

LAB 3 (by Svenja Lowitzsch)

[Chapter 7

[Chapter 7.1

[> eq1:=diff(y(t),t)+5*y(t)=2*t; dsolve(eq1,y(t));

$$eq1 := \left(\frac{\partial}{\partial t} y(t) \right) + 5 y(t) = 2 t$$

$$y(t) = \frac{2}{5} t - \frac{2}{25} + e^{(-5 t)} _C1$$

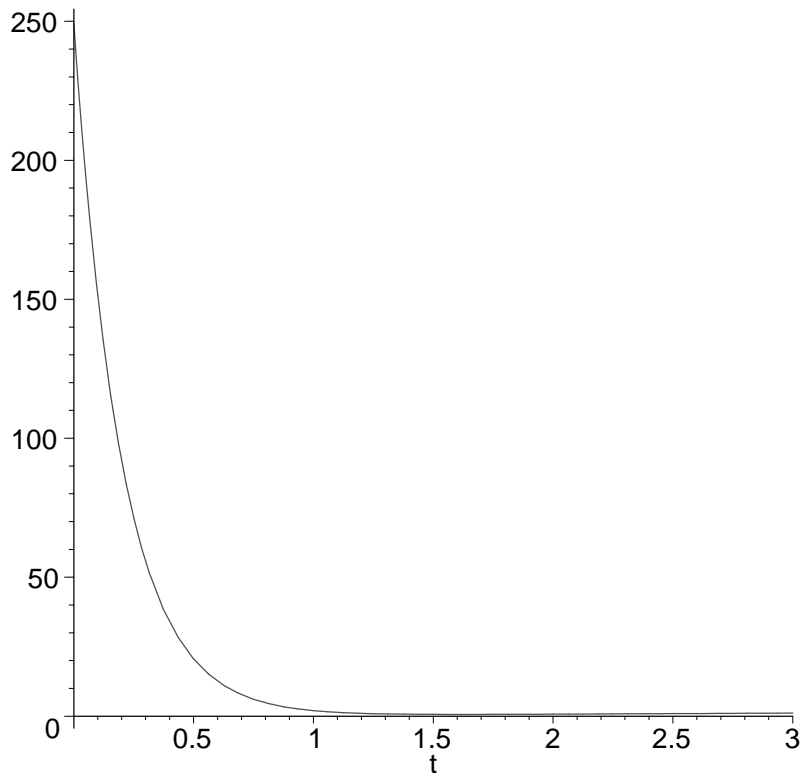
[> dsolve({eq1,y(1)=2},y(t));

$$y(t) = \frac{2}{5} t - \frac{2}{25} + \frac{42}{25} e^{(-5 t)}$$

[> ysol:=rhs(dsolve({eq1,y(1)=2},y(t)));

$$ysol := \frac{2}{5} t - \frac{2}{25} + \frac{42}{25} e^{(-5 t)}$$

[> plot(ysol,t=0..3);



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> y:='y'; eq2:=diff(y(t),t$2)+6*diff(y(t),t)-7*y(t)=1;
```

$$y:=y$$
$$eq2 := \left(\frac{\partial^2}{\partial t^2} y(t) \right) + 6 \left(\frac{\partial}{\partial t} y(t) \right) - 7 y(t) = 1$$

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> dsolve(eq2,y(t));
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$$y(t) = -\frac{1}{7} + _C1 e^t + _C2 e^{(-7t)}$$

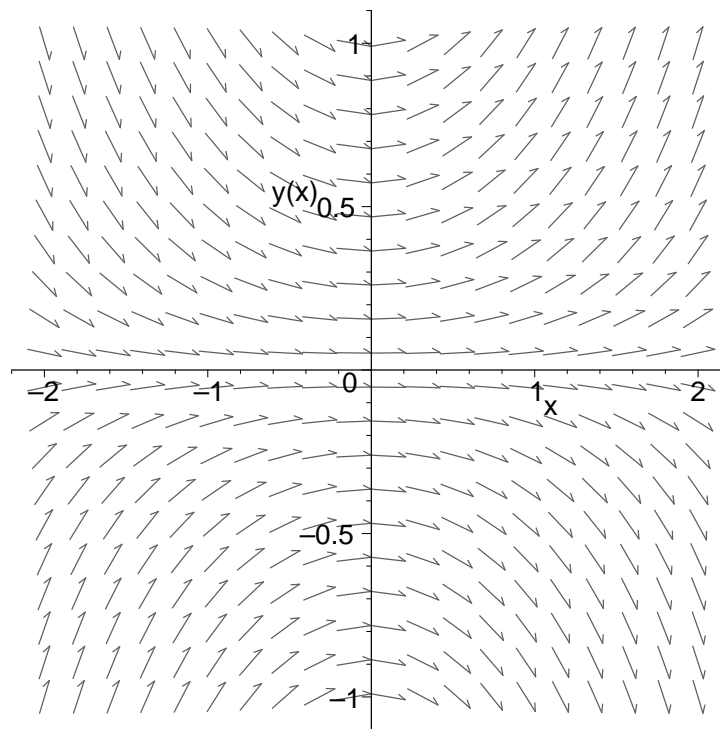
```
> dsolve({eq2,y(1)=5, D(y)(1)=2},y(t));
```

$$y(t) = -\frac{1}{7} + \frac{19}{4} e^t + \frac{11}{28} (e)^7 e^{(-7t)}$$

[Chapter 7.2

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[ > with(DEtools):
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> dfieldplot(diff(y(x),x)=x*sin(y(x)),y(x),x=-2..2,y=-1..1);
```



```
[ > with(plots):
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[ > plot1:=dfieldplot(diff(y(x),x)=x*sin(y(x)),y(x),x=-2..2,y=-1..1):
```

```
> dsolve({diff(y(x),x)=x*sin(y(x)),y(0)=.25},y(x));
```

```
y(x)=
```

