1. What is $\sum_{i=0}^{190} i$ $a_1 = 0+1$

$$\sum_{i=1}^{n} a_i = n \cdot \frac{a_1 + a_n}{2}$$

$= 190 \cdot \frac{1+190}{2}$

$= \boxed{18,145}$

2. What is the imag. part of $\frac{1}{1+j}$?

→ from calc. got $\frac{-1}{2}$

$\frac{1}{1+j} \cdot \frac{1-j}{1-j} = \frac{1-j}{1-(-1)} = \frac{1-j}{2} = \boxed{\frac{-1}{2}}$

Complex Number Format: $\underbrace{\frac{1}{2}}_{\text{real}} \underbrace{-\frac{1}{2}}_{\text{imag.}} j$

→ Real + Imag. j

3. What is the value of

$$\sum_{i=0}^{\infty} \left(\frac{1}{4}\right)^i$$

geometric series

$r = \frac{1}{4}$

Eq. $\frac{1}{1-\frac{1}{4}} = \frac{1}{.75} = \boxed{1.333}$

4. What is the power of:

$$y = \sin(2\pi t) + \cos(8\pi t)$$

$\hookrightarrow b = 2\pi$ $\quad T = 1$ $\quad\quad \hookrightarrow b = 8\pi$ $\quad T = \frac{1}{4}$

Equation $\quad P_y = \left[\lim_{T\to\infty} \frac{1}{2T}\right] \int_{-T}^{T} |x(t)|^2 \, dt$

$\boxed{T = \frac{2\pi}{b}}$

$$P_{y_1} = \left[\cancel{\lim_{T\to\infty}} \frac{1}{2}\right] \int_{-1}^{1} (\sin(2\pi t))^2 \, dt$$

$1/2$

$$P_{y_1} = \frac{1}{2} \cdot 1 = \frac{1}{2}$$

2

$$P_{y_2} = \left[\cancel{\lim_{T\to\infty}} 2\right] \int_{-\frac{1}{4}}^{\frac{1}{4}} (\cos(8\pi t))^2 \, dt$$

$$P_{y_2} = 2 \cdot \frac{1}{4} = \frac{1}{2}$$

$$P_y = P_{y_1} + P_{y_2} = \frac{1}{2} + \frac{1}{2} = \boxed{1}$$

Power = 1

5.

Question 5 10 / 10 pts

An analog accelerometer with +3V power supply is used to measure acceleration A in range +-2g. What is the voltage on the analog output pin if acceleration is A=1 g ?

Please use 3 decimal digits of precision.

2.25

$a_0 = \frac{V_{cc}}{2}$ $a = a_0 + sg$

$s = \frac{V_{cc}}{a_{swing}}$ → # of g's

$V_{cc} = 3V$

$a_{swing} = \pm 2g = 4$

$g = 1$

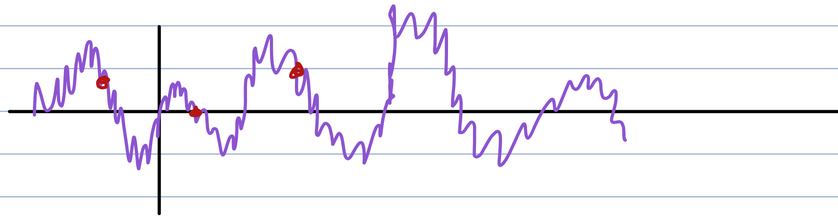
$a_0 = \frac{3}{2} = 1.5$ $s = \frac{3}{4}$

$a = \underset{a_0}{1.5} + \underset{s}{0.75}\,\underset{g}{(1)} = \boxed{2.250\ V}$

