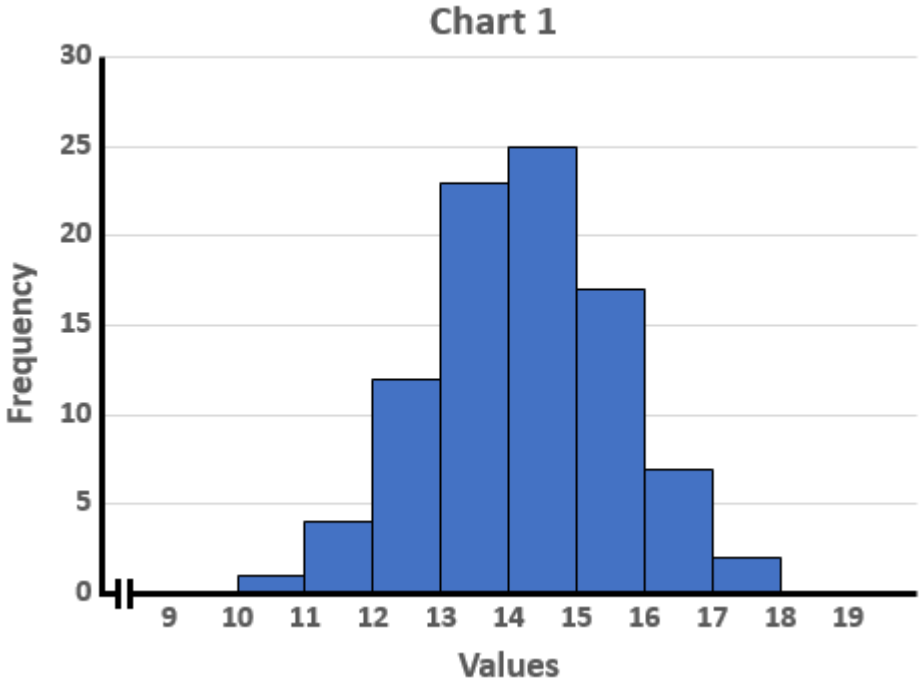
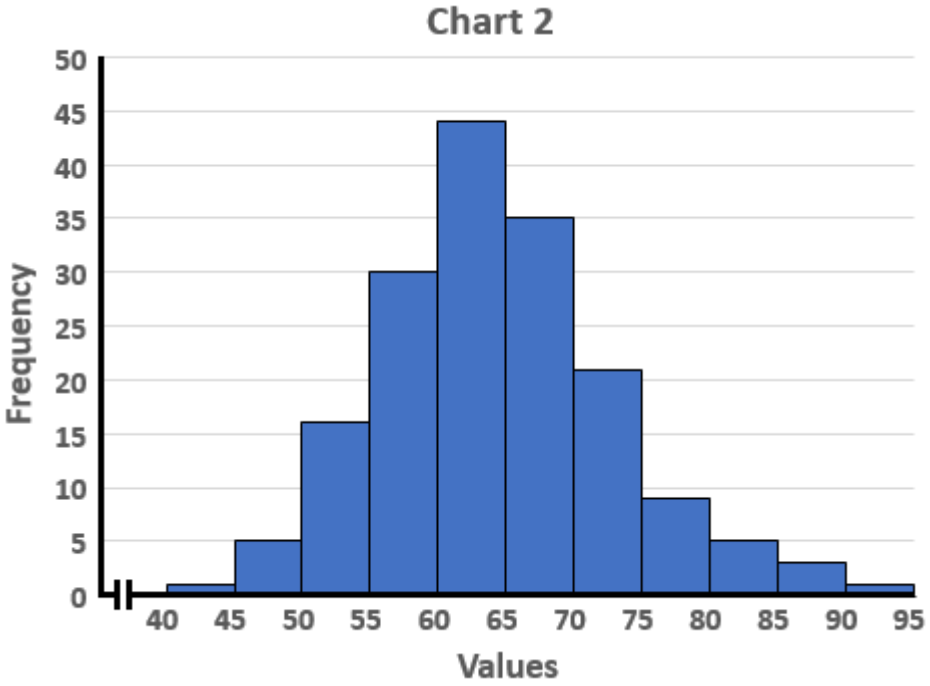
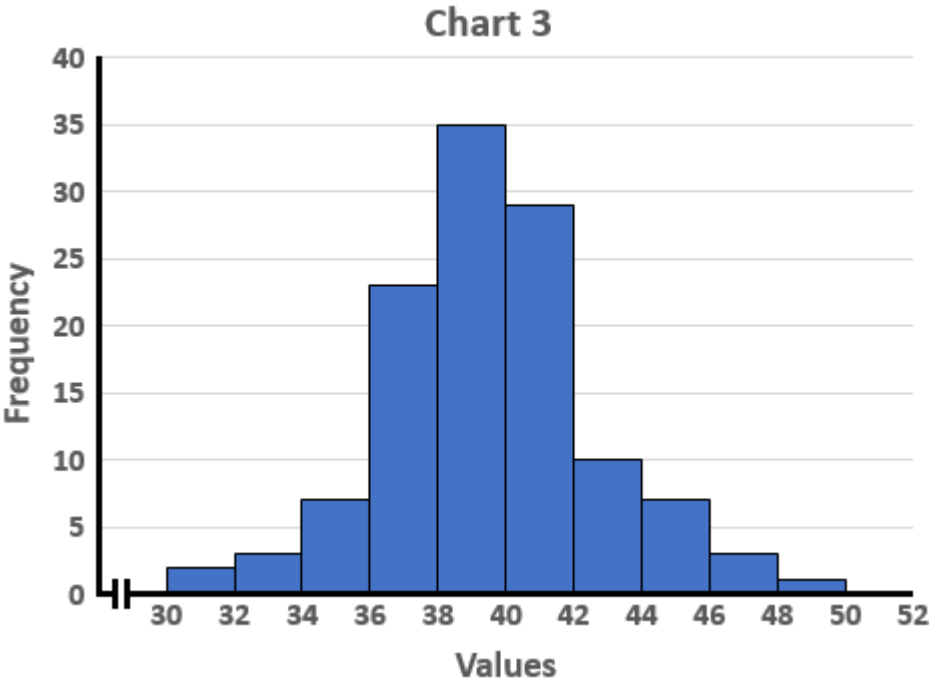
## L2 Histograms Practice #1

