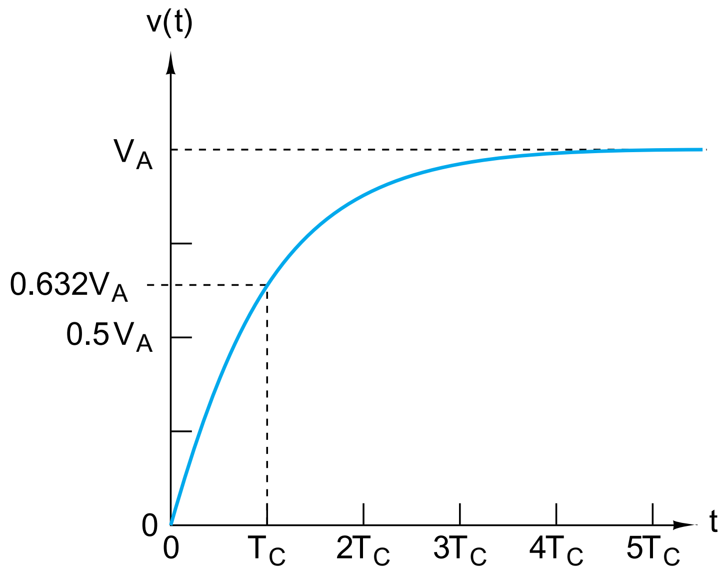
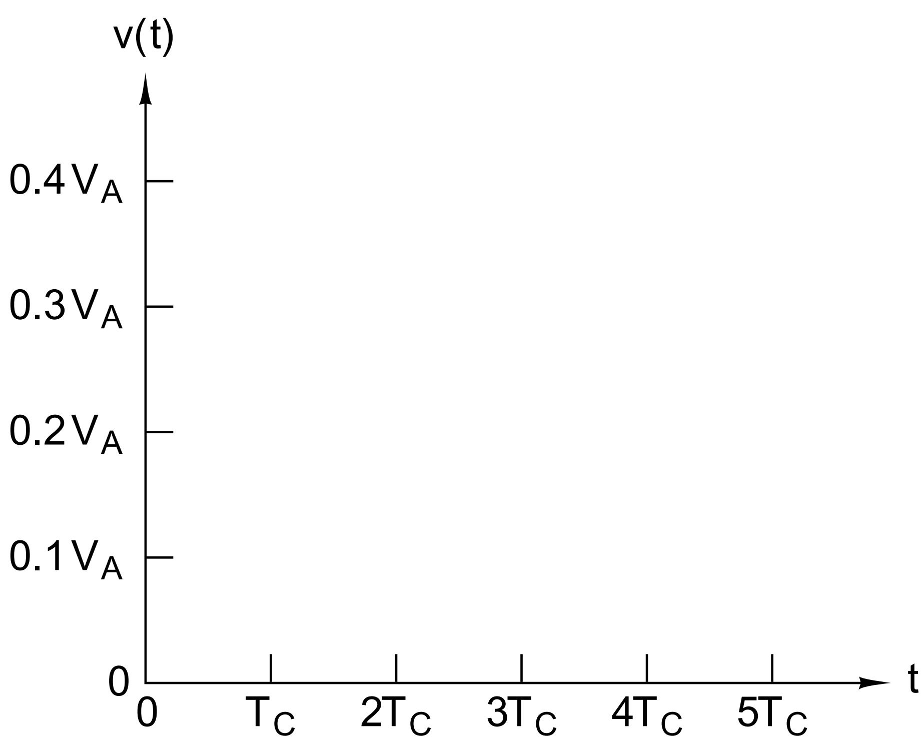
Composite Waveforms- combining the basic waveforms to make really nasty stuff.

e.g, express the following curve in terms of simple waveforms:



