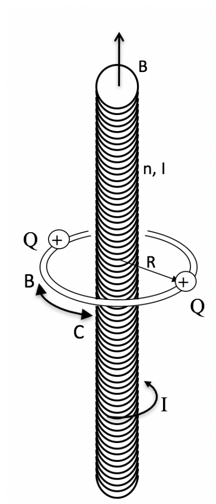
Feynman's Paradox: Two charged balls are attached to a horizontal ring that can rotate about a vertical axis without friction. A solenoid with current I is on the axis. Initially, everything is at rest.

The current in the solenoid is turned off. What is the direction of $d\mathbf{E}/dt$ when viewed from the top?

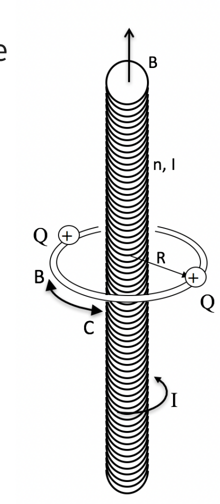
A. 0
B. CW.
C. CCW.



Feynman's Paradox: Two charged balls are attached to a horizontal ring that can rotate about a vertical axis without friction. A solenoid with current I is on the axis. Initially, everything is at rest.

The current in the solenoid is turned off. What happens to the charges?

A. They remain at rest
B. They rotate CW.
C. They rotate CCW.



Does the Feynman device violate Conservation of Angular Momentum?

A. Yes
B. No
C. Neither, Cons of Ang Mom does not apply in this case.

A function, $f(x, t)$, satisfies this PDE:

$$\frac{\partial^2 f}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 f}{\partial t^2}$$

Invent two different functions $f(x, t)$ that solve this equation. Try to make one of them "boring" and the other "interesting" in some way.

A function, $f(x, t)$, satisfies this PDE:

$$\frac{\partial^2 f}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 f}{\partial t^2}$$

Which of the following functions work?

A. $\sin(k(x - vt))$
B. $exp(k(-x - vt))$
C. $a(x + vt)^3$
D. All of these.
E. None of these.

A "right moving" solution to the wave equation is:

$$f_R(z, t) = A\cos(kz - \omega t + \delta)$$

Which of these do you prefer for a "left moving" soln?

A. $f_L(z, t) = A\cos(kz + \omega t + \delta)$
B. $f_L(z, t) = A\cos(kz + \omega t - \delta)$
C. $f_L(z, t) = A\cos(-kz - \omega t + \delta)$
D. $f_L(z, t) = A\cos(-kz - \omega t - \delta)$
E. more than one of these!

(Assume k, ω, δ are positive quantities)

A "right moving" solution to the wave equation is:

$$f_R(z, t) = A\cos(kz - \omega t + \delta)$$

How many of these could be a "left moving" soln?

- $f_L(z, t) = A\cos(kz + \omega t + \delta)$
- $f_L(z, t) = A\cos(kz + \omega t - \delta)$
- $f_L(z, t) = A\cos(-kz - \omega t + \delta)$
- $f_L(z, t) = A\cos(-kz - \omega t - \delta)$

Two different functions $f_1(x, t)$ and $f_2(x, t)$ are solutions of the wave equation.

$$\frac{\partial^2 f}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 f}{\partial t^2}$$

Is $(Af_1 + Bf_2)$ also a solution of the wave equation?

A. Yes, always
B. No, never
C. Yes, sometimes depending on f_1 and f_2

Two traveling waves 1 and 2 are described by the equations:

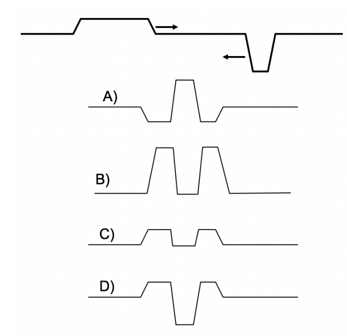
$$y_1(x,t) = 2\sin(2x - t)$$
$$y_2(x,t) = 4\sin(x - 0.8t)$$

All the numbers are in the appropriate SI (mks) units.

Which wave has the higher speed?

A. 1
B. 2
C. Both have the same speed

Two impulse waves are approaching each other, as shown. Which picture correctly shows the total wave when the two waves are passing through each other?



A solution to the wave equation is:

$$f(z,t) = A\cos(kz - \omega t + \delta)$$

- What is the speed of this wave?
- Which way is it moving?
- If δ is small (and >0), is this wave "delayed" or "advanced"?
- What is the frequency?
- The angular frequency?
- The wavelength?
- The wave number?

A solution to the wave equation is:

$$f(z,t) = Re\left[Ae^{i(kz - \omega t + \delta)}\right]$$

- What is the speed of this wave?
- Which way is it moving?
- If δ is small (and >0), is this wave "delayed" or "advanced"?
- What is the frequency?
- The angular frequency?
- The wavelength?
- The wave number?

A complex solution to the wave equation in 3D is:

$$\tilde{f}(\mathbf{r}, t) = \tilde{A} e^{i(\mathbf{k}\cdot\mathbf{r} - \omega t)}$$

- What is the speed of this wave?
- Which way is it moving?
- Why is there no δ?
- What is the frequency?
- The angular frequency?
- The wavelength?
- The wave number?