For the three histograms here:

- discuss whether the distribution is Normal or not;
- estimate mean and median, and discuss any difference;
- estimate standard deviation.



## Answers – L2 Histograms Practice #1

Marks will depend as much on discussion of evidence as values given. Key terminology should be used rather than general terms.

The key features for a distribution being Normal should be discussed in each answer:

- "bell curve" shape fits the middle of the columns;
- symmetrical, allowing for some random variation in practice;
- drops off to effectively zero at 3 standard deviations.

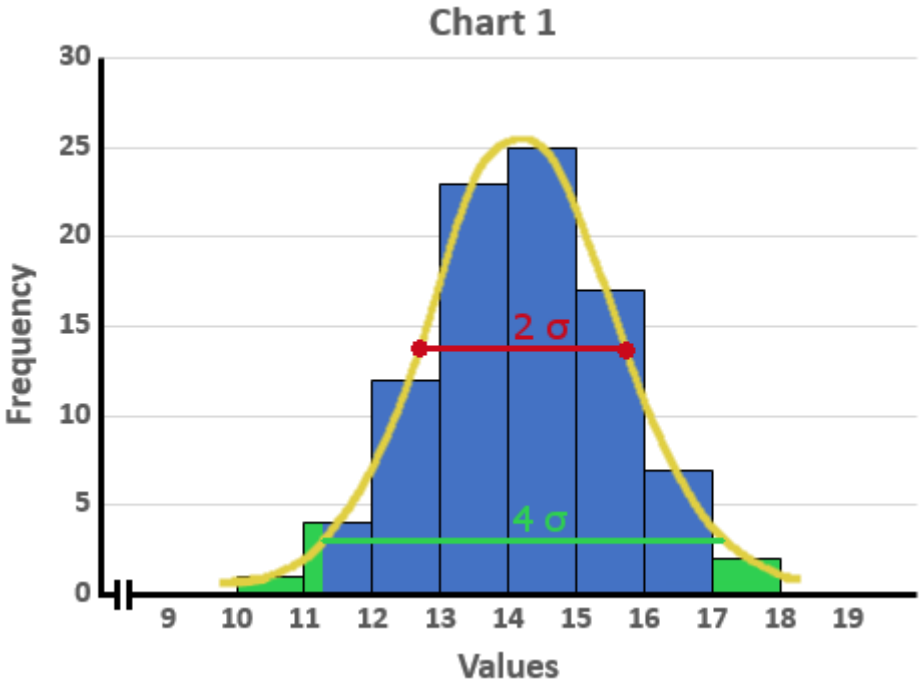
The median can be found by adding up the total frequency and counting in from either end.

