MATH 5 WORKSHEET : Adding pure tones.

9/29/08
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A) Find all times t where the signal $\sin(2\pi t)$ passes through zero:
[Hint: check its freq. is what you expect].

B) Find t where $\sin(3t+5)$ passes through zero:

C) Write $3\sin(10t) + 4\cos(10t)$ as one pure tone with a new amplitude & phase:

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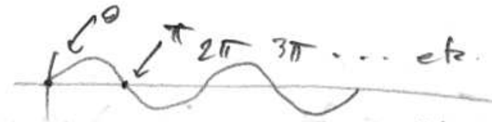
sin function looks like this:



ie $\sin(x) = 0$ for $x = n\pi$

So $2\pi t$ must equal $n\pi$, ie $2\pi t = n\pi \rightarrow \underline{t = \frac{n}{2}}$ n is integer.

Note: freq $f = \frac{\omega}{2\pi} = \frac{2\pi}{2\pi} = 1$ Hz, so you'd expect 2 crossings per second.

B) Find t where $\sin(3t + 5)$ passes through zero:

set this equal to $n\pi$, as before, solve for t

$$3t + 5 = n\pi$$

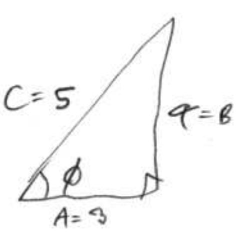
$$3t = n\pi - 5$$

$$t = \frac{n\pi - 5}{3}$$

note freq $= \frac{3}{2\pi}$ which is not a nice round fraction

C) Write $3\sin(10t) + 4\cos(10t)$ as one pure tone with a new amplitude & phase:

check: the two freq's (ω's) are equal!



pythagoras : $C^2 = A^2 + B^2$

ie $C = \sqrt{3^2 + 4^2} = \sqrt{25} = 5$

$\tan\phi = B/A = 4/3$

so $\phi = \tan^{-1} 4/3$

so signal is $5\sin(10t + \tan^{-1} 4/3)$

notice we didn't do anything with $\omega = 10$.