

Rounding to Significant Digits

When doing mathematical calculations or finding measurements that require rounding, a decision has to be made as to how *precise* that answer must be.

Example 1: The length of a room is measured by three different people. The measurements taken are 6.8 meters, 7 meters, and 6.76 meters.

Which is the most precise measurement?

This can be determined by the number of “significant digits”, also called “significant figures”, in the measurement.

6.8 meters has 2 significant digits.

7 meters has 1 significant digit.

6.76 meters has 3 significant digits.

The measurement of 6.76 meters is more precise than 6.8 meters or 7 meters because it has more significant digits.

Rules for Determining the Number of Significant Digits in a Number

- 1. All non-zero digits (1 through 9) are significant, as seen in Example 1.**
- 2. Zeroes between non-zero digits are significant.**
 - 2034 has 4 significant digits.
 - 3.0005 has 5 significant digits.
- 3. Any zeroes to the left of the first non-zero digit are NOT significant (called leading zeroes).**
 - 0.005 has 1 significant digit.
 - 0.036 has two significant digits.

4. Any zeroes at the end of a number that contains a decimal point ARE significant (called trailing zeroes).

3.0 has 2 significant digits.

0.0250 has 3 significant digits.

800. has 3 significant digits.

800.0 has 4 significant digits.

5. Zeroes at the end of a whole number that does not contain a decimal point are not significant.

800 has 1 significant digit.

102,000 has 3 significant digits.

6. When numbers are in scientific notation, disregard the power of ten and use the above rules on the decimal number only.

3.8 X has 2 significant digits.

3.08 X has 3 significant digits.

3.080 X has 4 significant digits.

Multiplication and Division

To determine the number of significant digits in your final answer when multiplying or dividing, first do the calculation. Then round the answer to the same number of significant digits that is in the number with the *least* number of significant digits in your calculation.

Example 2: Convert 116 pounds to kilograms. Use the approximation $1\text{kg} = 2.2$ pounds.

$$116 \div 2.2 = 52.727272 \dots$$

116 has 3 significant digits.

2.2 has 2 significant digits.

So the final answer will have 2 significant digits, making it no more precise than the least precise.

Final answer: 53 kg.

Example 3: A child measures 25.75 inches tall. Convert this to centimeters.

Use the approximation $1\text{ in.} = 2.54\text{ cm}$.

$$25.75 \times 2.54 = 65.405$$

25.75 has 4 significant digits.

2.54 has 3 significant digits.

So the final answer will have 3 significant digits.

Final answer: 65.4 cm.

Adding and Subtracting

When adding or subtracting, first do the calculation. Then round the answer to the same number of decimal places (places to the right of the decimal point) as the number in the calculation with the *fewest decimal places*.

Example 4: $4.89\text{ ft.} + 1.9\text{ ft.} + 3.506\text{ ft.} = 10.296\text{ ft.}$

4.89 has 2 decimal places.

1.9 has 1 decimal place.

3.506 has 3 decimal places.

The fewest decimal places is 1.

The final answer is 10.3 ft.

Example 5: 2.5 liters – 1.268 liters = 1.232 liters.

2.5 has 1 decimal place.

1.268 has 3 decimal places.

The fewest decimal places is 1.

The final answer is 1.2 liters.

Note that it is not necessary to count the number of significant digits when adding or subtracting.

Significant Digits Practice Sets

Set A: Determine the number of significant digits in each number.

1. 2605.40
2. 10, 733
3. 0.00420
4. 990.
5. 325
6. 0.0004
7. 3000.0
8. 9.0 X
9. 2.36 X
10. 7 X
11. 7.00 X
12. 52,000
13. 8000
14. 325.00

Set B: Round to the number of significant digits indicated.

1. 5.67498 to 1 sig. dig.
2. 0.04102 to 3 sig. dig.
3. 2.998 to 2 sig.dig.
4. 26, 384 to 2 sig. dig.
5. 37.446 to 3 sig. dig.
6. 49.0385 to 3 sig. dig.
7. 0.00794 to 1 sig. dig.
8. 0.006008 to 3 sig. dig.
9. 825,066 to 1 sig. dig.
10. 30.0026 to 4 sig. dig.

Set C: Multiply or divide as indicated. Round the final answer to the appropriate number of significant digits.

1. 27.3×4.5
2. 4.68×400
3. 323×0.0002
4. $4008 \div 2.763$
5. $69 \div 7.0$
6. $4000 \div 23$
7. 30.0×25.00
8. $4.1 \times 6.22 \times 5.478$
9. $32 \div 5$
10. $4008 \div 3.0$
11. $0.009 \div 7$
12. $6.14 \times 30.5 \times 500.$
13. $30,000 \div 3.004$
14. 7.0000×0.003

Set D: Add or subtract as indicated. Round to the appropriate number of decimal places.

1. $5.72 + 2$
2. $500 - 79.4$
3. $0.006 + 0.04$
4. $84.3 - 0.009$
5. $66.3 + 27.008$
6. $67.45 - 12.2$
7. $13.708 - 4$
8. $76.62 + 23.245 - 40.1$
9. $64 - 3.88$
10. $5.05 + 6.2 + 3.89$
11. $75.0006 - 3.42 - 8$
12. $4005.2 + 0.6659$
13. $20,623.1 - 839.54 + 11.8$
14. $0.00516 + 0.003$

Answers to Practice Sets

Set A Answers: 1.) 6 2.) 5 3.) 3 4.) 3 5.) 3 6.) 1 7.) 5 8.) 2 9.) 3 10.) 1
11.) 3 12.) 2 13.) 1 14.) 5

Set B Answers: 1.) 6 2.) 0.0410 3.) 3.0 4.) 26,000 5.) 37.4
6.) 49.0 7.) 0.008 8.) 0.00601 9.) 800,000 10.) 30.00

Set C Answers: 1.) 120 2.) 2000 3.) 0.06 4.) 1451 5.) 9.9 6.) 200 7.) 750.
8.) 140 9.) 6 10.) 1300 11.) 0.001 12.) 93,600 13.) 10,000 14.) 0.02

Set D Answers: 1.) 8 2.) 421 3.) 0.05 4.) 84.3 5.) 93.3 6.) 55.3
7.) 10 8.) 59.8 9.) 60 10.) 15.1 11.) 64 12.) 4005.9 13.) 19,795.4
14.) 0.008