

**Eulers metode for system i planet :  $dy_1/dx = f_1(y_1, y_2)$ ,  $dy_2/dt = f_2(y_1, y_2)$** 

Exercise 2, side 908 i Kreyszig

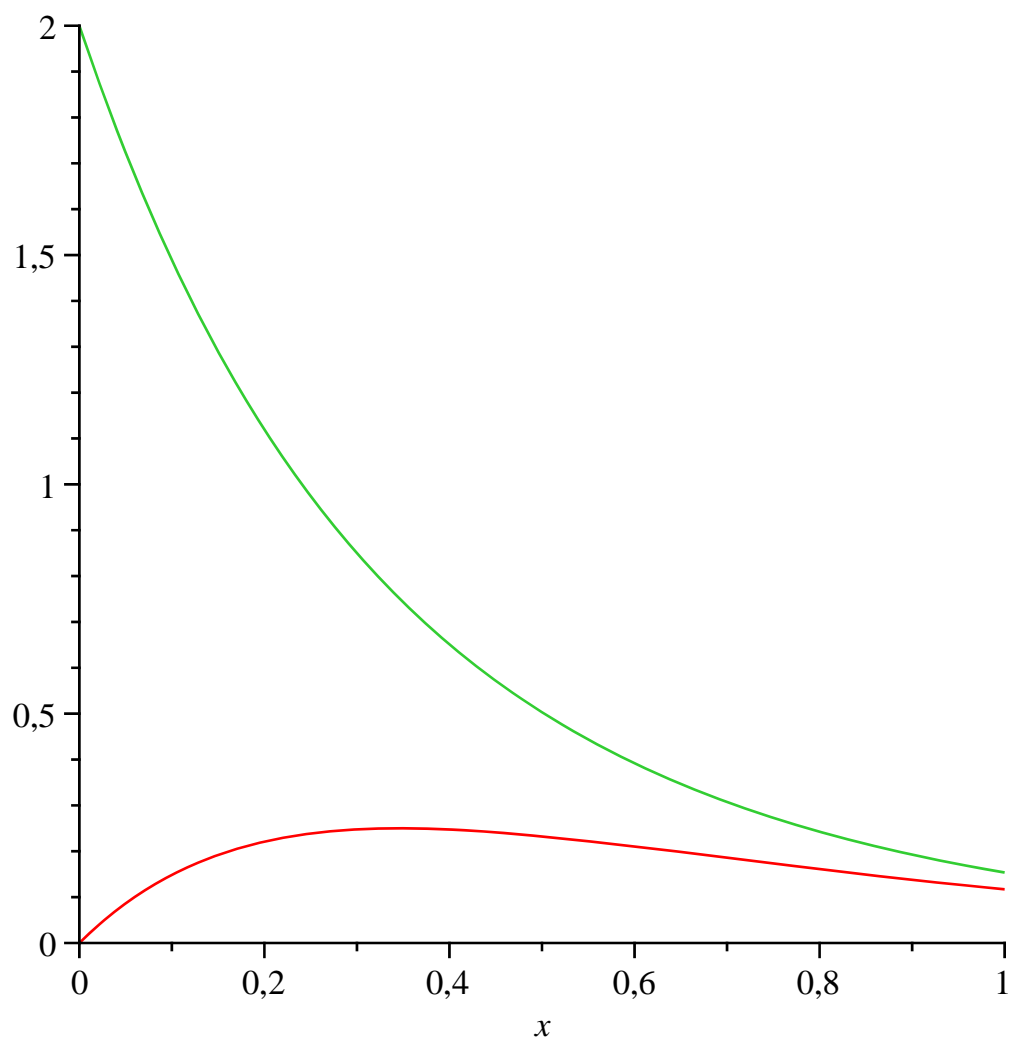
Studer dette eksemplet. Merk at Maple printar output i blått.

Koordinatar i planet :  $(y_1, y_2)$ Vi har altså eit autonomt vektorfelt i planet med komponentar  $f_1$  og  $f_2$ .

