
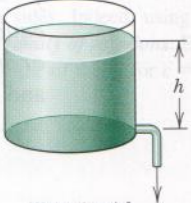
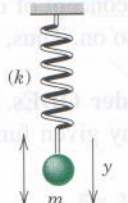
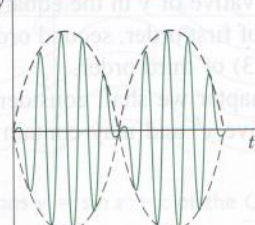
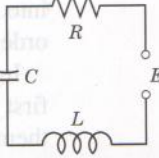
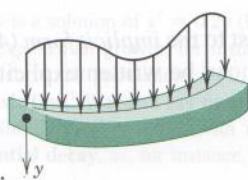
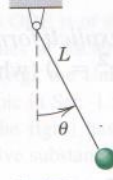
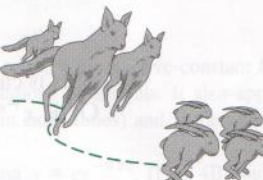
 <p>Falling stone  <math>y'' = g = \text{const.}</math>                      (Sec. 1.1)</p>	 <p>Parachutist  <math>mv' = mg - bv^2</math>                      (Sec. 1.2)</p>	 <p>Water level <math>h</math>                      Outflowing water  <math>h' = -k\sqrt{h}</math>                      (Sec. 1.3)</p>
 <p>Displacement <math>y</math>                      Vibrating mass on a spring  <math>my'' + ky = 0</math>                      (Secs. 2.4, 2.8)</p>	 <p>Beats of a vibrating system  <math>y'' + \omega_0^2 y = \cos \omega t, \omega_0 = \omega</math>                      (Sec. 2.8)</p>	 <p>Current <math>I</math> in an RLC circuit  <math>LI'' + RI' + \frac{1}{C}I = E'</math>                      (Sec. 2.9)</p>
 <p>Deformation of a beam  <math>EIy^{iv} = f(x)</math>                      (Sec. 3.3)</p>	 <p>Pendulum  <math>L\theta'' + g \sin \theta = 0</math>                      (Sec. 4.5)</p>	 <p>Lotka-Volterra predator-prey model  <math>y_1' = \alpha y_1 - \beta y_1 y_2</math>  <math>y_2' = k y_1 y_2 - l y_2</math>                      (Sec. 4.5)</p>

Fig. 2. Some applications of differential equations

An **ordinary differential equation (ODE)** is an equation that contains one or several derivatives of an unknown function, which we usually call  $y(x)$  (or sometimes  $y(t)$  if the independent variable is time  $t$ ). The equation may also contain  $y$  itself, known functions of  $x$  (or  $t$ ), and constants. For example,

- (1)  $y' = \cos x$
- (2)  $y'' + 9y = e^{-2x}$
- (3)  $y' y''' - \frac{3}{2} y'^2 = 0$