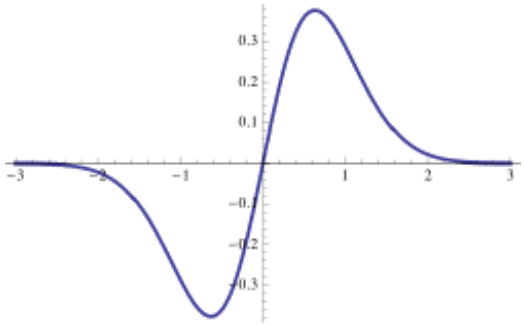
A wave pulse in one dimension is described by f(x,t) = e^[-(x + t)^2] ArcTan(x + t), which may be an intimidating equation but at t = 0 simply looks like this as a function of x:



The peak value of f(x, t) is 0.3780, and in this picture, at t = 0, that occurs at x = 0.6328. At a later time t = 1, at what value of x does f(x, t) take that same value of 0.3780? What about at t = 2? What does that tell you about the motion of this pulse? Explain your reasoning.

Hint: this one is not hard if you think first and don't immediately start trying to crank out tons of algebra or calculus. Focus on the function's argument, (x + t), not on the functions themselves.

Follow the money...no, follow the argument!

Since the function's argument is (x + t), in order to get the same peak value, the **values for x and t within the function must be the same**. If t increases then x must decrease accordingly to make the (x + t) argument remain the same. With this known, **an increase in t from t = 0 to t = 1 would require x = x_initial - 1. Similarly, t = 2 would mean x = x_inital - 2 and so on for each increase in time**.

Logic explained, but values not calculated

Since the function always pairs x and t together as (x + t), the combined value of that will be used throughout the equation. **If the function equals 0.3780 when t equals 0, then that means that the (x + t) combined value is equal to just x. So, at t = 1, x must equal its original value minus 1**. When the function equals 0.3780, x will always equal the value of its original value at t = 0 minus the value of t.

The values of peak x calculated, sparse logic

Using the function's argument, (x+t), **when t=1, x would need to equal -0.3672. When t=2, x would need to equal -1.3672**. Based on the coordinate system above, this tells you that the pulse is moving in the negative x-direction or to the left.

The neck of guitar has a regular series of frets on it, i.e., small raised ridges running across the neck immediately below the strings. A violin does not have frets, rather, the fingerboard beneath the strings is smooth. Discuss how this difference affects the types of vibrations musicians can produce with the two instruments.

Main consequence: frets constrain the length of the vibrating string

Since the guitar has raised frets, **one is not able to change the length of the cord as much**. This causes the guitar to be more limited than the violin in the types of vibrations musicians can produce.

Frets determine where nodes may occur

The vibrations of strings in both guitars and strings represent standing waves because there are two fixed endpoints in which points oscillate back and forth while staying in the same location. The frets on a guitar create areas in which the player can press to change the length of the string. Pressing of the violin strings with a bow also creates variation in length of the string. Therefore, different sounds are created by changing the vibrations occur in both instruments. **With guitars, there are specific set locations that can be pressed to create certain sounds. In a violin, these locations don't exist, so it is more difficult to create specific vibrations corresponding to certain sounds**.

A violin allows maximum flexibility

Because of the frets, guitars have a more limited range on which musical notes and vibrations it can play. **To change the tone of the sound wave, you would need to decrease the pitch by shortening or largening the wavelength.** You could shorter or largen the wavelength by placing your finger on one of these frets to create a new endpoint in which the sinusoidal wave of the string operates in. **The violin has more options to create these changes in wavelength because the smooth board means you can place your fingers everywhere on the instrument and change the sound more**.

For a typical trampoline, what condition would you expect to hold around the edge where the elastic sheet attaches to the frame? At the edge there should be a displacement

a. mode
b. node
c. antimode
d. antinode