Grade 9 Unit Test Outline
Test Date: Friday, October 14th

Outcomes

N01	Show an understanding of powers with integer bases (excluding base 0) and whole number exponents.
N02	Show an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents.
N04	Explain and apply the order of operations, including exponents.

Format

- Approximate time length: 50 minutes (you will have the entire class)
- 20 Questions:
  - Multiple Choice
  - Short Answer (e.g. solving/simplifying)
  - Constructed Response (e.g. explain why or how)
- 2 Extension problems that will cover more than one outcome
- Calculators allowed (notebooks are not allowed)
- The exponent laws will be given to you on the test

What should you use to study?

- Check-ins, Practice Worksheets, Textbook questions completed for homework

What do you need to know?

Study Guide

- A power represents repeated multiplication.

$2^5 = 2 \times 2 \times 2 \times 2 \times 2$
$= 32$
$(-3)^4 = (-3)(-3)(-3)(-3)$
$= 81$
$-3^4 = -(3)(3)(3)(3)$
$= -81$

- A power with an integer base, other than 0, and an exponent 0 is equal to 1.

$2^0 = 1$
$(-4)^0 = 1$
$-4^0 = -1$

- To evaluate an expression, follow this order of operations:
  Evaluate inside brackets.
  Evaluate powers.
  Multiply and divide, in order, from left to right.
  Add and subtract, in order, from left to right.

Exponent Laws

m and n are whole numbers.
a and b are any integers, except 0.

- Product of Powers
  $a^m \times a^n = a^{m+n}$
- Quotient of Powers
  $a^m \div a^n = a^{m-n} \quad m \geq n$
- Power of a Power
  $(a^m)^n = a^{mn}$
- Power of a Product
  $(ab)^m = a^m b^m$
- Power of a Quotient
  $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad b \neq 0$

Practice Test

1. Write as a product or quotient of powers.

a) $(3 \times 4)^3$ **b)** $[(-5) \times 2]^4$ **c)** $\left(\frac{1}{4}\right)^4$ **d)** $-\left(\frac{9}{3}\right)^3$

2. Simplify.

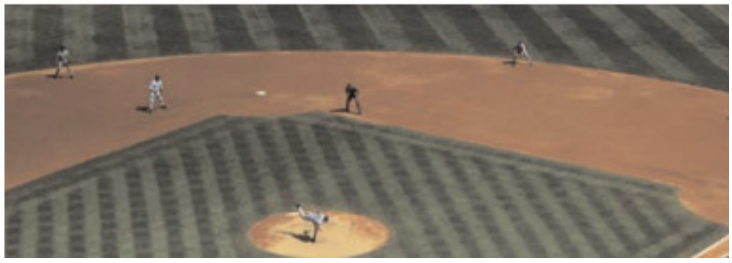
a) $-(2^3)^3$ **b)** $(6^2)^0$ **c)** $[(-5)^2]^3$ **d)** $-[(-3)^2]^4$

3. Simplify each expression, then evaluate it.

a) $[(-3) \times (-2)]^4$ **b)** $\left(\frac{1}{2}\right)^5$ **c)** $(6^0)^4$ **d)** $[(-3)^2]^3$

4. Is the value of a power with a negative base always negative?
Or, is it always positive? Or, is it sometimes negative and sometimes positive?
Illustrate your answer with some examples.

5. A baseball diamond is a square with side length about 27 m.
Is the area of the baseball diamond greater or less than 10^3 m^2?
How do you know?



6. Explain why the brackets are not necessary in this expression:
$(-3^5 \times 10) - (9 \div 3)$
Evaluate the expression, showing each step.

7. Identify the correct answer for $(2^3 + 4)^2 \times (-10)^3 \div (5 + 5)^2$.

a) -240 **b)** -1440 **c)** 1440 **d)** $-28\,825$

Explain how each of the other incorrect answers could have been determined.

8. Evaluate only the expressions with a positive value. Explain how you know the sign of each expression before you evaluate it.

a) $(-5)^3 \times (-5)^2 \div (-5)^1$ **b)** $[(-9)^6 - (-9)^3]^0$

c) $\dfrac{(-1)^2 \times (-1)^4}{(-1)^3 \times (-1)^2}$ **d)** $(-4)^6 + (-4)^4 \times (-4)^0$

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1. **a)** $3^3 \times 4^3$ **b)** $(-5)^4 \times 2^4$

c) $\frac{1^4}{4^4}$ **d)** $-\frac{9^3}{3^3}$

2. **a)** -2^9 **b)** 6^0

c) $(-5)^6$ **d)** $-(-3)^8$

3. **a)** 1296 **b)** $\frac{1}{32} = 0.031\,25$

c) 1 **d)** 729

4. The value of a power with a negative base is positive when the exponent is an even number, and is negative when the exponent is an odd number.
For example: $(-3)^2 = (-3) \times (-3) = 9$
$(-3)^3 = (-3) \times (-3) \times (-3) = -27$

5. The area of the diamond is: $27 \text{ m} \times 27 \text{ m} = 729 \text{ m}^2$, which is less than 1000 m^2.

6. The brackets are not necessary because the order of operations ensures that the multiplication and division are performed before the subtraction.
$(-3^5 \times 10) - (9 \div 3) = (-243 \times 10) - (9 \div 3) =$
$-2430 - 3 = -2433$

7. **a)** $(2^3 + 4)^2$ was calculated as $(2^3 + 4) \times 2$.

b) The answer **–**1440 is correct.

c) $(-10)^3$ was evaluated as 1000.

d) The brackets of $(5 + 5)^2$ were ignored, so $(-10)^3$ was divided by 5 and then 5^2 was added.

8. **a)** 625; The simplified expression $(-5)^{3+2-1} = (-5)^4$ has an even exponent, so the value will be positive.

b) 1; A power with an exponent of 0 gives a value of 1, so the answer will be positive.

c) The simplified expression $(-1)^{2+4-3-2} = (-1)^1$ has an odd exponent, so the answer will be negative.

d) 4352; Each power in the simplified expression $(-4)^6 + (-4)^4$ has an even exponent, so the value will be positive.