8 How to • • • • • • • Use Sequences and Exponents in Multiplication

Facts to Know

Sequences

A *sequence* is a set of numbers which follows a mathematical rule.

Sequences can be used with all four operations and with combinations of operations.

This is a simple sequence:

1, 2, 3, 4, 5, 6, 7, 8, …

Here is a multiplication sequence called the doubling sequence.

1, 2, 4, 8, 16, …

Some sequences use two operations like this one:

4, 9, 19, 39, 79, …

- The operations are multiply by 2 and add 1.
- The rule can be written this way: (a x 2) + 1.

Multiplication sequences are also called geometric progressions.

Exponents

When a number is to be multiplied by itself, it can be written as an exponent.

The *exponent* is the small raised number which tells how many times to multiply the base number by itself.

Sample A

5^2 means multiply 5 times 5.

5 is the base number.

The raised number ^{2} is the exponent. It also indicates that 5 is being raised to the second power.

Sample B

$5^3 = 5 \times 5 \times 5$

This indicates that 5 is to be multiplied by itself, and the answer (25) is to be multiplied again by 5.

5 x 5 = 25

25 x 5 = 125

$5^3 = 125$

Sample C

$3^4 = 3 \times 3 \times 3 \times 3$

This exponent (or the raised number) indicates that 3 is to be multiplied by 3.

The answer (9) is to be multiplied by 3 again.

The answer (27) is to be multiplied by 3 again.

3 x 3 = 9

9 x 3 = 27

27 x 3 = 81

$3^4 = 81$

8 Practice • • • • • • • • • • Multiplication Sequences

A **sequence** is a set of numbers which follows a mathematical rule.

5, 10, 20, 40, …

In this multiplication sequence, each term after the first is multiplied by 2.

Directions: Use the information on page 33 to help you complete these sequences by filling in the missing information.

1. 4, 8, 16, 32, _____, _____, _____, _____

2. 3, 9, 27, _____, _____, _____, _____

3. 4, 12, 36, _____, _____, _____, _____

4. 1, 5, 25, 125, _____, _____, _____, _____

5. 1, 4, 16, 64, _____, _____, _____, _____

6. 1, 7, 49, _____, _____, _____, _____

Directions: In these sequences two operations are used. Write a mathematical explanation and math sentence. Complete each sequence.

7. 2, 5, 11, 23, _____, _____, _____, _____

Written Explanation: _____

_____

Math Sentence: _____

8. 3, 5, 9, 17, 33, _____, _____, _____, _____

Written Explanation: _____

_____

Math Sentence: _____

9. 4, 11, 32, 95, _____, _____, _____, _____

Written Explanation: _____

_____

Math Sentence: _____

10. 5, 13, 29, 61, _____, _____, _____, _____

Written Explanation: _____

_____

Math Sentence: _____

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8 Practice • • • • • • • • • • Multiplying with Exponents

A number multiplied by itself can be written as an exponent.

The **exponent** tells how many times to multiply the base number by itself.

5^2 is 5 squared or "5 to the second power."
$5^2 = 25$

5^3 is "5 cubed" or "5 to the third power."
$5^3 = 5 \times 5 \times 5$
$5 \times 5 = 25$
$25 \times 5 = 125$
$5^3 = 125$

Directions: For each of the terms below, write an equation and solve it. The first one is done for you.

1. 3^2 3 x 3 = 9
2. 7^2 _____ x _____ = _____
3. 4^2 _____ x _____ = _____
4. 9^2 _____ x _____ = _____
5. 2^2 _____ x _____ = _____
6. 8^2 _____ x _____ = _____
7. 10^2 _____ x _____ = _____
8. 6^2 _____ x _____ = _____
9. 11^2 _____ x _____ = _____
10. 12^2 _____ x _____ = _____

Directions: For each of the terms below, write two equations and solve them. The first one is done for you.

11. 2^3 2 x 2 = 4
4 x 2 = 8
$2^3 = 8$

12. 3^3 _____ x _____ = _____
_____ x _____ = _____
3^3 = _____

13. 5^3 _____ x _____ = _____
_____ x _____ = _____
5^3 = _____

14. 7^3 _____ x _____ = _____
_____ x _____ = _____
7^3 = _____

15. 4^3 _____ x _____ = _____
_____ x _____ = _____
4^3 = _____

16. 6^3 _____ x _____ = _____
_____ x _____ = _____
6^3 = _____

17. 10^3 _____ x _____ = _____
_____ x _____ = _____
10^3 = _____

18. 9^3 _____ x _____ = _____
_____ x _____ = _____
9^3 = _____

19. 11^3 _____ x _____ = _____
_____ x _____ = _____
11^3 = _____

20. 12^3 _____ x _____ = _____
_____ x _____ = _____
12^3 = _____

8 Practice • • • • • • • • • • • • Multiplying with Higher-Power Exponents

The **exponent** tells how many times to multiply the base number by itself.

