

## Maple and Integral Transforms

The commands we use are: `laplace` and `invlaplace`. Here is an example- Notice that somewhere in the worksheet (usually at the beginning), we write `with(inttrans)`

First example: Compute some transforms

Here, solve the IVP

$$y'' + y' + y = 3 \sin(t) \quad y(0) = 1, y'(0) = 0$$

using Laplace transforms and with `dsolve`.

```
Eqn1:=diff(y(t),t$2)+diff(y(t),t)+y(t)=3*sin(t);
Y:=laplace(Eqn1,t,s);
Y2:=subs(y(0)=1,D(y)(0)=0,Y);
Y3:=solve(Y2,laplace(y(t),t,s));
Y4:=invlaplace(Y3,s,t);
dsolve({Eqn1,y(0)=1,D(y)(0)=0},y(t));
```

## Maple and the step function

In Maple, the step function is the Heaviside function. That is, `Heaviside(t-c)= $u_c(t)$`

Examples of its use: Solve  $y'' + y' + y = u_2(t) \cos(t - 2)$  with  $y(0) = 0$  and  $y'(0) = 0$ . Plot the result.

SOLUTION:

```
Eqn1:=diff(y(t),t$2)+diff(y(t),t)+y(t)=Heaviside(t-2)*cos(t-2);
Y1:=dsolve({Eqn1,y(0)=0,D(y)(0)=0},y(t));
plot(rhs(Y1),t=0..15);
```

Using the Heaviside function is one way to deal with piecewise defined functions. For example, plot

$$f(t) = \begin{cases} t & \text{if } 0 \leq t \leq 3 \\ 6 - t & \text{if } 3 < t \leq 6 \\ 0 & \text{elsewhere} \end{cases}$$

SOLUTION:

$$t(u_0(t) - u_3(t)) + (6 - t)(u_3(t) - u_6(t)) = t(1 - u_3(t)) + (6 - t)(u_3(t) - u_6(t))$$

In Maple:

```
F:=t*(Heaviside(t)-Heaviside(t-3))+(6-t)*(Heaviside(t-3)-Heaviside(t-6));
plot(F,t=-1..7);
```