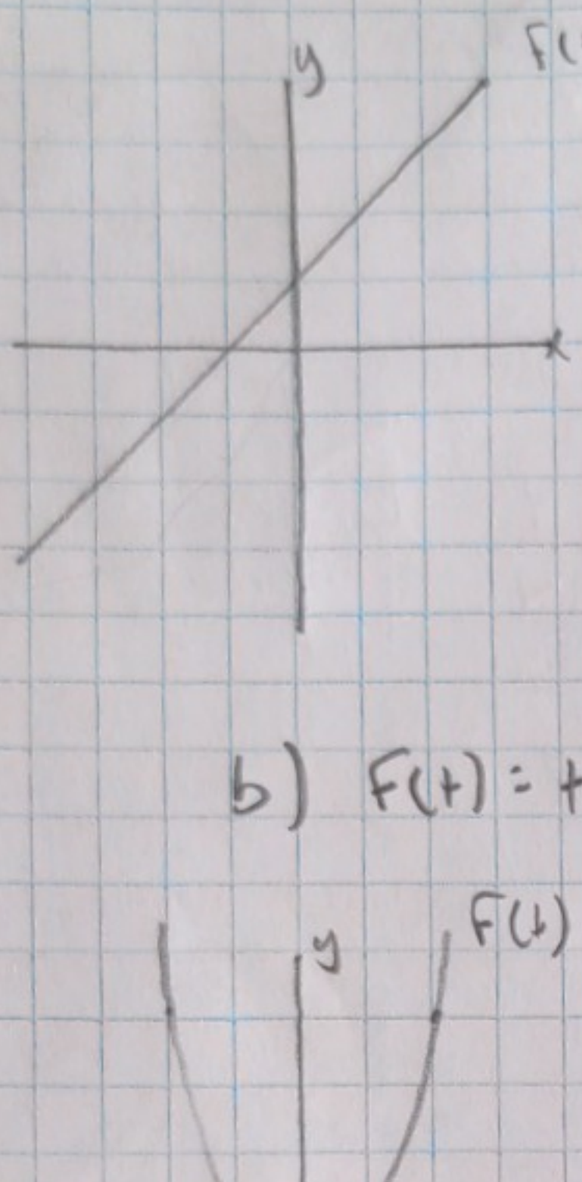
Chris Hunt

HW 14

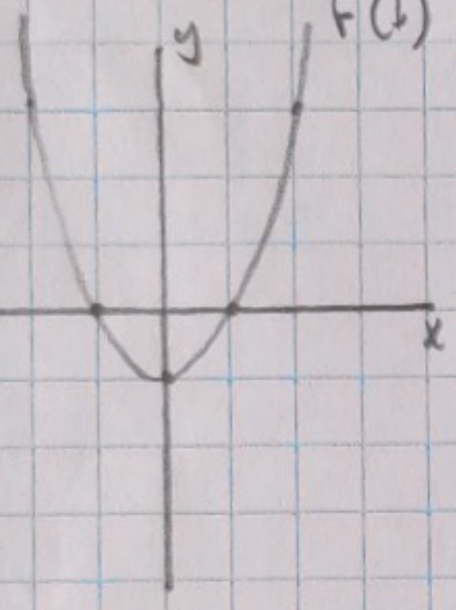
ENGR 203

14.1) a) $F(t) = 1 + t$



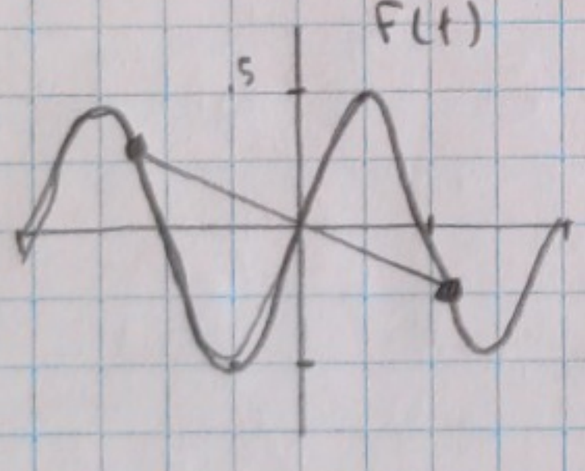
F(t) is neither even or odd because it is not symmetric about the y-axis (even) and if you pick a point and draw a line from it through the origin it does not meet a point on that Function (odd).