$$\arctan \left(\frac{e^{(1/2)x^2} \left(2 - 2\sqrt{1 + \tan\left(\frac{1}{4}\right)^2} \right)}{\tan\left(\frac{1}{4}\right) \left(1 + \frac{\frac{1}{4} e^{(x^2)} \left(2 - 2\sqrt{1 + \tan\left(\frac{1}{4}\right)^2} \right)^2}{\tan\left(\frac{1}{4}\right)^2} \right)} \right), \frac{-\frac{1}{4} e^{(x^2)} \left(2 - 2\sqrt{1 + \tan\left(\frac{1}{4}\right)^2} \right)^2}{\tan\left(\frac{1}{4}\right)^2} + 1 \right)$$

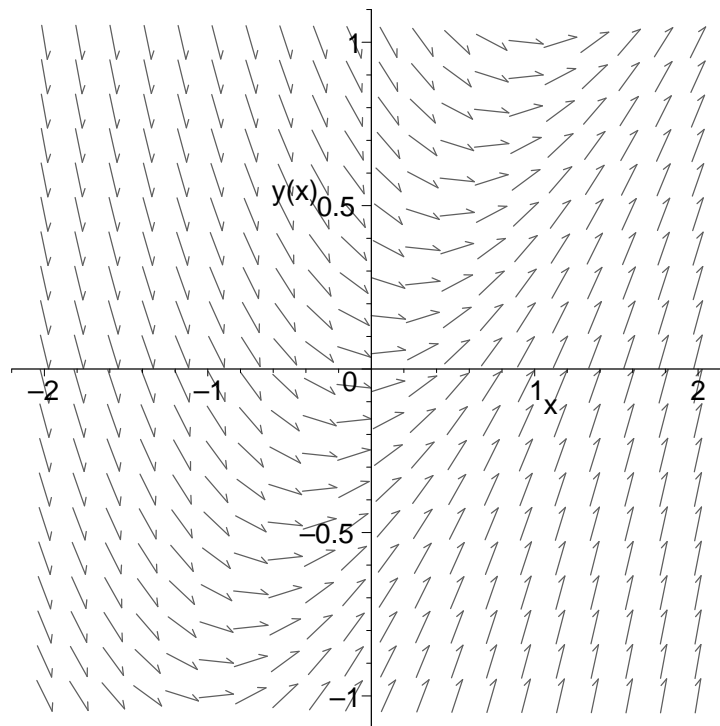
y(x) =

$$\arctan \left(\frac{e^{(1/2)x^2} \left(2 + 2\sqrt{1 + \tan\left(\frac{1}{4}\right)^2} \right)}{\tan\left(\frac{1}{4}\right) \left(1 + \frac{\frac{1}{4} e^{(x^2)} \left(2 + 2\sqrt{1 + \tan\left(\frac{1}{4}\right)^2} \right)^2}{\tan\left(\frac{1}{4}\right)^2} \right)} \right), \frac{-\frac{1}{4} e^{(x^2)} \left(2 + 2\sqrt{1 + \tan\left(\frac{1}{4}\right)^2} \right)^2}{\tan\left(\frac{1}{4}\right)^2} + 1 \right)$$

[Make sure you announce the change in the next command :

[> plot2:=plot(rhs(%[2]),x=-2..2):

[> display([plot1,plot2]);



[Chapter 7.3

> eq3:=diff(y(t),t)+sin(y(t)^2)=1;dsolve({eq3,y(0)=1},y(t));

$$eq3 := \left(\frac{\partial}{\partial t} y(t) \right) + \sin(y(t)^2) = 1$$

$$y(t) = \text{RootOf} \left(t + \int_0^{-z} \frac{1}{\sin(a^2) - 1} d_a - \int_0^1 \frac{1}{\sin(a^2) - 1} d_a \right)$$

