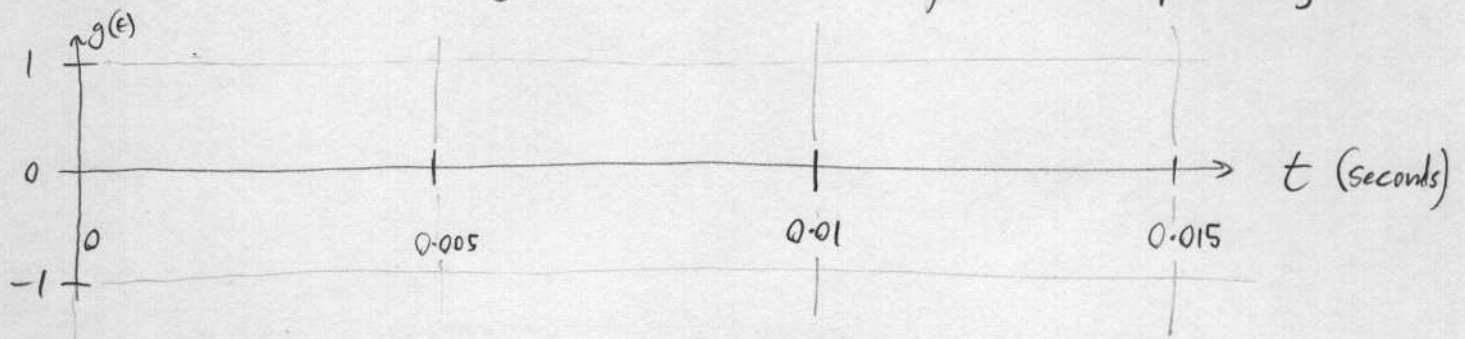
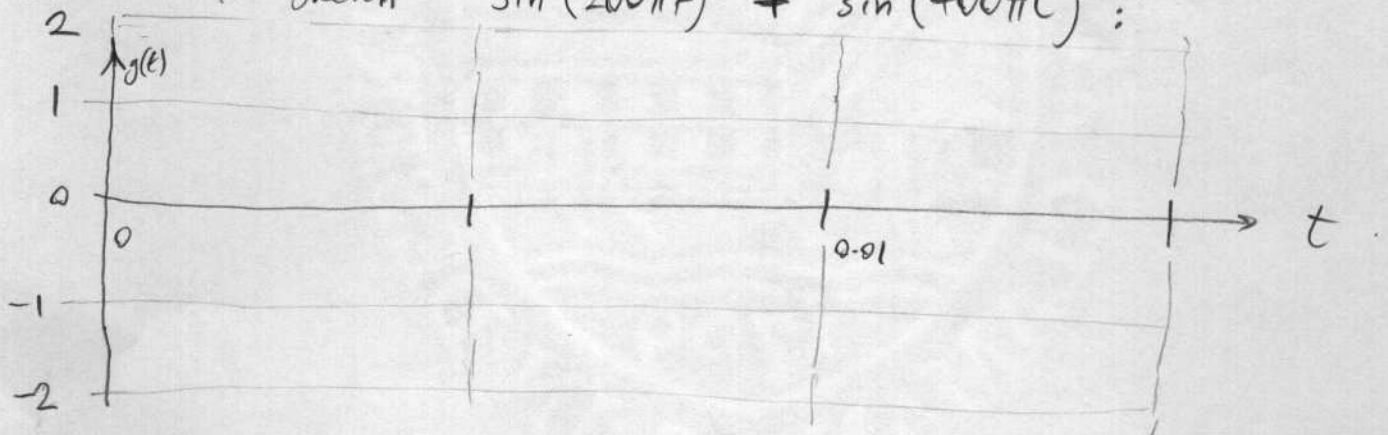


Sketch  $\sin(200\pi t)$  here [hint: first work out period!]



Draw on your sketch the signal  $\sin(400\pi t)$

Use this to sketch  $\sin(200\pi t) + \sin(400\pi t)$  :



[What is combined period?]

Does it have even, odd, or no symmetry?

(Check by substituting  $t \rightarrow -t$ . Use the answer to improve your sketch)

What is the harmonic content of this signal?

$a_0 = ?$   
 $a_1 = ?$   
 $a_2 = ?$   
 $a_3 = ?$   
 $b_1 = ?$   
 $b_2 = ?$   
 $b_3 = ?$   
 $b_4 = ?$   
 $\vdots$

Do you expect to sound harsh or mellow (timbre?)  
Why?

