# Project 1

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*https://github.uio.no/FYS3150-G2-2023/Project-1*

## PROBLEM 1

$$
\begin{aligned}
u(x) &= \int\int \frac{d^2u}{dx^2} dx^2 \\
&= \int\int -100e^{-10x} dx^2 \\
&= \int \frac{-100e^{-10x}}{-10} + c_1 dx \\
&= \int 10e^{-10x} + c_1 dx \\
&= \frac{10e^{-10x}}{-10} + c_1 x + c_2 \\
&= -e^{-10x} + c_1 x + c_2
\end{aligned}
$$

Using the boundary conditions, we can find $c_1$ and $c_2$ as shown below:

$$
\begin{aligned}
u(0) &= 0 \\
-e^{-10\cdot0} + c_1 \cdot 0 + c_2 &= 0 \\
-1 + c_2 &= 0 \\
c_2 &= 1
\end{aligned}
$$

$$
\begin{aligned}
u(1) &= 0 \\
-e^{-10\cdot1} + c_1 \cdot 1 + c_2 &= 0 \\
-e^{-10} + c_1 + c_2 &= 0 \\
c_1 &= e^{-10} - c_2 \\
c_1 &= e^{-10} - 1
\end{aligned}
$$

Using the values that we found for $c_1$ and $c_2$, we get

$$
\begin{aligned}
u(x) &= -e^{-10x} + (e^{-10} - 1)x + 1 \\
&= 1 - (1 - e^{-10}) - e^{-10x}
\end{aligned}
$$

**PROBLEM 2**

**PROBLEM 3**

**PROBLEM 4**

**PROBLEM 5**

**a)**

**b)**

**PROBLEM 6**

**a)**

**b)**

**PROBLEM 7**

**PROBLEM 8**

**PROBLEM 9**

**PROBLEM 10**