2^4 means 2 x 2 x 2 x 2
2 x 2 = 4
4 x 2 = 8
8 x 2 = 16
2^4 = 16

3^4 means 3 x 3 x 3 x 3
3 x 3 = 9
9 x 3 = 27
27 x 3 = 81
3^4 = 81

Directions: For each of the problems below, write the correct equation and solve it. The first one has been started for you.

1. 2^5
2 x 2 = 4
4 x 2 = 8
8 x 2 = 16
16 x 2 = _____
2^5 = _____

2. 3^4
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
3^4 = _____

3. 5^4
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
5^4 = _____

4. 3^5
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
3^5 = _____

5. 6^4
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
6^4 = _____

6. 6^5
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
6^5 = _____

7. 7^4
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
7^4 = _____

8. 7^5
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
7^5 = _____

9. 2^6
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
2^6 = _____

10. 3^6
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
_____ x _____ = _____
3^6 = _____

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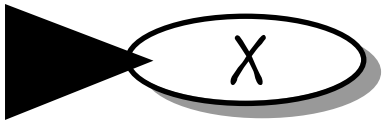

Answer Key

Page 26

1. 2,400 m^2
2. 3,000 $ft.^2$
3. 1,600 $yds.^2$
4. 2,800 cm^2
5. 1,800 mm^2
6. 6,300 mm^2
7. 42 m^2
8. 4,900 $ft.^2$
9. 5,980 $ft.^2$
10. 1,504 $in.^2$

Page 27

1. 108 $ft.^2$
2. 600 cm^2
3. 264 cm^2
4. 3,150 mm^2
5. 351 $in.^2$
6. 384 m^2
7. 11,550 $ft.^2$
8. 1,750 $yds.^2$

Page 28

1. 288 $ft.^3$
2. 900 m^3
3. 792,000 cm^3
4. 168,000 $in.^3$
5. 281,600 mm^3
6. 184,800 $yd.^3$
7. 153,600 cm^3
8. 1,200,000 $ft.^3$
9. 60,000,000 $ft.^3$
10. 135,000,000 $ft.^3$

Page 30

1. 600
2. 5,400
3. 775
4. 1,540
5. 3,312
6. 2,784
7. 4,500
8. 375
9. 748
10. 943
11. 1,008
12. 1,599

Page 31

1. 832
2. 1,080
3. 700
4. 960
5. 922
6. 1,150
7. 2,300
8. 1,755
9. 4,200
10. 2,900
11. 1,900
12. 3,350
13. 3,400
14. 3,900
15. 2,200
16. 1,550
17. 1,200
18. 2,300
19. 600
20. 2,050
21. 189
22. 288
23. 558
24. 387
25. 504

Page 32

	Actual	Estimate
1.	5,952	5,400
2.	3,654	3,600
3.	294,056	300,000
4.	178,308	160,000
5.	378,351	350,000
6.	623,715	600,000
7.	3,283	3,500
8.	2,262	2,400
9.	201,984	240,000
10.	333,062	350,000
11.	19,450,486	21,000,000
12.	27,642,244	27,000,000

Page 34

1. 64, 128, 256, 512
2. 81, 243, 729, 2,187
3. 108, 324, 972, 2,916
4. 625, 3,125, 15,625, 78,125
5. 256, 1,024, 4,096, 16,384
6. 343, 2,401, 16,807, 117,649
7. 47, 95, 191, 383
   (a x 2) + 1
8. 65, 129, 257, 513
   (a x 2) – 1
9. 284, 851, 2,552, 7,655
   (a x 3) – 1
10. 125, 253, 509, 1,021
    (a x 2) + 3

Page 35

1. 3 x 3 = 9
2. 7 x 7 = 49
3. 4 x 4 = 16
4. 9 x 9 = 81
5. 2 x 2 = 4
6. 8 x 8 = 64
7. 10 x 10 = 100
8. 6 x 6 = 36
9. 11 x 11 = 121
10. 12 x 12 = 144
11. 2 x 2 = 4
    4 x 2 = 8
    $2^3 = 8$
12. 3 x 3 = 9
    9 x 3 = 27
    $3^3 = 27$
13. 5 x 5 = 25
    25 x 5 = 125
    $5^3 = 125$
14. 7 x 7 = 49
    49 x 7 = 343
    $7^3 = 343$
15. 4 x 4 = 16
    16 x 4 = 64
    $4^3 = 64$
16. 6 x 6 = 36
    36 x 6 = 216
    $6^3 = 216$
17. 10 x 10 = 100
    100 x 10 = 1,000
    $10^3 = 1,000$
18. 9 x 9 = 81
    81 x 9 = 729
    $9^3 = 729$
19. 11 x 11 = 121
    121 x 11 = 1,331
    $11^3 = 1,331$
20. 12 x 12 = 144
    144 x 12 = 1,728
    $12^3 = 1,728$

