Multiplying & Dividing by Powers of 10 and Scientific Notation

Multiplying & Dividing by Powers of 10:

Powers of 10 can be written in two ways:

- With an exponent: 10^3.
- In expanded form: 1000 which equals 10^3. (Note that the number of zeros is equivalent to the exponent)

To multiply by a power of 10, simply move the decimal to the **right** the same number of places as the exponent or as the number of zeros.

Example:

$32.5 \times 10^4 = 325\underline{} = 325,000.$

To divide by a power of 10, simply move the decimal to the **left** the same number of places as the exponent or as the number of zeros.

Example:

$\frac{674}{1000} = .674 = 0.674$

(**Note:** The decimal of a whole number is always to the right of the one's place.)

Another Way to Indicate Division by a power of 10 is to multiply by 10 to a negative exponent.

Example:

$\frac{4.56}{10^3} = \mathbf{4.56 \times 10^{-3}} = 0.00456$

So, to multiply by a negative exponent, you simply move the decimal point left the same number of places as the exponent indicates.

Scientific Notation:

Scientific notation is a way to write very large numbers and very small numbers (where the first significant digit is at least 3 or 4 places to the right of the decimal) in a more concise form, retaining the significant digits, but without writing so many zeros or the "insignificant" digits.

To Write a Number in Scientific Notation

1. Move the decimal to the right or left until there is **only one** nonzero digit to the left of the decimal point.
2. Multiply that number by a power of 10 that would give back the original number if you multiplied using the rules for multiplying & dividing by powers of 10.
   a. If you would need to move the decimal to the **right** to give back the original number, multiply by a 10 to a **positive** exponent.
   b. If you would need to move the decimal to the **left** to give back the original number, multiply by a 10 to a **negative** exponent.

Examples:

$5,739,987 = 5.739987 \times 10^6$

$0.00345 = 3.45 \times 10^{-3}$

To Change from Scientific Notation to a Number (Write the Place Value Name) – Simply follow the rules for multiplying & dividing by powers of 10 as shown above.

Multiplying & Dividing by Powers of 10 & Scientific Notation Practice

Multiply by Powers of 10:

1. $34.1 \times 10 =$ _____

2. $2.34 \times 10^2 =$ _____

3. $0.075 \times 1000 =$ _____

4. $8.23 \times 10^4 =$ _____

5. $0.00068 \times 100,000 =$ _____

6. $174.6 \times 10^4 =$ _____

7. $1.067 \times 100 =$ _____

8. $0.023 \times 10^5 =$ _____

9. $1.0 \times 1,000,000 =$ _____

10. $0.04 \times 10^5 =$ _____

Divide by Powers of 10:

11. $34.1 \div 10 =$ _____

12. $\frac{2.34}{10^2} =$ _____

13. $0.075 \div 1000 =$ _____

14. $\frac{8.23}{10^4} =$ _____

15. $0.00068 \div 100,000 =$ _____

16. $174 \times 10^{-4} =$ _____

17. $\frac{1.067}{100} =$ _____

18. $0.023 \times 10^{-5} =$ _____

19. $\frac{1.0}{1,000,000} =$ _____

20. $0.04 \times 10^{-5} =$ _____

Write the following numbers in scientific notation:

21. $13,900 =$ _____

22. $0.00000237 =$ _____

23. $28,170.3 =$ _____

24. $18,390,000 =$ _____

25. $0.0000426 =$ _____

26. $0.00000000777 =$ _____

27. $4369.107 =$ _____

28. $0.0087 =$ _____

Change from scientific notation to the number (place value name):

29. $5 \times 10^6 =$ _____

30. $8 \times 10^{-7} =$ _____

31. $2.18 \times 10^5 =$ _____

32. $7.39 \times 10^{-6} =$ _____

33. $3.47 \times 10^8 =$ _____

34. $6.5 \times 10^{-9} =$ _____

35. $6.11155 \times 10^6 =$ _____

36. $3.18 \times 10^{-6} =$ _____

Practice Key:

1. 341
2. 234
3. 75
4. 82,300
5. 68
6. 1,746,000
7. 106.7
8. 2300
9. 1,000,000

10. 4000
11. 3.41
12. 0.0234
13. 0.000075
14. 0.000823
15. 0.0000000068
16. 0.0174
17. 0.01067
18. 0.00000023

19. 0.000001
20. 0.0000004
21. 1.39×10^4
22. 2.37×10^{-6}
23. 2.81703×10^4
24. 1.839×10^7
25. 4.26×10^{-5}
26. 7.77×10^{-9}
27. 4.369107×10^3

28. 8.7×10^{-3}
29. 5,000,000
30. 0.0000008
31. 218,000
32. 0.00000739
33. 347,000,000
34. 0.0000000065
35. 6,111,550
36. 0.00000318