Review: Mechanical wave

Review: Wave function

Review: Wave equation

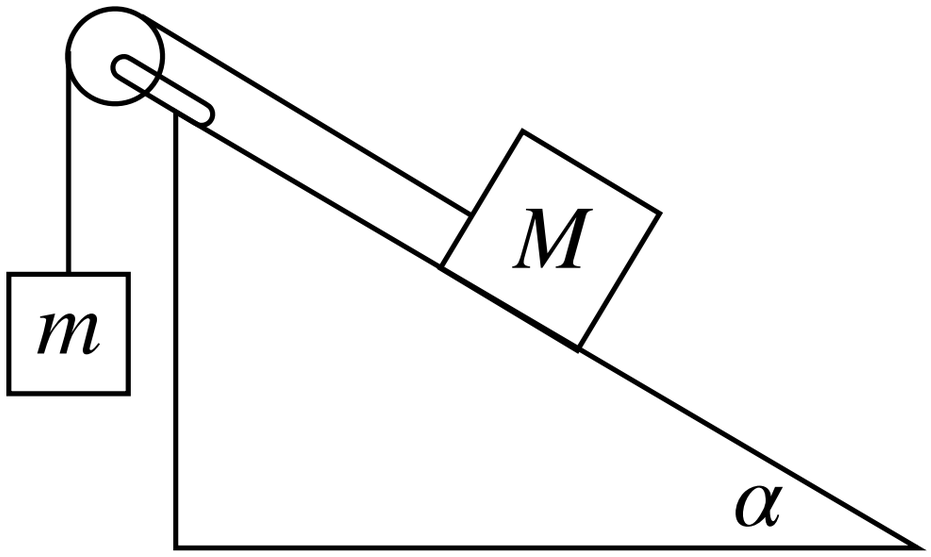
Review: Wave equation

Example (1)

Demonstrate that any differentiable function $f(t + \alpha x)$ where α is a constant, provides a solution of wave equation. What is the physical meaning of the constant α?

Example (2)

A block of mass M sits on an frictionless inclined plane of angle $\alpha = \pi/4$ as in Figure. It is connected by a wire of linear mass density μ = 0.03 kg/m that goes over a pulley that supports mass m. Both masses are at rest. If transverse waves travel at v = 80 m/s in the wire find M and m. Ignore the mass of the string in computing the tension on the string, use it just to find the velocity of waves.



Example (3)

A wire of density ρ is tapered so that its cross-sectional area varies with x according to

$$A = 1.0 \times 10^{-5} x + 1.0 \times 10^{-6}$$

where A is in meters squared and x is in meters. The tension in the wire is T.

(a) Derive a relationship for the speed of a wave as a function of position.

(b) If the wire has density 2.7 g/cm^3 (aluminum) and is under a tension T = 24.0 N, determine the wave speed at the origin and at x = 10.0 m.

Example (4)

เชือกเส้นหนึ่งยาว L มีค่าความหนาแน่นคงที่ ρ_0 มีเส้นผ่านศูนย์กลางที่เปลี่ยนแปลงไปตามระยะทางจากปลายด้านหนึ่งเป็นไปตามสมการ

$$d = d_0 \sin(\pi x/L); 0 \leq x \leq L$$

เมื่อเชือกเส้นนี้ถูกดึงด้วยความตึง T จงหา

- มวลต่อหน่วยความยาวของเชือกเส้นนี้
- ความเร็วของคลื่นในเส้นเชือกของเชือกเส้นนี้
- เวลาที่คลื่นในเส้นเชือกจะเคลื่อนที่จากปลายด้านหนึ่งไปถึงปลายอีกด้านหนึ่ง

Example (4)

Review: Reflection

Review: Sinusoidal wave

Review: Sinusoidal wave

Example (5)

A sinusoidal wave traveling in the negative x-direction (to the left) has an amplitude of 20.0 cm, a wavelength of 35.0 cm, and a frequency of 12.0 Hz. The transverse position of an element of the medium at $t = 0, x = 0$ is $y = -3.00$ cm, and the element has a positive velocity here. We wish to find an expression for the wave function describing this wave.

(a) Sketch the wave at $t = 0$.

(b) Find the angular wave number k from the wavelength.

(c) Find the period T from the frequency.

(d) Find the angular frequency ω.

(e) Find the wave speed v.

(f) From the information about $t = 0$, find the phase constant ϕ.

(g) Write an expression for the wave function $y(x, t)$.

Example (5)

Example (6)

The equation of a traveling wave has the form $y(x,t) = 60\cos(1800t - 5.3x)$ where y is expressed in micrometers, t in seconds, and x in meters. Find

- the ratio of the displacement amplitude, with which the particles of medium oscillate, to the wavelength;
- the velocity oscillation amplitude of particles of the medium and its ratio to the wave propagation velocity.

Example (6)