NAVY DEPARTMENT

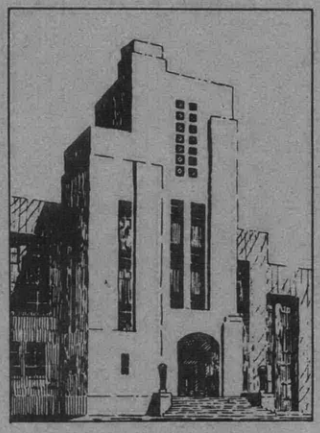
THE DAVID W. TAYLOR MODEL BASIN

WASHINGTON 7, D.C.

A MANUAL FOR WAVEFORM ANALYSIS

by

Alice W. Mathewson



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A MANUAL FOR WAVEFORM ANALYSIS

by

Alice W. Mathewson

In the analysis of vibration records a laborious harmonic analysis may frequently be avoided by direct comparison of the records with the waveforms obtained by combining simple harmonic functions of various frequencies, phase relations, and amplitudes. A reasonably accurate harmonic analysis of such records is essential for their interpretation. The purpose of this manual is to present a simple guide for the approximate analysis of such records. A group of sample curves and their sinusoidal components, which represent the most frequent forms encountered, has been plotted for the convenience of technical personnel working in the fields of vibration, sound, and electricity.

Several texts treat the subject of the analysis of waveforms very thoroughly, notably "Waveform Analysis," by R.G. Manley.* This manual is intended to act only as a supplement to such a text. Since most test data consist of many hundreds of records, the element of time is very important and it is very convenient to have a set of sample curves for comparative purposes. Most sets given in texts are not extensive enough. It is hoped that the set given herein covers the most general records obtained and will aid in a speedier performance of an otherwise tedious task.

The waveforms included are combinations of the fundamental and higher harmonics up to and including the fourth harmonic. Each combination is plotted for phase angles from 0 to 2π taken in increments of $\pi/4$.

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*Manley, R.G., "Waveform Analysis," John Wiley and Sons, Inc., 1946.