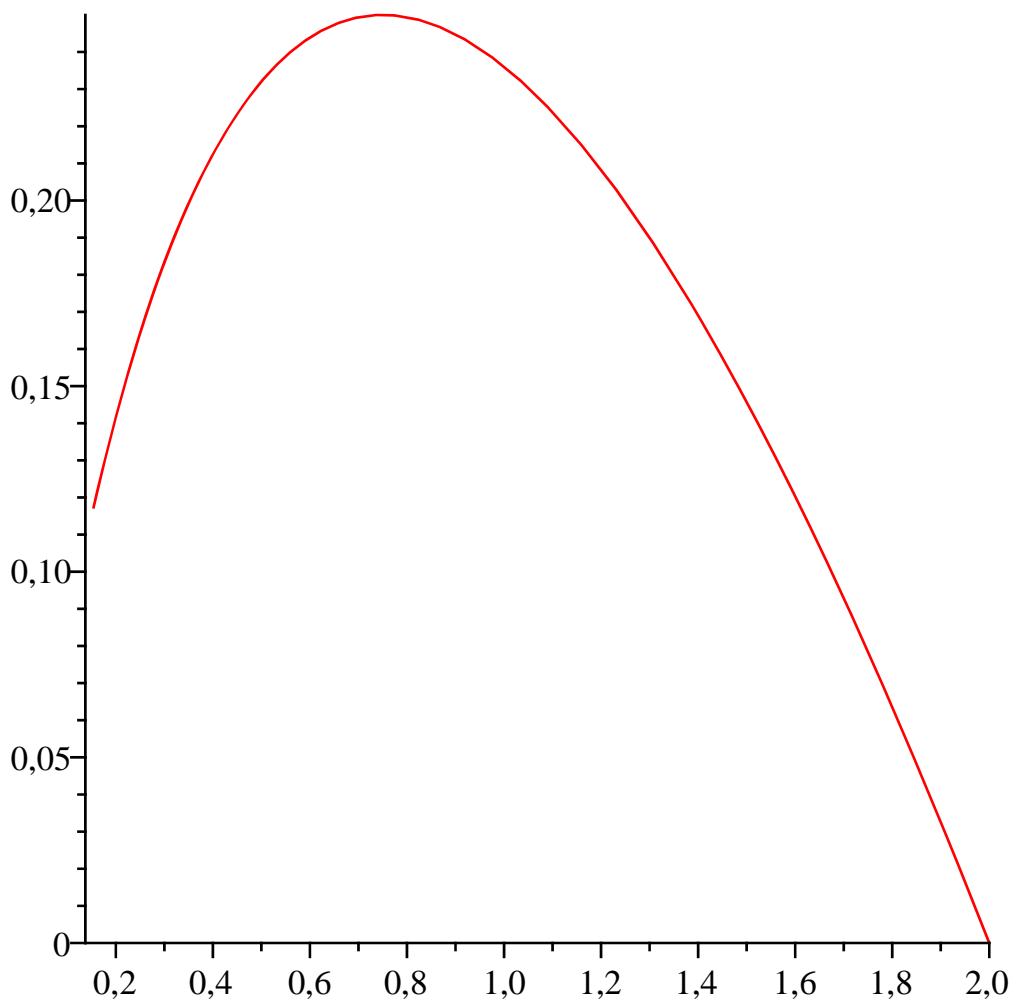
```

> f1 := (y1, y2) → -3·y1 + y2;
                                     f1 := (y1, y2) → -3 y1 + y2
(1)
> f2 := (y1, y2) → y1 - 3·y2;
                                     f2 := (y1, y2) → y1 - 3 y2
(2)
> #initialbetingelse (for x =0)
> y1 := 2; y2 := 0;
                                     y1 := 2
                                     y2 := 0
(3)
> #eksakt løysing;
> F1 := x → exp(-4·x) + exp(-2·x); F2 := x → -exp(-4·x) + exp(-2·x);
                                     F1 := x → e-4x + e-2x
                                     F2 := x → -e-4x + e-2x
(4)
> plot( {F1(x), F2(x)}, x=0..1);

```



```
> plot([F1(x), F2(x), x=0..1]);
```



> # Dette er løysingskurva i  $(y1, y2)$ -planet, og den startar i punktet  $(2, 0)$

> #  $Y1$  og  $Y2$  er dei eksakte verdiar, og  $eps1$  og  $eps2$  er feila til  $y1$  og  $y2$

>  $h := 0.1; x := 0; y1 := 2; y2 := 0; Digits := 3;$

$h := 0.1$

$x := 0$

$y1 := 2$

$y2 := 0$

$Digits := 3$

> **for**  $i$  **from** 1 **to** 5 **do**  $x := x + h; y1, y2 := y1 + h \cdot f1(y1, y2), y2 + h \cdot f2(y1, y2) : Y1, Y2$   
 $:= F1(x), F2(x) : eps1, eps2 := Y1 - y1, Y2 - y2$  **end do;**

$x := 0.1$

$y1, y2 := 1.4, 0.2$

$Y1, Y2 := 1.49, 0.149$

$eps1, eps2 := 0.09, -0.051$

$x := 0.2$

$y1, y2 := 1.00, 0.28$

$Y1, Y2 := 1.12, 0.221$

$eps1, eps2 := 0.12, -0.059$

(5)

```

      x := 0.3
      y1, y2 := 0.728, 0.296
      Y1, Y2 := 0.850, 0.248
      eps1, eps2 := 0.122, -0.048
      x := 0.4
      y1, y2 := 0.540, 0.280
      Y1, Y2 := 0.651, 0.247
      eps1, eps2 := 0.111, -0.033
      x := 0.5
      y1, y2 := 0.406, 0.250
      Y1, Y2 := 0.503, 0.233
      eps1, eps2 := 0.097, -0.017

