Assignment 1 - Differential Equations

Do the SOWISO practice exercises **Determining the type and order of ODEs** and **Solving an initial value problem** in the chapter **Differential Equations** before you start with the tasks below..

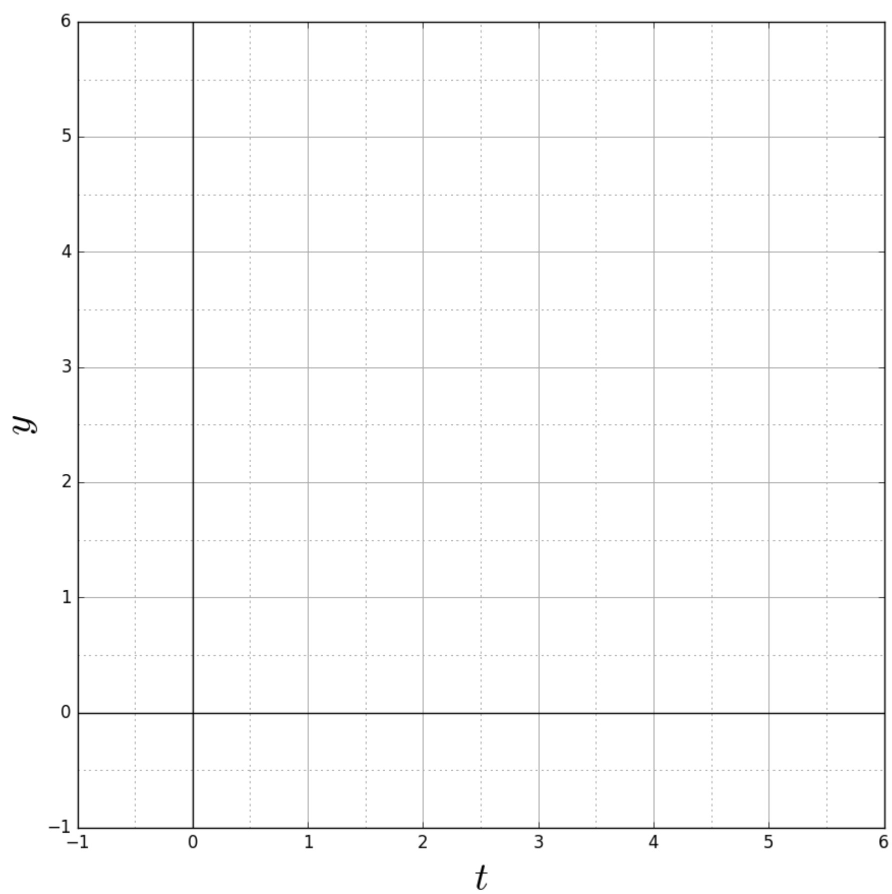
Slope fields and solution curves

Read the SOWISO theory page **Slope field** in the section **Slope fields and solution curves** of the chapter **Differential equations**.

Assignment 2 - Logistic growth

a Draw in the below diagram the slope field corresponding with the differential equation

$$y' = y\left(1 - \frac{y}{5}\right)$$



Read the SOWISO theory page **Behaviour of solutions** in the section **Slope fields and solution curves**.

b Draw the two equilibrium solutions with a solid line.

c Given the initial value

$$y(0) = 1$$

sketch the solution curve that corresponds with this initial value.

d What can you say about the stability of the equilibrium solutions drawn in part **b**?

