Measurement of a Sine-wave signal:

The sine-wave signal shown below is typical of what you would measure with an oscilloscope. This particular example here the signal has a positive peak of 14.1415 volts and a negative peak of –14.1415 volts. If you were to measure the signal from the positive peak to the negative peak that would be defined as its peak to peak voltage or Vpp. In the example here that would be Vpp = 2 Vp = (2)(14.1415) = 28.283 volts. The oscilloscope has moveable cursors which can be placed at any point on the waveform to get a voltage reading at that point.

However, if you were to measure this same signal with typical DVM (Digital Voltmeter) you would fine it would read 10 volts. The reason the measurement values are different is that the DVM reads the RMS (Root Mean Square) of the sine-wave voltage. Mathematically, for the Sine-wave only, that would come out to be 0.707 of its peak voltage

\[ V_{rms} = (0.707)(V_p) = (0.707)(14.1415) = 10 \text{ volts} \]

This Vrms is the effective heating value of the sinusoidal voltage. In other words it’s the voltage you would use to when you make Power calculations. The 0.707 is equal to one over the square root of 2.

In summary:

\[ V_{pp} = 2 V_p \text{ or } V_p = V_{pp}/2 \]

\[ V_{rms} = 0.707 V_p \text{ or } V_p = V_{rms}/0.707 \]

The two diagrams that follow on the next page illustrate what was just stated. The second diagram shows how the signal is measured.
For a Sinewave only, Vrms = 0.707Vp
so for this example Vrms = (0.707)(14.1415) = 10 volts

\[ V_{pp} = 2V_p = 28.283 \text{ volts} \]

\[ V_p = 0 \text{ volts} \]

\[ V_p = 14.1415 \text{ volts} \]