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1-3 Lesson Reading Guide

Powers and Exponents

Get Ready for the Lesson

Complete the Mini Lab at the top of page 32 in your textbook. Write your answers below.

1. What prime factors did you record?

2. How does the number of folds relate to the number of factors in the prime factorization of the number of holes?

3. Write the prime factorization of the number of holes made if you folded it eight times.

Read the Lesson

4. Describe the expression 2^5. In your description, use the terms *power*, *base*, and *exponent*.

5. In the power 3^5, what does the exponent 5 indicate?

6. Complete the following table.

Expression	Words
4^3	
7^2	
9^6	
$8 \times 8 \times 8 \times 8$	
$3 \times 3 \times 3 \times 3 \times 3$	

Remember What You Learned

7. Explain how to find the value of 5^4.

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1-3 Study Guide and Intervention

Powers and Exponents

A product of prime factors can be written using exponents and a base. Numbers expressed using exponents are called **powers**.

Powers	Words	Expression	Value
4^2	4 to the second power or 4 squared	4×4	16
5^6	5 to the sixth power	$5 \times 5 \times 5 \times 5 \times 5 \times 5$	15,625
7^4	7 to the fourth power	$7 \times 7 \times 7 \times 7$	2,401
9^3	9 to the third power or 9 cubed	$9 \times 9 \times 9$	729

Example 1 **Write $6 \times 6 \times 6$ using an exponent. Then find the value.**

The base is 6. Since 6 is a factor 3 times, the exponent is 3.
$6 \times 6 \times 6 = 6^3$ or 216

Example 2 **Write 2^4 as a product of the same factor. Then find the value.**

The base is 2. The exponent is 4. So, 2 is a factor 4 times.
$2^4 = 2 \times 2 \times 2 \times 2$ or 16

Example 3 **Write the prime factorization of 225 using exponents.**

The prime factorization of 225 can be written as $3 \times 3 \times 5 \times 5$, or $3^2 \times 5^2$.

Exercises

Write each product using an exponent. Then find the value.

1. $2 \times 2 \times 2 \times 2 \times 2$

2. 9×9

3. $3 \times 3 \times 3$

4. $5 \times 5 \times 5$

5. $3 \times 3 \times 3 \times 3 \times 3$

6. 10×10

Write each power as a product of the same factor. Then find the value.

7. 7^2

8. 4^3

9. 8^4

10. 5^5

11. 2^8

12. 7^3

Write the prime factorization of each number using exponents.

13. 40

14. 75

15. 100

16. 147

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1-3 Skills Practice

Powers and Exponents

Write each expression in words.

1. 7^2

2. 8^3

3. 4^4

4. 5^6

Write each product using an exponent. Then find the value.

5. $4 \times 4 \times 4 \times 4$

6. $3 \times 3 \times 3 \times 3$

7. $5 \times 5 \times 5 \times 5$

8. 7×7

9. $3 \times 3 \times 3 \times 3 \times 3$

10. $2 \times 2 \times 2 \times 2 \times 2 \times 2$

11. $6 \times 6 \times 6$

12. $6 \times 6 \times 6 \times 6$

Write each power as a product of the same factor. Then find the value.

13. 3^8

14. 2^5

15. 8^3

16. 10^5

17. 6^2

18. 7^4

19. 2^3

20. 3^5

21. 6^5

22. 2^7

Write the prime factorization of each number using exponents.

23. 54

24. 36

25. 63

26. 245

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1-3 Practice

Powers and Exponents

Write each product using an exponent.

1. 6×6

2. $10 \times 10 \times 10 \times 10$

3. $4 \times 4 \times 4 \times 4 \times 4$

4. $8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8$

5. $5 \times 5 \times 5 \times 5 \times 5 \times 5$

6. $13 \times 13 \times 13$

Write each power as a product of the same factor. Then find the value.

7. 10^1

8. 2^7

9. 8^3

10. 3^8

11. nine squared

12. four to the sixth power

Write the prime factorization of each number using exponents.

13. 32

14. 100

15. 63

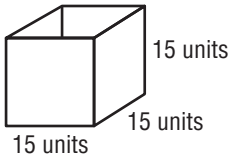
16. 99

17. 52

18. 147

19. **LABELS** A sheet of labels has 8 rows of labels with 8 labels in each row. How many total labels are on the sheet? Write your answer using exponents, and then find the value.

20. **CANDLES** To find how much wax the candle mold holds, use the expression $s \times s \times s$, where s is the length of a side. Write this expression as a power. The amount of wax the mold holds is measured in cubic units. How many cubic units of wax does the mold hold?



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1-3 Word Problem Practice

Powers and Exponents

1. SPACE The Sun is about $10 \cdot 10$ million miles away from Earth. Write $10 \cdot 10$ using an exponent. Then find the value of the power. How many miles away is the Sun?

2. WEIGHT A 100-pound person on Earth would weigh about $4 \cdot 4 \cdot 4 \cdot 4$ pounds on Jupiter. Write $4 \cdot 4 \cdot 4 \cdot 4$ using an exponent. Then find the value of the power. How much would a 100-pound person weigh on Jupiter?

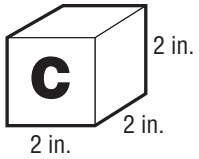
3. ELECTIONS In the year 2000, the governor of Washington, Gary Locke, received about 10^6 votes to win the election. Write this as a product. How many votes did Gary Locke receive?

4. SPACE The diameter of Mars is about 9^4 kilometers. Write 9^4 as a product. Then find the value of the product.

5. SPACE The length of one day on Venus is 3^5 Earth days. Express this exponent as a product. Then find the value of the product:

6. GEOGRAPHY The area of San Bernardino County, California, the largest county in the U.S., is about 3^9 square miles. Write this as a product. What is the area of San Bernardino County?

7. GEOMETRY The volume of the block shown can be found by multiplying the width, length, and height. Write the volume using an exponent. Find the volume.



8. SPACE A day on Jupiter lasts about 10 hours. Write a product and an exponent to show how many hours are in 10 Jupiter days. Then find the value of the power.

Lesson 1–3

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1-3 Enrichment

The Sieve of Erathosthenes

Erathosthenes was a Greek mathematician who lived from about 276 B.C. to 194 B.C. He devised the **Sieve of Erathosthenes** as a method of identifying all the prime numbers up to a certain number. Using the chart below, you can use his method to find all the prime numbers up to 120. Just follow these numbered steps.

1. The number 1 is not prime. Cross it out.

2. The number 2 is prime. Circle it. Then cross out every second number—4, 6, 8, 10, and so on.

3. The number 3 is prime. Circle it. Then cross out every third number—6, 9, 12, and so on.

4. The number 4 is crossed out. Go to the next number that is not crossed out.

5. The number 5 is prime. Circle it. Then cross out every fifth number—10, 15, 20, 25, and so on.

6. Continue crossing out numbers as described in Steps 2–5. The numbers that remain at the end of this process are prime numbers.

7. **CHALLENGE** Look at the prime numbers that are circled in the chart. Do you see a pattern among the prime numbers that are greater than 3? What do you think the pattern is?

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114
115	116	117	118	119	120