> f:=dsolve({eq3,y(0)=1},y(t),numeric);

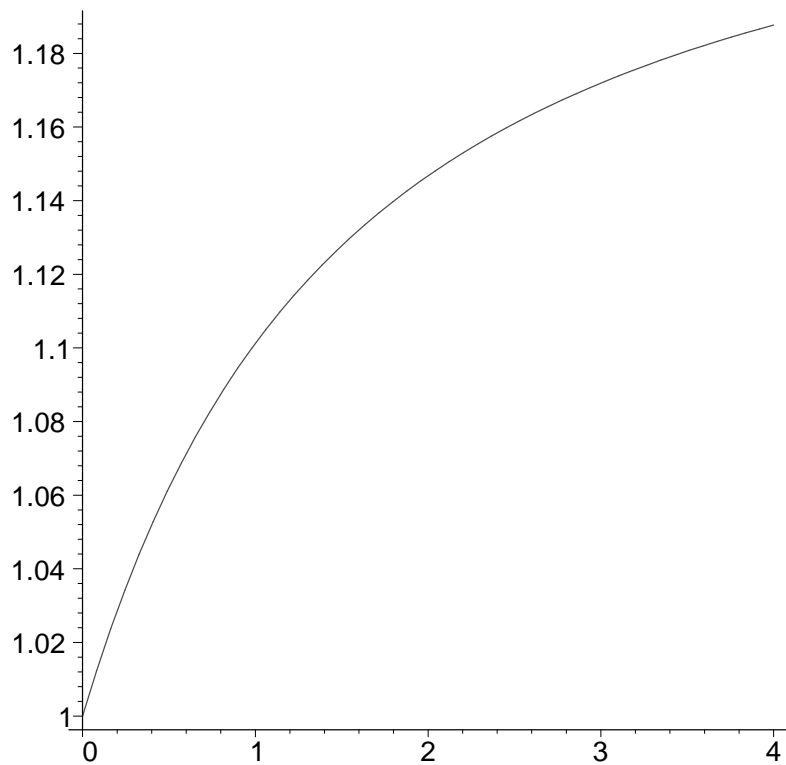
f:=proc(rkf45_x) ... end proc

> f(0); f(0.5);

[t=0, y(t)=1.]

[t=.5, y(t)=1.06203232971291727]

> with(plots): odeplot(f,[t,y(t)],0..4);



[Chapter 7.6

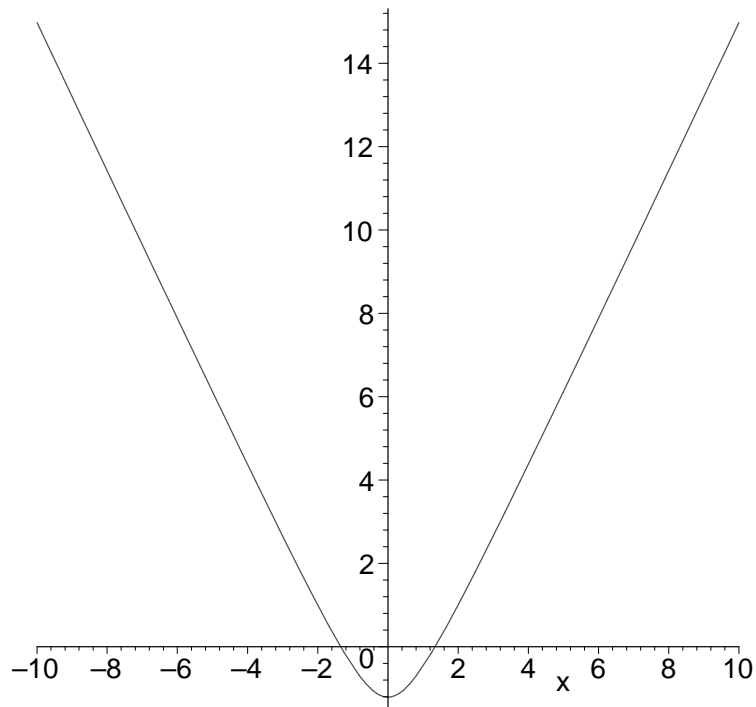
[Problem 1

```
> eq1:=diff(y(x),x)=(x*y(x)+3*x)/(x^2+1);
  ysol1:=rhs(dsolve({eq1,y(2)=1}, y(x)));
```

$$eq1 := \frac{\partial}{\partial x} y(x) = \frac{x y(x) + 3x}{x^2 + 1}$$

$$ysol1 := -3 + \frac{4}{5} \sqrt{x^2 + 1} \sqrt{5}$$

```
> plot(ysol1,x=-10..10);
```



[Problem 5

[> eq:=diff(y(x),x)+y(x)=sin(x); ysol:=rhs(dsolve({eq,y(0)=0},
y(x)));

$$eq := \left(\frac{\partial}{\partial x} y(x) \right) + y(x) = \sin(x)$$

$$ysol := -\frac{1}{2} \cos(x) + \frac{1}{2} \sin(x) + \frac{1}{2} e^{(-x)}$$

[> f:=dsolve({eq,y(0)=0}, y(x), numeric);

f:= **proc**(rkf45_x) ... **end proc**

[> f(0); f(.5);

[x=0, y(x)=0.]

