Solutions to xaktly.com problems: Average/Mean

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Problem 0:

I worked this problem out using a spreadsheet. It's a little confusing with atomic weights, because the weight of the isotope gets confused with the relative weight of that data point in the average (the percent abundances, in this case).

Isotope	Atomic weight	Weight	Data*weight
^{28}Si	27.9769	92.23	2580.31
^{29}Si	28.9765	4.67	135.32
^{30}Si	29.9738	3.10	92.92
	Sum of wts. →	100	2808.55 ← sum of data*weight
			28.09 ← weighted average

Problem 1:

(a) Arithmetic: $\bar{x} = 62.4$ Geometric: $\bar{x} = 10.4$

For this data, the two points near 200 skew the arithmetic average far from the five other points, therefore the geometric mean might be more appropriate. It depends on the circumstances.

(b) Arithmetic: $\bar{x} = 11.6$ Geometric: $\bar{x} = 11.4$

For this data, the geometric and arithmetic means are nearly the same. Either average is OK, but we would usually default to the arithmetic mean.

(c) Arithmetic: $\bar{x} = 5.8$ Geometric: $\bar{x} = 5.8$

Because both means are identical, either will work, though in such cases we usually opt for the arithmetic mean.

(d) Arithmetic: $\bar{x} = 60.6$ Geometric: $\bar{x} = 7.9$

This is a tough one. Each datapoint differs in value by an order of magnitude from the next. Which mean is more appropriate will be situation-dependent.

Problem 2:

I used a spreadsheet for this problem. It's an easy way to do the calculations, keep everything organized and annotate the whole thing so it's readable.

Datum	Uncertainty	Weight	Data*weight	
30.1	0.2	5.00	150.5	
40.2	1.0	1.00	40.2	
37.3	0.5	2.00	74.6	
31.4	0.6	1.67	52.3	
29.9	1.1	0.91	27.2	
32.0	0.2	5.00	160.0	
33.9	0.2	5.00	169.5	
33.1	0.1	10.00	331.0	← most significant data point
32.3	0.7	1.43	46.1	
33.9	0.4	2.50	84.8	
38.4	0.7	1.43	54.9	
28.2	1.2	0.83	23.5	← least significant data point
	Sum of wts. →	36.77	1214.6	← sum of data*weight
			33.0	← weighted average

Problem 3:

Datum	(Datum)^2	
-4.1	16.8	
-2.1	4.4	
3.2	10.2	
-3.3	10.9	
2.2	4.8	
2.8	7.8	
-2.7	7.3	
-3.5	12.3	
4.3	18.5	
8.4	70.6	
-4.9	24.0	
-2.1	4.4	
-0.15	192.0	← Sum of the squares of the data

16.0 ← Sum of squares divided by (n=12)

4.0 ← Square root

On average, the points are about 4 units from zero.

Datum is singular
Data is plural

This is the straight arithmetic average of the data. Because it includes a roughly equal mixture of positive and negative points, it's close to zero.