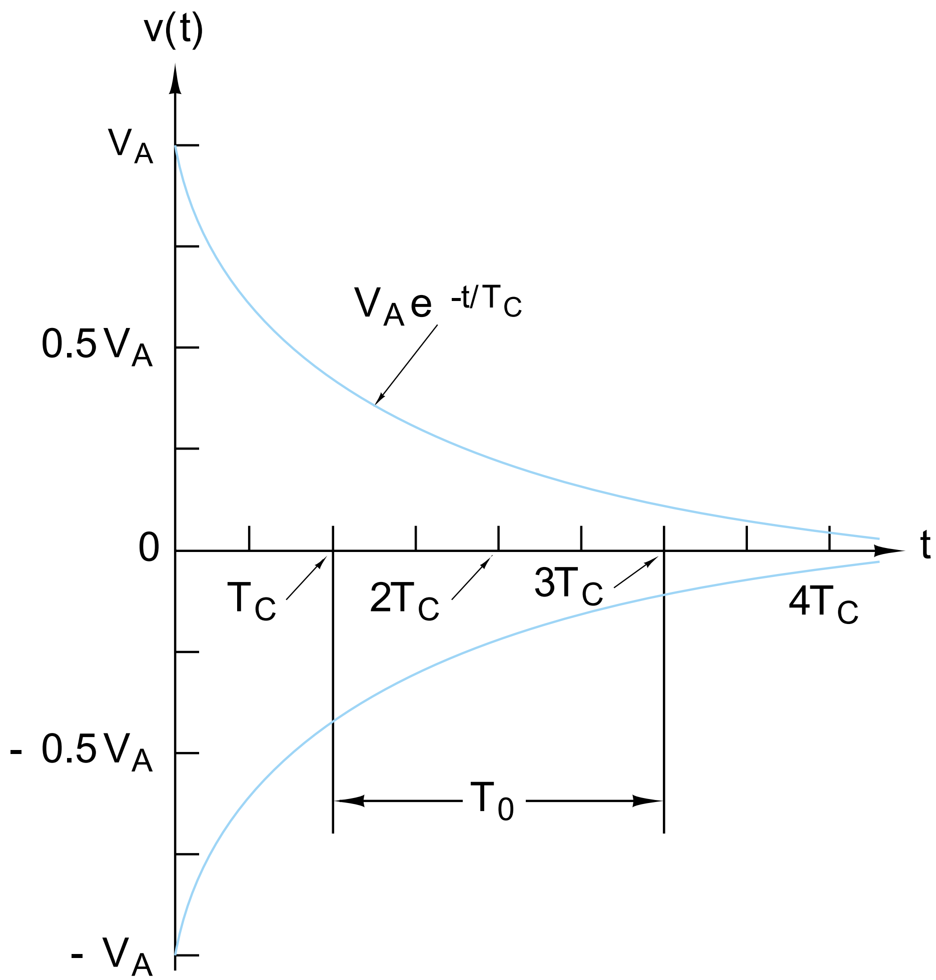
Putting the hand on the other foot, characterize the following waveform:

$$v(t) = \frac{r(t)}{T_C}\left[V_A e^{-t/T_C}\right]u(t)$$

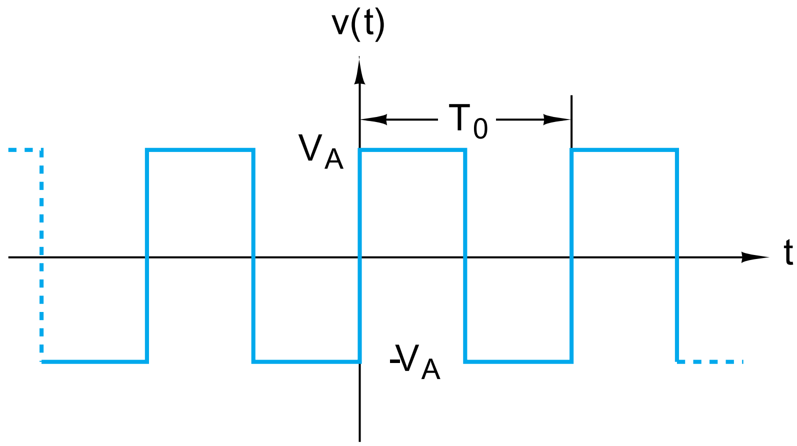


And you thought you only had two feet... characterize this waveform too:

$$v(t) = \sin \omega_o t \left[V_A e^{-t/T_C} \right] u(t)$$



And back to stepping on our hands, develop an equation for the following square wave:



Back to the books...

instantaneous value vs. waveform/function/signal

Temporal descriptors:

a signal is periodic iff $\exists\ T_o$ s.t. $v(t+T_o)=v(t)\ \forall\ t$

a signal is causal iff $\exists$ T s.t. $v(t)\equiv 0\ \forall\ t<T$

(If you can't follow this notation, the book says the same thing in English)

<u>Amplitude descriptors</u>:

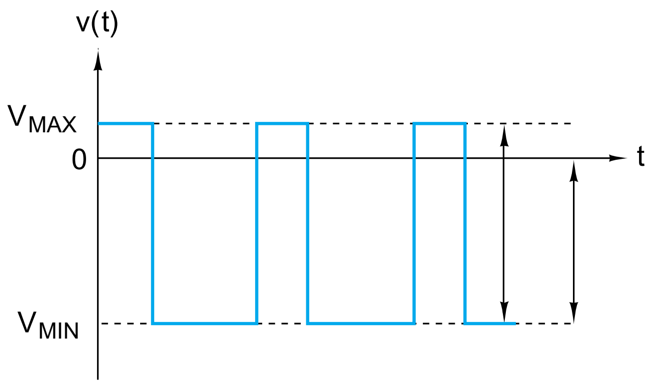
When we're out together dancing peek to peek...

