



# Mathematics Curriculum Guide

## *High School Algebra 1*

*2017-18*



**Topic 7: Exponents**

Transfer Goals		
1) Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution. 2) Effectively communicate orally, in writing, and using models (e.g., concrete, representational, abstract) for a given purpose and audience. 3) Construct viable arguments and critique the reasoning of others using precise mathematical language.		<b>Timeframe:</b> 3 weeks/16 days <b>Start Date:</b> February 14, 2018 <b>Assessment Dates:</b> March 7-8, 2018
Standards	Meaning-Making	
<p><b>N-RN 1.</b> Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)^3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</p> <p><b>N-RN 2.</b> Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p>	Understandings	Essential Questions
	<p><i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li>The idea of exponents can be extended to include zero and negative exponents.</li> <li>The properties of exponents make it easier to simplify products or quotients of powers with the same base or powers raised to a power or products raised to a power.</li> <li>You can use rational exponents to represent radicals.</li> </ul>	<p><i>Students will keep considering...</i></p> <ul style="list-style-type: none"> <li>How can you represent numbers less than 1 using exponents?</li> <li>How does the sign of an exponent (whether it is positive or negative) represent its operation?</li> <li>How can you simplify expressions involving exponents?</li> </ul>
	Acquisition	
	Knowledge	Skills
	<p><i>Students will know...</i></p> <p><b>Vocabulary:</b> power, exponent, base, zero as an exponent, reciprocal, simplest form of an exponential expression, radical expression, radical sign, radicand, index</p> <p><b>Procedures for solving:</b></p> <ul style="list-style-type: none"> <li>The properties of exponents including:               <ul style="list-style-type: none"> <li>zero and negative exponents</li> <li>multiplying powers with the same base</li> <li>raising a power to a power</li> <li>raising a product to a power</li> <li>dividing powers with the same base</li> <li>raising a quotient to a power</li> </ul> </li> </ul>	<p><i>Students will be skilled at and able to do the following...</i></p> <ul style="list-style-type: none"> <li>Represent numbers that are less than one using negative exponents.</li> <li>Simplify expressions involving exponents using the rules for multiplying and dividing powers.</li> <li>Represent radical expressions using rational exponents and vice versa.</li> </ul>



**Topic 7: Exponents**

Transfer is a student’s ability to independently apply understanding in a novel or unfamiliar situation. In mathematics, this requires that students use reasoning and strategy, not merely plug in numbers in a familiar-looking exercise, via a memorized algorithm.

**Transfer goals** highlight the effective uses of understanding, knowledge, and skills we seek in the long run – that is, what we want students to be able to do when they confront new challenges, both in and outside school, beyond the current lessons and unit. These goals were developed so all students can apply their learning to mathematical or real-world problems while simultaneously engaging in the Standards for Mathematical Practices. In the mathematics classroom, assessment opportunities should reflect student progress towards meeting the transfer goals.

With this in mind, the revised **PUSD transfer goals** are:

- 1) **Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution.**
- 2) **Effectively communicate orally, in writing, and by using models (e.g., concrete, representational, abstract) for a given purpose and audience.**
- 3) **Construct viable arguments and critique the reasoning of others using precise mathematical language.**

**Multiple measures** will be used to evaluate student acquisition, meaning-making and transfer. Formative and summative assessments play an important role in determining the extent to which students achieve the desired results in stage one.

Formative Assessment	Summative Assessment
<b>Aligning Assessment to Stage One</b>	
<ul style="list-style-type: none"> <li>• What constitutes evidence of understanding for this lesson?</li> <li>• Through what other evidence during the lesson (e.g. response to questions, observations, journals, etc.) will students demonstrate achievement of the desired results?</li> <li>• How will students reflect upon, self-assess, and set goals for their future learning?</li> </ul>	<ul style="list-style-type: none"> <li>• What evidence must be collected and assessed, given the desired results defined in stage one?</li> <li>• What is evidence of understanding (as opposed to recall)?</li> <li>• Through what task(s) will students demonstrate the desired understandings?</li> </ul>
<b>Opportunities</b>	
<ul style="list-style-type: none"> <li>• Discussions and student presentations</li> <li>• Checking for understanding (using response boards)</li> <li>• Ticket out the door, Cornell note summary, and error analysis</li> <li>• <i>Performance Tasks</i> within a Unit</li> <li>• Teacher-created assessments/quizzes</li> </ul>	<ul style="list-style-type: none"> <li>• Unit assessments</li> <li>• Teacher-created quizzes and/or mid-unit assessments</li> <li>• <i>Illustrative Mathematics</i> tasks (<a href="https://www.illustrativemathematics.org/">https://www.illustrativemathematics.org/</a>)</li> <li>• Performance tasks</li> </ul>