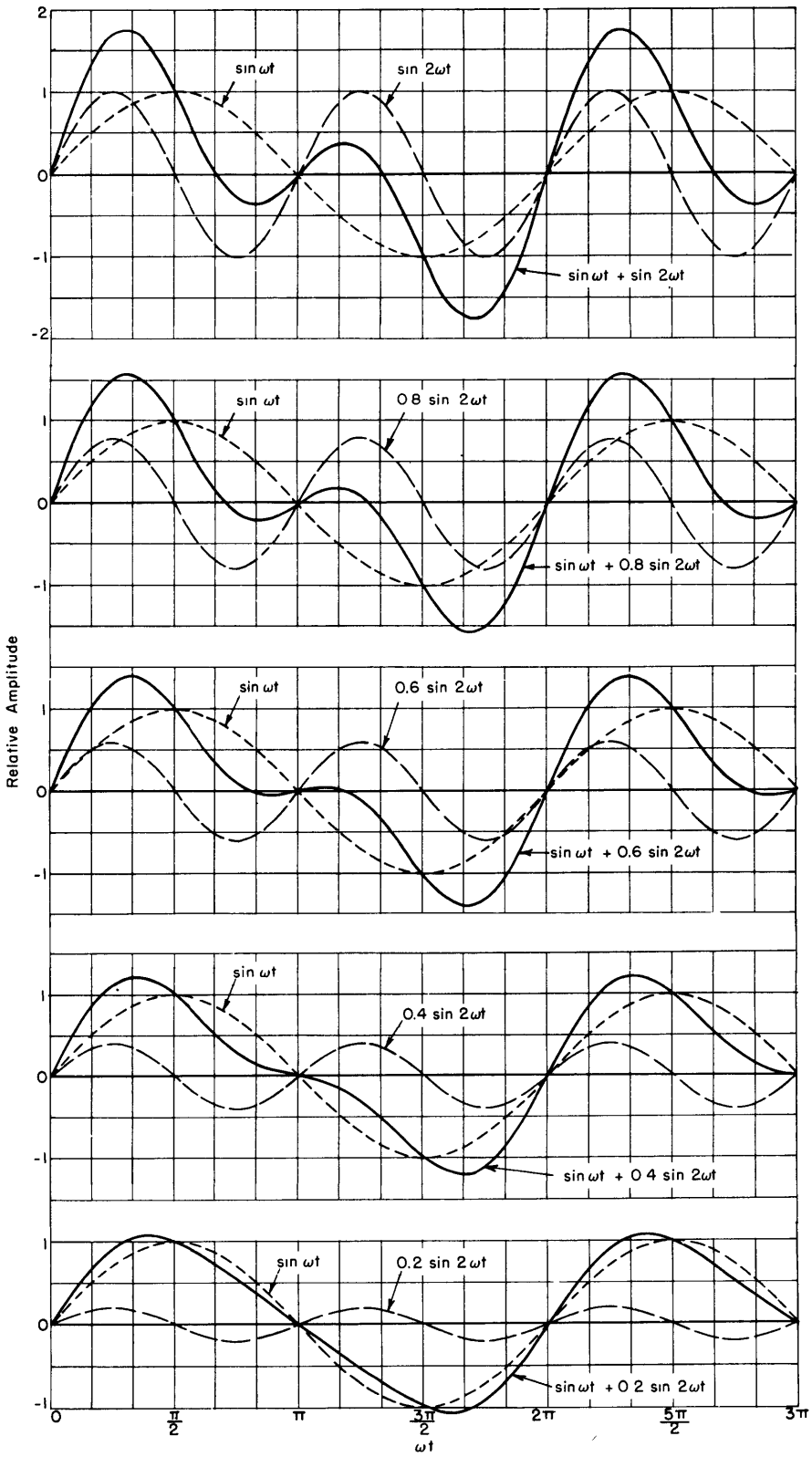

Figure 1 - Fundamental and Second Harmonic, 0 Phase Angle

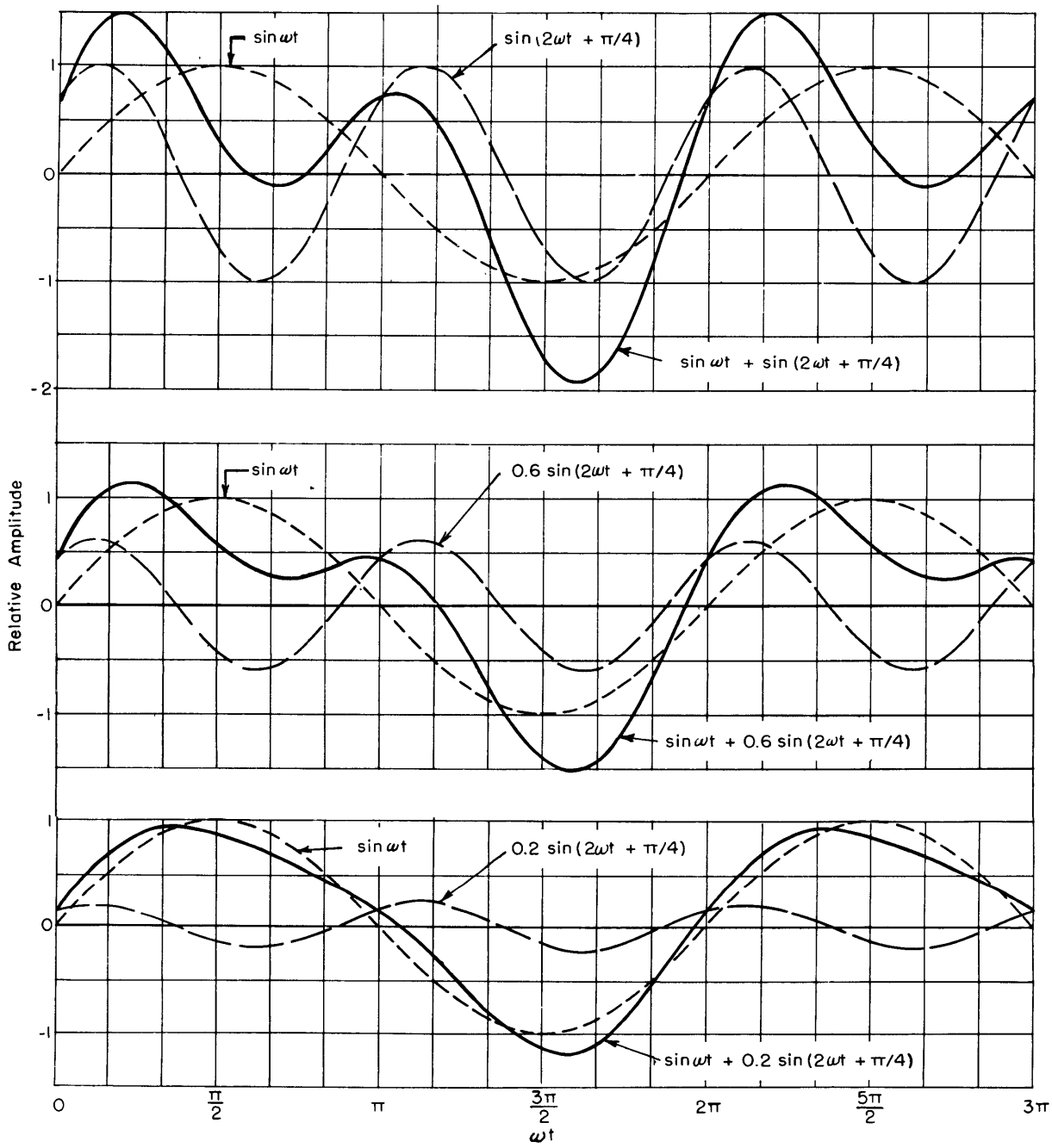

Figure 2 - Fundamental and Second Harmonic, $\pi/4$ Phase Angle

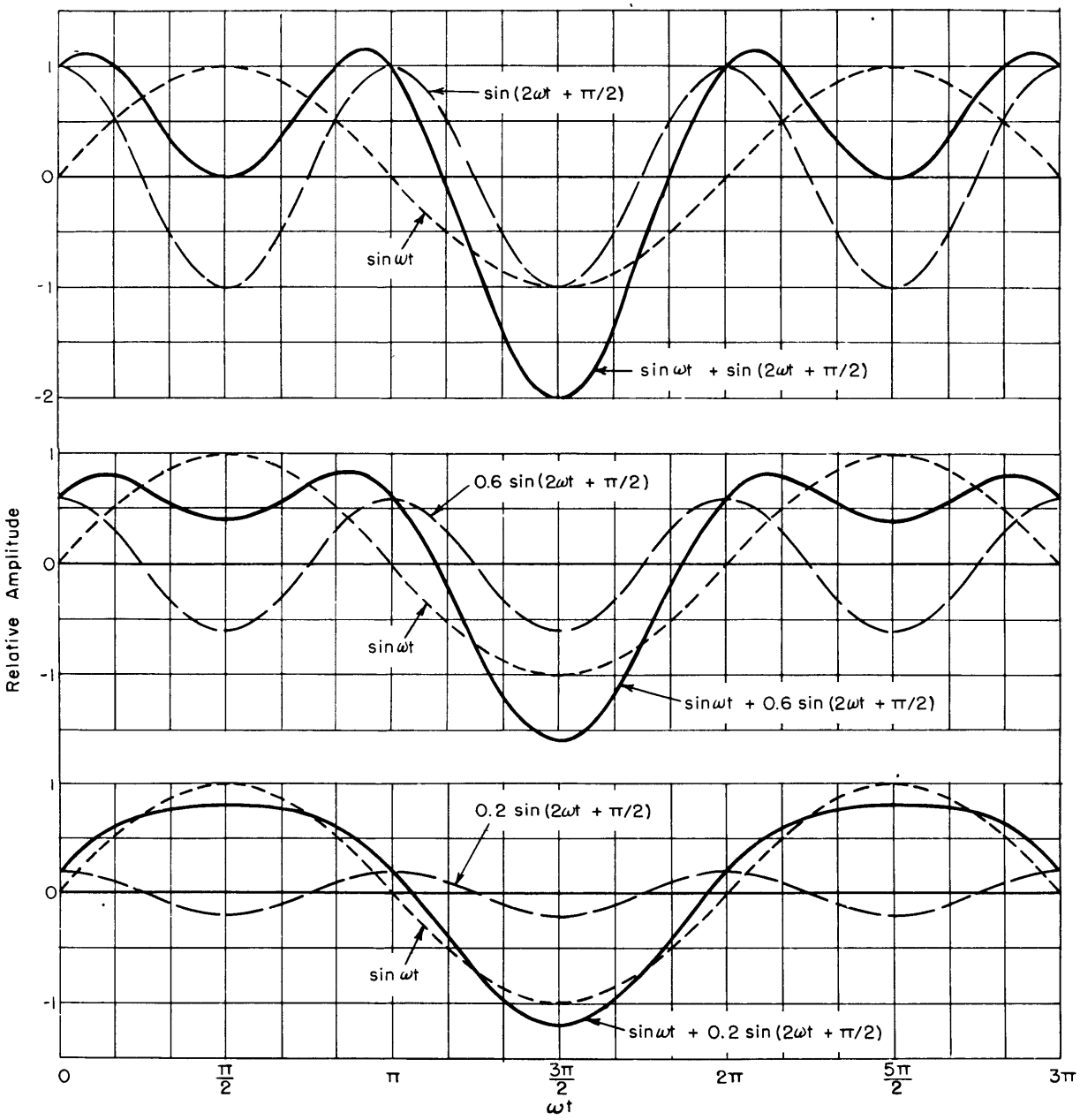

Figure 3 - Fundamental and Second Harmonic, $\pi/2$ Phase Angle

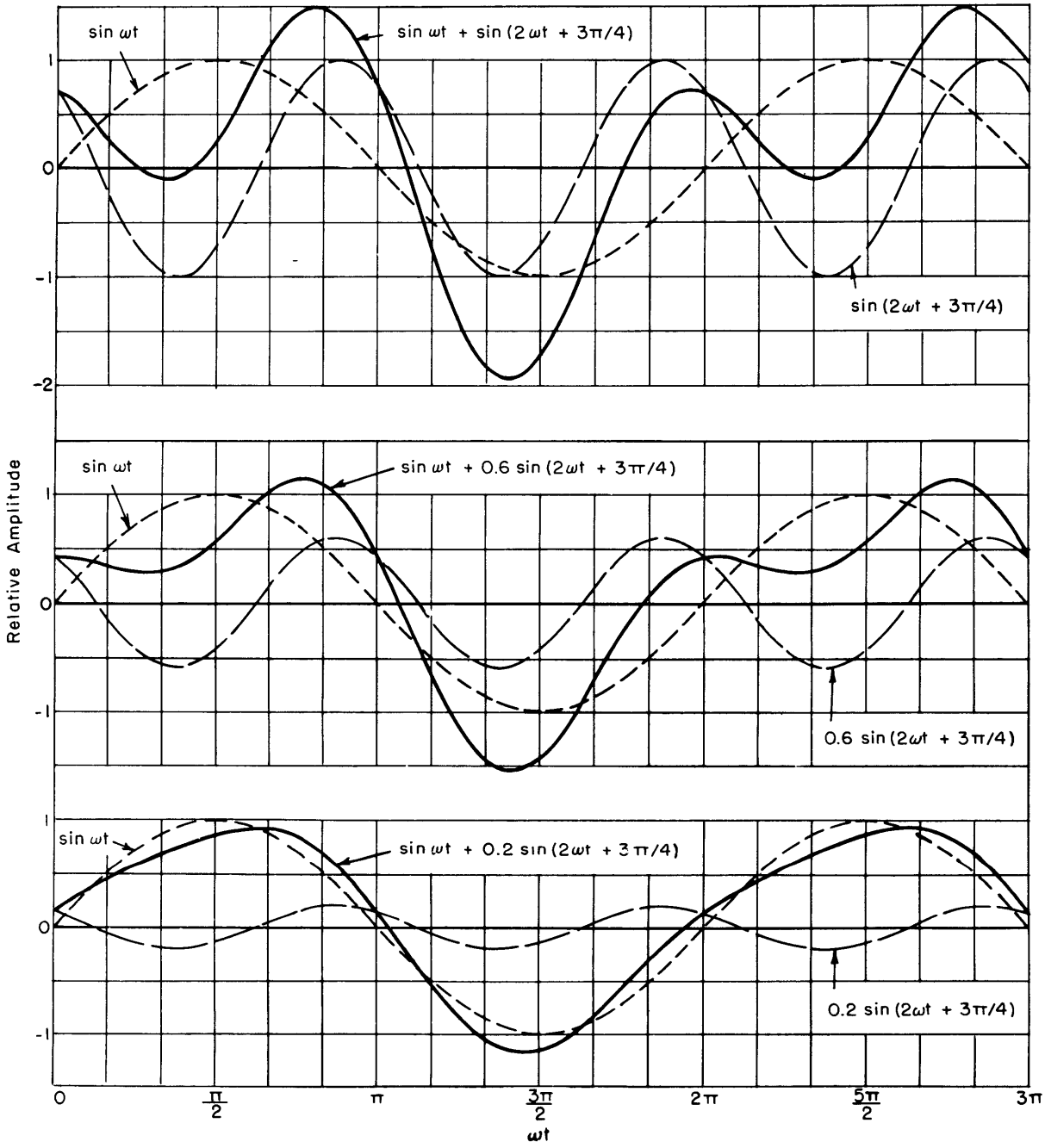