b) $F(t) = t^2 - 1$



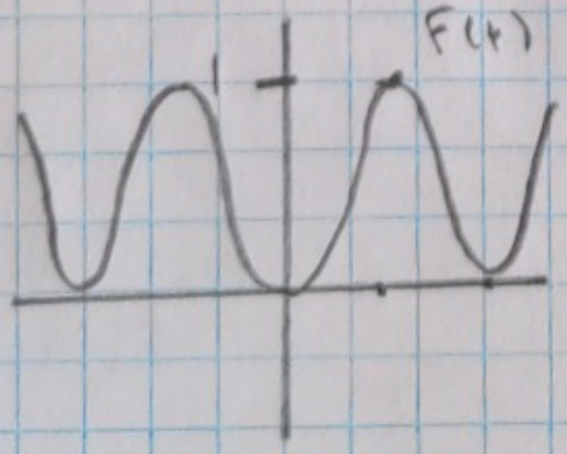
F(t) is even, it is symmetric about the y-axis

C) $f(t) = \cos(n\pi t)\sin(n\pi t$



F(t) is an odd Function

d) $F(t) = \sin^2(\pi t)$



F(t) is an even Function

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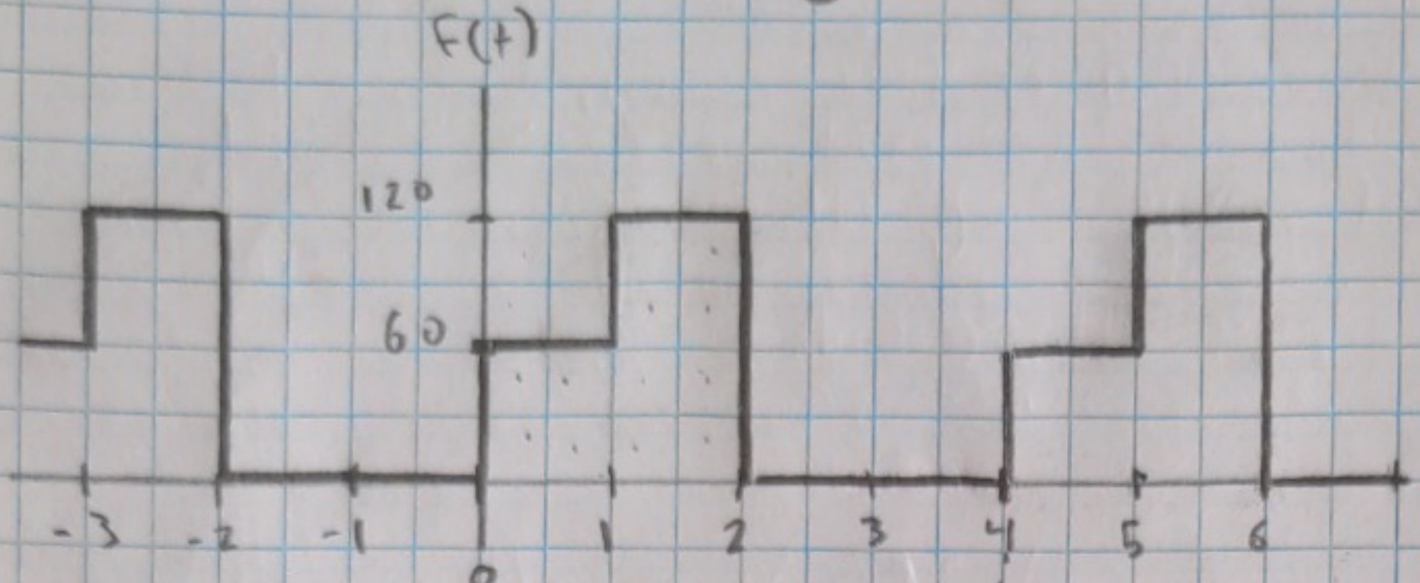
14.2) Given the Following waveform:



Neither even or odd...

$T = 4$

$$f(t) = \begin{cases} 60, & 0 \le t < 1 \\ 120, & 1 \le t < 2 \\ 0, & 2 \le t < 4 \end{cases}$$

a) Find a_0 and the Fourier coefficients for the first 5 harmonics.

$$a_0 = \frac{1}{T}\int_0^T F(t)\,dt$$

$$a_0 = \frac{1}{4}\left(\int_0^1 60\,dt + \int_1^2 120\,dt\right)$$

$$a_0 = \frac{1}{4}(60 + 120)$$

$$a_0 = 45$$

$$a_n = \frac{2}{T}\int_0^T F(t)\cos(n\omega_0 t) \qquad \omega_0 = \frac{2\pi}{T} = \frac{\pi}{2}$$

$$a_n = \frac{1}{2}\left(\int_0^1 60\cos\left(\frac{n\pi}{2}t\right)dt + \int_1^2 120\cos\left(\frac{n\pi}{2}t\right)dt\right)$$

