Algebra and Number (continued)

Specific Outcome

It is expected that students will:

3. Demonstrate an understanding of powers with integral and
    rational exponents.
    [C, CN, PS, R]

Notes

- Prior knowledge from previous grade levels includes:
    - powers with integral bases, excluding base 0, and whole
      number exponents (Grade 9)
    - exponent laws for whole number exponents (Grade 9).
- Technology [T] has not been identified as one of the
  mathematical processes to be emphasized in completing this
  outcome. Students are expected to apply the exponent laws
  without relying on the use of technology.
- It is important that students are able to provide explanations for
  the restrictions on the variables in the definitions and exponent
  laws in Achievement Indicators 3.1, 3.2 and 3.3. In particular, in
  Achievement Indicator 3.2, students are expected to explain
  when $a \geq 0$:
    - If *n* is even, then $a \geq 0$.
    - If *n* is odd, then there is no restriction on the variable *a*.
- Students are expected to perform simple operations with rational
  numbers. This outcome is not intended to assess operations with
  rational numbers but may be used to reinforce students'
  understanding of rational numbers.
- Exponents should be restricted to simple rational numbers.

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence

3.1   Explain, using patterns, why $a^{-n} = \dfrac{1}{a^n}, a \neq 0.$
 	
	✓
	
	 STUDENT RESOURCE
	 MHR: p. 163,
	      Investigate
	      Negative Exponents
	 Pearson: p. 230, Try This	

3.2   Explain, using patterns, why $a^{\frac{1}{n}} = \sqrt[n]{a}, \ n > 0$.
 	
	✓
	
	 STUDENT RESOURCE
	 MHR: pp. 174–175,
	      Investigate
	      Rational Exponents
	      p. 186,
	      Link the Ideas
	 Pearson: pp. 222–223,
	      Try This	

3.3 Apply the exponent laws: • $\left(a^m\right)\left(a^n\right) = a^{m+n}$ • $a^m \div a^n = a^{m-n}$, $a \neq 0$ • $\left(a^m\right)^n = a^{mn}$ • $\left(ab\right)^m = a^m b^m$ • $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$, $b \neq 0$ to expressions with rational and variable bases and integral and rational exponents, and explain the reasoning.	✓ STUDENT RESOURCE MHR: p. 180, #1, #2 Pearson: p. 242, #9, #10	

(continued)

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Achievement Indicators	Acceptable Standard	Standard of Excellence

3.4 Express powers with rational exponents as radicals and vice versa.	✓ Use exponents such as $\frac{1}{n}$.
	
	STUDENT RESOURCE
	MHR: p. 187,
	        Example 1a, c
	        p. 192, #1b, c, d, e
	Pearson: p. 224, Example 1
		✓ Use exponents such as $\frac{m}{n}$ where $m \neq 1$.
		
		STUDENT RESOURCE
		MHR: p. 187 Example 1b
		        p. 192, #1a, f
		Pearson: p. 225, Example 2

3.5 Solve a problem that involves exponent laws or radicals.	✓ Solve simple problems. STUDENT RESOURCE MHR: p. 193, #11, #12 Pearson: p. 247, #20	✓ Solve complex problems that involve applying more than one exponent law. STUDENT RESOURCE MHR: p. 194, #14 Pearson: p. 247, #26
3.6 Identify and correct errors in a simplification of an expression that involves powers.	✓ STUDENT RESOURCE MHR: p. 181, #7; p. 200, #11 Pearson: p. 242, #19	