Figure 4 - Fundamental and Second Harmonic, $3\pi/4$ Phase Angle

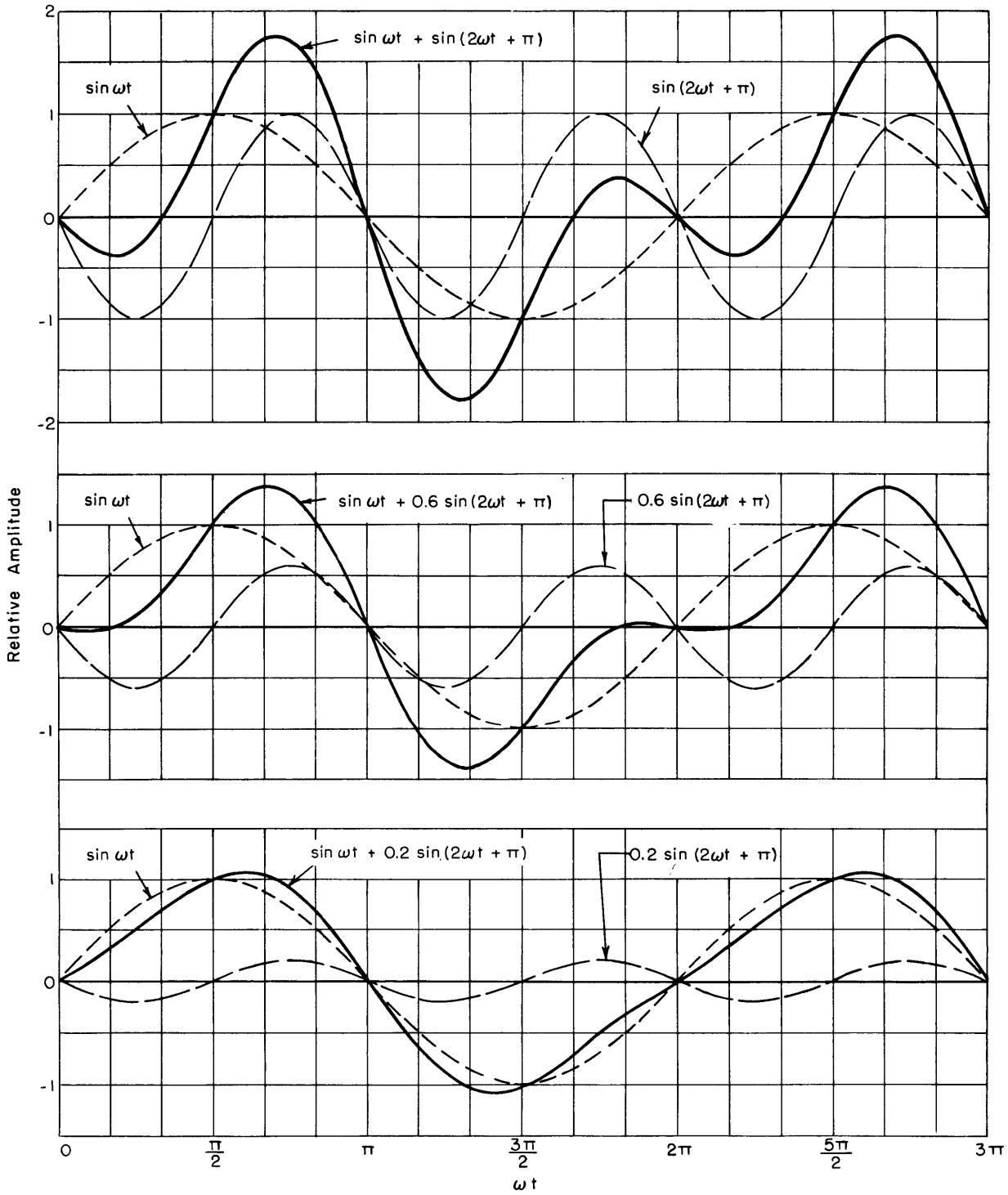

Figure 5 - Fundamental and Second Harmonic, π Phase Angle

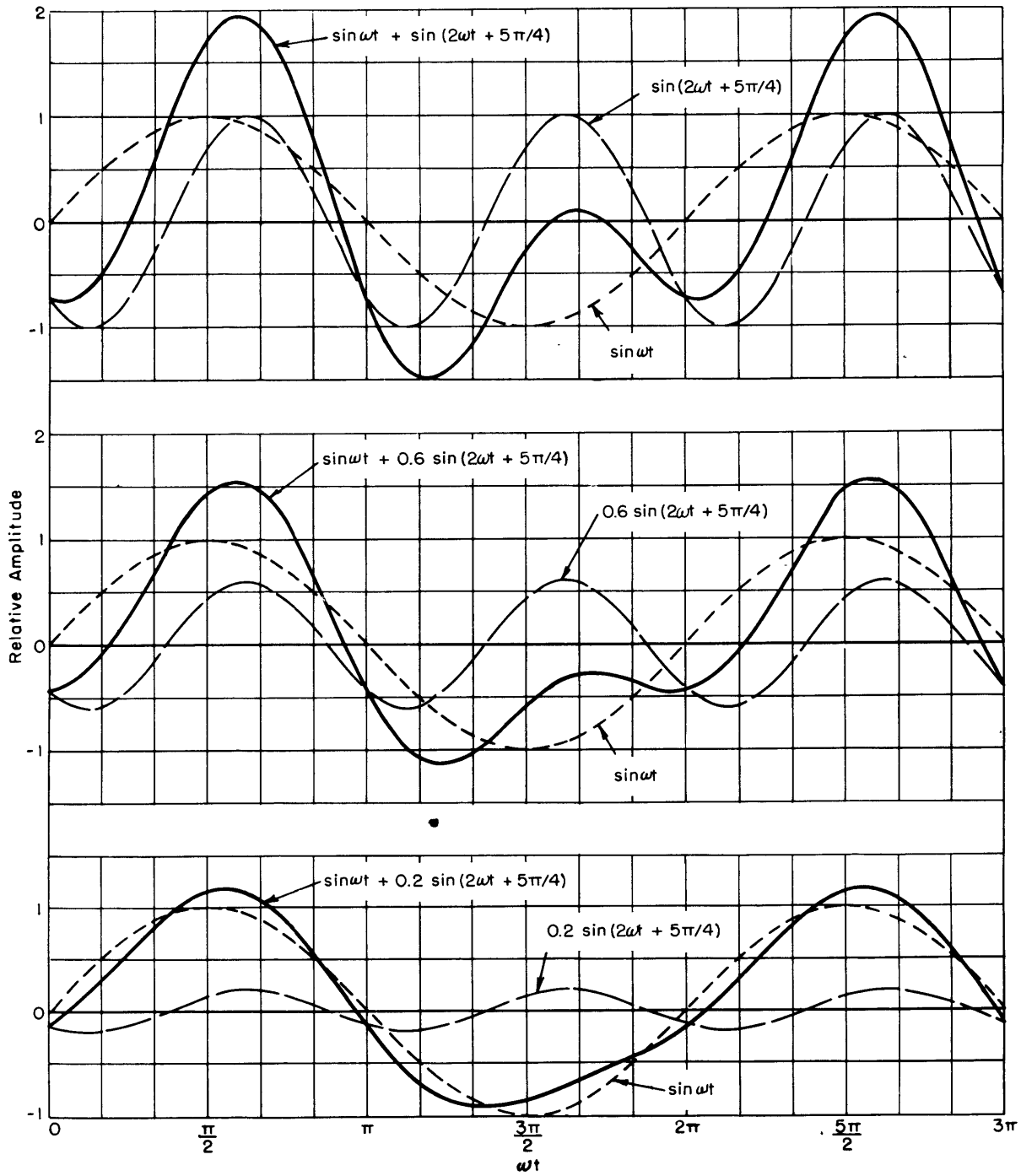

Figure 6 - Fundamental and Second Harmonic, $5\pi/4$ Phase Angle

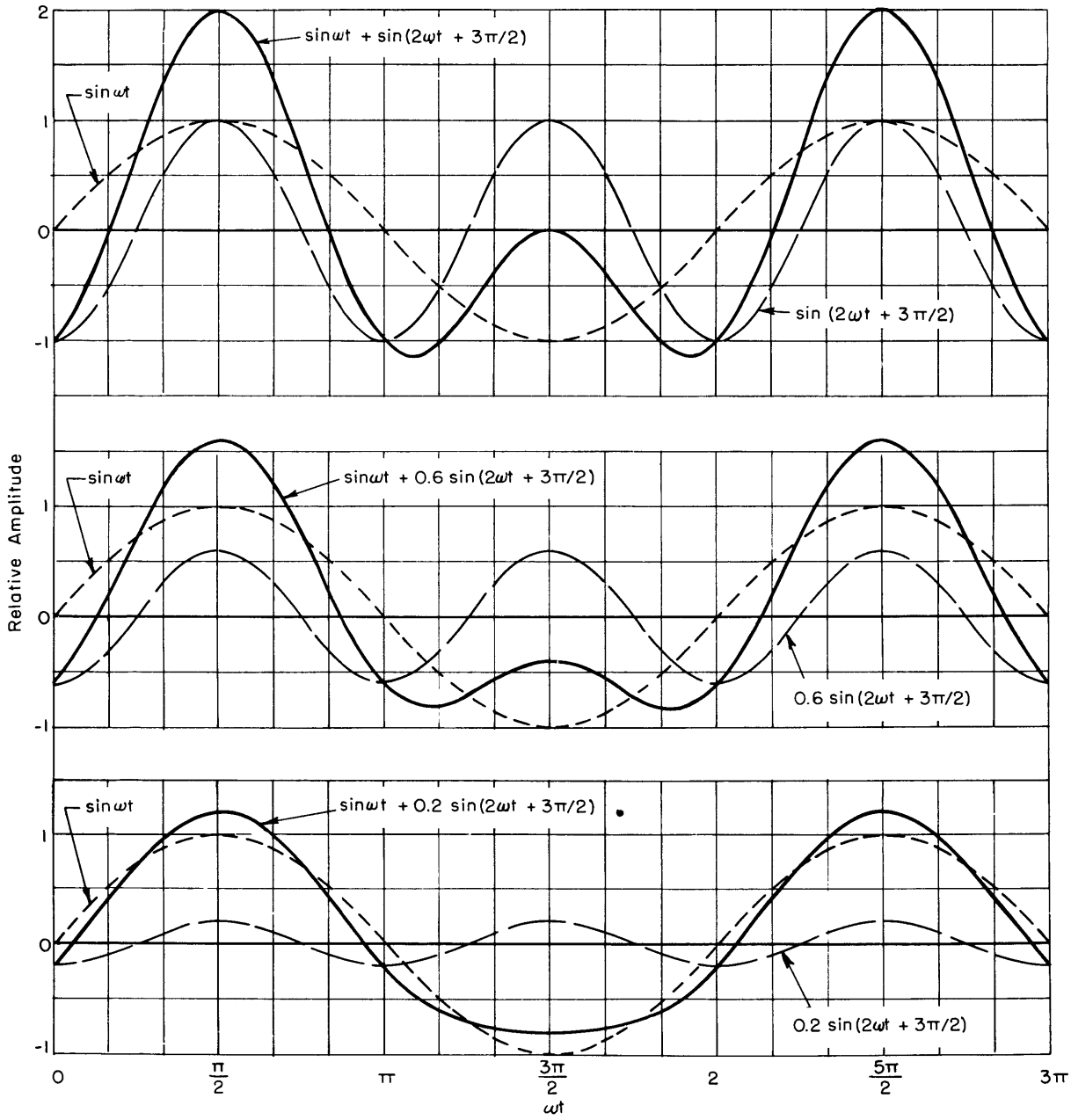

Figure 7 - Fundamental and Second Harmonic, $3\pi/2$ Phase Angle