$$a_n = \frac{1}{2}\left(\left(\frac{120\sin\left(\frac{n\pi}{2}t\right)}{\pi n}\right)\Bigg|_0^1 + \left(\frac{240\sin\left(\frac{n\pi}{2}t\right)}{\pi n}\right)\Bigg|_1^2\right)$$

$$a_n = \frac{1}{2}\left(\frac{120\sin\left(\frac{n\pi}{2}\right)}{\pi n} + \left(\frac{240\sin(n\pi)}{\pi n} - \frac{240\sin\left(\frac{n\pi}{2}\right)}{\pi n}\right)\right)$$

$$a_n = -\frac{60\sin\left(\frac{n\pi}{2}\right)}{\pi n}$$

I couldn't Figure out the $(-1)^{something}$ part out but why not just leave it as a sine Function?

I'm going to leave both that way...

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14.2) $b_n = \frac{1}{2}\left(\int_0^1 60\sin\left(\frac{n\pi}{2}t\right)dt + \int_1^2 120\sin\left(\frac{n\pi}{2}t\right)dt\right)$

$b_n = 30\int_0^1 \sin\left(\frac{n\pi}{2}t\right)dt + 60\int_1^2 \sin\left(\frac{n\pi}{2}t\right)dt$

$b_n = 30\left(\frac{-2\cos\left(\frac{n\pi}{2}t\right)}{n\pi}\right)_0^1 + 60\left(\frac{-2\cos\left(\frac{n\pi}{2}t\right)}{n\pi}\right)_1^2$

$b_n = \frac{-60}{n\pi}\left(\cos\left(\frac{n\pi}{2}\right) - 1\right) - \frac{120}{n\pi}\left(\cos(n\pi) - \cos\left(\frac{n\pi}{2}\right)\right)$

$b_n = \frac{60}{n\pi}\left(1 - \cos\left(\frac{n\pi}{2}\right)\right) + \frac{120}{n\pi}\left(\cos\left(\frac{n\pi}{2}\right) - \cos(n\pi)\right)$

$A_n = \sqrt{a_n^2 + b_n^2}$ $\quad \phi_n = -\tan^{-1}\left(\frac{b_n}{a_n}\right)$

$A_1 = 60.4$ $\quad \phi_1 = 35.78°$

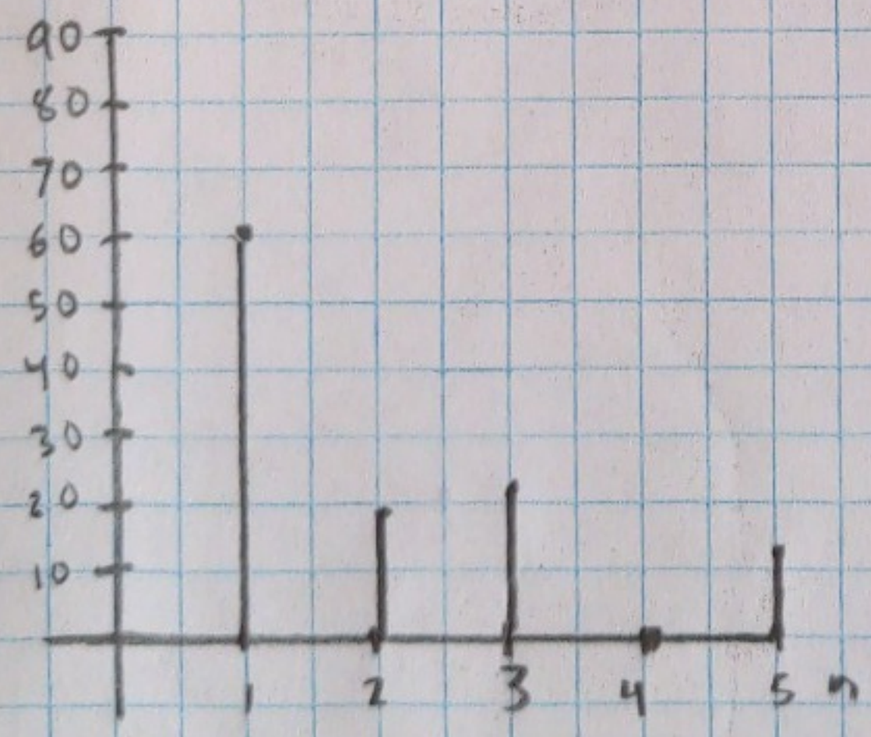
$A_2 = 19.1$ $\quad \phi_2 = -45°$

$A_3 = 20.13$ $\quad \phi_3 = -35.78$

$A_4 = 0$ $\quad \phi_4 = 0°$

$A_5 = 12.1$ $\quad \phi_5 = 35.78$

b) Amplitude vs. n



Phase vs. n