Maple-worksheet som som viser noen løsninger av svingeligningen uten pådrag.
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Definerer først diff.ligningen for systemet og finner generell løsning når massen m=1, fjærkonstanten k=1.
Klossen står stille i likevektsposisjon og vi gir den en impuls som gir hastighet 1. [Altså x(0)=0 og v(0)=1]

```
> ode1 := m*diff(x(t),t,t)+c*diff(x(t),t)+k*x(t);
```

$$ode1 := m\left(\frac{d^2}{dt^2}x(t)\right) + c\left(\frac{d}{dt}x(t)\right) + k\,x(t)$$

```
> m := 1: k := 1:
```

```
> dsolve( {ode1,x(0)=0,D(x)(0)=1});
```

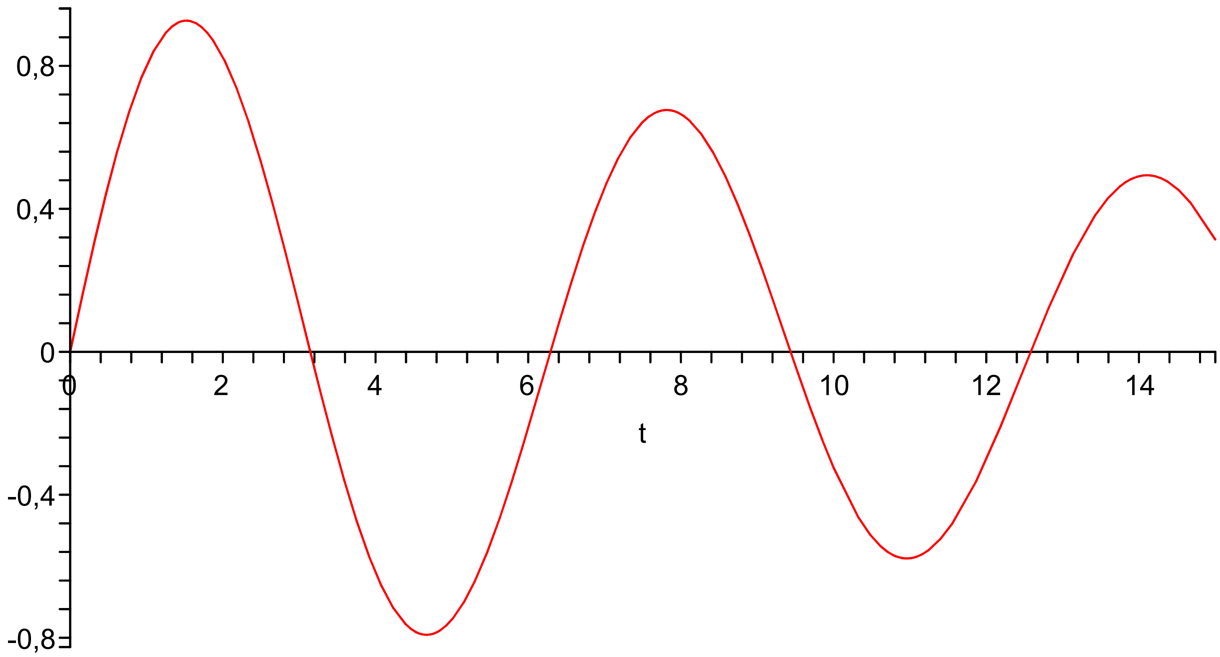
$$x(t) = \frac{\mathbf{e}^{\left(\left(-\frac{1}{2}c+\frac{1}{2}\sqrt{c^2-4}\right)t\right)}}{\sqrt{c^2-4}} - \frac{\mathbf{e}^{\left(\left(-\frac{1}{2}c-\frac{1}{2}\sqrt{c^2-4}\right)t\right)}}{\sqrt{c^2-4}}$$

Finner og plotter løsning for c=0.1 (Underdempet system)

```
> c := 0.1: dsolve( {ode1,x(0)=0,D(x)(0)=1});
```

$$x(t) = \frac{20}{399}\sqrt{399}\,\mathbf{e}^{\left(-\frac{1}{20}t\right)}\sin\left(\frac{1}{20}\sqrt{399}\,t\right)$$

```
> L1 := 20/399*399^(1/2)*exp(-1/20*t)*sin(1/20*399^(1/2)*t):
  plot(L1,t=0..15,color=red);
```