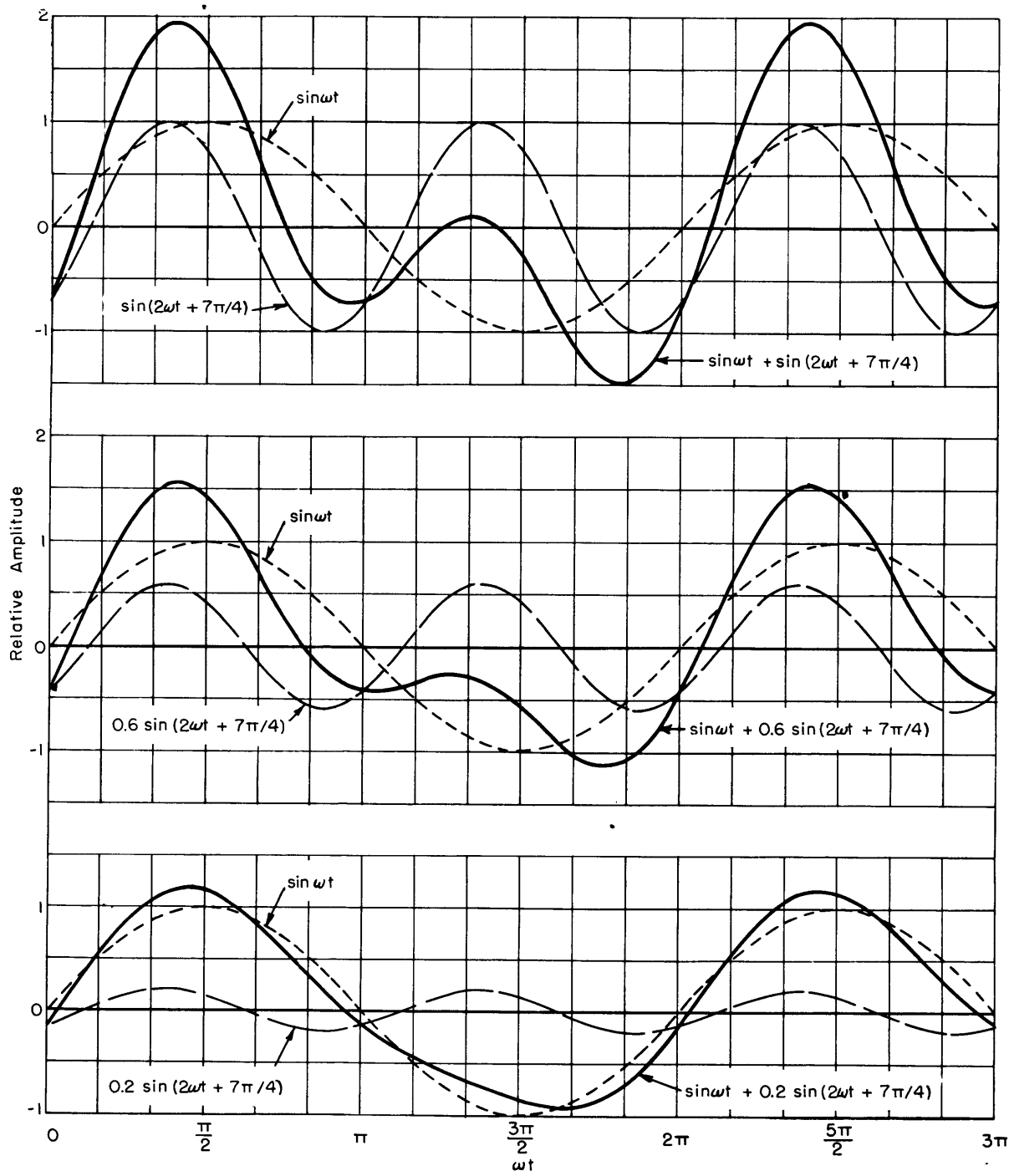

Figure 8 - Fundamental and Second Harmonic, $7\pi/4$ Phase Angle

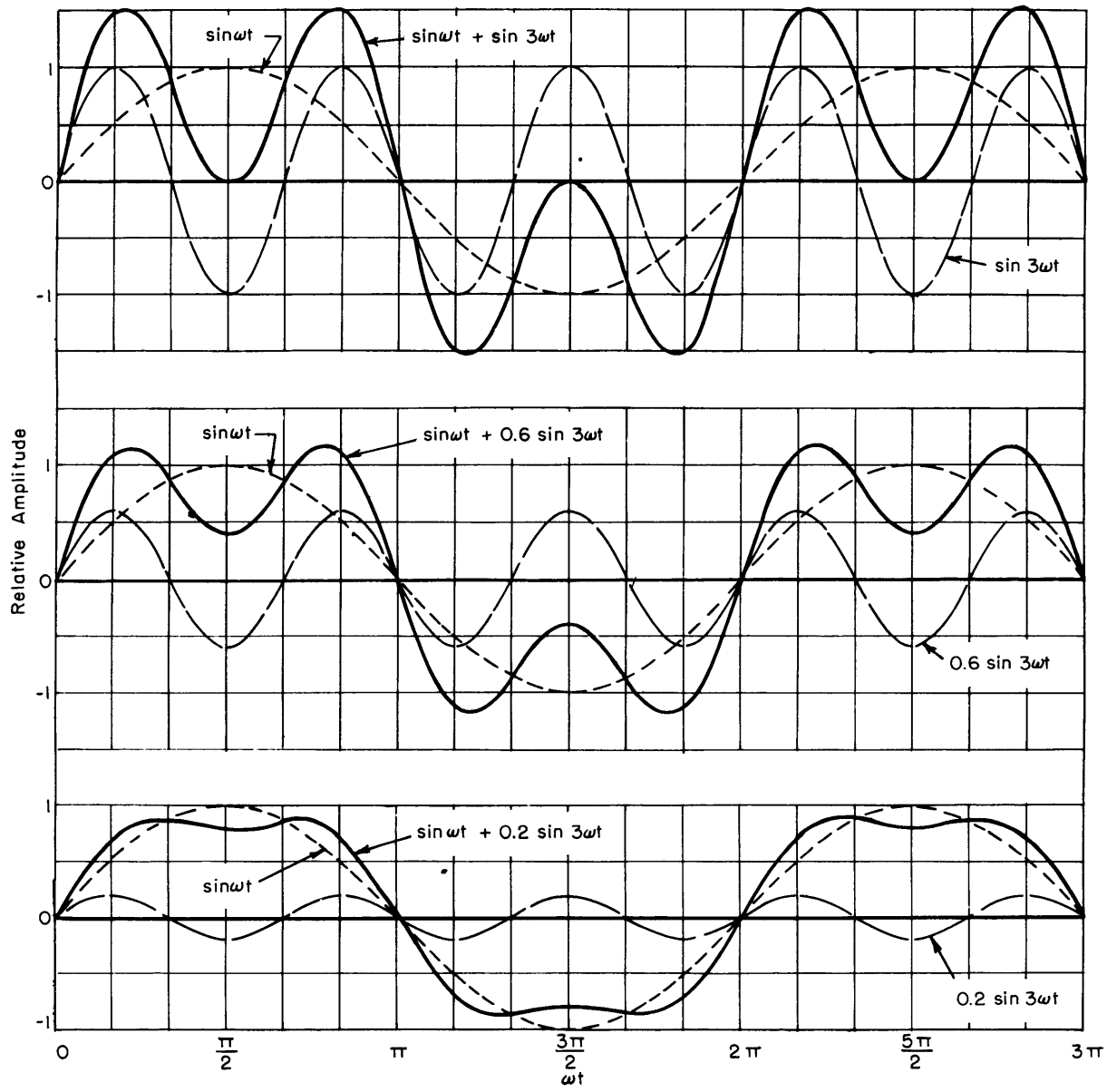

Figure 9 - Fundamental and Third Harmonic, 0 Phase Angle

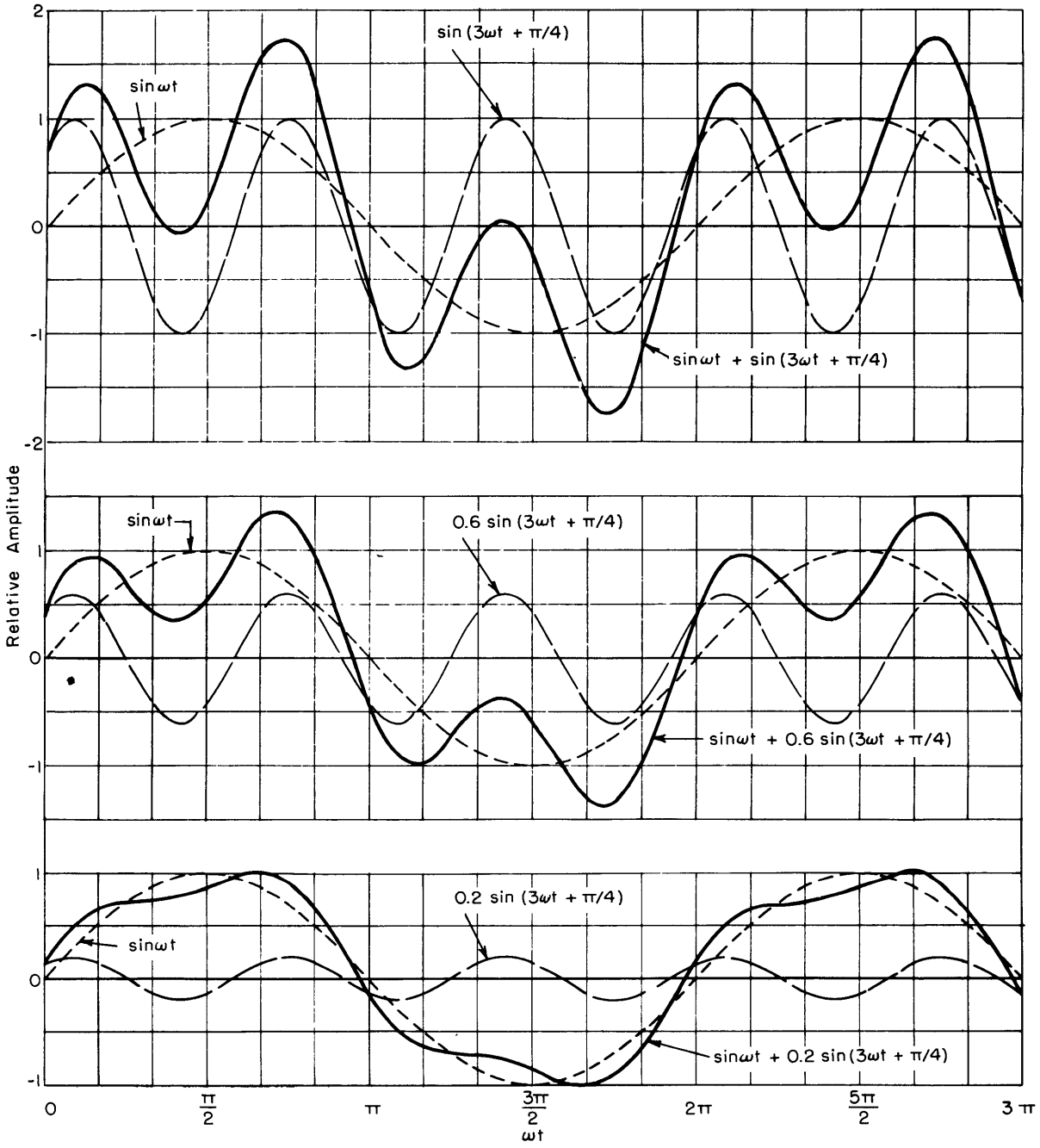

Figure 10 - Fundamental and Third Harmonic, $\pi/4$ Phase Angle

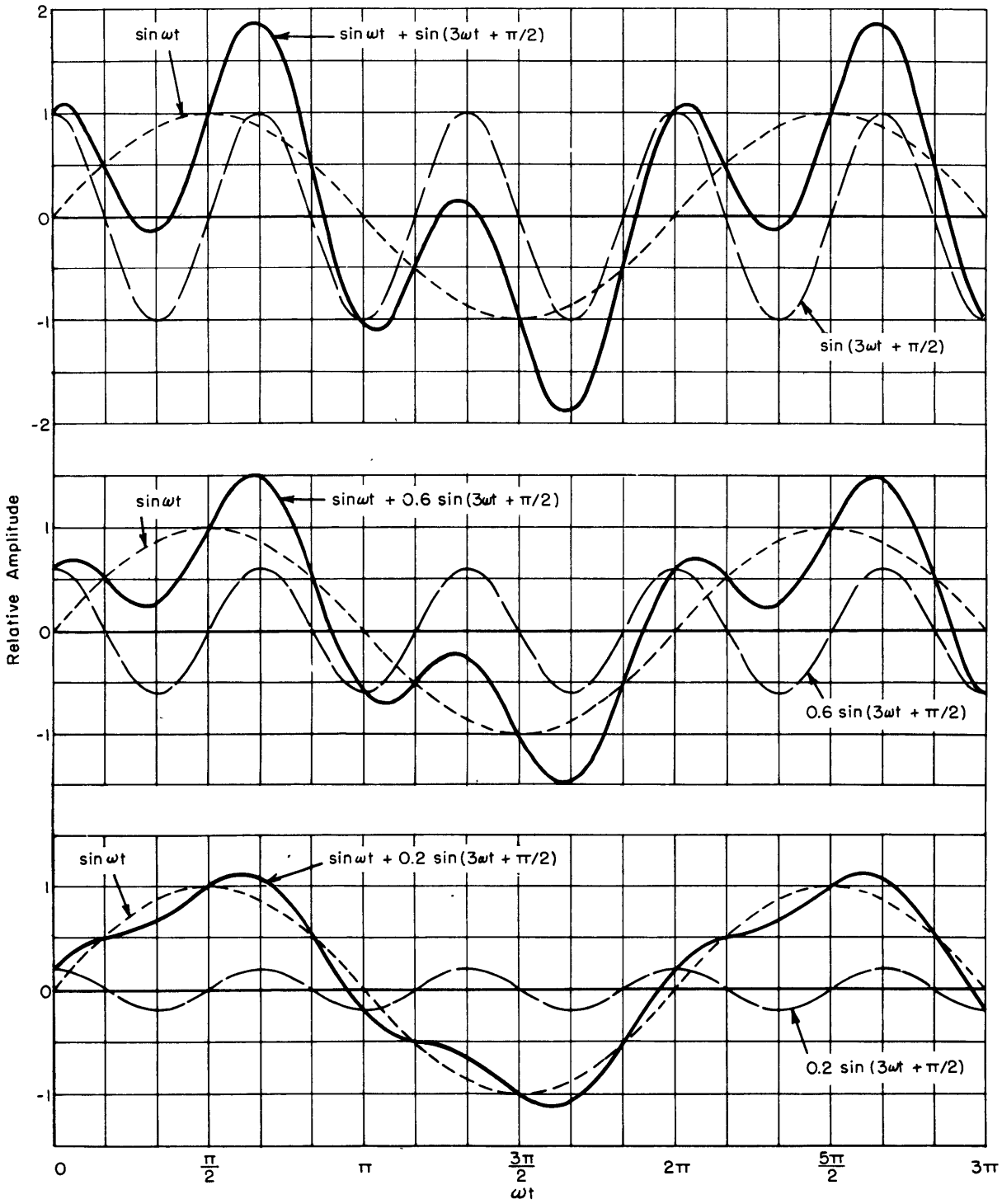