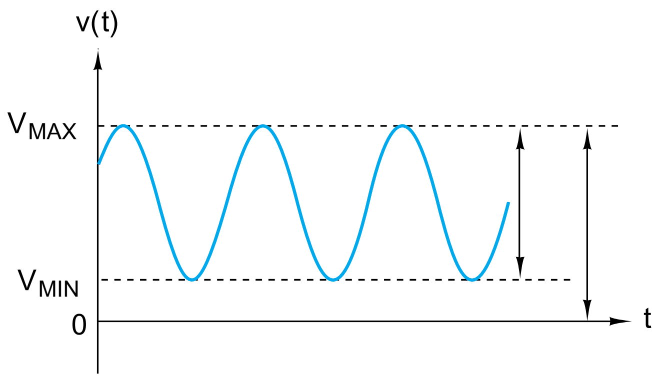
<u>peek to peek</u> voltage (or other signal) is defined by:

$$V_{pp} = V_{Max} - V_{Min}$$

<u>peek</u> voltage (or other signal) is defined by:

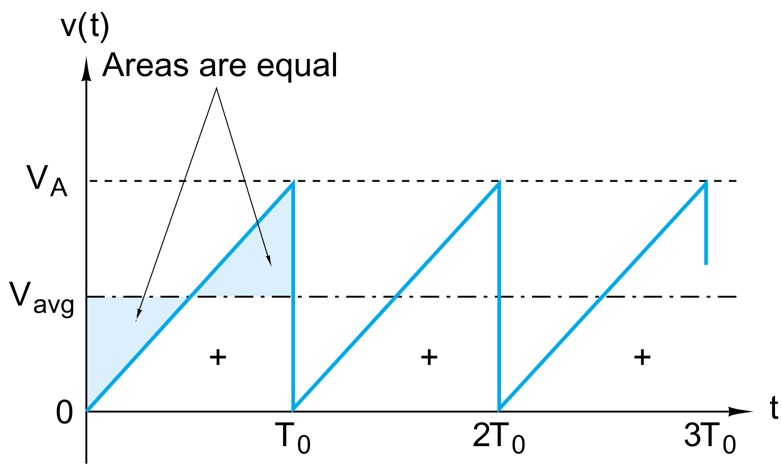
$$V_p = \max\left(\left|V_{Max}\right|, \left|-V_{Min}\right|\right)$$

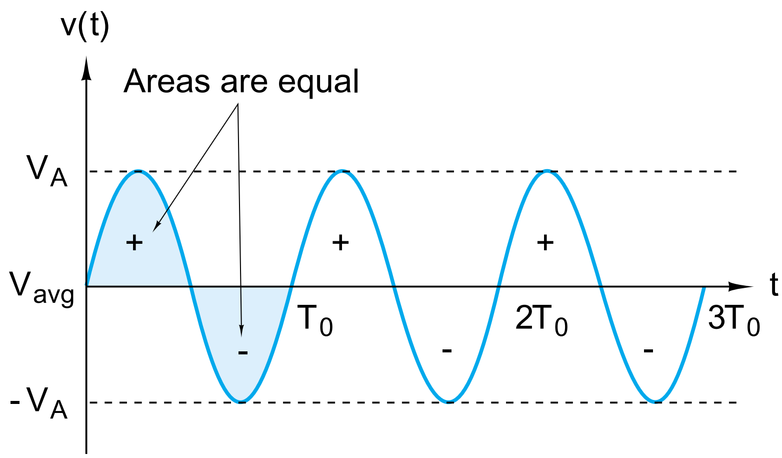




<u>average</u> voltage (or other signal) over interval T is defined by:

$$V_{avg} = \frac{1}{T}\int_{t}^{t+T} v(x)dx$$





Root mean square (RMS) - applying what we know to something you will see much more of in future classes

instantaneous power: $p(t) = \frac{1}{R}[v(t)]^2$

average power: $P_{avg} = \frac{1}{T}\int_t^{t+T} p(x)dx = \frac{1}{R}\left[\frac{1}{T}\int_t^{t+T}[v(x)]^2 dx\right]$

now take the square root and note that "mean"="avarage"

RMS voltage: $V_{rms} = \sqrt{\frac{1}{T}\int_t^{t+T}[v(x)]^2 dx}$

finally, $P_{avg} = \frac{1}{R}V_{rms}^2$

RMS voltage provides a measure of the power carried by a periodic signal.

