Worksheet to support Exercise 3.4.11, modeling a cooling potato with an ODE u'(t) = -k*(u(t)-A)^r.

```
> restart;
  with(plots) :
```

The data, in time/temperature pairs:

```
> data := [[0, 204], [2, 193], [4, 184], [8, 169], [10, 162], [13, 156], [17, 149], [20, 143],
      [24, 138], [30, 130]] :
```

Number of data points is

```
> N := nops(data)
```

A plot

```
> plt1 := pointplot(data, color = red, symbol = solidcircle, symbolsize = 20, labels
      = ["time (minutes)", "Temperature"], labeldirections = [horizontal, vertical]) :
  display(plt1);
```

We seek to fit a function

```
> A := 72; u0 := 204;
```

$$> \quad u(t) := A + \left((u0 - A)^{1-r} + k \cdot (r-1) \cdot t \right)^{\frac{1}{1-r}}$$

A least-squares function can be formed as

$$> \quad SS := add\left((u(data[j][1]) - data[j][2])^2, j = 1..N \right)$$

Now adjust k and r to minimize this.

```
> plot3d(ln(SS), k = 0..0.0004, r = 2..2.5, grid = [100, 100])
>
```