Figure 11 - Fundamental and Third Harmonic, $\pi/2$ Phase Angle

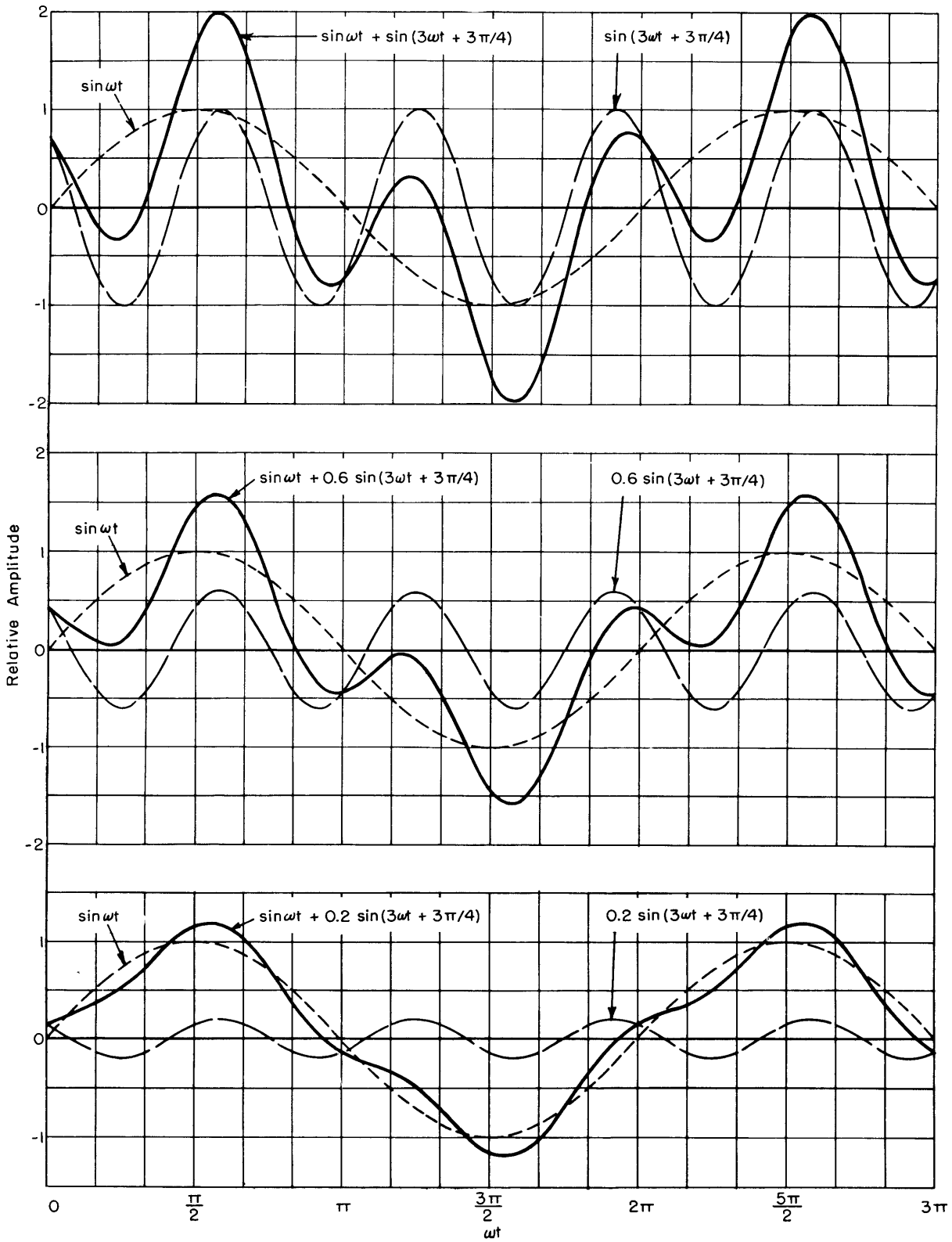

Figure 12 - Fundamental and Third Harmonic, $3\pi/4$ Phase Angle

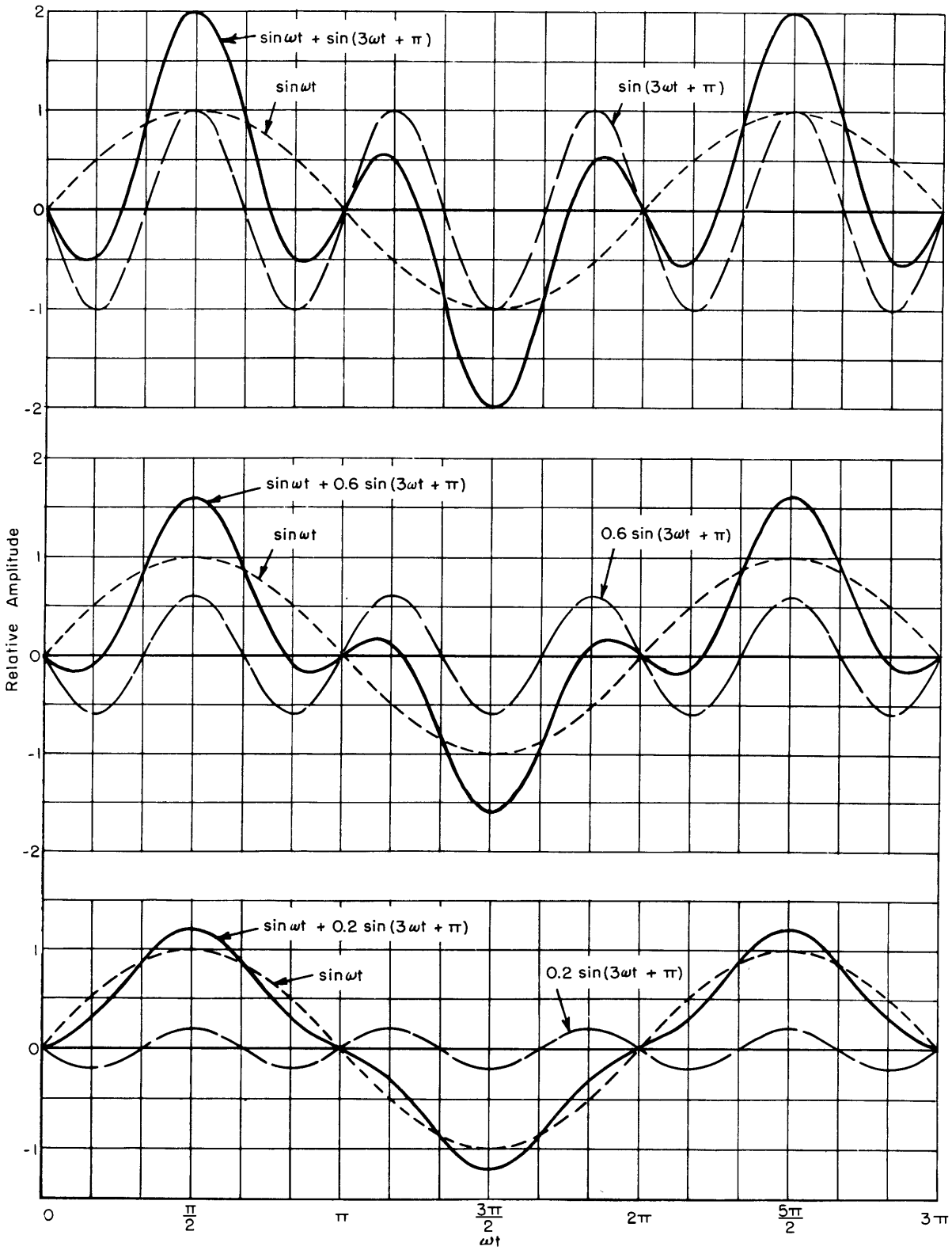

Figure 13 - Fundamental and Third Harmonic, π Phase Angle

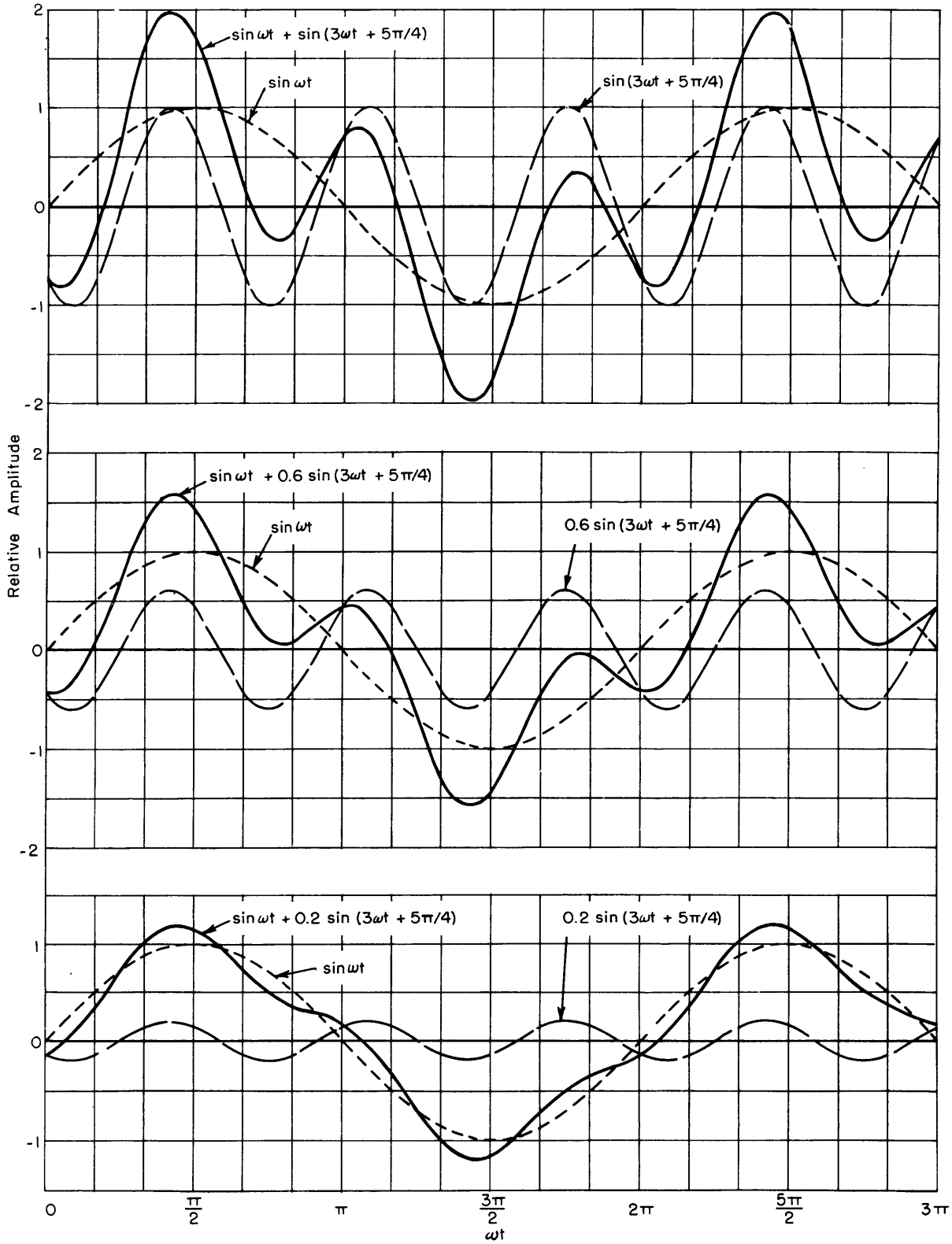

Figure 14 - Fundamental and Third Harmonic, $5\pi/4$ Phase Angle

