

# New York State Next Generation Mathematics Learning Standards Unpacking Document (DRAFT)

<b>Course:</b> Algebra I	<b>DOMAIN: Algebra (A) – Seeing Structure in Expressions (SSE)</b>
<p><b>CLUSTER: Write expressions in equivalent forms to reveal their characteristics.</b> In order to reveal and explain their properties, a student will transform expressions into equivalent forms. The ability to manipulate expressions develops the skills necessary to work with linear, quadratic, and exponential functions, and equations.</p>	
<p><b>Grade Level Standard:</b> <b>AI-A.SSE.3c</b> Use the properties of exponents to rewrite exponential expressions. <i>(Shared standard with Algebra II)</i></p> <p><b>Note: Exponential expressions will include those with integer exponents, as well as those whose exponents are linear expressions. Any linear term in those expressions will have an integer coefficient. Rational exponents are an expectation of Algebra II.</b></p>	

<b>PERFORMANCE/KNOWLEDGE TARGETS (measurable and observable)</b>				
<ul style="list-style-type: none"> <li>• Rewrite exponential expressions using laws of exponents; and</li> <li>• rewrite exponential expressions to compare/contrast them with other exponential expressions.</li> </ul>				
<b>ASPECTS OF RIGOR</b>				
<table style="width: 100%; border: none;"> <tr> <td style="width: 33%; border: none;">Procedural</td> <td style="width: 33%; border: none;">Conceptual</td> <td style="width: 33%; border: none;">Application</td> </tr> </table>		Procedural	Conceptual	Application
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<b>MATHEMATICAL PRACTICES</b>	<ol style="list-style-type: none"> <li>1. Make sense of problems and persevere in solving them.</li> <li>2. Reason abstractly and quantitatively.</li> <li>3. Construct viable arguments and critique the reasoning of others.</li> <li>4. Model with mathematics.</li> <li>5. Use appropriate tools strategically.</li> <li>6. Attend to precision.</li> <li>7. Look for and make use of structure.</li> <li>8. Look for and express regularity in repeated reasoning.</li> </ol>			
<b>FOUNDATIONAL UNDERSTANDING</b>	<p><b>NY-8.EE.1</b> Know and apply the properties of integer exponents to generate equivalent numerical expressions.</p> <p><b>NY-7.EE.2</b> Understand that rewriting an expression in different forms in real-world and mathematical problems can reveal and explain how the quantities are related.</p>			

The following pages contain **EXAMPLES** to support current instruction of the content standard and may be used at the discretion of the teacher and adapted to best serve the needs of the learners in the classroom.

Students can be presented with similar situations such as the following:

Example 1: Which of the expressions are equivalent?  $-9x^2$   $-3x^2$   $(-3x)^2$   $-(3x^2)$   $9x^2$

Example 2: Write an expression equivalent to the following expressions:

1.  $(cd^3)^4$       2.  $(x^m y^2 z)^6$       3.  $(\frac{4a^2}{b^4})^3$       4.  $\frac{c^5 d}{c^2 d^9}$

Classroom discussion that allows for the comparing and contrasting of various expressions generated is encouraged.

Example 3: Determine whether each expression is equivalent to  $16^{2x-5}$

1.  $\frac{4^{2x}}{16^5}$
2.  $\frac{16^{2x}}{4^5}$
3.  $\frac{16^{2x}}{16^5}$
4.  $16^{2x} \cdot 16^5$

Example 4: Mindy inherited a savings account that was started by her grandmother 25 years ago. This scenario is modeled by the following equivalent functions, where  $f(t)$  represents the value of the account, in dollars,  $t$  years after the inheritance.

$$f(t) = 5000(1 + 0.013)^{t+25}$$

$$f(t) = 5000(1.013)^{t+25}$$

$$f(t) = 5000(1.013)^t(1.013)^{25}$$

Choose an equivalent function of  $f(t)$  and answer the following questions:

What does 5000 represent in this function?

What is the growth rate for this savings account?

What does 25 represent in this problem?

How much will this account be worth 10 years from now?

Example 5:

- a. Show how  $8 \cdot 2^t$  is equivalent to  $2^{t+3}$
- b. Show that  $6 \cdot 16^x$  is equivalent to  $6 \cdot 2^{4x}$
- c. Show that  $10(1.25)^{5x}$  is equivalent to  $10(3.05)^x$  (approximately)
- d. What is the value of  $B$  when we rewrite  $(\frac{3}{2})^{2x}$  as  $B^x$ ?

**The following pages contain EXAMPLES to support current instruction of the content standard and may be used at the discretion of the teacher and adapted to best serve the needs of the learners in the classroom.**

**Within grade level connection:**

This standard focuses on generating equivalent forms of exponential expressions using properties of exponents and how the purposeful transformation of these expressions can be used to efficiently answer questions about a situation.

AI-A.SSE.3c relates to work in the function domain in Algebra I; specifically, standards AI-F.IF.3, AI-F.IF.4, AI-F.IF.7a, AI-F.IF.8, AI-F.IF.9, AI-BF.1a, AI-F.LE.2 and AI-F.LE.5. These functions standards require students to analyze and interpret key features of situations defined by functions verbally, numerically, graphically, and algebraically. AI-F.IF.3, AI-F.IF.4, AI-F.IF.7a, AI-F.IF.8, AI-F.IF.9, AI-BF.1a, AI-F.LE.2 and AI-F.LE.5 give a context to why it is important for students to understand how exponential expressions can be manipulated in order to solve real-world problems.

Situations in Algebra I are limited to exponential expressions with integer exponents and exponents that are linear expressions. AI-A.SSE.3c is extended into Algebra II with more complex exponential expressions that will include rational exponents. Example 5 exposes students to re-writing expressions in terms of a different base in preparation for what is expected in AII with regards to annual vs. monthly interest rate problems.

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