5-Minute Check

Over Lesson 7–3

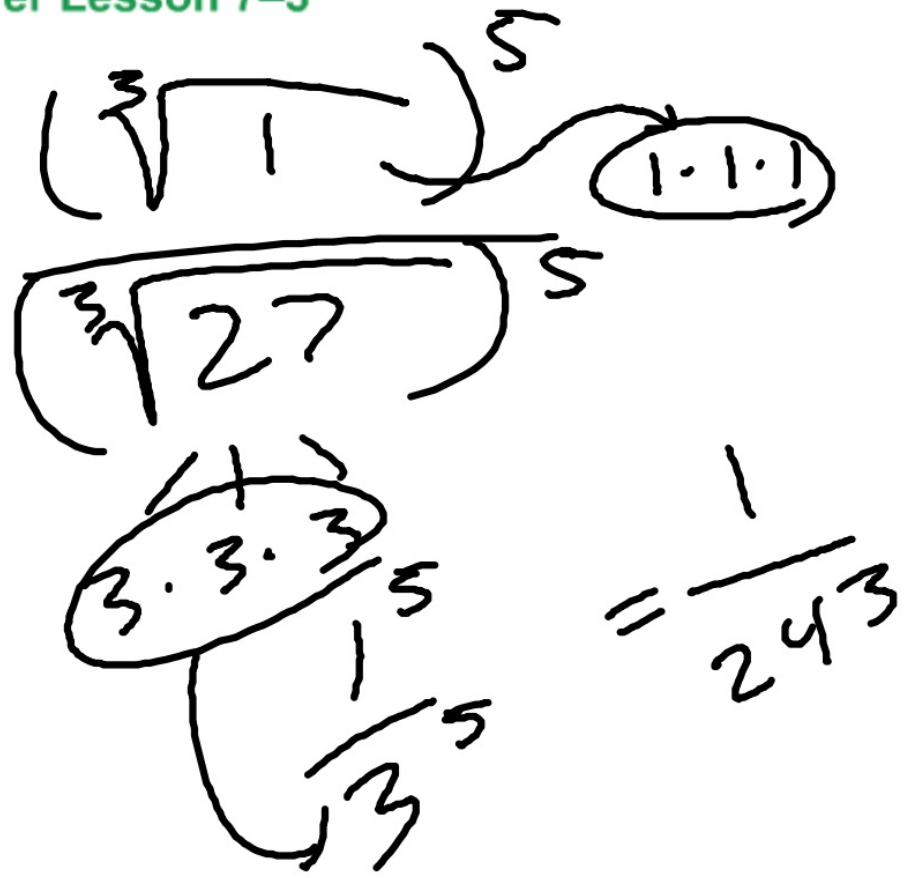
4 Simply $\left(\frac{1}{27}\right)^{\frac{5}{3}}$.

A. $\frac{1}{243}$

B. $\frac{1}{81}$

C. $\frac{1}{15}$

D. 243



5-Minute Check

Over Lesson 7–3

hint: distribute the exponent first...

4 Simply $\left(\frac{1}{27}\right)^{\frac{5}{3}}$.

A. $\frac{1}{243}$

B. $\frac{1}{81}$

C. $\frac{1}{15}$

D. 243

5-Minute Check Over Lesson 7–3

Standardized Test Practice

5 Solve $5^{2x-5} = 125$.

A. 3

B. 3.5

C. 4

D. 4.5

$5^{2x-5} = 5^3$

$2x - 5 = 3$

$+5 \quad +5$

$2x = 8$

$\frac{2x}{2} = \frac{8}{2}$

5-Minute Check Over Lesson 7–3

Standardized Test Practice

5 Solve $5^{2x-5} = 125$.

A. 3

B. 3.5

C. 4

D. 4.5

LESSON 7–4 Scientific Notation

"a" must be between 1 and 10!