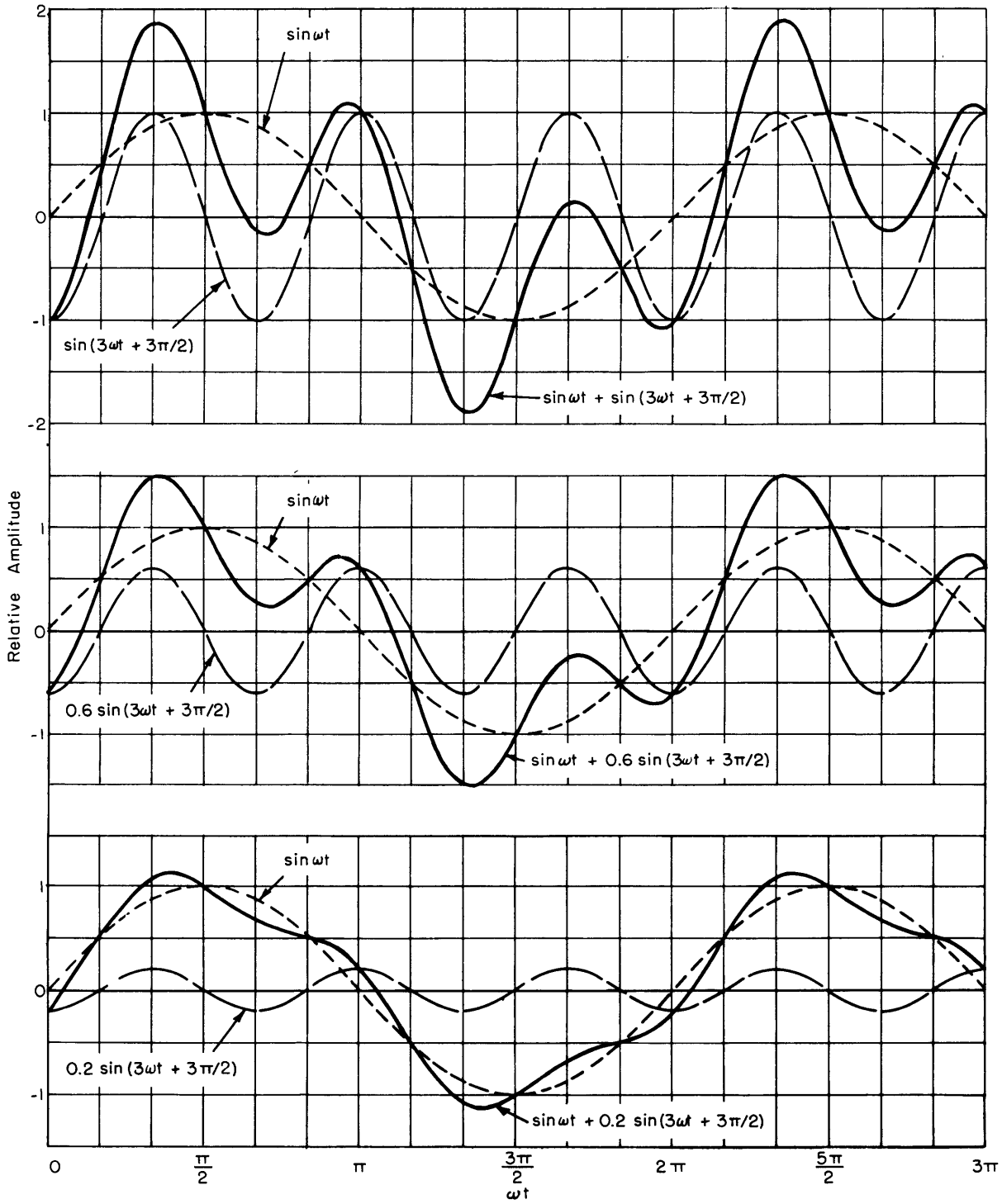

Figure 15 - Fundamental and Third Harmonic, $3\pi/2$ Phase Angle

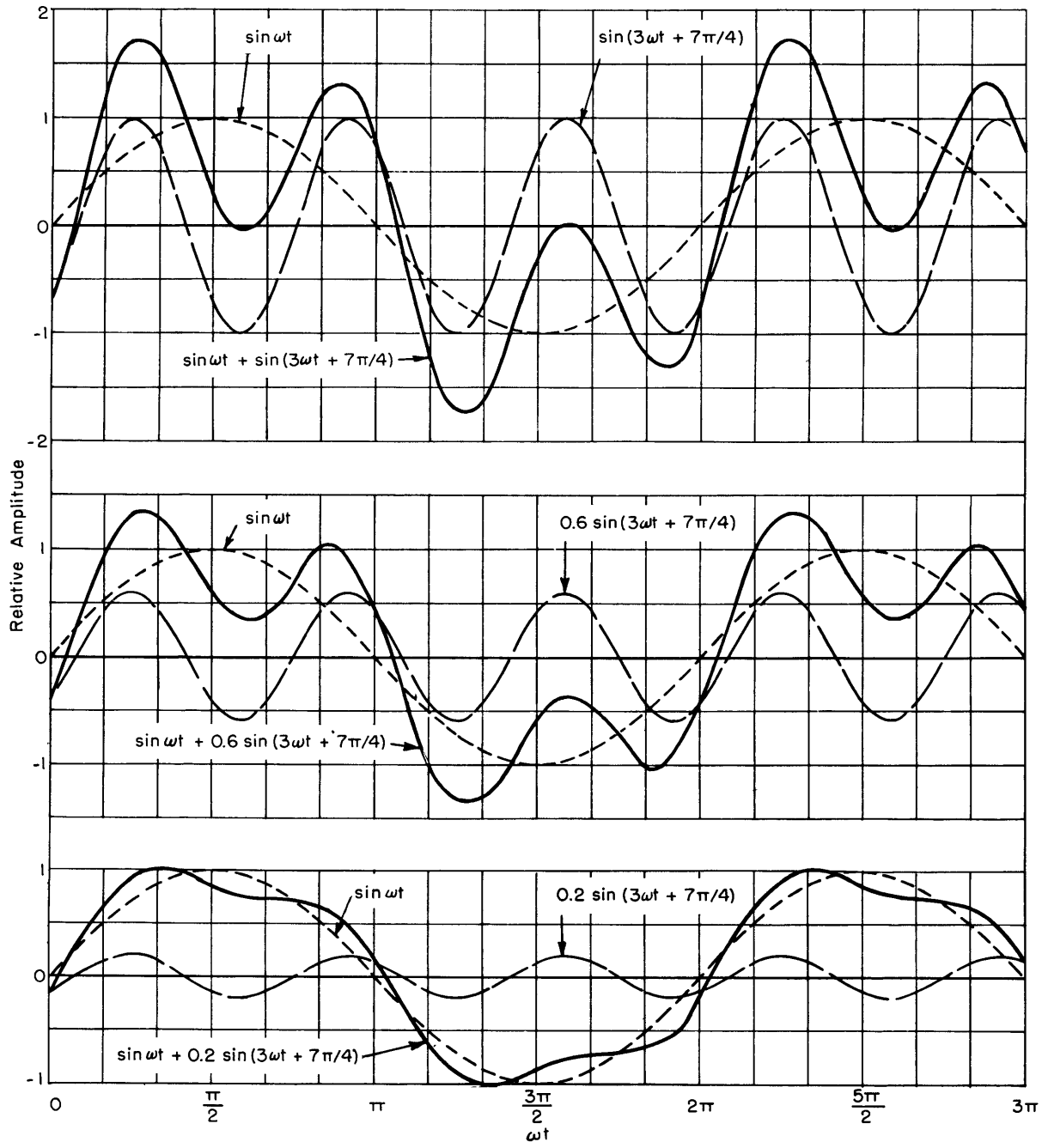

Figure 16 - Fundamental and Third Harmonic, $7\pi/4$ Phase Angle

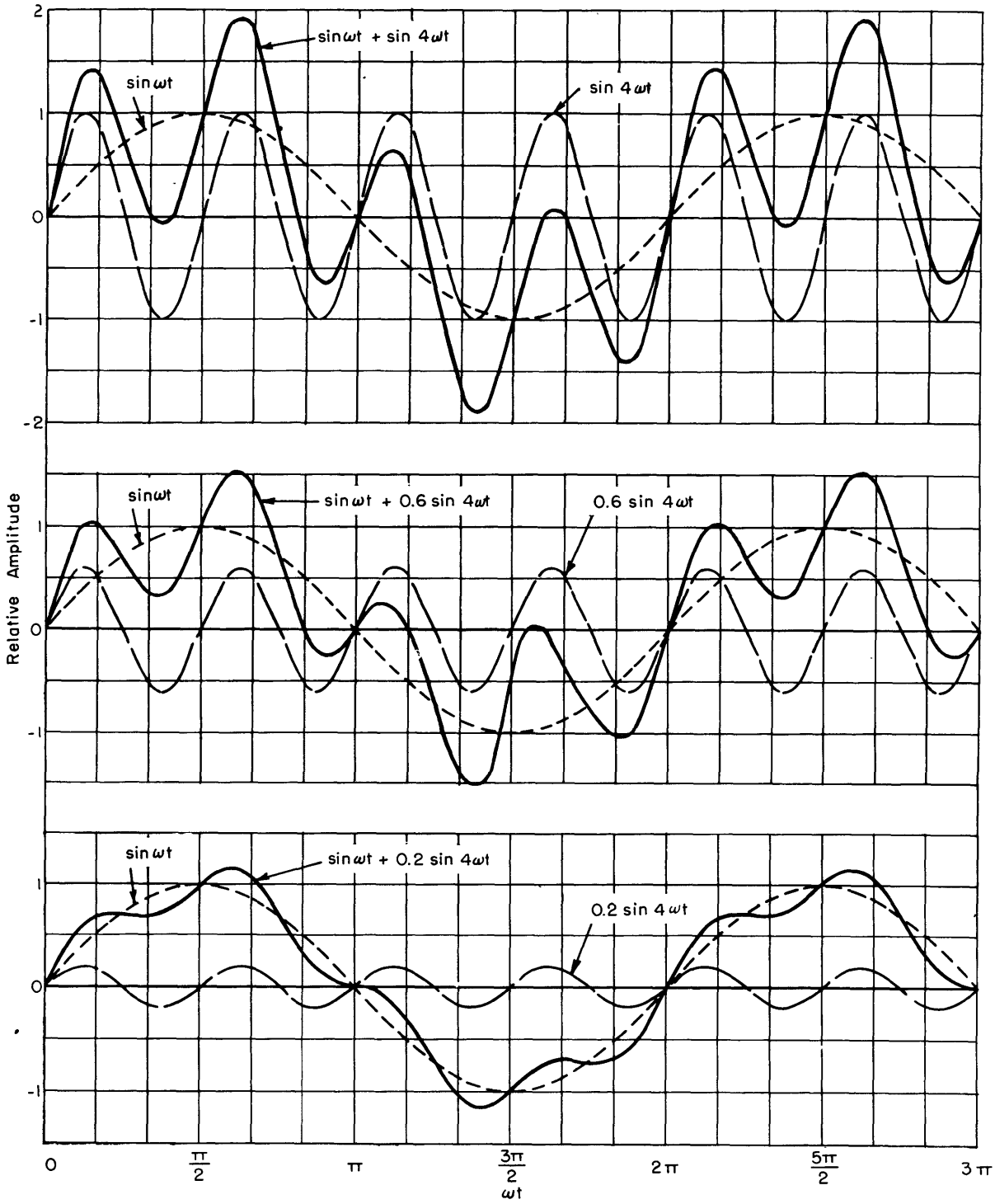

Figure 17 - Fundamental and Fourth Harmonic, 0 Phase Angle

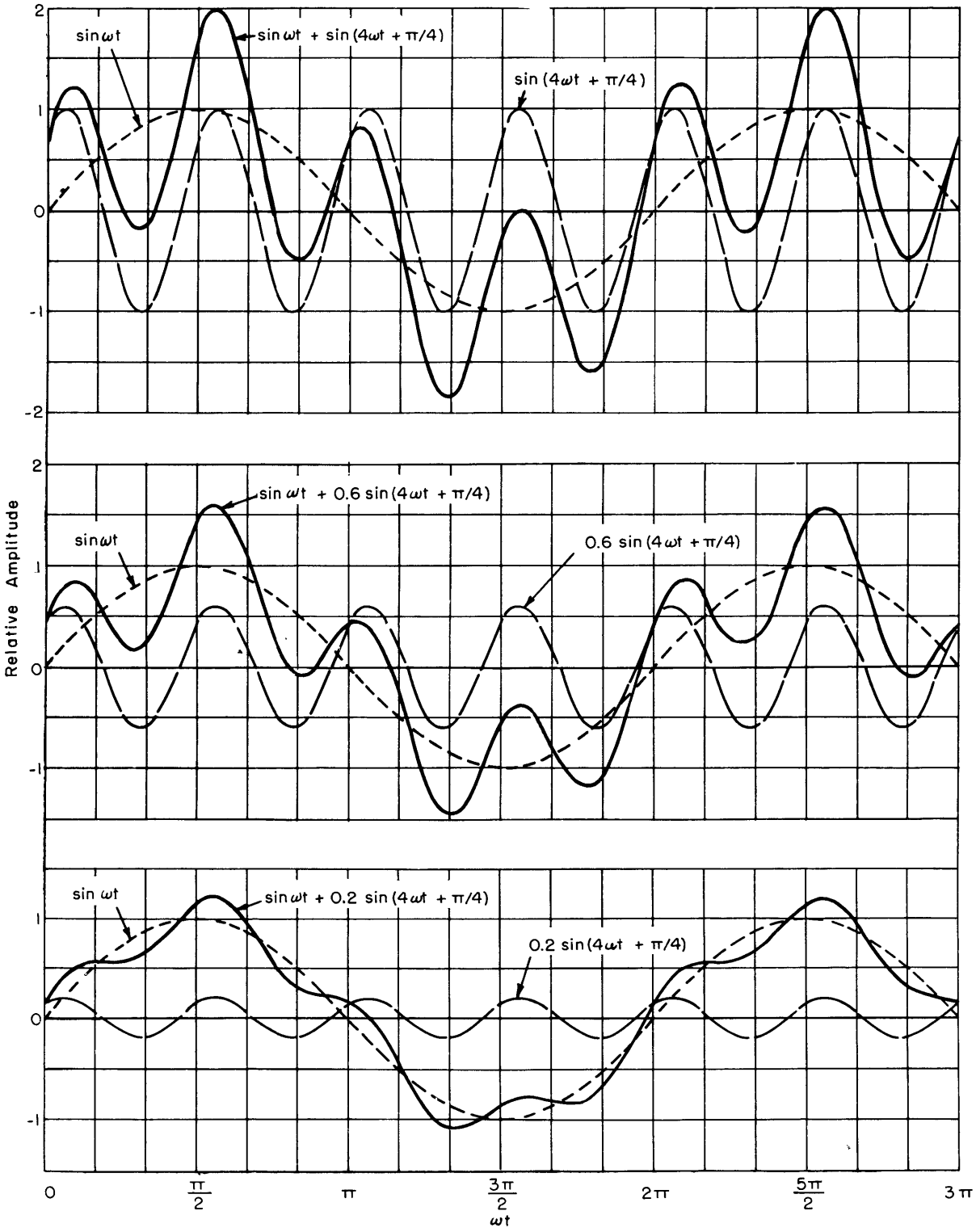