**Topic 7: Exponents**

Transfer Goals						
1) Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution. 2) Effectively communicate orally, in writing, and using models (e.g., concrete, representational, abstract) for a given purpose and audience. 3) Construct viable arguments and critique the reasoning of others using precise mathematical language.						
<b>Essential Questions:</b> <ul style="list-style-type: none"> <li>• How can you represent numbers less than 1 using exponents?</li> <li>• How does the sign of an exponent (whether it is positive or negative) represent its operation?</li> <li>• How can you simplify expressions involving exponents?</li> </ul>					<b>Standards:</b> N-RN 1, N-RN 2 <b>Timeframe:</b> 3 weeks/16 days <b>Start Date:</b> February 14, 2017 <b>Assessment Dates:</b> March 7-8, 2017	
Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Resources
1 Day	<b>Lesson 7-1 Zero and Negative Exponents</b> (pp. 418-423)  SMP 1, 2, 3, 4, 6, 7, 8  <b>Preparation for N-RN.A.1</b>	<ul style="list-style-type: none"> <li>• How do you use powers to model repeated multiplication?</li> <li>• How can you represent numbers less than 1 using exponents?</li> <li>• How can you simplify expressions involving negative exponents?</li> <li>• A positive exponent shows repeated multiplication. What repeated operation does a negative exponent show?</li> </ul>	<ul style="list-style-type: none"> <li>• Powers can be used to shorten the representation of repeated multiplication such as <math>2 \times 2 \times 2 \times 2 \times 2</math></li> <li>• The idea of exponents can be extended to include zero and negative exponents.</li> </ul>	<b>Vocabulary:</b> base, exponent, power, zero exponents, simplify, negative exponents, simplified form of an exponential expression.  <b>Students will know...</b> <ul style="list-style-type: none"> <li>• The Properties of exponents: Raising a Power to a Power, Raising a Product to a Power, Zero and Negative Exponents.</li> <li>• That powers can be used to represent repeated multiplication.</li> </ul>	<ul style="list-style-type: none"> <li>• Represent numbers that are less than one using negative exponents.</li> <li>• Simplify expressions with powers, zero and negative exponents.</li> </ul>	Online: Section 7-1 Student Companion, Additional Vocabulary Support, Practice Form G, and Standardized Test Prep.  <b>Thinking Maps:</b> Create a Tree Map that can be added to throughout lessons 7.1-7.4 for the various properties of exponents.  <b>CC Problems:</b> #7,8, 45, 46, 55, 60, 61, 62, 63, 64, 65, 74

Common Core Practices

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| <input type="checkbox"/> Instruction in the Standards for Mathematical Practices | <input type="checkbox"/> Use of Manipulatives        | <input type="checkbox"/> Project-based Learning |
| <input type="checkbox"/> Use of Talk Moves                                       | <input type="checkbox"/> Use of Technology           | <input type="checkbox"/> Thinking Maps          |
| <input type="checkbox"/> Note-taking   | <input type="checkbox"/> Use of Real-world Scenarios |   |

