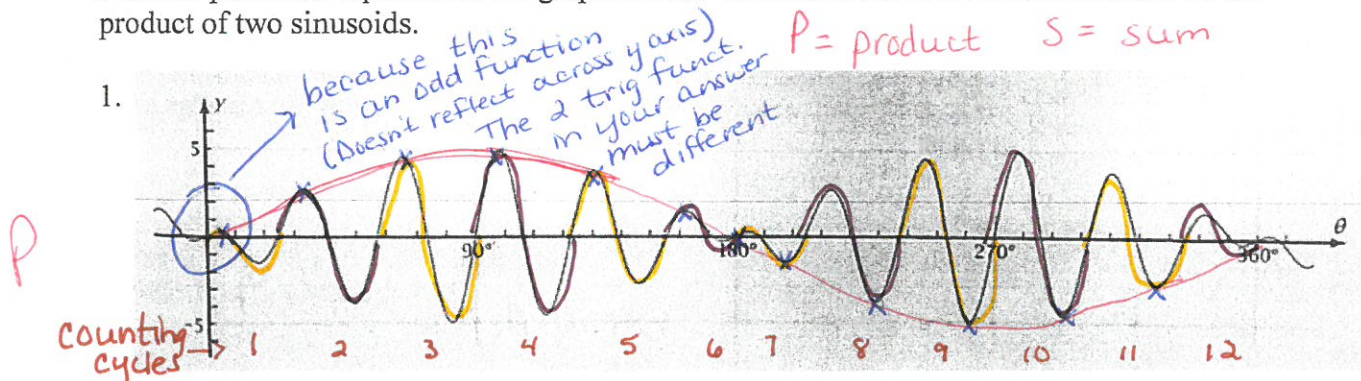


Section 5-4 Harmonic Analysis

**Harmonic Analysis** is the reverse process of the Composition of Ordinates. You will "decompose" a complicated graph into the two sinusoids that formed it.

Find the particular equation of the graph shown. It is either the sum of two sinusoids or the product of two sinusoids.



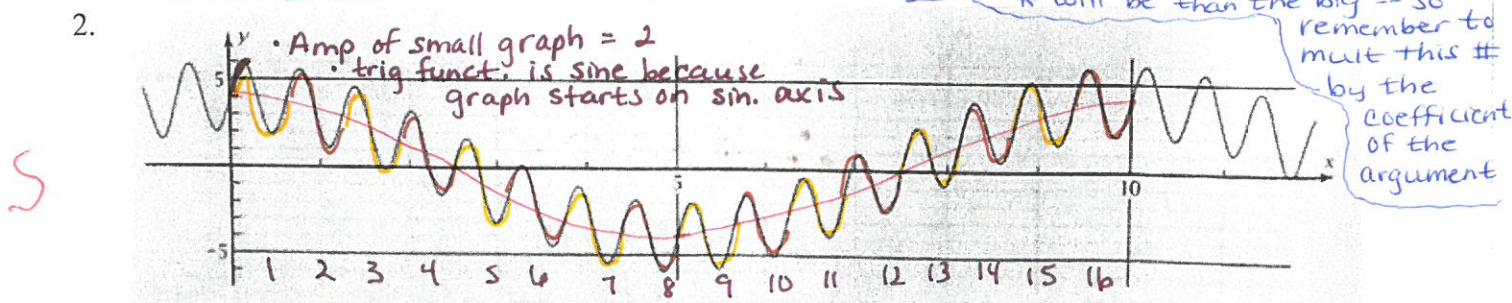
1.) Draw larger graph (envelope) -- this should touch all extreme points. Then write the equation for it.

$VD = 5$  Amp  $\Rightarrow 5$   
 $HT = 0$  Ph. Shift  $\Rightarrow$  none  
 $VT = 0$  S.A.  $\Rightarrow y = 0$   
 $HO = 1$  Period = 360

$$y = 5 \sin \theta \cdot \cos 12\theta$$

this is amp for smaller graph  $\rightarrow$  because amp. varies, it's an equation rather than a constant

2.) Determine trig function for smaller graph (see above in blue) then count # of little cycles in one big cycle \* this is how much faster it will be than the big -- so remember to mult this # by the coefficient of the argument



1.) Draw in larger graph (midline) - should go right through center -- then write equation for it

