Final Exam

You should be prepared to

1. Find the Laplace transform of a piecewise continuous function of exponential order using the definition

\[ \mathcal{L}[f] = \int_0^\infty e^{-st} f(t) \, dt = F(s) \]

2. Use the table (Table 6.2.1 on page 252) to find the Laplace transform of \( f \) and the inverse Laplace transform of \( F(s) \).

3. Solve first and second order ODEs using the Laplace transform.

1 - 3 are sections 6.1 and 6.2

4. Understand how the second order system

\[ m u'' + \gamma u' + ku = F(t) \]

describes:

(i) free undamped oscillations \((F(t) = 0 \text{ and } \gamma = 0)\)

(ii) free damped oscillations \((F(t) = 0, \gamma \neq 0)\)

\[ \rightarrow \text{ Understand the concepts of} \]

1. Overdamping
2. Underdamping
3. Critical damping

* You should be able to set up and solve the second order problem describing the mechanical oscillations.

4 is Sections 8.7 and 8.8
5) Solve first order problems of the form \( y' = f(x, y) \)

Here there are several techniques:

- **Separable**
- **Integrating factor**
- **Bernoulli Type**
- **Method of Exact Equations**