We will use `dsolve` to compare a pure-time differential equation with an autonomous differential equation. Our pure-time differential equation is

$$\frac{dV}{dt} = 2 - t.$$  

Our autonomous equation is Newton’s law of cooling

$$\frac{dH}{dt} = 2 - H.$$  

with ambient temperature \( A = 2 \) and rate of decay \( a = 1 \). We will solve each equation starting from two initial conditions.

To get Maple to solve these with the initial condition \( V(0) = 0 \) or \( H(0) = 0 \), try

```maple
> diffv0 := {diff(v(t),t)=2-t,v(0)=0};
> V0 := unapply(rhs(dsolve(diffv0,v(t))),t);
> diffh0 := {diff(h(t),t)=2-h(t),h(0)=0};
> H0 := unapply(rhs(dsolve(diffh0,h(t))),t);
```

Create functions \( V_4 \) and \( H_4 \) by solving the same differential equations with initial conditions \( V(0) = 4 \) and \( H(0) = 4 \).

**PROBLEMS**

1. Plot \( V_0 \), \( V_4 \), \( dV_0/dt \) and \( dV_4/dt \) as functions of time for \( t=0 \) to \( t=4 \). Compute the derivatives for plotting with commands like `diff(V0(t),t)`. Label the curves and write the corresponding formulas. Where is \( V_0 \) increasing? \( V_4? \) Does \( V \) have an equilibrium? If so, where is it?

2. Do the same for \( H_0 \) and \( H_4 \).

3. For Newton’s law of cooling, plot the rate of change of temperature as a function of temperature for \( 0 \leq H \leq 4 \). Now think of the solution \( H_0 \). Points on your graph correspond to different values of \( t \). At \( t=0 \), the temperature is 0 and the rate of change is 2, corresponding to the point \((0,2)\). Mark this point. Find and mark the points corresponding to \( t=1,2,3 \) and \( 4 \). Do the same for the solution \( H_4 \). Draw arrows on your graph to indicate which way the temperature is changing. Draw a phase-line diagram below your picture and draw arrows corresponding to your graph.