Using the Laplace transform to solve IVPs

We learn to use the Laplace transform to solve IVPs with the initial condition including $x_0 = 0$.

Suppose we have a differential equation involving the unknown function $y = y(t)$.

Loosely, our steps are as follows:

- Apply the Laplace transform $\mathcal{L}$ to the entire IVP, transforming it into a function of $Y(s)$.
  - In doing so, there will be typically be many terms of s and $Y(s)$ which occur.
- Solve for $Y(s)$.
- Use the inverse Laplace transform $\mathcal{L}^{-1}$ to transform back to
  - To apply $\mathcal{L}^{-1}$ to $Y(s)$, it is common to need to use partial fraction decomposition in order to express $Y(s)$ as a sum of expressions which we know what the inverse Laplace transform is.

We look at some examples in the video below.

Discussion, comments, and examples:

Click on each of the tabs below to view a different video.

Theory and set-up | Example One | Example Two

Theory and set-up:

WeBWorK module 16 exercises:

- Problems 12, 13

Relevant Wikipedia articles:

- **Some applications of the Laplace transform**