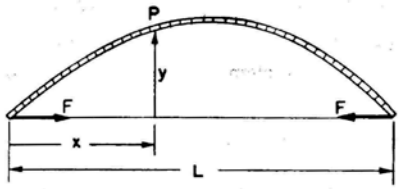
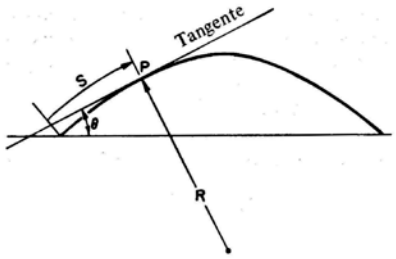
I. In a beam (length *l*) the following bending moment was measured as function of coordinate x: $M(x) = M_0 e^{x/l}$.
Determine the support reactions at both ends of the beam! Is a line load acting on the beam? If so, determine the line load!

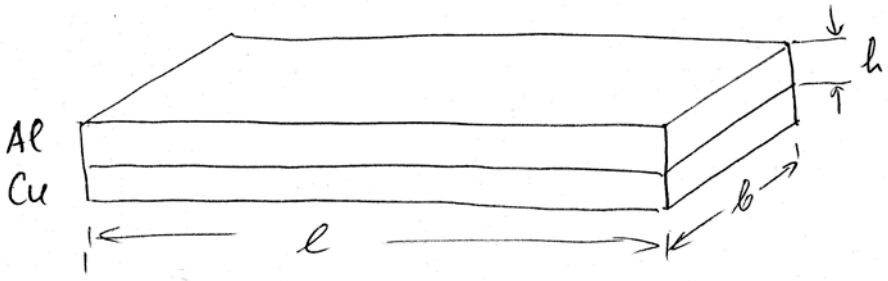
II. Determine the torsional stiffness of a helical spring with the following parameters: material of the wire is steel, diameter of the wire 1 mm, diameter of the coil 1 cm, number of turns: 10.
Note: Think of the beam equation in the form $M = -EI\dfrac{d\theta(s)}{ds}$.

III. Prove that for the shown curved elastic rod the following equation applies:
$\dfrac{d^2\theta}{ds^2} = -\dfrac{F}{EI}\sin\theta$:





IV. Determine the deflection of a bimetallic plate (aluminum-copper) due to increase in temperature of 50°.
Material data: $E_{Al} = 70\,\text{GPa}$, $E_{Cu} = 120\,\text{GPa}$, $\alpha_{Al} = 23\cdot10^{-5}1/\text{K}$, $\alpha_{Cu} = 16\cdot10^{-5}1/\text{K}$.
First try to solve a simplified task by assuming that the two elastic moduli are both equal to 100 GPa.



V. Determine the bending stiffness of a beam consisting of three plates with elastic moduli E_1, E_2, E_1.

Cross-section: