**Session Six: Exponential Notation**

**Common Core Standards Addressed**

#### Students will need a strong grasp of multiplication, factors, multiples and related concepts to be prepared for this concept. The foundational skills for exponents are not introduced until the Grade 4, so that is our starting point.

#### Grade 4

#### Gain familiarity with factors and multiples.

[CCSS.Math.Content.4.OA.B.4](http://www.corestandards.org/Math/Content/4/OA/B/4/)
Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1-100 is prime or composite.

#### Use place value understanding and properties of operations to perform multi-digit arithmetic.

[CCSS.Math.Content.4.NBT.B.6](http://www.corestandards.org/Math/Content/4/NBT/B/6/)
Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

#### Grade 5

#### Understand the place value system.

[CCSS.Math.Content.5.NBT.A.2](http://www.corestandards.org/Math/Content/5/NBT/A/2/)
Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

#### Grade 6

#### Apply and extend previous understandings of arithmetic to algebraic expressions.

[CCSS.Math.Content.6.EE.A.1](http://www.corestandards.org/Math/Content/6/EE/A/1/)
Write and evaluate numerical expressions involving whole-number exponents.

[CCSS.Math.Content.6.EE.A.2.c](http://www.corestandards.org/Math/Content/6/EE/A/2/c/)
Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas V = s3 and A = 6 s2 to find the volume and surface area of a cube with sides of length s = 1/2*.

#### Grade 7

#### Apply and extend previous understandings of operations with fractions.

[CCSS.Math.Content.7.NS.A.1](http://www.corestandards.org/Math/Content/7/NS/A/1/)
Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

[CCSS.Math.Content.7.NS.A.2](http://www.corestandards.org/Math/Content/7/NS/A/2/)
Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

[CCSS.Math.Content.7.NS.A.2.a](http://www.corestandards.org/Math/Content/7/NS/A/2/a/)
Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (-1)(-1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

#### Grade 8

#### Expressions and Equations Work with radicals and integer exponents.

[CCSS.Math.Content.8.EE.A.1](http://www.corestandards.org/Math/Content/8/EE/A/1/)
Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 32 × 3-5 = 3-3 = 1/33 = 1/27.

[CCSS.Math.Content.8.EE.A.2](http://www.corestandards.org/Math/Content/8/EE/A/2/)
Use square root and cube root symbols to represent solutions to equations of the form *x*2 = *p* and *x*3 = p, where *p* is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.