

Mathematica (13)

Mathematica knows how to solve some differential equations. The built in function DSolve will solve equations symbolically. To solve the equation $y' + (2/x)y = 2g$ (the equation for a chain piled up at the edge of a table sliding off the table under gravity), we proceed as follows:

```
In[4]:= DSolve[y' [x] + 2 / x y[x] == 2 g, y, x]
```

```
Out[4]= {{y -> Function[{x},  $\frac{2 g x}{3} + \frac{C[1]}{x^2}$ ]}}
```

Note that y' is the first derivative of the function $y[x]$ and an equation requires the double equals sign. DSolve needs three arguments, the equation, the dependent variable, and the independent variable. $C[1]$ is the (single) arbitrary constant of integration.

To solve the equation $y'' + 3 y' + 2 y = x$, we proceed as follows:

```
In[1]:= DSolve[y'' [x] + 3 y' [x] + 2 y[x] == x, y, x]
```

```
Out[1]= {{y -> Function[{x},  $\frac{1}{4} (-3 + 2 x) + e^{-2 x} C[1] + e^{-x} C[2]$ ]}}
```

This second order differential equation has two arbitrary constants $C[1]$ and $C[2]$ and a particular solution $\frac{1}{2} x - \frac{3}{4}$ which has no arbitrary constants.