The mean will be the median, moved towards any skew away from symmetrical.

The standard deviation can be estimated by two methods:

- shown in red, the distance between the inflection points (where the curve stops getting steeper) is 2 σ;
- shown in green, the middle 95% of values covers 4 σ, so the outermost 5% of values can be counted off and the distance found ÷ 4.

Note, while all distributions have a standard deviation that we cannot make probability calculations for non-Normal ones. If a distribution is wildly non-Normal then σ cannot be calculated as if it is Normal.




This is pretty much a perfect Normal distribution. (Too perfect to likely to be real, in fact, because real curves will have some random variation from perfect.)

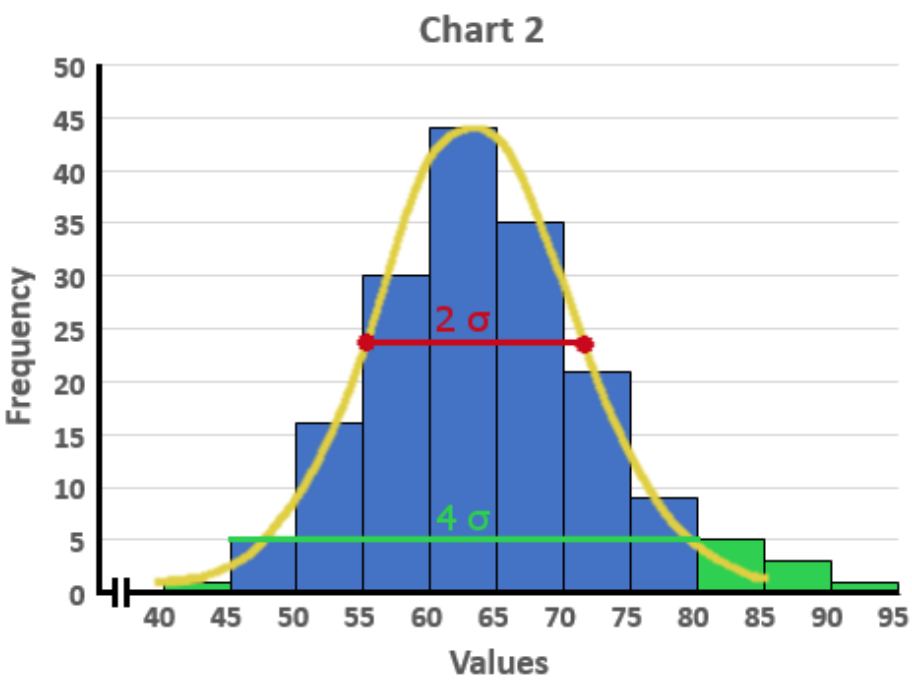
A curve through the centres of each column head is a bell shape, completely symmetrical. The values taper off quickly at the ends.

There are 91 values, and the 41$^{st}$ = median = about 14.2, but certainly somewhere in the region of 14.1 to 14.5.

The mean will be the same as the median. The peak of the bell curve is at 14.2 or so, which fits with calculation of the median.

