

1.5 The Exponent Rules

MATHPOWER™ Nine, pp. 20-21

To multiply powers with the same base, add the exponents.

$$y^m \times y^n = y^{m+n}$$

To divide powers with the same base, subtract the exponents.

$$y^m \div y^n = y^{m-n}$$

To raise a power to a power, multiply the exponents.

$$(y^m)^n = y^{m \times n}$$

Simplify.

- | | | |
|--|---|---|
| 1. $4^4 \times 4^2$
<u>4⁶</u> | 2. $3^5 \times 3^3$
<u>3⁸</u> | 3. $2^2 \times 2^3$
<u>2⁵</u> |
| 4. $10^3 \times 10$
<u>10⁴</u> | 5. $5^4 \times 5^3$
<u>5⁷</u> | 6. 6×6^4
<u>6⁵</u> |
| 7. $x^2 \times x^5$
<u>x⁷</u> | 8. $y^3 \times y^3$
<u>y⁶</u> | 9. $z^3 \times z^2$
<u>z⁵</u> |

Find the missing exponent.

- | | |
|---|---|
| 10. $3^2 \times 3^{\square} = 3^4$ <u>2</u> | 11. $5^{\square} \times 5^4 = 5^7$ <u>3</u> |
| 12. $8^3 \times 8^{\square} = 8^5$ <u>2</u> | 13. $7^{\square} \times 7^3 = 7^4$ <u>1</u> |
| 14. $y^5 \times y^{\square} = y^8$ <u>3</u> | 15. $b^{\square} \times b^5 = b^9$ <u>4</u> |
| 16. $x \times x^9 = x^{\square}$ <u>10</u> | 17. $s^6 \times s^{\square} = s^7$ <u>1</u> |

Simplify.

- | | | |
|--|--|--|
| 18. $5^4 \div 5^2$
<u>5²</u> | 19. $4^6 \div 4^3$
<u>4³</u> | 20. $3^3 \div 3^2$
<u>3</u> |
| 21. $9^5 \div 9^2$
<u>9³</u> | 22. $7^4 \div 7^3$
<u>7</u> | 23. $2^6 \div 2^4$
<u>2²</u> |
| 24. $x^7 \div x^5$
<u>x²</u> | 25. $y^8 \div y^6$
<u>y²</u> | 26. $a^5 \div a^4$
<u>a</u> |

Find the missing exponent.

- | | |
|---|---|
| 27. $2^5 \div 2^{\square} = 2^3$ <u>2</u> | 28. $3^4 \div 3^{\square} = 3^2$ <u>2</u> |
| 29. $4^{\square} \div 4^2 = 4^4$ <u>2</u> | 30. $5^{\square} \div 5^3 = 5$ <u>4</u> |
| 31. $n^4 \div n^{\square} = n^2$ <u>2</u> | 32. $c^{\square} \div c^4 = c^3$ <u>7</u> |
| 33. $y^{\square} \div y^2 = y^2$ <u>4</u> | 34. $z^9 \div z^{\square} = z$ <u>8</u> |

Simplify.

- | | | |
|---------------------------------------|---------------------------------------|--|
| 35. $(3^2)^3$
<u>3⁶</u> | 36. $(2^4)^2$
<u>2⁸</u> | 37. $(7^3)^4$
<u>7¹²</u> |
| 38. $(6^2)^4$
<u>6⁸</u> | 39. $(5^3)^2$
<u>5⁶</u> | 40. $(4^5)^3$
<u>4¹⁵</u> |
| 41. $(x^3)^3$
<u>x⁹</u> | 42. $(s^2)^2$
<u>s⁴</u> | 43. $(r^5)^2$
<u>r¹⁰</u> |

Find the missing exponent.

- | | |
|--|---|
| 44. $(3^{\square})^{\square} = 3^9$ <u>3</u> | 45. $(2^5)^{\square} = 2^{10}$ <u>2</u> |
| 46. $(5^{\square})^2 = 5^8$ <u>4</u> | 47. $(4^{\square})^3 = 4^{12}$ <u>4</u> |
| 48. $(g^2)^{\square} = g^6$ <u>3</u> | 49. $(m^3)^{\square} = m^9$ <u>3</u> |
| 50. $(s^{\square})^5 = s^{20}$ <u>4</u> | 51. $(t^{\square})^2 = t^6$ <u>3</u> |

Find the value of each expression.

