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Homework 6 for the Physics for OI

This homework is focused on waves and their propagation and on standing waves.

Your tasks:

- To depict a sinusoidal wave propagating in the positive or negative direction of the x-axis.
- To depict a standing wave along the x-axis.

Additional instructions and hints:

- a) **The wave propagating** in the positive direction of the x-axis can be described by the equation

$$y = A \sin(kx - \omega t)$$

where A is amplitude of the wave, k is wavenumber and ω is angular frequency. The wave propagating in the negative direction of the x-axis differs just in the sign.

$$y = A \sin(kx + \omega t)$$

Use the *Manipulate* function for depiction of the propagating wave, where the time t , the wavenumber k and the angular frequency ω are variables. Recommended ranges are 0 to 10 for the time, 0.1 to 1 for the wavenumber and -3 to +3 for the angular frequency (default initial value 0.2). The possibility of both signs at the angular frequency represents the motion in the positive or negative direction of the x-axis. The amplitude $A=1$ and recommended range for the x-axis is 0 to 30.

To obtain larger and longer picture than the default one, use the *ImageSize* function setting the image size to 500x200 pixels and the *AspectRatio* function setting its parameter to 1/5.

- b) **The standing wave** result from the interference of two waves of equal basic parameters (A , k and ω) propagating in the opposite directions. More theory can be found in the textbook. Equation of such wave is

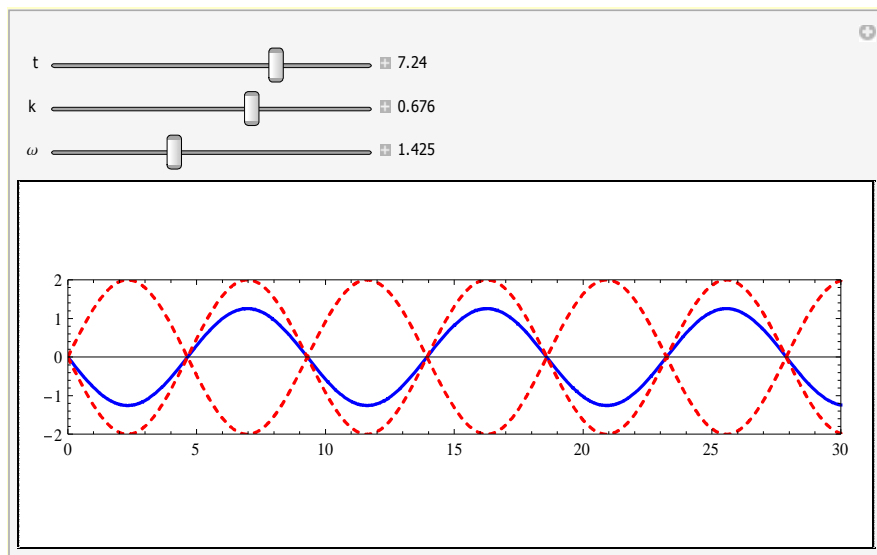
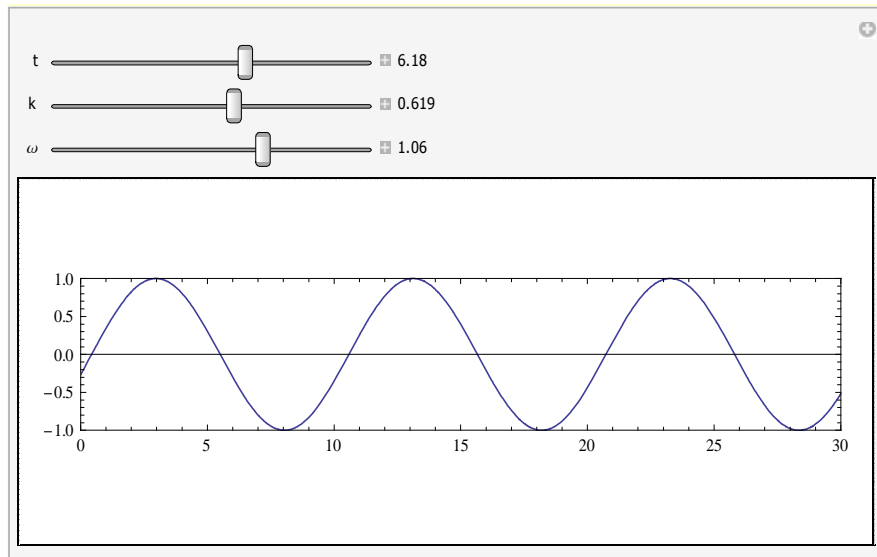
$$y = 2A \sin(kx) \cos(\omega t)$$

where A , k and ω are parameters of two particular waves.

Use the *Manipulate* function again, where the standing wave itself will be represented by the blue thick line and maximum and minimum amplitudes will be represented by the dashed red lines not dependent on the time parameter. The same variables will be used – the time (range 0 to 10), the wavenumber (0.1 to 1) and the angular frequency (0.5 to 3).

Needed functions and parameters: Manipulate, ImageSize, AspectRatio, Plot, PlotRange, PlotStyle, Frame

Two pictures below show the required appearance of both solutions.





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