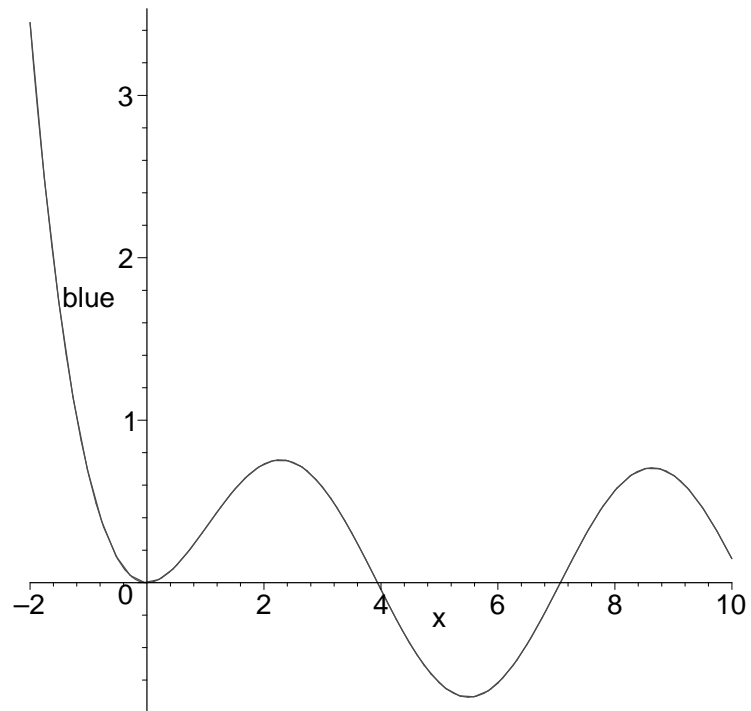
[x=.5, y(x)=.104186817165709030]

[> with(plots):

[> plot1:=odeplot(f,[x,y(x)],-2..10):

[> plot2:=plot(ysol,x=-2..10,blue):

[> display([plot1,plot2]);

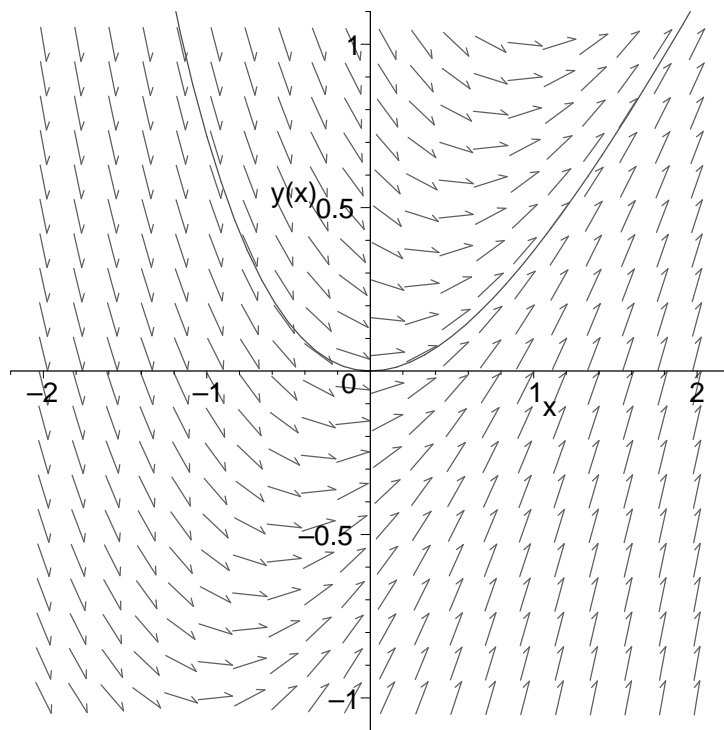


[Problem 6

```
[ > eq:=diff(y(x),x)=x-y(x);
```

$$eq := \frac{\partial}{\partial x} y(x) = x - y(x)$$

```
[ > dfieldplot(eq,y(x),x=-2..2,y=-1..1);
```

[>