$VD = 4$  Amp  $\Rightarrow 4$   
 $HT = 0$  Ph. Shift  $\Rightarrow$  none  
 $VT = 0$  S.A.  $\Rightarrow y = 0$   
 $HO = \frac{5}{\pi}$  period  $\Rightarrow 10$

$$y = 4 \cos \theta + 2 \sin 16\theta$$

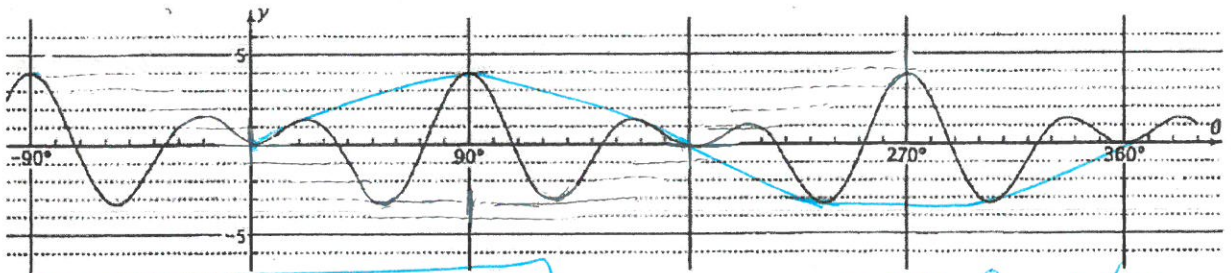
this is sin. axis for smaller graph  $\rightarrow$  because S.A. varies, it's an equation rather than a constant

$2\pi * hd = \text{period}$   
 $2\pi * hd = 10$   
 $hd = \frac{10}{2\pi}$   
 $hd = \frac{5}{\pi}$

2.) Determine amp. + trig function for smaller graph by looking at how it relates to S.A. you drew (larger graph) count cycles + do same as above (in blue) (can just count max. pts.)

3.

\* Start here  
@  $x=0$



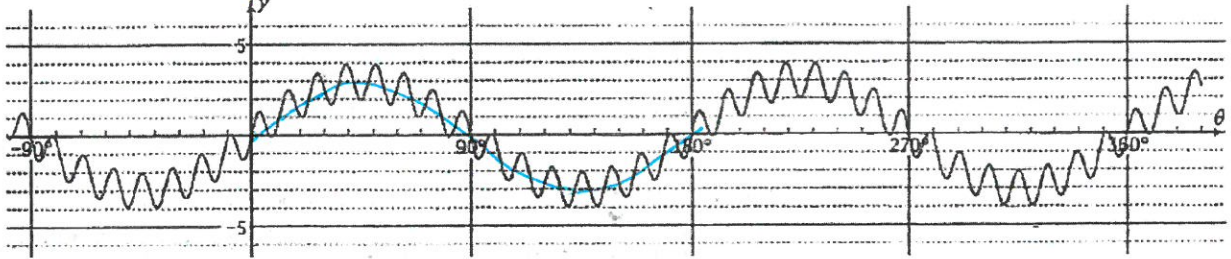
$$y = 4 \sin \theta \cdot \sin 5\theta$$

\* even funct (see y axis)  
trig functions the same

4.

\* Start here  
@  $x=0$

\* only draw 1 cycle



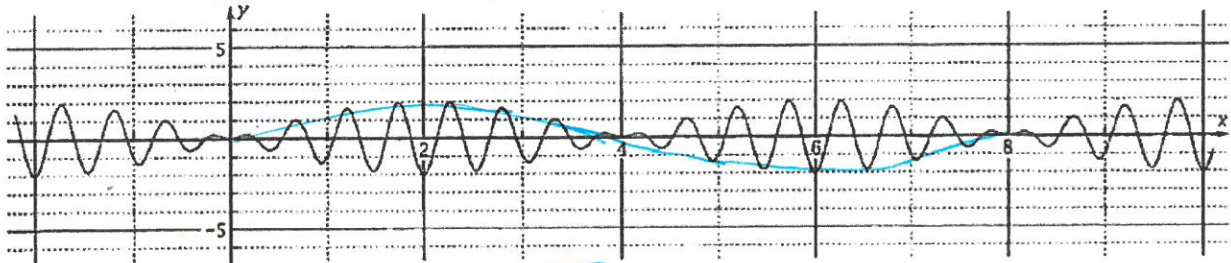
$$y = 3 \sin 2\theta + 1 \sin 30\theta$$

15 small cycles in 1 large cycle

- 15 times faster
- $15 * 2 \Rightarrow 30$

5.

\* Start here  
@  $x=0$



$$y = 2 \sin \frac{\pi}{4} x \cdot \sin \frac{15\pi}{4} x$$

Smaller graph cycles  
15 times faster  
so  $15 * \frac{\pi}{4}$

$2\pi \times \text{hd} = \text{per}$

$2\pi \times \text{hd} = 8$

$\text{hd} = \frac{8}{2\pi}$

$\text{hd} = \frac{4}{\pi}$