SOLVING WITH MATLAB

These examples set out the syntax for solving a differential equation using MATLAB.

**Example 0.1.** A first order equation without initial conditions:

\[ y' + 2y = t + 1 \]

Type

```matlab
dsolve('Dy + 2*y(t) = t + 1','t')
```

This will produce

\[ y(t) = t/2 + C_1 * \exp(-2 * t)/4 + 1/4. \]

Remember to include the ‘\( t' \)' at the end to tell MATLAB that you want a solution for \( y \) in terms of \( t \).

If you have an initial condition, say \( y(0) = 3 \), then this is incorporated by typing

```matlab
dsolve('Dy + 2*y(t) = t + 1','y(0) = 3','t')
```

Note that the differential equation and initial condition are each contained within separate ‘\( t' \)’.

This will produce

\[ y(t) = t/2 + 11 * \exp(-2 * t)/4 + 1/4. \]
Example 0.2. A second order equation without initial conditions:

\[ y'' + 3y' - 4y = e^t \]

Type

\texttt{dsolve(D2y + 3*Dy - 4*y = exp(t)', t')}

This will produce

\[ y(t) = C_3 * exp(t) - exp(t)/25 + t * exp(t)/5 + C_4 * exp(-4 * t) \]

If we have initial conditions, say \( y(0) = 0, y'(0) = 1 \), then type

\texttt{dsolve(D2y + 3*Dy - 4*y = exp(t)', y(0) = 0', Dy(0) = 1', t')}

This will produce

\[ y(t) = (4 * exp(t))/25 - (4 * exp(-4 * t))/25 + (t * exp(t))/5 \]