Solving the logistic equation (p. 244)

$$\frac{d}{dt}x = r\cdot\left(1-\frac{x}{K}\right)\cdot x$$

The increasing rate of x = (a rate)*x

The solution is $x = x(t)$

```
> dsolve(  diff(x(t),t) = r*x(t)*(1-x(t)/K),  x(t) );
```

$$x(t) = \frac{K}{1+e^{-rt}\_C1\,K} \qquad \textbf{(1)}$$

```
>
```

The general solution: $x(t) = \dfrac{K}{1+C\cdot e^{-r\cdot t}\cdot K}$

Example: Page 249

$$\frac{d}{dt}P(t) = \left(b_0 + b_1\cdot t\right)\cdot P(t)$$

```
> dsolve( diff(P(t),t) = (b[0]+b[1]*t)*P(t), P(t) );
```

$$P(t) = \_C1\, e^{\left(b_0+\frac{1}{2}b_1 t\right)t} \qquad \textbf{(2)}$$

```
>
```

The solution is $P(t) = C\cdot e^{\left(b_0+\frac{1}{2}b_1\cdot t\right)\cdot t}$

$$P(t) = C\, e^{\left(b_0+\frac{1}{2}b_1 t\right)t} \qquad \textbf{(3)}$$

Now we need to decide C, b_0, b_1 using the data on Page 246, Table 5.1 by solving a least squares problem.

Example: Page 256, bottom

$$\frac{d^2}{dt^2}x - \frac{d}{dt}x - 6\cdot x = 0$$

```
> dsolve(  diff(x(t),t$2) - diff(x(t),t) - 6*x(t)=0, x(t) );
```

$$x(t) = \_C1\, e^{-2t} + \_C2\, e^{3t} \qquad \textbf{(4)}$$

```
>
```

The equation in P. 257

$$\frac{d^2}{d\,t^2}x + \frac{d}{d\,t}x + x = 0$$

```
> dsolve( diff(x(t),t$2) + diff(x(t),t) + x(t) = 0, x(t));
```

$$x(t) = \_C1\, e^{-\frac{1}{2}t} \sin\left(\frac{1}{2}\sqrt{3}\,t\right) + \_C2\, e^{-\frac{1}{2}t} \cos\left(\frac{1}{2}\sqrt{3}\,t\right) \quad \textbf{(5)}$$

```
>
```

Example: The differential equation at the bottom of p 260.

```
> dsolve( {diff(x(t),t)=2*x(t)+y(t), diff(y(t),t)=-3*x(t)+4*y(t),x
  (0)=0,y(0)=0});
```

$$\{x(t) = 0, y(t) = 0\} \quad \textbf{(6)}$$

```
> ?dsolve
>
```