Page 36

1. $2^5 = 32$
2. 3 x 3 = 9
   9 x 3 = 27
   27 x 3 = 81
   $3^4 = 81$
3. 5 x 5 = 25
   25 x 5 = 125
   125 x 5 = 625
   $5^4 = 625$
4. 3 x 3 = 9
   9 x 3 = 27
   27 x 3 = 81
   81 x 3 = 243
   $3^5 = 243$
5. 6 x 6 = 36
   36 x 6 = 216
   216 x 6 = 1,296
   $6^4 = 1,296$
6. 6 x 6 = 36
   36 x 6 = 216
   216 x 6 = 1,296
   1,296 x 6 = 7,776
   $6^5 = 7,776$
7. 7 x 7 = 49
   49 x 7 = 343
   343 x 7 = 2,401
   $7^4 = 2,401$
8. 7 x 7 = 49
   49 x 7 = 343
   343 x 7 = 2,401
   2,401 x 7 = 16,807
   $7^5 = 16,807$
9. 2 x 2 = 4
   4 x 2 = 8
   8 x 2 = 16
   16 x 2 = 32
   32 x 2 = 64
   $2^6 = 64$
10. 3 x 3 = 9
    9 x 3 = 27
    27 x 3 = 81
    81 x 3 = 243
    243 x 3 = 729
    $3^6 = 729$

Page 38

1. 120
2. 468
3. 800
4. 1,350
5. 630
6. 2,100
7. 12
8. 80
9. 16
10. 72
11. 180
12. 144
13. 144
14. 119
15. 600
16. 160
17. 72
18. 250
19. 600
20. 510
21. 3,000
22. 260
23. 432
24. 640
25. 27a
26. 32b
27. 60b
28. 240
29. 20a
30. 84a

Page 39

1. 32
2. 45
3. 6
4. 35
5. 160
6. 5
7. 48
8. 31
9. 79
10. 10
11. 16
12. 60
13. 6
14. 32
15. 4

Page 40

1. $2,450.00
2. $1,360.00
3. $3,920.00
4. $1,785.00
5. $1,270.40
6. $2,037.50
7. $935.25
8. $2,441.40
9. $5,028.54
10. $2,334.96
11. $50,240.00
12. $172,625.00
13. $300,015.00
14. $192,675.00
15. $4,886.25

Page 41

1. 960 times
2. 23,040 breaths
3. 1,080 times
4. 25,920 times
5. 1,440 qts.
6. 180,000,000 red blood cells
7. 4,320,000,000 red blood cells
8. 36,500,000 times
9. 547,500 gal.
10. 187,200 times a day
11. 720,000,000 cells
12. 7,300,000,000 particles

Page 42

1. 720 lbs.
2. 1,120 lbs.
3. 6,600 lbs.
4. 15,500 lbs.
5. 4,375 lbs.
6. 11,130 lbs.
7. 672 lbs.
8. 16,080 lbs.
9. 1,665 lbs.
10. 2,025 lbs.
11. 3,267 lbs.
12. 375 lbs.
13. 48,050 lbs.
14. 101,625 lbs.
15. 12,300 lbs.

Page 43

1. 81 ÷ 9 x 7 ÷ 21 x 6 ÷ 2 = 9
2. 12 x 6 x 2 ÷ 12 ÷ 4 x 5 = 15
3. 88 ÷ 11 x 3 ÷ 4 x 12 ÷ 8 = 9
4. 108 ÷ 4 ÷ 9 x 5 x 6 ÷ 30 = 3
5. 54 ÷ 9 x 6 x 2 ÷ 8 x 15 = 135
6. 32 x 2 ÷ 8 x 12 ÷ 3 ÷ 2 = 16
7. 15 ÷ 5 x 7 x 3 ÷ 7 x 5 = 45
8. 91 ÷ 13 x 3 x 5 x 4 ÷ 21 = 20
9. 33 ÷ 11 x 5 x 2 ÷ 6 x 21 = 105
10. 100 ÷ 100 x 12 x 2 x 3 ÷ 9 = 8

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Sometimes rabbits just multiply.

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