

Chinese Beginnings

Section 1

2.1	Exponents; Exponents and Negative Signs	2
2.2	Translating from Word Expressions to Math Expressions	7
2.3	Operations With Exponential Expressions	12
2.4	Order of Operations.....	17
2.5	Quiz 1 ► Marvelous Squares	22

Section 2

2.6	Using Parentheses to Translate from Word Expressions to Math Expressions	24
2.7	Combining Like Terms.....	28
2.8	Multiplying Terms.....	32
2.9	Dividing Terms	36
2.10	Quiz 2 ► Dürer's Beautiful Square	40

Section 3

2.11	The Distributive Property.....	41
2.12	Roots and Radicals.....	46
2.13	Recognizing and Representing Values Algebraically	50
2.14	Equations.....	54
2.15	Review for Test	61
2.16	Test ► The Game of Nim.....	64

2.1

Words to Know

exponent: a small numeral raised to the right of a base number that tells how many times the base is used as a factor.

base: the number or variable that is raised to a power

“ The best time to plant a tree is twenty years ago. The second best time is now. ”
Chinese proverb

Exponents; Exponents and Negative Signs

Exponents

Just as multiplication is used to show repeated addition, exponents show repeated multiplication.

An **exponent** is a small numeral raised to the right of a number called the **base**. The exponent tells how many times the base is multiplied by itself.

base → 6^2 ← exponent

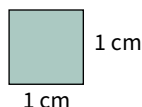
$$6^2 = 6 \cdot 6 = 36$$

$$5^3 = 5 \cdot 5 \cdot 5 = 125$$

$$x^7 = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^7$$

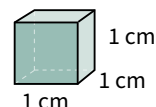
A number with an exponent is sometimes referred to as a power or an exponential expression. It is sometimes said that a number with an exponent has been raised to a power. Powers can also be named more specifically. The third example above is x raised to the seventh power or x to the seventh power.

Two special powers, the square (2) and the cube (3) have a connection with geometry.



$$1^2 \text{ (1 squared)} = 1 \cdot 1$$

1 cm by 1 cm = 1 square centimeter of area



$$1^3 \text{ (1 cubed)} = 1 \cdot 1 \cdot 1$$

1 cm by 1 cm by 1 cm = 1 cubic centimeter of volume

Negative Signs and Base

There are two ways to show a negative sign with the base of an exponent. The two ways -3^2 and $(-3)^2$ give different results.

-3^2 means “the opposite of three squared.” In this case, *the negative sign is not part of the base*. Therefore, the negative sign is not applied until after the power of the positive base is calculated.

$$-3^2 = -(3 \cdot 3) = -9$$

$(-3)^2$ means “the square of negative three.” In this case, *the negative sign is part of the base*, so a negative base is multiplied repeatedly.

$$(-3)^2 = (-3) \cdot (-3) = 9$$

Even and Odd Exponents

In the next couple of examples, notice the pattern that occurs with negative bases that have even and odd exponents.

$$(-3)^2 = (-3) \cdot (-3) = 9$$

even number of negative factors = positive answer

$$(-3)^3 = (-3) \cdot (-3) \cdot (-3) = (-27)$$

odd number of negative factors = negative answer

$$(-3)^4 = (-3) \cdot (-3) \cdot (-3) \cdot (-3) = 81$$

even number of negative factors = positive answer

$$(-3)^5 = (-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3) = (-243)$$

odd number of negative factors = negative answer

Rules Exponents of Negative Bases

- Even exponents of negative bases = positive answer.
- Odd exponents of negative bases = negative answer.

Math in History

In 2008 China's Tsinghua University cleaned and deciphered a bundle of nearly 2,500 ancient bamboo strips dating back to 310 B.C. Most of the strips were covered with alphabetical characters, but twenty-one were inscribed with numbers. Arranged properly, these numerical strips form a multiplication table with columns and rows showing the answers at their intersections.