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
1 Day	<p><b>Lesson 7-2</b> <b>Multiplying Powers with the Same Base</b> (pp. 425-431)</p> <p>SMP 1, 2, 3, 4, and 7</p> <p><b>N-RN.A.1</b></p>	<p><b>Focus Question(s):</b></p> <ul style="list-style-type: none"> <li>How can you simplify expressions involving exponents?</li> </ul> <p><b>Inquiry Question:</b> p. 425 Solve It!</p>	<ul style="list-style-type: none"> <li>A property of exponents can be used to multiply powers with the same base.</li> <li>To multiply powers with the same base, add the exponents.</li> </ul>	<p><b>Vocabulary:</b> base, exponent, power, zero exponents, negative exponents, simplified form of an exponential expression</p> <p><b>Students will know...</b></p> <ul style="list-style-type: none"> <li>That the property of exponents can be used to multiply powers with the same base.</li> <li>That the exponents will be added when multiplying powers with the same base.</li> </ul>	<ul style="list-style-type: none"> <li>Simplify expressions involving exponents using the rules for multiplying.</li> <li>Multiply powers with the same base.</li> </ul>	<p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li><b>Omit scientific notation.</b></li> <li>Include examples where the exponents are rational numbers.</li> <li>Include examples of areas of rectangles.</li> </ul> <p><b>Thinking Maps:</b> Add to the Tree Map started in 7.1.</p> <p><b>CC Problems:</b> #5,6,7,37, 38, 42, 46, 53, 58</p>
3 Days	<p><b>Lesson 7-3 More Multiplication Properties of Exponents</b> (pp. 433-438)</p> <p>SMP 1, 2, 3, 4, and 7</p> <p><b>N-RN.A.1</b></p> <p><b>Day 1:</b> Raising a Power to a Power <b>Day 2:</b> Combination of Raising a Power to a Power and Multiplying Powers with Like Bases</p>	<p><b>Focus Question(s):</b></p> <ul style="list-style-type: none"> <li>What is the relationship between the property of power of a power to positive and negative exponents?</li> <li>What is the difference between a “power of a power” and “power of a product”?</li> </ul> <p><b>Inquiry Question:</b> p. 433 Solve It!</p>	<ul style="list-style-type: none"> <li>Properties of exponents can be used to simplify a power raised to a power or a product raised to a power.</li> <li>To raise a power to a power, multiply the exponents.</li> <li>To raise a product to a power, raise each factor to the power and multiply.</li> </ul>	<p><b>Vocabulary:</b> power of a power, power of a product</p> <p><b>Students will know...</b></p> <ul style="list-style-type: none"> <li>Which properties of exponents such as raising a power to a power and raising a product to a power are more appropriate in simplifying expressions involving powers.</li> </ul>	<ul style="list-style-type: none"> <li>Simplify expressions involving exponents using the rules for multiplying powers.</li> <li>Raise a power to a power.</li> <li>Raise a product to a power.</li> </ul>	<p><b>NOTES:</b></p> <ul style="list-style-type: none"> <li><b>Omit scientific notation.</b></li> <li>Include an example like problem 2 on pg. 434</li> <li>Include examples on finding the area of a rectangle and finding the volume of a rectangular prism.</li> </ul> <p><b>Thinking Maps:</b> Add to the Tree Map started in 7.1.</p> <p><b>CC Problems:</b> #7, 8, 9, 52, 62, 63, 64, 65, 66, 73</p>

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Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
1 Day	<b>Lesson 7-4 Division Properties of Exponents</b> (pp.439-445) SMP 1, 2, 3, 4, and 7 <b>N-RN.A.1</b> Day 1: Lesson Day 2: Review/ Quiz	<b>Focus Question(s):</b> <ul style="list-style-type: none"> <li>What is the benefit of applying the Dividing Powers with the Same Base Property before the Power of a Quotient Property?</li> </ul> <b>Inquiry Question:</b> p. 439 Solve It!	<ul style="list-style-type: none"> <li>Properties of exponents can be extended to division of powers with the same base.</li> <li>To divide powers with the same base, subtract the exponents.</li> <li>To raise a quotient to a power, raise the numerator and the denominator to the power and simplify.</li> </ul>	<b>Vocabulary:</b> same base <b>Students will know...</b> <ul style="list-style-type: none"> <li>Which properties of exponents such as dividing powers with the same base and raising a quotient to a power are more appropriate in simplifying expressions involving powers.</li> </ul>	<ul style="list-style-type: none"> <li>Simplify expressions involving exponents using the rules for multiplying and dividing powers.</li> <li>Divide powers with the same base.</li> <li>Raise a quotient to a power.</li> </ul>	<b>NOTES:</b> <ul style="list-style-type: none"> <li>Omit scientific notation.</li> <li>Teacher generated quiz covering concepts from 7.1-7.4</li> </ul> <b>Thinking Maps:</b> Add to the Tree Map started in 7.1.  <b>CC Problems:</b> #6,7,30, 31, 32, 54, 55, 68, 70, 79, 80, 81, 82, 87, 92, 93, 97
2 Days	<b>Lesson 7-5 Rational Exponents and Radicals</b> (pp.448-452) SMP 1, 3, 4, 6, and 7 <b>N-RN.A.2</b> Day 1: Lesson Day 2: Review/ Teacher Generated Quiz	<b>Focus Question(s):</b> <ul style="list-style-type: none"> <li>What is the relationship between radical expressions and expressions using rational exponents?</li> </ul> <b>Inquiry Question:</b> p. 448 Solve It!	<ul style="list-style-type: none"> <li>Rational exponents can be used to represent radicals.</li> </ul>	<b>Vocabulary:</b> index, radicand, radical sign  <b>Students will know...</b> <ul style="list-style-type: none"> <li>The equivalence of Radicals and Rational Exponents</li> </ul>	<ul style="list-style-type: none"> <li>Represent radical expressions using rational exponents and vice versa.</li> <li>Rewrite expressions involving radicals and rational exponents.</li> </ul>	<b>NOTE:</b> <ul style="list-style-type: none"> <li>Provide examples similar to problem 1 on pg. 448 including radicals where the index is 2.</li> <li>Review Key Concept on pg. 449.</li> </ul> <b>Thinking Maps:</b> Flow Maps to show how to convert to Radical Form and Exponential Form  <b>CC Problems:</b> #8, 35, 36, 49, 51, 52, 53, 54
3 Days	<b>Lesson 10-2 Simplifying Radicals</b> (pp. 619-625) SMP 1, 2, 3, 4, and 7 <b>Preparation for A-REI.A.2</b> Day 1: Products Day 2: Quotients Day 3: Review	<ul style="list-style-type: none"> <li>How do you simplify radicals involving products and quotients?</li> </ul>	<ul style="list-style-type: none"> <li>Radical expressions can be simplified using multiplication and division properties of square roots.</li> </ul>	<b>Vocabulary:</b> radical expression  <b>Students will know...</b> <ul style="list-style-type: none"> <li>That the Multiplication Property of Square roots can be used to simplify radicals by removing perfect-square factors from the radicand.</li> </ul>	<ul style="list-style-type: none"> <li>Simplify radicals by removing perfect-square factors from the radicand.</li> </ul>	<b>NOTES:</b> <ul style="list-style-type: none"> <li>Provide examples similar to problems 1-3, and 5 on pp. 620-622.</li> <li>See attachment for a sample lesson as provided by L. Gonzalez.</li> </ul>