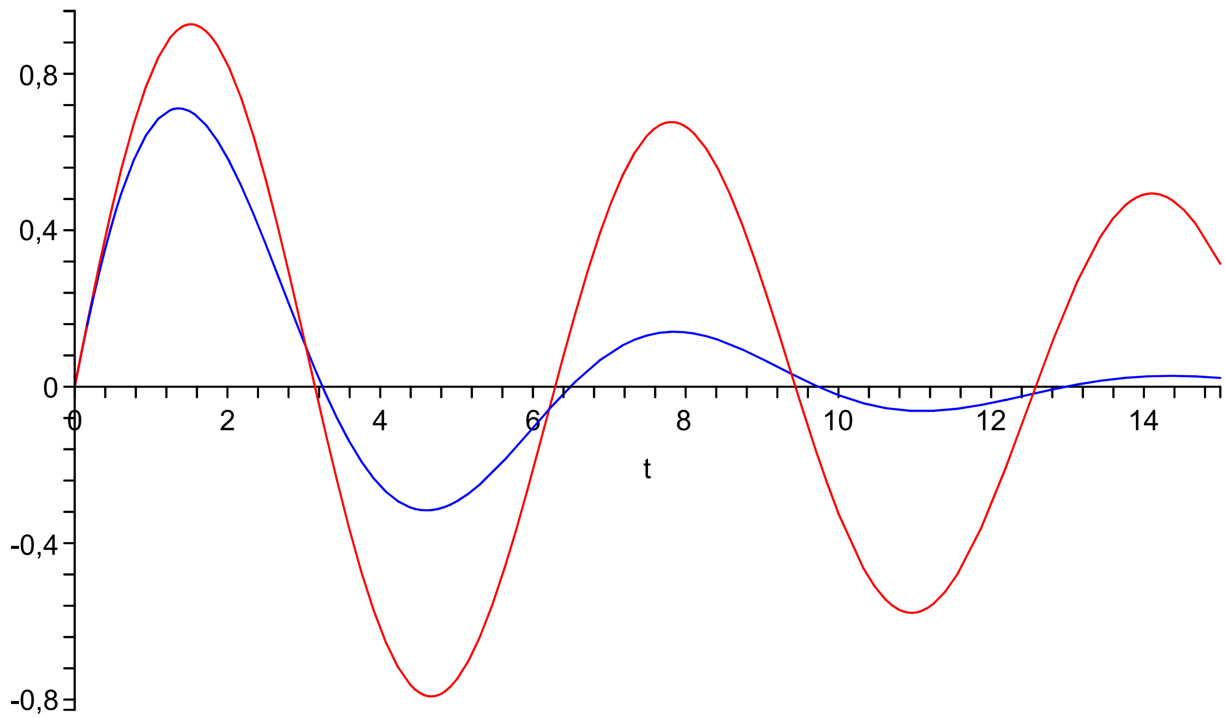


Finner og plotter løsning for c=0.5 (Underdempet system)

```
> c := 0.5: dsolve( {ode1,x(0)=0,D(x)(0)=1});
```

$$x(t) = \frac{4}{15}\sqrt{15}\,\mathbf{e}^{\left(-\frac{1}{4}t\right)}\sin\left(\frac{1}{4}\sqrt{15}\,t\right)$$

```
> L2 := 4/15*15^(1/2)*exp(-1/4*t)*sin(1/4*15^(1/2)*t):
  plot([L1,L2],t=0..15,color=[red,blue]);
```



Finner og plotter løsning for c=2 (Kritisk demping)

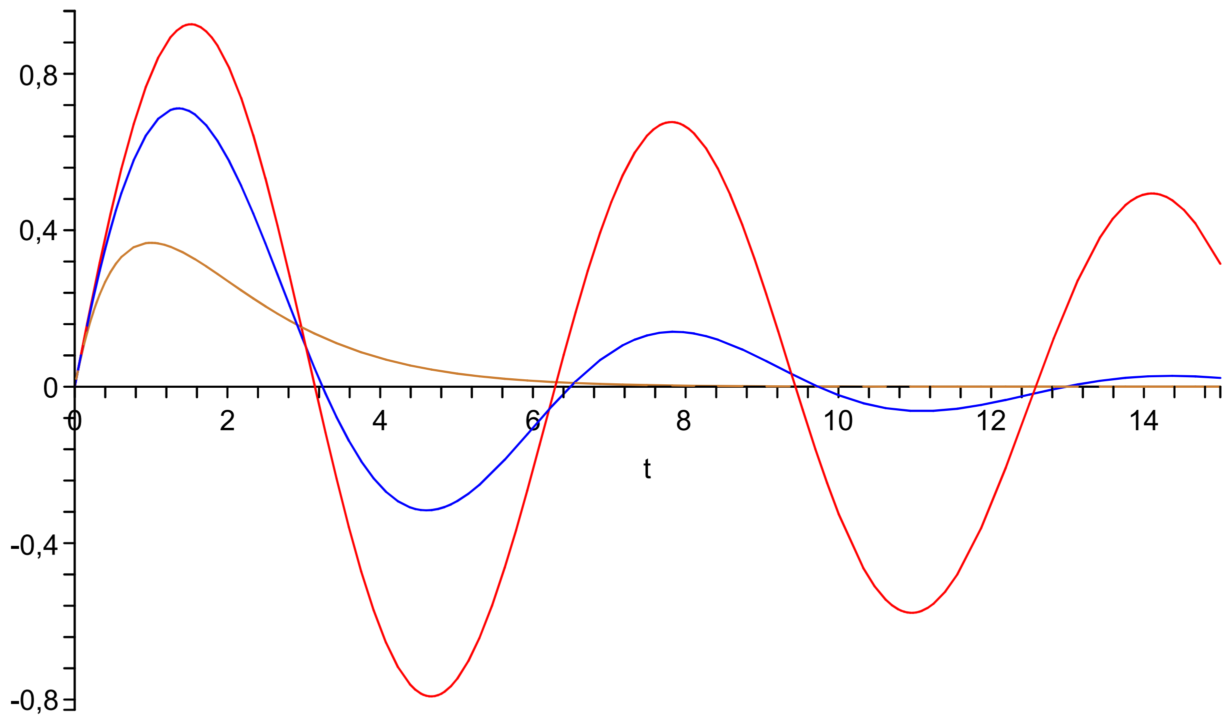
```
> c := 2; dsolve( {ode1,x(0)=0,D(x)(0)=1});
```