```

(6)

```
> # la oss velge h = 0.01, og utføre 20 steg
```

```
> h := 0.01; x := 0; y1 := 2; y2 := 0; Digits := 5;
```

```
      h := 0.01
```

```
      x := 0
```

```
      y1 := 2
```

```
      y2 := 0
```

```
      Digits := 5
```

(7)

```
> for i from 1 to 20 do x := x + h; y1, y2 := y1 + h*f1(y1, y2), y2 + h*f2(y1, y2) : Y1, Y2
:= F1(x), F2(x) : eps1, eps2 := Y1 - y1, Y2 - y2 end do;
```

```
      x := 0.01
```

```
      y1, y2 := 1.94, 0.02
```

```
      Y1, Y2 := 1.9410, 0.01941
```

```
      eps1, eps2 := 0.0010, -0.00059
```

```
      x := 0.02
```

```
      y1, y2 := 1.8820, 0.0388
```

```
      Y1, Y2 := 1.8839, 0.03767
```

```
      eps1, eps2 := 0.0019, -0.00113
```

```
      x := 0.03
```

```
      y1, y2 := 1.8259, 0.056456
```

```
      Y1, Y2 := 1.8287, 0.05484
```

```
      eps1, eps2 := 0.0028, -0.001616
```

```
      x := 0.04
```

```
      y1, y2 := 1.7717, 0.073021
```

```
      Y1, Y2 := 1.7753, 0.07098
```

```
      eps1, eps2 := 0.0036, -0.002041
```

```
      x := 0.05
```

```
      y1, y2 := 1.7193, 0.088547
```

```
      Y1, Y2 := 1.7236, 0.08611
```

```
      eps1, eps2 := 0.0043, -0.002437
```

```
      x := 0.06
```

```
      y1, y2 := 1.6686, 0.10308
```

$Y1, Y2 := 1.6736, 0.10029$   
 $eps1, eps2 := 0.0050, -0.00279$   
 $x := 0.07$   
 $y1, y2 := 1.6196, 0.11667$   
 $Y1, Y2 := 1.6251, 0.11358$   
 $eps1, eps2 := 0.0055, -0.00309$   
 $x := 0.08$   
 $y1, y2 := 1.5722, 0.12937$   
 $Y1, Y2 := 1.5783, 0.12599$   
 $eps1, eps2 := 0.0061, -0.00338$   
 $x := 0.09$   
 $y1, y2 := 1.5263, 0.14121$   
 $Y1, Y2 := 1.5330, 0.13759$   
 $eps1, eps2 := 0.0067, -0.00362$   
 $x := 0.10$   
 $y1, y2 := 1.4819, 0.15224$   
 $Y1, Y2 := 1.4890, 0.14841$   
 $eps1, eps2 := 0.0071, -0.00383$   
 $x := 0.11$   
 $y1, y2 := 1.4390, 0.16249$   
 $Y1, Y2 := 1.4466, 0.15848$   
 $eps1, eps2 := 0.0076, -0.00401$   
 $x := 0.12$   
 $y1, y2 := 1.3975, 0.17201$   
 $Y1, Y2 := 1.4054, 0.16785$   
 $eps1, eps2 := 0.0079, -0.00416$   
 $x := 0.13$   
 $y1, y2 := 1.3573, 0.18082$   
 $Y1, Y2 := 1.3656, 0.17653$   
 $eps1, eps2 := 0.0083, -0.00429$   
 $x := 0.14$   
 $y1, y2 := 1.3184, 0.18897$   
 $Y1, Y2 := 1.3270, 0.18457$   
 $eps1, eps2 := 0.0086, -0.00440$   
 $x := 0.15$   
 $y1, y2 := 1.2807, 0.19648$   
 $Y1, Y2 := 1.2896, 0.19201$   
 $eps1, eps2 := 0.0089, -0.00447$   
 $x := 0.16$   
 $y1, y2 := 1.2442, 0.20339$   
 $Y1, Y2 := 1.2534, 0.19886$   
 $eps1, eps2 := 0.0092, -0.00453$

$x := 0.17$   
 $y1, y2 := 1.2089, 0.20973$   
 $Y1, Y2 := 1.2184, 0.20515$   
 $eps1, eps2 := 0.0095, -0.00458$   
 $x := 0.18$   
 $y1, y2 := 1.1747, 0.21553$   
 $Y1, Y2 := 1.1844, 0.21093$   
 $eps1, eps2 := 0.0097, -0.00460$   
 $x := 0.19$   
 $y1, y2 := 1.1416, 0.22081$   
 $Y1, Y2 := 1.1515, 0.21619$   
 $eps1, eps2 := 0.0099, -0.00462$   
 $x := 0.20$   
 $y1, y2 := 1.1096, 0.22560$   
 $Y1, Y2 := 1.1196, 0.22099$   
 $eps1, eps2 := 0.0100, -0.00461$

(8)