6. Is this periodic?

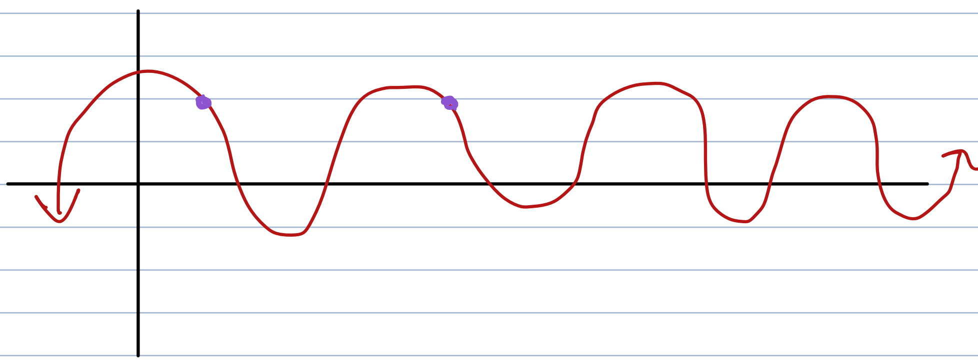
$$y = 3\sin(6\pi t) + 4\cos(3t)$$

$\boxed{\text{False}}$



How to be periodic

1. has to be defined from $-\infty$ to ∞
   ↳ no discontinuities
2. have to get to the same value after each period.



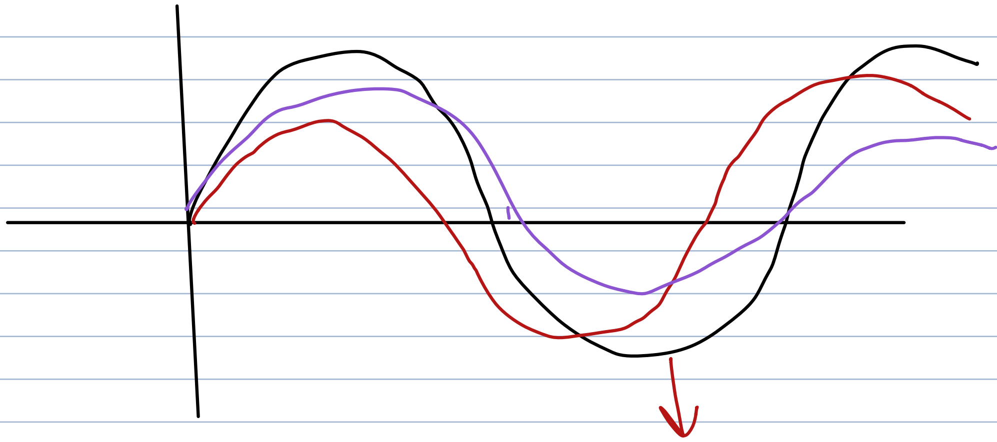
7. Is this even, odd, or neither

$$y = \sin\left(2\pi t + \frac{\pi}{4}\right)$$

$\boxed{\text{neither}}$

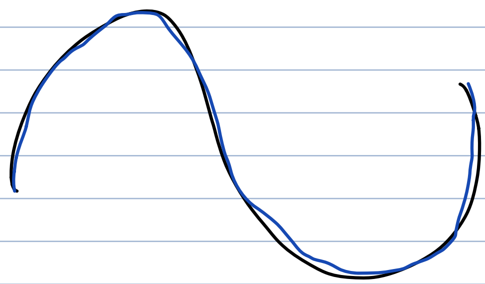
even: try $\sin\left(-2\pi t + \frac{\pi}{4}\right)$

odd: try: $-\sin\left(-2\pi t + \frac{\pi}{4}\right)$



wanted to match this

Ex.



$x(t)$

$x(-t)$ → even

8. If $x(t)$ is the input, how is this modulated?

$$y = A \cdot \sin(2\pi \cdot x(t) \cdot t + \frac{\pi}{3})$$

$\boxed{\text{Freq. Modulated}}$

Normal form:

$$y = A \cdot \sin(\Omega_0 t + \theta)$$

amp. freq. phase

→ modulation depends on what your change (inputs) is attached to.

Amp. modulation Ex.

$$y = A \cdot x(t) \sin(2\pi t + \frac{\pi}{3})$$

Phase mod.

$$y = 3A \cos(3t + \frac{\pi}{4} x(t))$$

Not Mod.

$$y = A \sin(2\pi t + \frac{\pi}{3})$$

9. For inductor w/ inductance L, what is the complex impedence in the laplace domain?

Circuit Element	Complex imp. in Laplace
R	R
L	$\boxed{Ls}$
→ C	$\frac{1}{Cs}$

10. Is this right?

$$x(t) = \sin(3t)$$

$$X(s) = \mathcal{L}[x(t)] = \frac{1}{s^2+9}$$

Property: $\mathcal{L}[\sin(at)] = \dfrac{a}{s^2+a^2}$

$\sin(3t) \rightarrow a = 3$

true answer: $\dfrac{3}{s^2+9}$

$\boxed{\text{False}}$