Standard deviation is about 1.4, definitely in the range 1.25–1.6.

This can be seen from the red 2σ distance between the two points of inflection which are 3 apart, indicating σ = 1.5. Alternatively the green 4σ distance containing the middle 95% of values is 5.5, indicating σ = 1.4.




This is not Normal. This is somewhat like a Normal distribution, but skewed with too many very high values – too many to be merely random fluctuation.

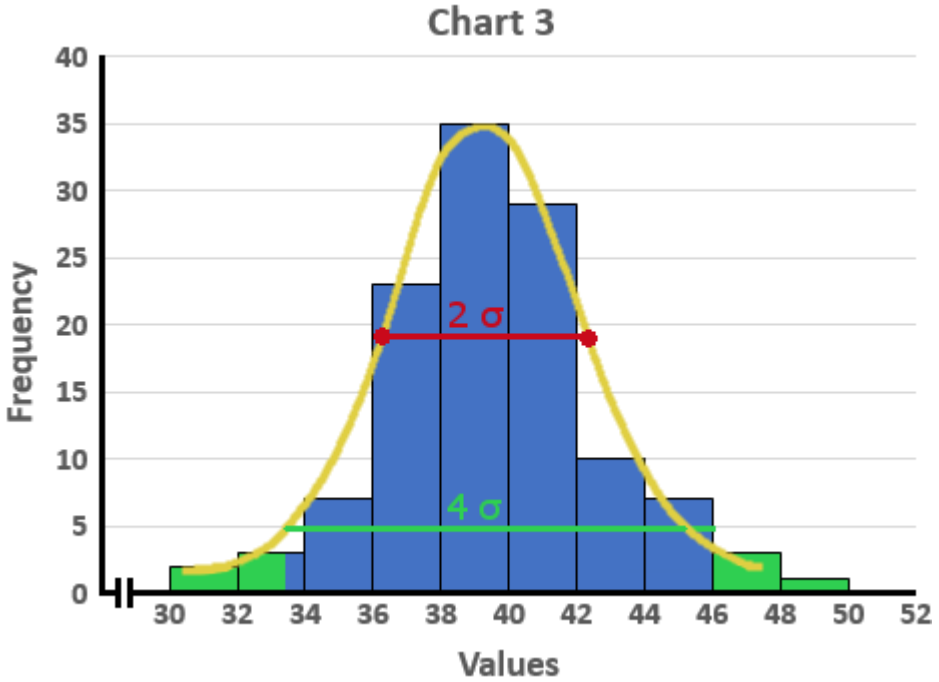
A symmetrical curve through the centres of each column in a bell shape, shows the strong skew for high values.

There are 160 values, so the median is the 80$^{th}$/81$^{st}$, which is about 64. The eight very high values only drift it four values right from the peak at 63.

The mean will be higher than the median because extreme values have a much larger effect on mean, giving a mean of around 66.

Standard deviation is in the range 8–9, although being non-Normal the s.d. is not useful for calculations of probability.

This can be seen from the red 2σ distance between the two points of inflection which are 17 apart, indicating σ = 8.5. Alternatively the green 4σ distance containing the middle 95% of values is 35, indicating σ = 8.75.




This is not Normal. This is very like a Normal distribution, but with too many very high values at both ends – too many to be merely random fluctuation. (Alternatively, the centre spikes too high for the ends a low flat curve would fit the ends, but not the middle.)

A symmetrical curve through the centres of each column is a bell shape, but it does not drop to zero at the ends fast enough.

The mean and media are about 39.5, surely in the range 39–40.

There are 125 values, so the median is the 63$^{rd}$, which is about 39. This matches that our bell curve peaks at just over 39 as the column right of 38–40 is higher than the one left.

Standard deviation is about 3, although being non-Normal the s.d. is not useful for calculations of probability.

This can be seen from the red 2σ distance between the two points of inflection which are 6 apart, indicating σ = 3. Alternatively the green 4σ distance containing the middle 95% of values is 12.5, indicating σ = 3.1.