Today's Lesson

Evaluate.

1. 3^4 _____
2. 2^6 _____
3. -12^3 _____
4. $(-2)^3$ _____
5. -2^4 _____
6. -5^2 _____
7. 2^5 _____
8. $(-7)^2$ _____
9. 9^3 _____

REVIEW

Write the answer. 1.14

10. Andrew has one brother and four sisters. Give the ratios in lowest terms between boys and girls and of each to the total children in Andrew's family. Remember to count Andrew.

Lesson 2.1

11. After Rockwell Farms installed an irrigation system, their yield per acre of corn rose 15% from 150 bushels per acre. What was their new yield per acre?
12. Chicken Pride was selling their drumsticks in a 40 lb case for \$51.60. What was the cost per lb?

Combine the numbers. 1.6

13. $-7 + (-8)$ _____ 14. $16 + (-9)$ _____ 15. $14 + (-7) + (-9)$ _____

Combine the numbers. 1.8

16. $-10 - 7$ _____ 17. $-18 - (-28)$ _____ 18. $-32 - 11$ _____ 19. $15 - (-6)$ _____

Divide. If the answer is undefined, write $\emptyset$. 1.13

20. $-42 \div 6$ _____ 21. $0 \div 6$ _____ 22. $-63 \div (-7)$ _____

Evaluate the expressions if $x = 5$. 1.9

23. $x^2 + 25$ 24. $\frac{x}{2} + 7$ 25. $x + 20 + x - 2$

Add or subtract. 1.4

26. $\frac{5}{3} + \frac{8}{7}$ 27. $\frac{7}{12} - \frac{7}{20}$ 28. $\frac{8}{5} + \frac{2}{6}$ 29. $9 - \frac{3}{11}$

Evaluate. 1.7

30. $8.36 \cdot 3.5$ 31. $20.08 \div 2.4$ 32. $0.35 + 1.68$ 33. $16.03 - 10.48$

Write the answer. 1.11

34. The ancient olympic games were first held in Olympia, Greece in 766 B.C. These games were usually held every fourth year until Emperor Theodosius I restrained them in A.D. 394 in his attempt to enforce Christianity as the state religion of Rome. How many years had passed from the time the first games were held until they were suppressed?
35. Hikers leave the rim of the Grand Canyon and begin the 8,000 ft descent to the canyon floor. They stop to rest 345 ft into the canyon. How high are they above the canyon floor?
36. The Sea of Galilee is 693 feet (211 meters) below sea level. The water that flows out of the Sea of Galilee flows southward in the zigzagging Jordan River and empties into the Dead Sea 1,388 feet (423 meters) below sea level. How far does the water descend between the Sea of Galilee and the Dead Sea?
37. Death Valley in California is 282 feet below sea level. If the Dead Sea is 1,388 feet below sea level, how much further below sea level is the Dead Sea than Death Valley?

Write the word to complete the statement. 1.8

38. To subtract a negative number, add its _____.

Write the word(s) for each definition.

39. letters representing number values 1.9 _____
40. a numeral or symbol whose value never changes 1.9 _____
41. a group of numbers, variables, and symbols of mathematical operations 1.9 _____
42. a number factor in front of a variable 1.9 _____

Today's Lesson

Evaluate.

43. 10^2 _____ 44. 10^3 _____ 45. 10^4 _____ 46. 10^5 _____

Lesson 2.1

Write the answer.

47. Using the pattern in exercises 43 – 46, write a rule for quickly calculating the powers of ten. _____

Write the word(s) for each definition.

48. a number or variable that is raised to a power _____

49. small raised number to the right of a number or variable _____

Extra Practice

Evaluate.

50. 3^3 _____

51. $(-3)^3$ _____

52. -3^3 _____

53. -5^2 _____

54. -5^3 _____

55. $(-6)^2$ _____

56. 1^2 _____

57. $(-1)^3$ _____

58. $(-1)^4$ _____