$$c := 2$$

$$x(t) = \mathbf{e}^{(-t)}\, t$$

```
> L3 := exp(-t)*t; plot([L1,L2,L3],t=0..15,color=[red,blue,gold]);
```

$$L3 := \mathbf{e}^{(-t)}\, t$$



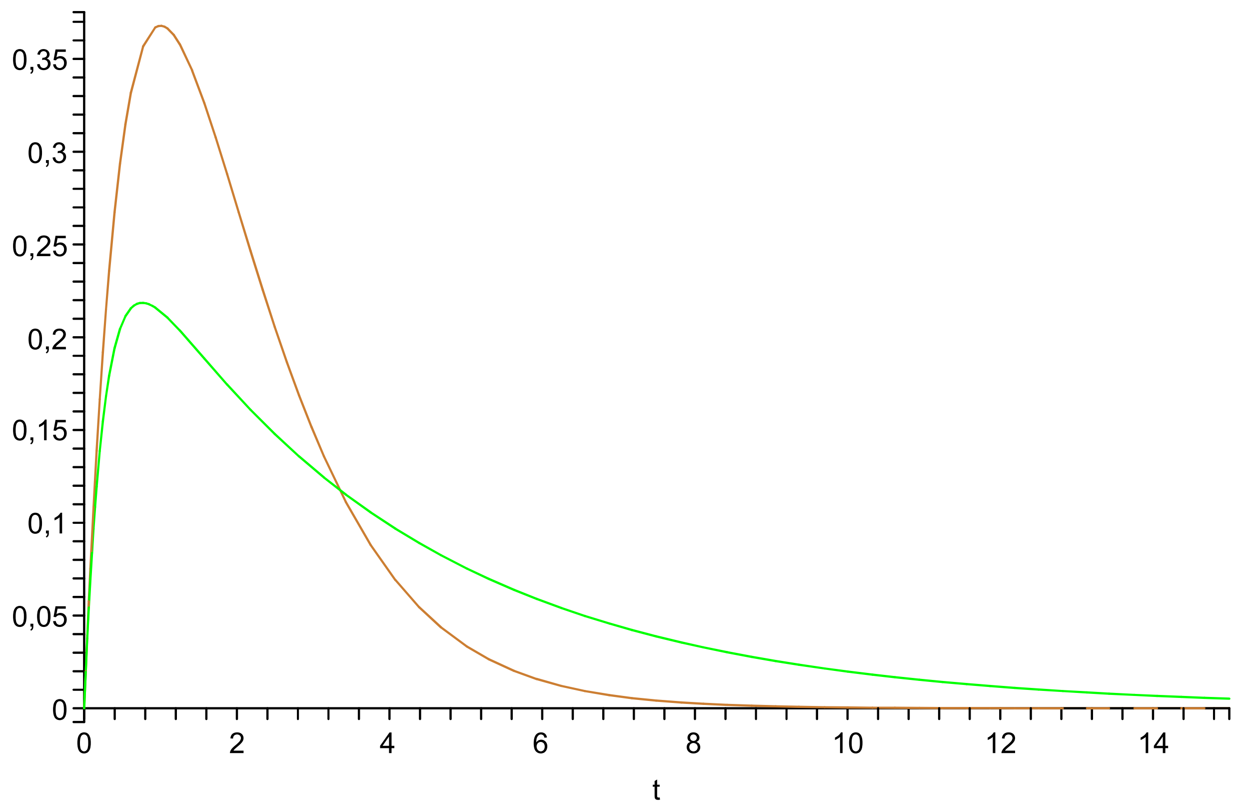
Finner og plotter løsning for c=10 (Overdemping)

```
> c := 10: dsolve( {ode1,x(0)=0,D(x)(0)=1});
```

$$x(t) = \frac{1}{24}\sqrt{6}\, \mathbf{e}^{((-5+2\sqrt{6})\,t)} - \frac{1}{24}\sqrt{6}\, \mathbf{e}^{(-(5+2\sqrt{6})\,t)}$$

```
> L4 := 1/6*3^(1/2)*exp((-2+3^(1/2))*t)-1/6*3^(1/2)*exp(-(2+3^(1/2))*t);
  plot([L3,L4],t=0..15,color=[gold,green]);
```

$$L4 := \frac{1}{6}\sqrt{3}\, \mathbf{e}^{((-2+\sqrt{3})\,t)} - \frac{1}{6}\sqrt{3}\, \mathbf{e}^{(-(2+\sqrt{3})\,t)}$$


0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
0
2
4
6
8
10
12
14
t