We have 3 weeks of class (20% of the term!)
Still to come:
Dirac delta function, PDEs, and Fourier transforms

If we have time after that, how would *you* like to wrap up the term? More useful math-y stuff like e.g.
A) Special functions ("Bessel Functions" and/or "Legendre Polynomials")
or more physics-y stuff like...
B) Non-inertial reference frames (fictitious forces, like centrifugal and Coriolis)

C) I have something else in mind (that I think the whole class would benefit from!)
D) I think Prof Rey and Pollock should choose!

2- 1

$$f(t) = \sum_{n=0}^{\infty} a_n \cos n\omega t + b_n \sin n\omega t$$

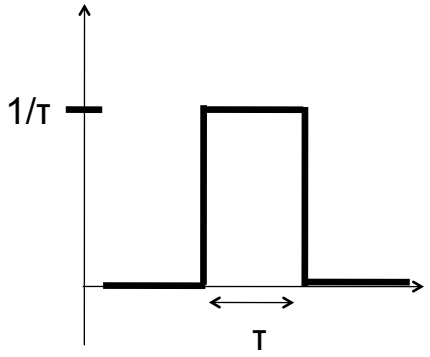
This Fourier sum is used for functions f(t) with period $T=2\pi/\omega$, which means $f(t+T)=f(t)$ (for all times t)

What can you say about the periodicity of the function $\sin(n\omega t)$ ...

A) It has period $T = 2\pi/(n\omega)$, but NOT $T = 2\pi/\omega$
B) It has period $T = 2\pi/\omega$, but NOT $T = 2\pi/(n\omega)$
C) It has period $T = 2\pi/\omega$, and ALSO $T = 2\pi/(n\omega)$
D) It has NEITHER period (not $T = 2\pi/\omega$, not $T = 2\pi/n\omega$)

2- 2

Given this little "impulse" f(t) (height 1/τ, duration τ),



In the limit τ ➔0, what is

$$\int_{-\infty}^{\infty} f(t)dt\,?$$

A) 0 B) 1 C) ∞
D) Finite but not necessarily 1 E) ??

Challenge: Sketch f(t) in this limit.

2- 3

What is the value of $\int_{-\infty}^{\infty} x^2\delta(x-2)dx$

A) 0
B) 2
C) 4
D) ∞
E) Something different!

2- 4

What is the value of $\int_{-\infty}^{\infty} x^2 \delta(x)\,dx$

A) 0
B) 1
C) 2
D) 4
E) 5

2- 5

What is the value of $\int_{-\infty}^{2} (x^2 + 1)\delta(x)\,dx$

A) 0
B) 1
C) 2
D) 4
E) 5

2- 6

What is the value of $\int_0^\infty x^2\delta(x+2)dx$

A) 0
B) 2
C) 4
D) ∞
E) Something different!

2- 7

What is the value of $\int_{-\infty}^\infty x^2\delta(x+2)dx$

A) 0
B) 2
C) 4
D) ∞
E) Something different!

2- 8

What is the value of $\int_{-\infty}^{\infty} x^2 \delta(2-x)dx$

A) 2
B) - 2
C) 4
D) – 4
E) Something different!

2- 9

Recall that $\int_{-\infty}^{\infty} f(t')\delta(t-t')dt' = f(t)$

What are the UNITS of $\delta(t-t')$ (where t is seconds)

A) sec
B) sec^{-1}
C) unitless
D) depends on the units of f(t)
E) Something different!

2- 10

PDEs

Partial Differential Equations

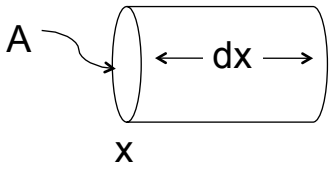
Heat flow (H = Joules passing by/sec):

$$H(x,t) \propto \frac{\partial T(x,t)}{\partial x}$$

How does the prop constant depend on the area , A?

A) linearly
B) ~ some other positive power of A
C) inversely
D) ~ some negative power of A
E) It should be *independent* of area!

Thermal heat flow H(x,t) has units (J passing)/sec



If you have H(x,t) *entering* on the left, and
H(x+dx,t) *exiting* on the right,
what is the energy building up inside, in time dt?

A) H(x)-H(x+dx)
B) H(x+dx)-H(x)
C) (H(x)-H(x+dx))dt
D) (H(x+dx)-H(x))dt
E) Something else?! (Signs, units, factor of A, ...?)

2- 13