"If you put a tin can in the microwave, you'll be as powerful as they are"

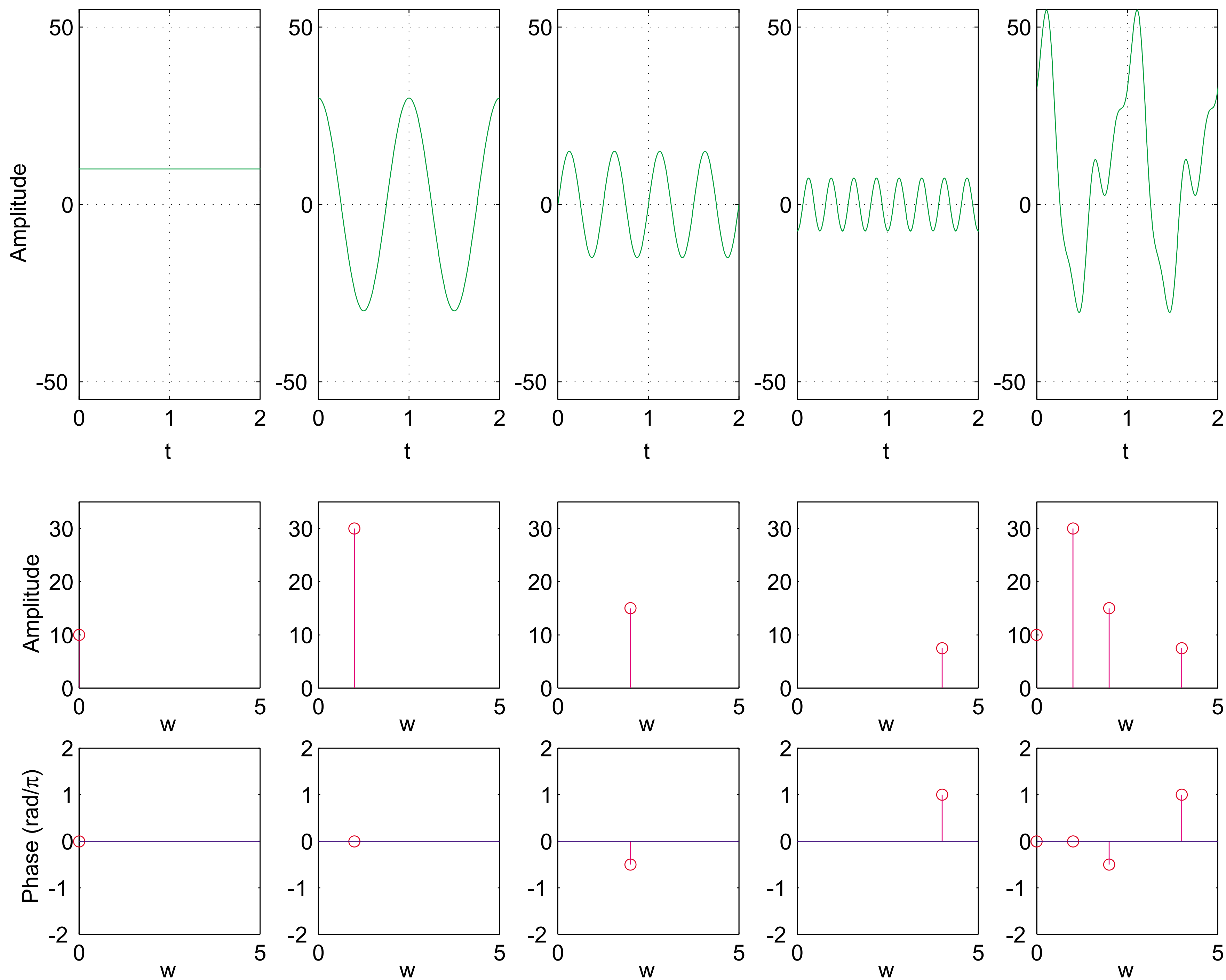
$$v(t) = V_A \cos(\omega_O t + \phi)$$

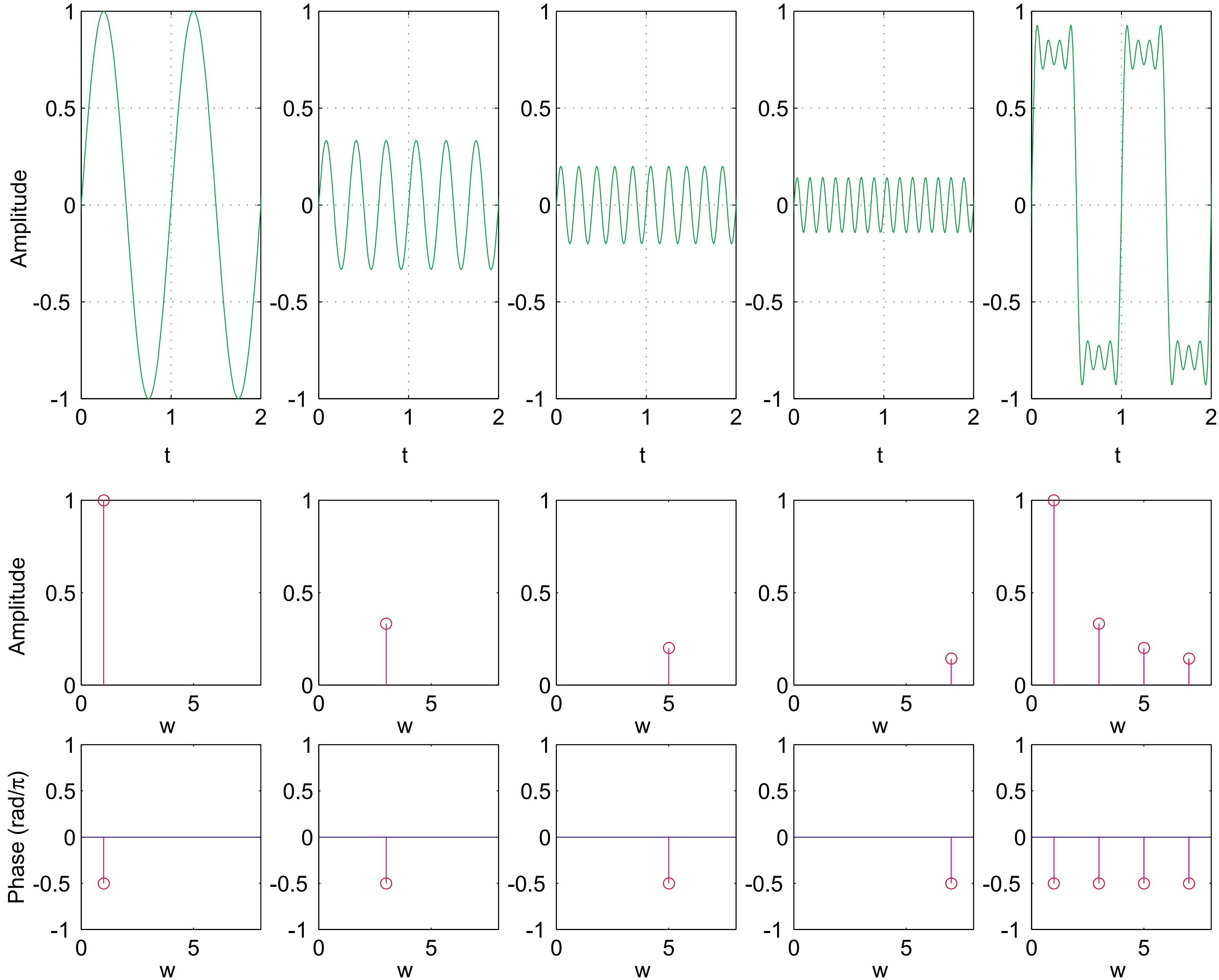
this periodic signal is characterized by three parameters:

Amplitude: V_A
Frequency: ω_o
Phase: ϕ

By combining sinusoids (some times an infinite number of them), we can build any periodic signal.

In fact, if the signal of interest has a frequency ω_o (how does this relate to T?) we will only need to use sinusoids at the <u>fundamental frequency</u>, ω_o and <u>harmonic frequencies</u> $n \cdot \omega_o$.


Amplitude
t
Amplitude
w
Phase (rad/π)
w


Amplitude
t
Amplitude
w
Phase (rad/π)
w