1. Write down the quadratic Taylor approximation of function $f(x) = \exp(2x)$ near *x*=0, and use it to estimate the function value $f(0.02)$

2. Find all constants ω and all functions $\phi(x)$ solving the following ordinary differential equation (boundary value problem):

$$\begin{cases} \dfrac{d^2\phi}{dx^2} + \omega^2\phi = 0 & (0 < x < 1) \\ \phi(0) = 0 \\ \phi'(1) = 0 \end{cases}$$

3. Let $\vec{r} = \langle x, y, z \rangle = x\,\mathbf{i} + y\,\mathbf{j} + z\,\mathbf{k}$ denote the position vector. Calculate the following:
    a) $div\ \vec{r} \equiv \nabla \cdot \vec{r}$
    b) $curl\ \vec{r} \equiv \nabla \times \vec{r}$
    c) $grad\ |\vec{r}|^2 \equiv \nabla\,|\vec{r}|^2$