KeyConcept Standard Form to Scientific Notation

Step 1 Move the decimal point until it is to the right of the first nonzero digit. The result is a real number a.

Step 2 Note the number of places n and the direction that you moved the decimal point.

Step 3 If the decimal point is moved left, write the number as $a \times 10^{n}$.
If the decimal point is moved right, write the number as $a \times 10^{-n}$.

Step 4 Remove the unnecessary zeros.

$\frac{1}{10}$

6200×10^{-1}

62×10^{1}

6.2×10^{2}

62^{0}

EXAMPLE 1 Standard Form to Scientific Notation

A. Express 4,062,000,000,000 in scientific notation.

Step 1 $4{,}062{,}000{,}000{,}000 \rightarrow 4{,}062{,}000{,}000{,}000$

$a = 4.062000000000$

Step 2 The decimal point moved 12 places to the left, so $n = 12$.

Step 3 $4{,}062{,}000{,}000{,}000 = 4.062000000000 \times 10^{12}$

Step 4 4.062×10^{12}

EXAMPLE 1 Standard Form to Scientific Notation

B. Express 0.000000823 in scientific notation.

Step 1 $0.000000823 \rightarrow 0.0000008223$

$a = 0000008.23$

Step 2 The decimal point moved 7 places to the right, so $n = 7$.

Step 3 $0.000000823 = 0000008.23 \times 10^{-7}$

Step 4 8.23×10^{-7}

Answer: 8.23×10^{-7}

LESSON 7–4 Scientific Notation

KeyConcept Scientific Notation to Standard Form

Step 1 In $a \times 10^n$, note whether $n > 0$ or $n < 0$.

Step 2 If $n > 0$, move the decimal point n places right.
If $n < 0$, move the decimal point $-n$ places left.

Step 3 Insert zeros, decimal point, and commas as needed for place value.

EXAMPLE 2 Scientific Notation to Standard Form

A. Express 6.49×10^5 in standard form.

EXAMPLE 2 Scientific Notation to Standard Form

B. Express 1.8×10^{-3} in standard form.

EXAMPLE 3 Multiply with Scientific Notation

Evaluate $(5 \times 10^{-6})(2.3 \times 10^{12})$. Express the result in both scientific notation and standard form.

EXAMPLE 4 Divide with Scientific Notation

Evaluate $\frac{4.5\times10^{8}}{1.5\times10^{10}}$. Express the result in both scientific notation and standard form.

Check Your Understanding

= Step-by-Step Solutions begin on page R13.

Example 1 Express each number in scientific notation.

1. 185,000,000 1.85×10^8
2. 1,902,500,000 1.9025×10^9
3. 0.000564 5.64×10^{-4}
4. 0.00000804

MONEY Express each number in scientific notation.

5. Teens spend $13 billion annually on clothing. 1.3×10^{10}
6. Teens have an influence on their families' spending habit. They control about $1.5 billion of discretionary income.

Example 2 Express each number in standard form.

7. 1.98×10^7 19,800,000
8. 4.052×10^6
9. 3.405×10^{-8}
10. 6.8×10^{-5}

Example 3 Evaluate each product. Express the results in both scientific notation and standard form. 11–14. See margin.

11. $(1.2 \times 10^3)(1.45 \times 10^{12})$
12. $(7.08 \times 10^{14})(5 \times 10^{-9})$
13. $(5.18 \times 10^2)(9.1 \times 10^{-5})$
14. $(2.18 \times 10^{-2})^2$

Example 4 Evaluate each quotient. Express the results in both scientific notation and standard form. 15–18. See margin.

15. $\frac{1.035 \times 10^8}{2.3 \times 10^4}$
16. $\frac{2.542 \times 10^5}{4.1 \times 10^{-10}}$
17. $\frac{1.445 \times 10^{-7}}{1.7 \times 10^5}$
18. $\frac{2.05 \times 10^{-8}}{4 \times 10^{-2}}$

Additional Answers

11. 1.74×10^{15}; 1,740,000,000,000,000
12. 3.54×10^6; 3,540,000
13. 4.7138×10^{-2}; 0.047138
14. 4.7524×10^{-4}; 0.00047524
15. 4.5×10^3; 4500
16. 6.2×10^{14}; 620,000,000,000,000
17. 8.5×10^{-13}; 0.00000000000085

Practice and Problem Solving

Extra Practice is on page R7.

Example 1 **Express each number in scientific notation.**

20. 1,220,000 1.22×10^6

21. 58,600,000 5.86×10^7

22. 1,405,000,000,000 1.405×10^{12}

23. 0.0000013 1.3×10^{-6}

24. 0.000056 5.6×10^{-5}

25. 0.000000000709 7.09×10^{-10}

EMAIL **Express each number in scientific notation.**

26. Approximately 100 million emails sent to the President are put into the National Archives. 1×10^8

27. By 2015, the email security market will generate \$6.5 billion. 6.5×10^9

Example 2 **Express each number in standard form.** **28. 1,000,000,000,000**

28. 1×10^{12}

29. 9.4×10^7 94,000,000

30. 8.1×10^{-3} 0.0081

31. 5×10^{-4} 0.0005

32. 8.73×10^{11} 873,000,000,000

33. 6.22×10^{-6} 0.00000622

nple 2 **INTERNET** **Express each number in standard form.**

34. About 2.1×10^7 people aged 12 to 17 use the Internet. **21,000,000**

35. Approximately 1.1×10^7 teens go online daily. **11,000,000**

Examples 3–4 **Evaluate each product or quotient. Express the results in both scientific notation and standard form.**

36. $(3.807 \times 10^3)(5 \times 10^2)$ **1.9035×10^6; 1,903,500**

37. $\frac{9.6 \times 10^3}{1.2 \times 10^{-4}}$ **8×10^7; 80,000,000**

38. $\frac{2.88 \times 10^3}{1.2 \times 10^{-5}}$ **2.4×10^8; 240,000,000**

39 $(6.5 \times 10^7)(7.2 \times 10^{-2})$ **4.68×10^6; 4,680,000**

40. $(9.5 \times 10^{-18})(9 \times 10^9)$ **8.55×10^{-8}; 0.0000000855**

41. $\frac{8.8 \times 10^3}{4 \times 10^{-4}}$ **2.2×10^7; 22,000,000**

42. $\frac{9.15 \times 10^{-3}}{6.1 \times 10}$ **1.5×10^{-4}; 0.00015**

43. $(1.4 \times 10^6)^2$ **1.96×10^{12}; 1,960,000,000,000**

44. $(2.58 \times 10^2)(3.6 \times 10^6)$ **9.288×10^8; 928,800,000**

45. $\frac{5.6498 \times 10^{10}}{8.2 \times 10^4}$ **6.89×10^5; 689,000**

46. $\frac{1.363 \times 10^{16}}{2.9 \times 10^6}$ **4.7×10^9; 4,700,000,000**

47. $(5 \times 10^3)(1.8 \times 10^{-7})$ **9×10^{-4}; 0.0009**

48. $(2.3 \times 10^{-3})^2$ **5.29×10^{-6}; 0.00000529**

49. $\frac{6.25 \times 10^{-4}}{1.25 \times 10^2}$ **5×10^{-6}; 0.000005**

50. $\frac{3.75 \times 10^{-9}}{1.5 \times 10^{-4}}$ **2.5×10^{-5}; 0.000025**

51. $(7.2 \times 10^7)^2$ **5.184×10^{15}; 5,184,000,000,000,000**

52. $\frac{8.6 \times 10^4}{2 \times 10^{-6}}$ **4.3×10^{10}; 43,000,000,000**

53. $(6.3 \times 10^{-5})^2$ **3.969×10^{-9}; 0.000000003969**