Figure 18 - Fundamental and Fourth Harmonic, $\pi/4$ Phase Angle

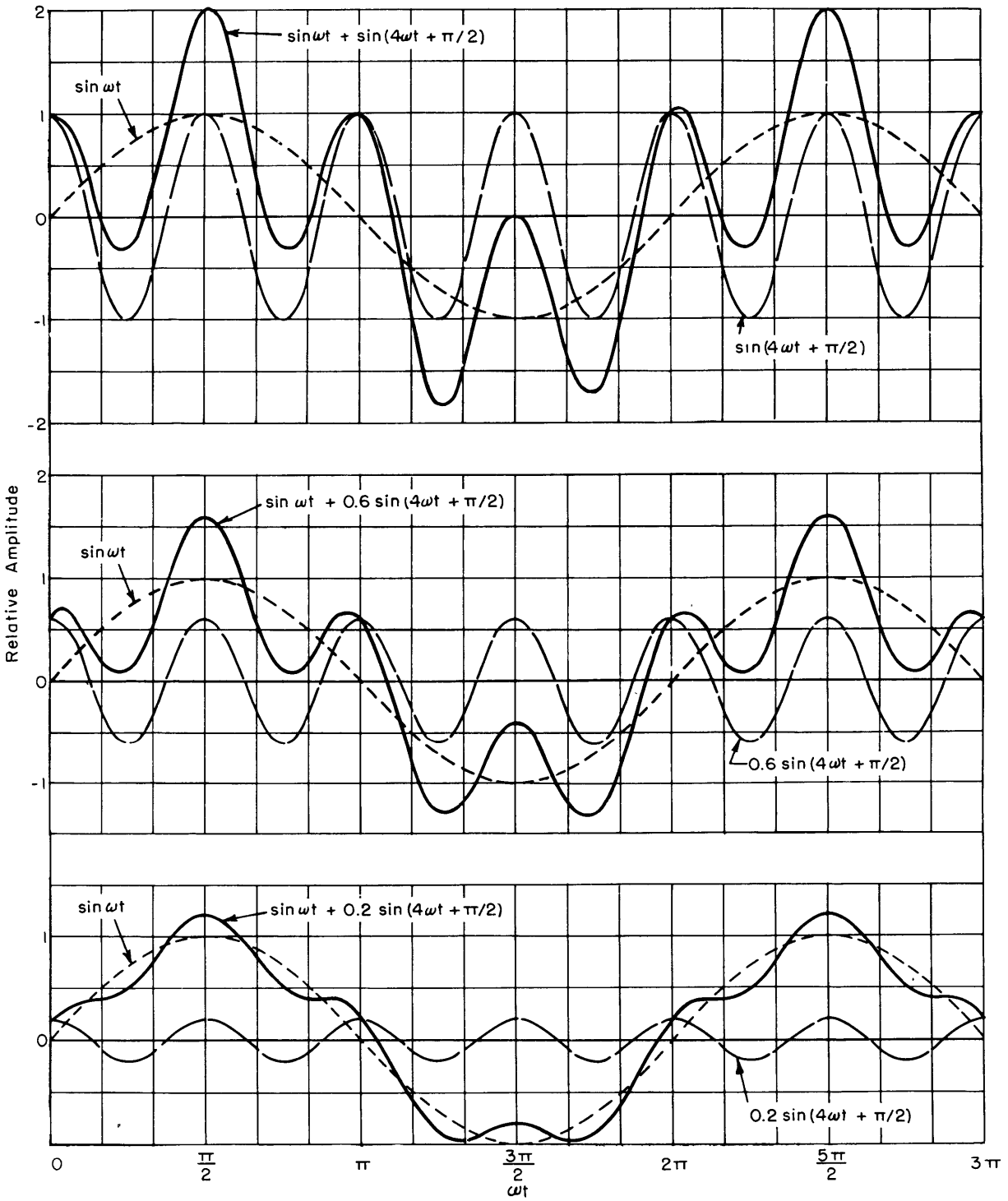

Figure 19 - Fundamental and Fourth Harmonic, $\pi/2$ Phase Angle

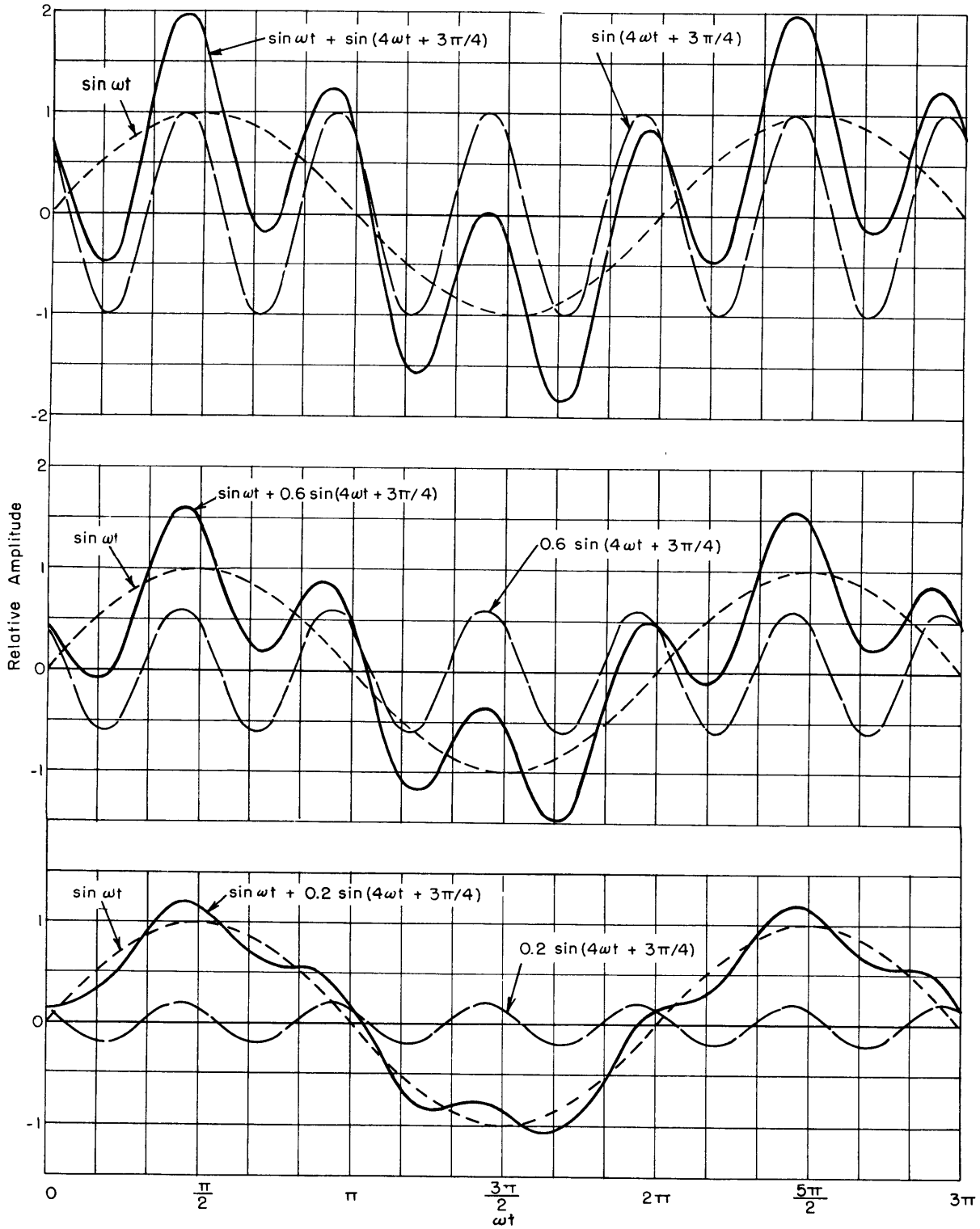

Figure 20 - Fundamental and Fourth Harmonic, $3\pi/4$ Phase Angle

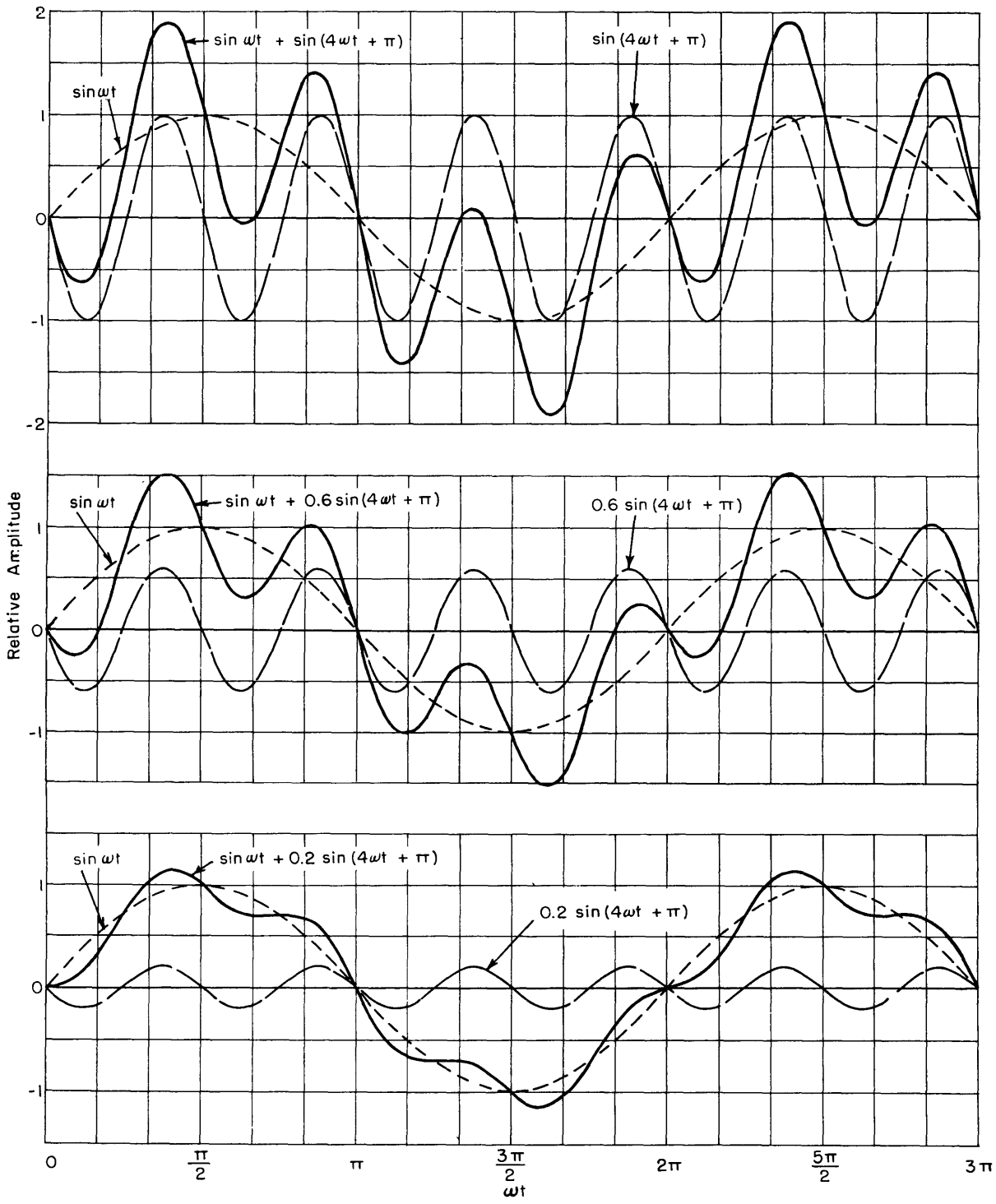

