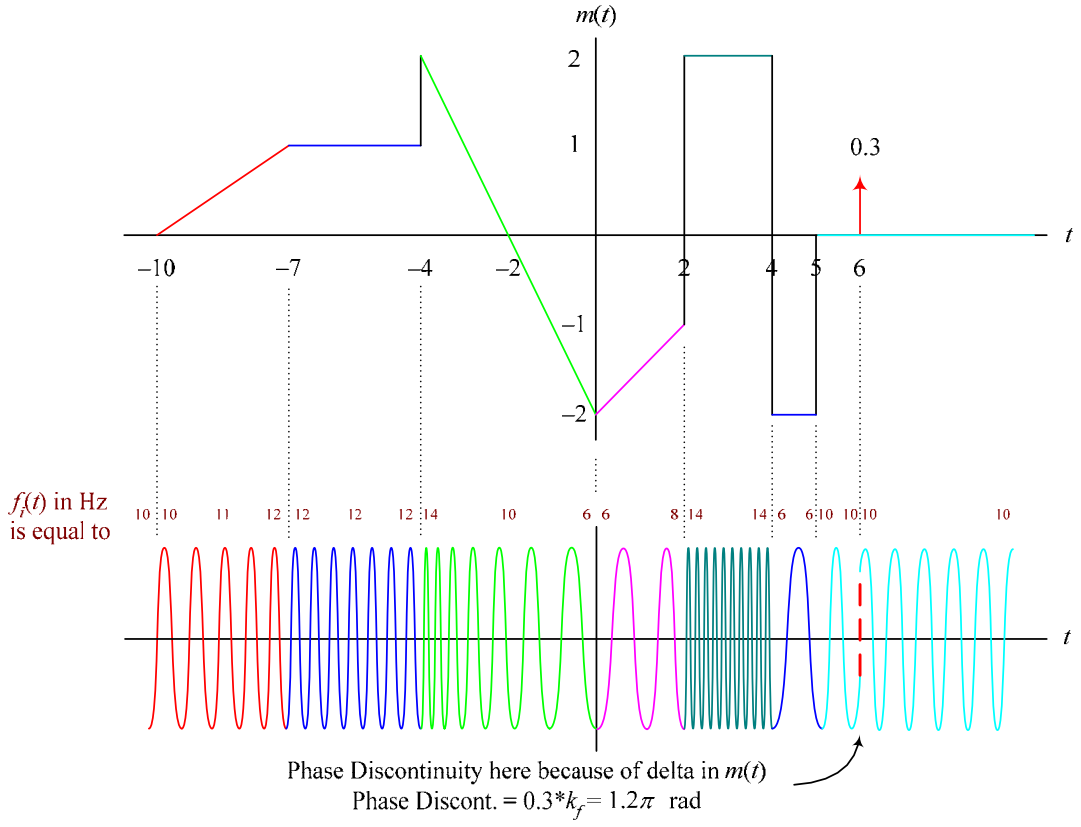
Continuity of the Phase of PM and FM signals

Message signals that are phase or frequency modulated can be classified into
a) continuous signals WITH NO delta functions,
b) discontinuous signals WITH NO delta functions,
c) continuous signals WITH delta functions.
c) discontinuous signals WITH delta functions.
For the above signals, we can summarize the continuity or discontinuity of the phase of PM and FM signals in the following table.

Signal	$\theta_{PM}(t)=\omega_c t+k_p m(t)$	$g_{PM}(t)$	$\theta_{FM}(t)=\omega_c t+k_f\int_{-\infty}^{t} m(\alpha)d\alpha$	$g_{FM}(t)$
a)	Continuous	Cont.	Continuous	Cont.
b)	Discontinuous	Discont.	Continuous	Cont.
c)	Cont. with delta functions	Cont. with random phase at deltas	Discontinuous WITH NO delta functions	Discont.
d)	Discont. with delta functions	Discont. with random phase at deltas	Discontinuous WITH NO delta functions	Discont.

Example 1: Sketch the FM signal that results when modulating the message signal $m(t)$ shown below with $k_f = 2\pi(2)$ and $\omega_c = 2\pi(10)$ rad/s.



Example 2: Sketch the PM signal that results when modulating the message signal $m(t)$ shown below with $k_p = 2\pi$ and $\omega_c = 2\pi(14)$ rad/s.

To sketch the PM signal, we can compute $dm(t)/dt$ and sketch the frequency modulated signal when $dm(t)/dt$ is input to an FM block similar to Example 1.