

Multiplication and division of decimals worksheet.

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Multiplication and division by powers of 10

Remember: To multiply a decimal by 10^n , move the decimal point n places to the right, adding zeros when necessary.

For example, $34.57 \cdot 10 = 345.7$; $45.23546 \cdot 1000 = 45235.46$; $23.7 \cdot 10000 = 237000.$.

Exercises: Multiply

- | | | |
|-----------------------|------------------------|-----------------------|
| 1. $23.456 \cdot 100$ | 2. $0.3456 \cdot 1000$ | 3. $12.45 \cdot 1000$ |
| 4. $0.4 \cdot 1000$ | 5. $1.3496 \cdot 10^5$ | 6. $25 \cdot 10^6$ |

Remember: To divide a decimal by 10^n , move the decimal point n places to the left, adding zeros when necessary.

For example, $34.57 \div 10 = 3.457$; $45.23546 \div 1000 = 0.04523546$; $0.237 \div 10000 = 0.0000237.$.

Exercises: divide

- | | | |
|----------------------|------------------------|----------------------|
| 7. $23.456 \div 100$ | 8. $0.3456 \div 1000$ | 9. $12.45 \div 1000$ |
| 10. $0.4 \div 1000$ | 11. $1.3496 \div 10^5$ | 12. $25 \div 10^6$ |
| 13. $1 \div 1000$ | 14. $1 \div 10^5$ | 15. $1 \div 100$ |
| 16. $1 \div 10^3$ | 17. $1 \div 10^7$ | 18. $1 \div 10$ |

A way to remember which direction the decimal point moves: When we multiply by a power of 10, we get a *bigger* number, so the decimal point moves to the right. When we divide, we get a *smaller* number, so the decimal point moves to the left.

Multiplication of general decimals

Recall: To multiply two or more decimals:

1. Multiply the decimals as if they were whole numbers, ignoring the decimal points.
2. Add the number of decimal places in each factor. This number will be the number of decimal places in the result.

Example: $2.3 \cdot 0.12$

1. Multiply $23 \cdot 12$ as usual, to get $23 \cdot 12 = 276$:

$$\begin{array}{r} 23 \\ \times 12 \\ \hline 46 \\ 230 \\ \hline 276 \end{array}$$

2. 2.3 has 1 decimal, 0.12 has 2 decimals, for a total of 3. Therefore the answer is 0.276 .

Example: $1.001 \cdot 1.12$

1. Multiply $1001 \cdot 112$ as usual, to get $1001 \cdot 112 = 112112$:

$$\begin{array}{r} 1001 \\ \times 112 \\ \hline 2002 \\ 10010 \\ 100100 \\ \hline 112112 \end{array}$$

2. 1.001 has 3 decimals, 1.12 has 2 decimals, for a total of 5. Therefore the answer is 1.12112 .

Multiply:

- | | | |
|--------------------------|------------------------|---------------------------|
| 19. $12.1 \cdot 1.2$ | 20. $0.12 \cdot 11$ | 21. $23.1 \cdot 0.002$ |
| 22. $13.1 \cdot 1.1$ | 23. $15 \cdot 11.2$ | 24. $0.00127 \cdot 0.005$ |
| 25. $5.5 \cdot 110$ | 26. $10.2 \cdot 42$ | 27. $3.1 \cdot 0.021$ |
| 28. $1002.1 \cdot 1.002$ | 29. $0.012 \cdot 0.02$ | 30. $21.1 \cdot 0.001$ |

31. $12.1 \cdot 0.1$

32. $0.12 \cdot 0.0001$

33. $23.1 \cdot 0.0000001$

(NOTE: multiplying by, for example 0.01 is the same as dividing by 100.)

Division of a decimal by a whole number

Recall: To divide a decimal by a whole number, divide as usual, remembering to put the decimal “.” in the quotient at the moment when you use the first digit in the dividend to the right of the decimal point.

If the division is not exact after all the numbers in the dividend have been used, add zeros after the decimal point in the dividend and keep dividing until the remainder is 0 or until you see a pattern.

When you have a pattern in the quotient that repeats, instead of writing the pattern infinitely many times, write a bar above the pattern that repeats. For example:

$$1.3333333 \dots = 1.\overline{3}. \text{ Or } 12.024653653653 \dots = 12.024\overline{653}$$

Exercises:

34. $12.6 \div 3$

35. $122.5 \div 5$

36. $231 \div 2$

37. $131 \div 5$

38. $14 \div 3$

39. $25 \div 6$

40. $5.25 \div 9$

41. $16.8 \div 42$

42. $1.344 \div 21$

43. $1002.1 \div 5$

44. $0.012 \div 6$

45. $21.1 \div 20$

Division of a decimal by another decimal

Recall: To divide a decimal by another decimal,

1. Move the decimal point to the right simultaneously in the dividend and divisor until the divisor becomes a whole number.
2. Divide as before.

Exercises:

46. $12.6 \div 0.03$

47. $122.5 \div 0.005$

48. $2.31 \div 2$

49. $133 \div 1.5$

50. $14 \div 0.03$

51. $0.121 \div 1.1$

52. $5.4 \div 0.9$

53. $16.8 \div 4.2$

54. $1.344 \div 0.021$

55. $1 \div 0.1$

56. $1 \div 0.000001$

57. $1 \div 0.0001$

Negative exponents

We have noticed that:

- Dividing by, say, 100 is the same as multiplying by 0.01.
- Dividing by, say, 0.001 is the same as multiplying by 1000.

Same as we express the numbers 10, 100, 1000, ... as $10^1, 10^2, 10^3, \dots$, it is very useful to have a way to express the numbers 0.1, 0.01, 0.001, ... in a similar way. This gives the following definition:

$$10^{-k} = \frac{1}{10^k}.$$

So for example, $10^{-1} = 1/10 = 0.1$; $10^{-4} = 1/10^4 = 0.0001$. In general, 10^{-k} will be 0.00...01, with a total of k decimals.

Exercises: Write the following powers of 10 as decimals.

58. $10^{-3} =$

59. $10^{-6} =$

60. 10^{-2}

61. $10^{-1} =$

62. $10^{-9} =$

63. 10^{-4}

64. $10^3 =$

65. $10^6 =$

66. 10^{-5}