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Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
3 Days	<b>Review Topic 7 Concepts &amp; Skills</b> These 3 days of review include 1 day for Smarter Balance Interim Assessment Blocks, to be done at some point during this unit.					
2 Days (Mar. 7-8)	<b>Topic 7 Assessment</b> (Created and provided by PUSD)					

Common Core Practices

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**Lesson: Simplifying Radicals**

<p><i>WU#1 Simplify</i></p> $(-5x^2y^3)^3$	<p><i>WU#2 Simplify</i></p> $(-2a^4b)(-8ab^5)$	<p><i>WU#3 Simplify</i></p> $\frac{36x^8yz^8}{9x^{13}y^7z^5}$
<p><i>WU#4 Complete this list of perfect squares.</i></p> <p> <math>1^2 =</math>            <math>2^2 =</math>            <math>3^2 =</math>            <math>4^2 =</math>            <math>5^2 =</math>            <math>6^2 =</math>  <math>7^2 =</math>            <math>8^2 =</math>            <math>9^2 =</math>            <math>10^2 =</math>            <math>11^2 =</math>            <math>12^2 =</math> </p>		
<p><b>Vocabulary</b></p> $\sqrt{25}$	<p><b>Perfect Square Radicals</b></p> <p> <math>\sqrt{1} =</math>            <math>\sqrt{4} =</math>            <math>\sqrt{9} =</math>  <math>\sqrt{16} =</math>            <math>\sqrt{25} =</math>            <math>\sqrt{36} =</math>  <math>\sqrt{49} =</math>            <math>\sqrt{64} =</math>            <math>\sqrt{81} =</math>  <math>\sqrt{100} =</math>            <math>\sqrt{121} =</math>            <math>\sqrt{144} =</math> </p>	
<p><b>Simplify by Factoring out Perfect Squares</b></p> <p> <i>Ex1</i>    <math>\sqrt{45}</math>                      <i>Ex2</i>    <math>\sqrt{50}</math>   <i>Ex3</i>    <math>\sqrt{300}</math>                      <i>Ex4</i>    <math>5\sqrt{24}</math> </p>	<p><b>Simplify by Prime Factorization</b></p> <p> <i>Ex1</i>    <math>\sqrt{45}</math>                      <i>Ex2</i>    <math>\sqrt{50}</math>   <i>Ex3</i>    <math>\sqrt{300}</math>                      <i>Ex4</i>    <math>5\sqrt{24}</math> </p>	

1. $\sqrt{20}$	2. $\sqrt{44}$	3. $\sqrt{54}$	4. $\sqrt{75}$
5. $\sqrt{60}$	6. $\sqrt{52}$	7. $\sqrt{18}$	8. $\sqrt{32}$
9. $\sqrt{63}$	10. $\sqrt{15}$	11. $\sqrt{150}$	12. $\sqrt{99}$
13. $\sqrt{80}$	14. $\sqrt{44}$	15. $\sqrt{96}$	16. $\sqrt{250}$
17. $5\sqrt{64}$	18. $7\sqrt{100}$	19. $-10\sqrt{81}$	20. $-6\sqrt{49}$
21. $2\sqrt{60}$	22. $4\sqrt{175}$	23. $5\sqrt{120}$	24. $7\sqrt{88}$

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