

PME1.8: CALCULATIONS FOR SIGNIFICANT FIGURES:

Rounding Off

Sometimes, numbers must be “rounded off” so that values do not appear to have more significant figures than would be appropriate or realistic.

Rule 1 If the last digit is greater than 5, the second last digit increases by 1 when rounding off.

Example 5.78 rounded off to 2 sig figs becomes 5.8
5.8 rounded off to 1 sig fig becomes 6 (not 6.0)

Rule 2 If the last digit is less than 5, the second last digit does not change.

Example 1.304 rounded off to 3 sig figs becomes 1.30
1.30 rounded off to 2 sig figs becomes 1.3
1.3 rounded off to 1 sig fig becomes 1.

Rule 3 If the last digit is 5, the number is rounded off to the nearest even number.

Example 4.85 rounded off to 2 sig figs becomes 4.8
4.55 rounded off, becomes 4.6

Exercise 1

Round off each of the following numbers to one less significant figure and then to two less significant figures.

Example: 6.549 → 6.55 → 6.6

- (a) 7.668 (b) 0.0854 (c) 21.092
(d) 255.6 (e) 35.3 (f) 6.75 (g) 2.85

Addition and Subtraction

When adding or subtracting, line up the values with the decimal places aligned. Examine the example below.

Only complete columns can be added or subtracted, so first round off all values to the same number of decimal places.

Example 1

Add 6.703, 2.49 and 11.7368, giving the answer to the correct number of decimal places.

6.703	rounds off to 2 dec. places	6.70
2.49	rounds off to 2 dec. places	2.49
11.7368	rounds off to 2 dec. places	<u>11.74</u>
		20.93

Answer: 20.93 (not 20.9298)

Note: If numbers are added and subtracted by the method shown above, the number of significant figures in the answer will automatically be correct.

Exercise 2

Calculate the following, giving answers to the correct number of decimal places.

- (a) $6.9 + 0.35 + 12.625$ (b) $27.1 + 13 + 64.51$
(c) $8.72 - 3.001 - 0.2$ (d) $67.4 - 18.37 + 0.55$
(e) $0.003 + 0.0125 - 0.00378$

Multiplication and Division

When multiplying and dividing, the answer must not have more significant figures than the original value with the least number of significant figures.

Example 2

$5.2 \times 6.3 = 32.76$ if you multiply it all the way, but both the original values have only 2 sig figs, so the answer must be rounded off to 2 sig figs.

Thus, $5.2 \times 6.3 = 33$, correct to 2 sig figs.

Example 3

$0.93 \times 5.41 = 5.03013$ if you multiply it all the way, but one of the original values has 2 sig figs, while the other has 3 sig figs, so the answer must be given to 2 sig figs, ie the answer must not have more significant figures than the original value with the least number of significant figures.

Thus, $0.93 \times 5.41 = 5.0$, correct to 2 sig figs.

Example 4

$2.70 \div 16.44 = 0.1642335 = 0.164$, corrected to 3 sig figs.

ie the answer must not have more significant figures than the original value with the least number of significant figures.

Exercise 3

Calculate the following, giving answers to the correct number of significant figures.

- (a) 8.3×0.25 (b) 0.2×1.3 (c) $1.13 \times 3.5 \times 0.964$
(d) 6.71×3.4 (e) $3.000 \times 91 \div 72.60$ (f) $450 \times 3 \div 0.671$

ANSWERS

Exercise 1

- (a) 7.668 → 7.67 → 7.7
(b) 0.0854 → 0.085 → 0.08
(c) 21.092 → 21.09 → 21.1
(d) 255.6 → 256 → 260
(e) 35.3 → 35 → 40
(f) 6.75 → 6.8 → 7
(g) 2.85 → 2.8 → 3

Exercise 2

- (a) 19.9 (b) 104 (c) 5.5 (d) 49.6 (e) 0.011

Exercise 3

- (a) 2.1 2 sig figs
(b) 0.3 1 sig fig
(c) 3.8 2 sig figs
(d) 2.3×10^1 2 sig figs
(e) 3.8 2 sig figs
(f) 2×10^3 1 sig fig