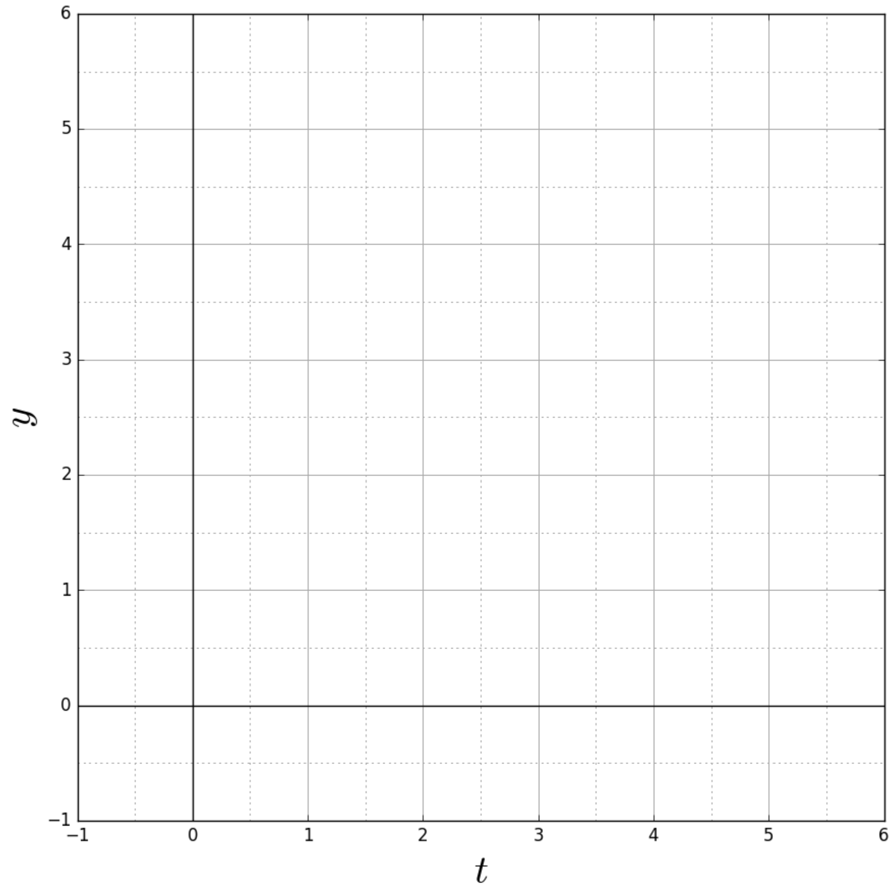
Assignment 3

Do the SOWISO practice exercises **Working with slope fields**.

Assignment 4 - Time dependency

a Sketch in the below diagram the slope field that corresponds with the differential equation

$$y' = 3 - y - t$$



b Sketch the solution curve that corresponds with the initial value

$$y(0) = 0$$

c Also sketch the solution curve that corresponds with the initial value

$$y(0) = 6$$

d As you may notice, both solution curves tend to approach a straight line with slope -1. Such a line is also called an *isocline*. Determine the equation of this line. Write your answer in the form

$$y = at + b$$

Draw this line in the diagram.

Assignement 5 - Transformation

We consider the differential equation of the previous assignment once more:

$$y' = 3 - y - t$$

As you may notice, this differential equation depends explicitly on time. We can get rid of this time dependency by transforming the equation.

a Define a new variable $u(t) = 3 - y(t) - t$ and show that you can rewrite the original differrential equation in y as the following differential equation in u:

$$u' = -(u + 1)$$

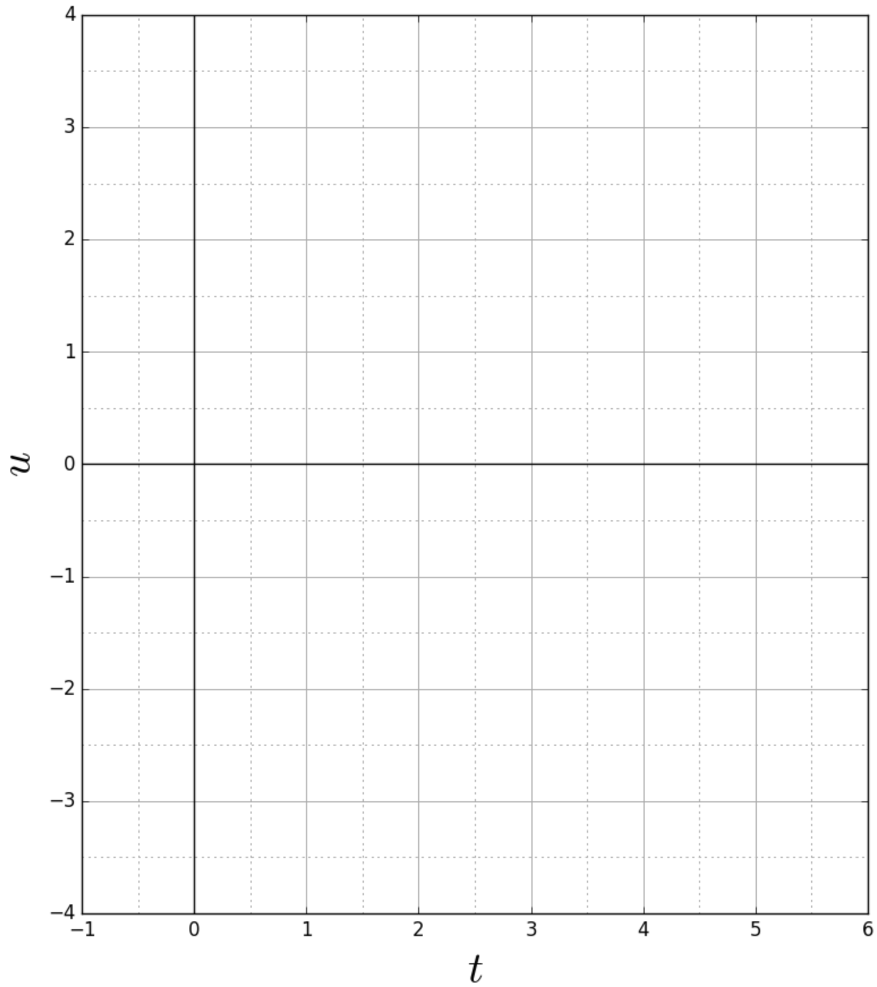
b Write the initial values of y from the previous assignment

$$y(0) = 0, \quad y(0) = 6$$

in terms of u. So, you get two answers of the form

$$u(0) = a, \quad u(0) = b$$

c Sketch in the below diagram the slope field that corresponds with the differential equation of u.



d Sketch the solution curve that corresponds with the initial values a and b that you found in part **b**.

e Both solutions approach the line $u = -1$. Substitute this value in the defining equation of u in terms y and t, so

$$u = 3 - y - t$$

and solve for y in terms of t. Compare your answer with the one found in question **4d**.