Replace the blanks with the corresponding letter or symbol to decode the message.

- | | |
|-------------------------|-----------------------|
| 52. $2^3 \times 2^2$ C | 53. $2^9 \div 2^2$ R |
| 54. $2^4 \div 2^3$ A | 55. $(2^3)^2$ O |
| 56. $2^{13} \div 2^3$ C | 57. $(2^6)^2$! |
| 58. 2×2 L | 59. $(2^4)^2$ R |
| 60. $2^2 \times 2^2$ * | 61. $2^2 \times 2$ L |
| 62. $(2^3)^3$ E | 63. $2^{12} \div 2$ T |

A L L * C O R R E C T !
 $2^1 \ 2^2 \ 2^3 \ 2^4 \ 2^5 \ 2^6 \ 2^7 \ 2^8 \ 2^9 \ 2^{10} \ 2^{11} \ 2^{12}$

1.8 Working with Exponents

MATHPOWER™ Nine, pp. 26-29

To multiply powers with the same integral base, add the exponents.

$$x^m \times x^n = x^{m+n}$$

To divide powers with the same integral base, subtract the exponents.

$$x^m \div x^n = x^{m-n}$$

To raise a power with an integral base to a power, multiply the exponents.

$$(x^m)^n = x^{m \times n}$$

Complete the table.

	Exponential Form	Base	Exponent	Standard Form
1.	$(-2)^3$	-2	3	-8
2.	3	3	1	3
3.	5	5	1	5
4.	$(-3)^3$	-3	3	-27
5.	$(-2)^5$	-2	5	-32
6.	7	7	2	49

Complete the table.

	Exponential Form	Repeated Multiplication	Standard Form
7.	$(-3)^2 \times (-3)^2$	$(-3)(-3)(-3)(-3)$	81
8.	$(-4)^3$	$(-4) \times (-4) \times (-4)$	-64
9.	$(-5)^3$	$(-5)(-5)(-5)$	-125
10.	$(-4)^3 \div (-4)$	$\frac{(-4) \times (-4) \times (-4)}{(-4)}$	16
11.	$(+5)^4 \div (+5)^2$	$\frac{(5)(5)(5)(5)}{(5)(5)}$	25
12.	$\frac{(+5)^2}{(+5)}$	$\frac{(+5) \times (+5) \times (+5)}{(+5) \times (+5)}$	5
13.	$(-3)^5 \div (-3)^2$	$\frac{(-3)(-3)(-3)(-3)(-3)}{(-3)(-3)}$	-27
14.	$\frac{(-2)^6}{(-2)}$	$(-2) \times (-2) \div (-2)$	-2

Write in standard form.

15. $3^2 \times 3^3$ 243 16. $(-2)^3 \times (-2)^2$ -32
 17. $(5)^4(5)^3$ 78125 18. $(3.2)^2(3.2)^2$ 104.8576
 19. $((y)^2)^3$ y^6 20. $(3)^4 \div (3)^2$ 9
 21. $((-4.5)^2)^5$ 340502.322 22. $(-5)^3 \div (-5)$ 25
 23. $\frac{3^5}{3^3}$ 9 24. $\frac{(-7)^3}{(-7)^2}$ -7

Is each statement true or false?

25. $3^3 = 81$ F 26. $6(-2)^3 = 48$ F
 27. $(-4)^2 \times (-4)^2 = -64$ F
 28. $y^2 \times y^4 = y^6$ T
 29. $(-a)^4 \div (-a)^2 = a^2$ T
 30. $(-5)^3 \div (-5)^2 = 5$ F

Evaluate for $s = -3$ and $t = 2$.

31. t^3 8 32. $\frac{6}{s^2}$ $\frac{2}{3}$
 33. $s^3 + t^2$ -23 34. $2s^3 \div 3t$ -9
 35. $-3st$ 18 36. $-2s^2 - 4t$ -26

37. The formula for the volume, V , of a sphere is $V = 4.19r^3$, where r is the radius. Complete the table.

Radius (m)	Volume (m^3)
4	268.16
7	1437.17
2	33.52
2.3	50.98
10	4190

38. If the base of a power is negative and the exponent is five, the standard form of the number is negative. Explain. _____

If the power is odd the number is multiplied an odd number of times and remains odd.

39. The standard forms of the following terms are not the same. Explain why this is true.

$(-2)^4$ -2^4
with the brackets the answer is four, without it is negative.