, position, location, and /or relationships. (K+) The same value can be represented in multiple ways.	Essential Questions: • (K-1) How do I show this number? How does this help me answer the problem? (2+) How do I determine the best way to represent this number/value/expression based on the problem in front of me? How does this help me become an efficient problem solver? (U 1, 2, 3) • (K-1) How do I use numbers to make sense of things around me? (2+) How do I use numbers to make sense of the world? (U 1, 3)
Critical Vocabulary: square root and perfect square	Skills: Determine the square root of a perfect square less than or equal to 400.