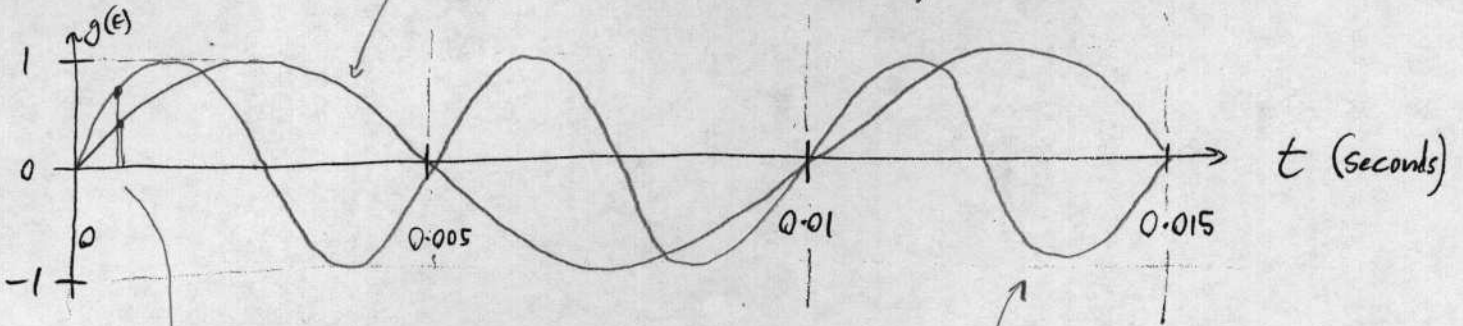
MATH 5 WORKSHEET : Fourier series

4/4/07  
Barnett.

SOLUTIONS

$\omega = 2\pi f$  so  $2\pi f = 200\pi$  ie  $f = 100\text{Hz}$ ,  $T = \frac{1}{100} = 0.01\text{s}$ .

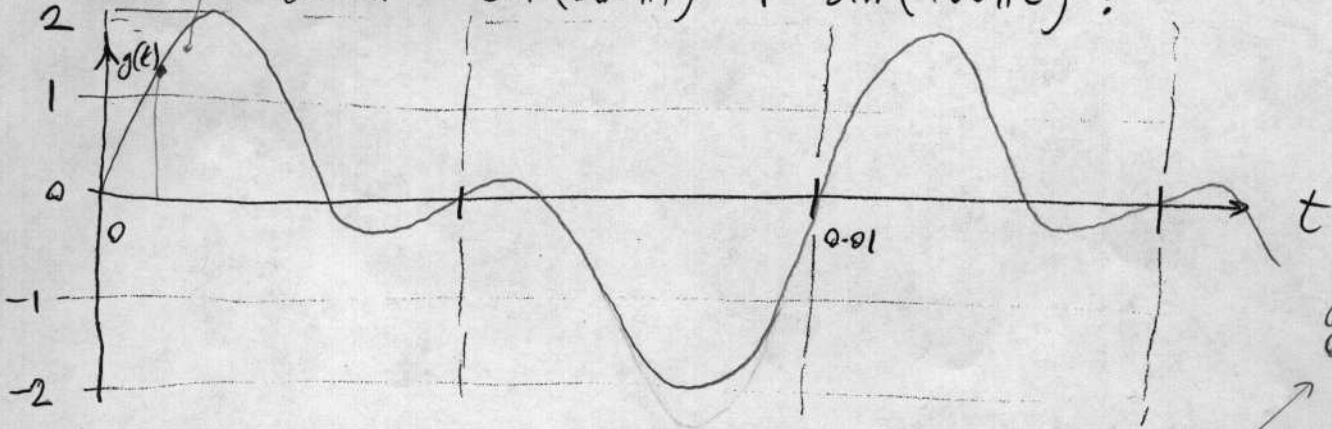
Sketch  $\sin(200\pi t)$  here [hint: first work out period!]



add the heights at each t value.

Draw on your sketch the signal  $\sin(400\pi t)$

Use this to sketch  $\sin(200\pi t) + \sin(400\pi t)$  :



0.01 s  
0.005 s  
LCM gives 0.01s

[What is combined period?  
good - it repeats still at 0.01s.]

Does it have even, odd, or no symmetry?   
by looking, or prove it.

$$g(-t) = \sin(-200\pi t) + \sin(-400\pi t) = -\sin(200\pi t) - \sin(400\pi t) = -g(t)$$

(Check by substituting  $t \rightarrow -t$ . Use the answer to improve your sketch)

What is the harmonic content of this signal?

- $b_1 = ? 1$
- $b_2 = ? 1$
- $b_3 = ? 0$
- $b_4 = ? 0$
- $\vdots$

} since the amplitude of each sinusoid you added was 1.

Do you expect to sound harsh or mellow (timbre?)  
Why? Since high harmonics absent.