Figure 21 - Fundamental and Fourth Harmonic, π Phase Angle

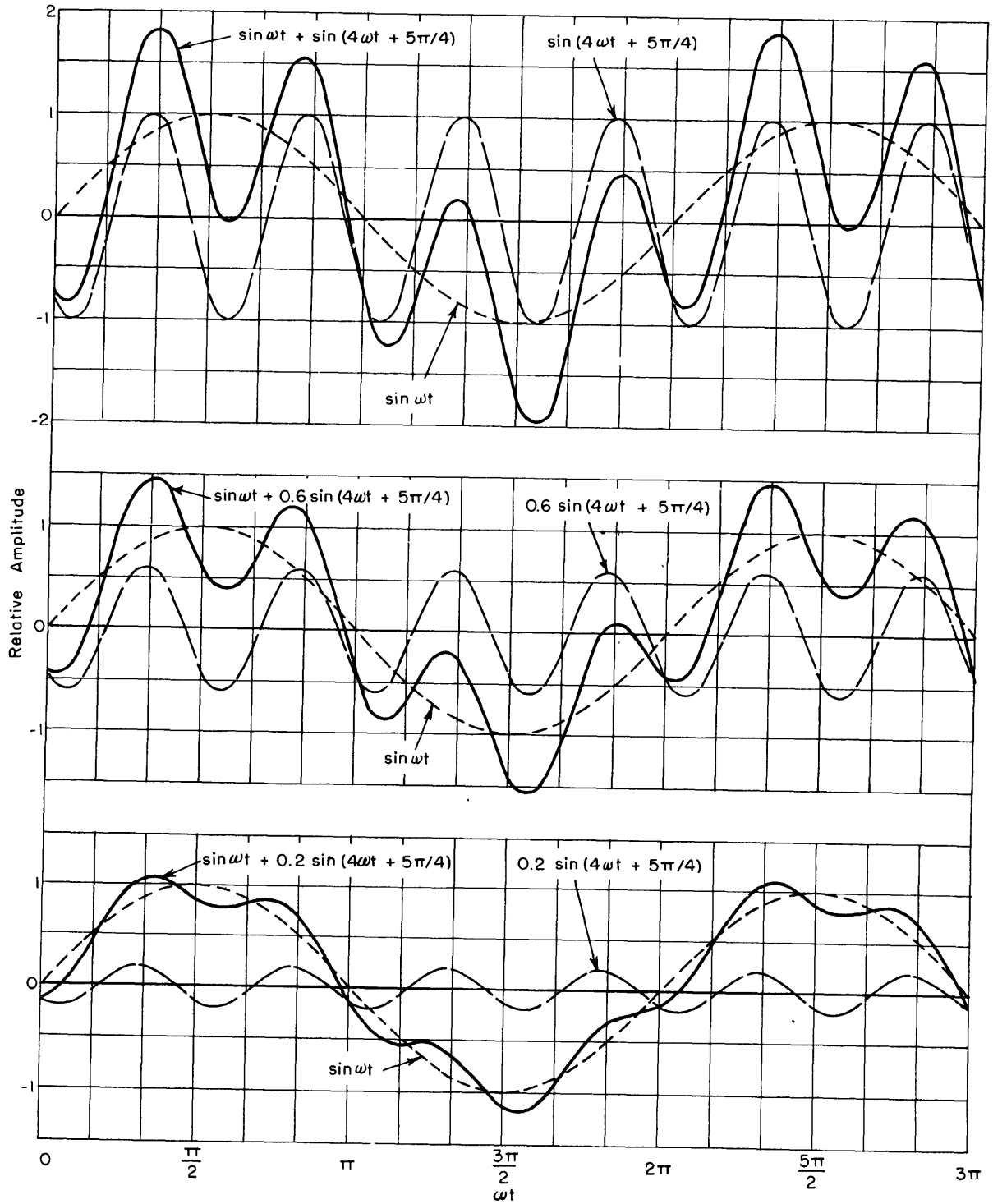

Figure 22 - Fundamental and Fourth Harmonic, $5\pi/4$ Phase Angle

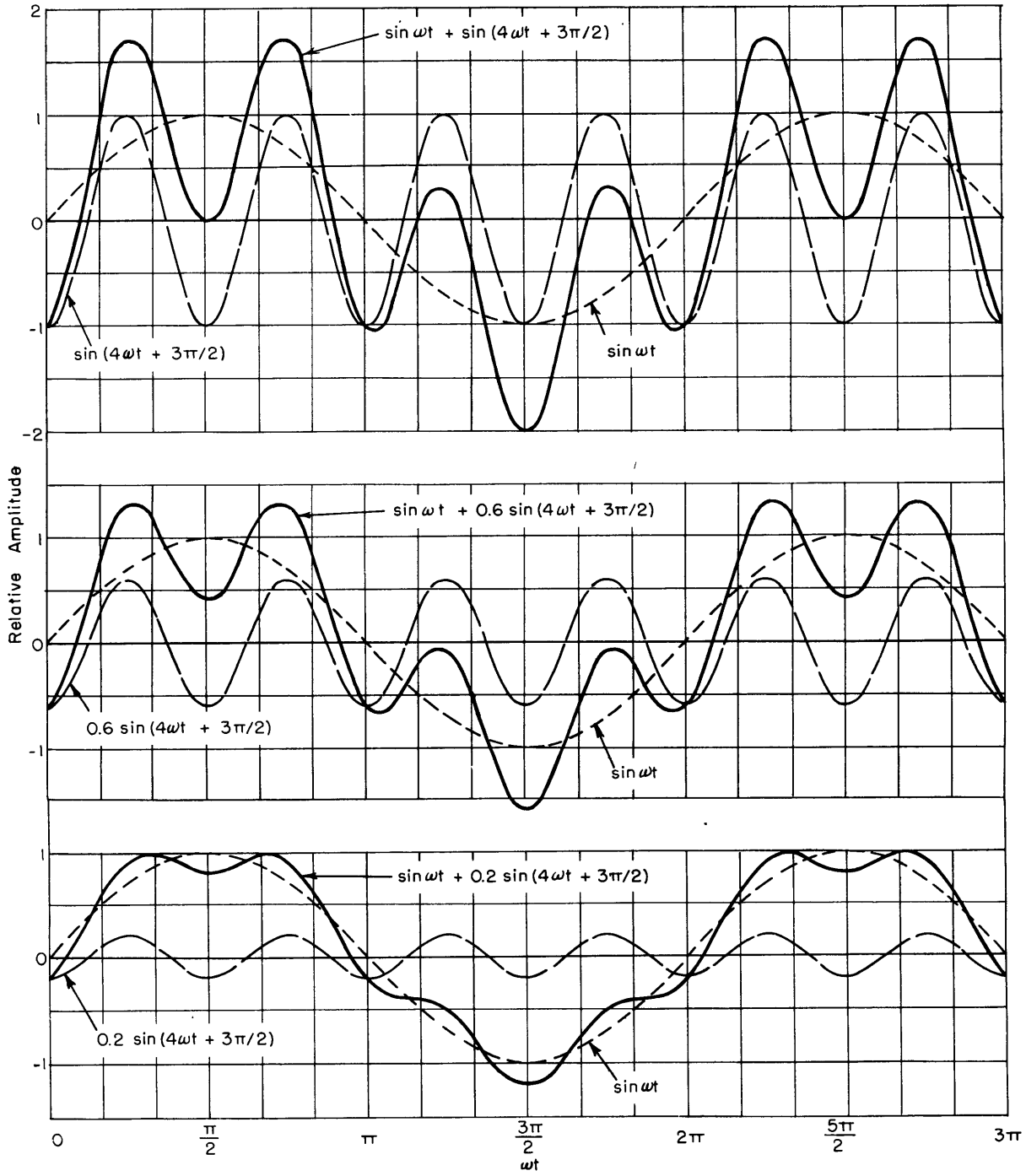

Figure 23 - Fundamental and Fourth Harmonic, $3\pi/2$ Phase Angle

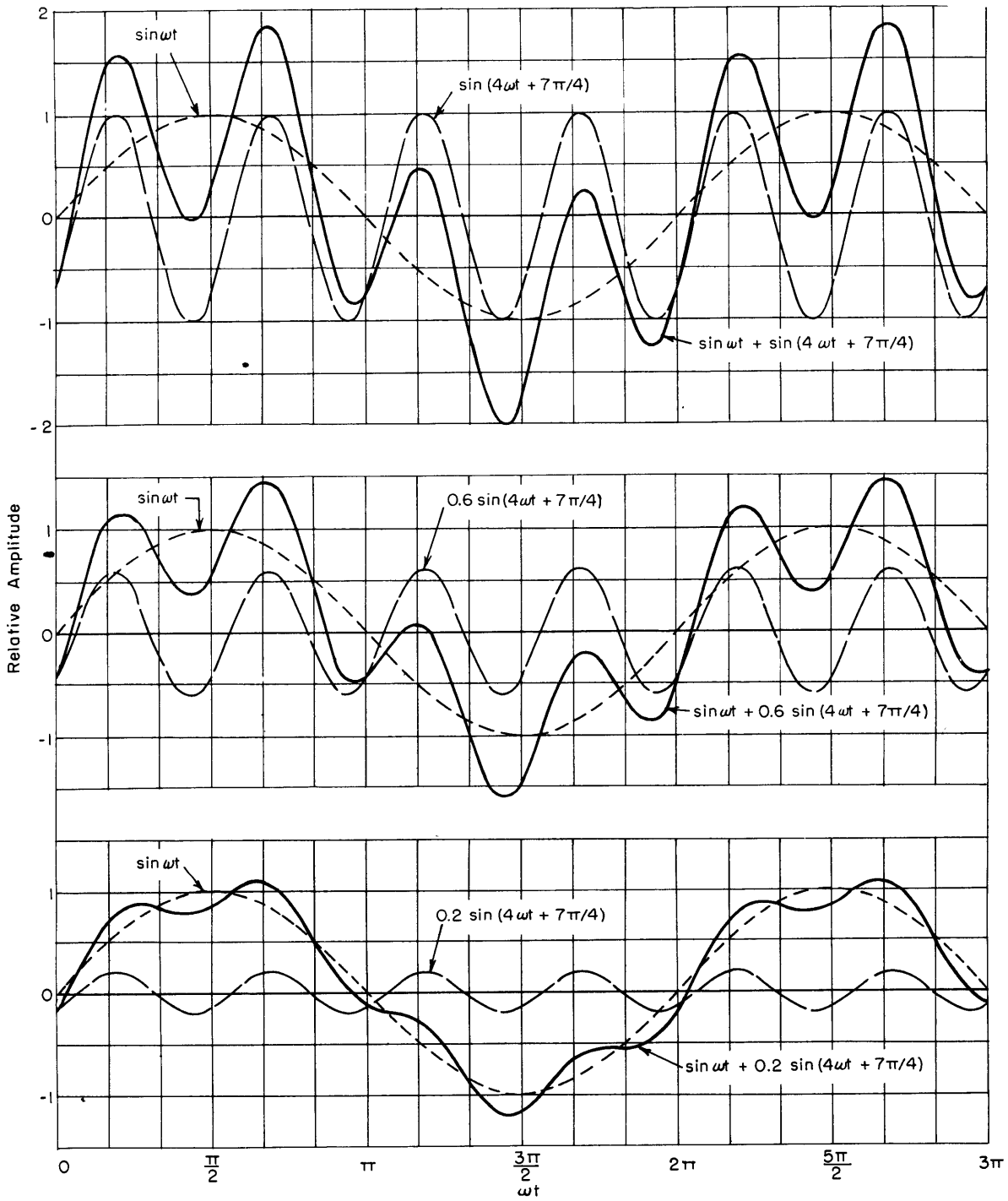

Figure 24 - Fundamental and Fourth Harmonic, $7\pi/4$ Phase Angle