

```

> with(plots)
[animate, animate3d, animatecurve, arrow, changecoords, complexplot,
complexplot3d, conformal, conformal3d, contourplot, contourplot3d,
coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot,
fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal,
interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d,
listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot, multiple,
odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot,
polygonplot, polygonplot3d, polyhedra_supported, polyhedraplot,
rootlocus, semilogplot, setcolors, setoptions, setoptions3d, shadebetween,
spacecurve, sparsematrixplot, surfdata, textplot, textplot3d, tubeplot]

```

(1)

```

> ec1:=diff(x(t),t)=-k*x(t)

```

$$ec1 := \frac{d}{dt} x(t) = -k x(t) \quad (2)$$

```

> cond:=x(0)=x0

```

$$cond := x(0) = x0 \quad (3)$$

```

> xs:=unapply(rhs(dsolve({ec1,cond},x(t))),t,x0,k)

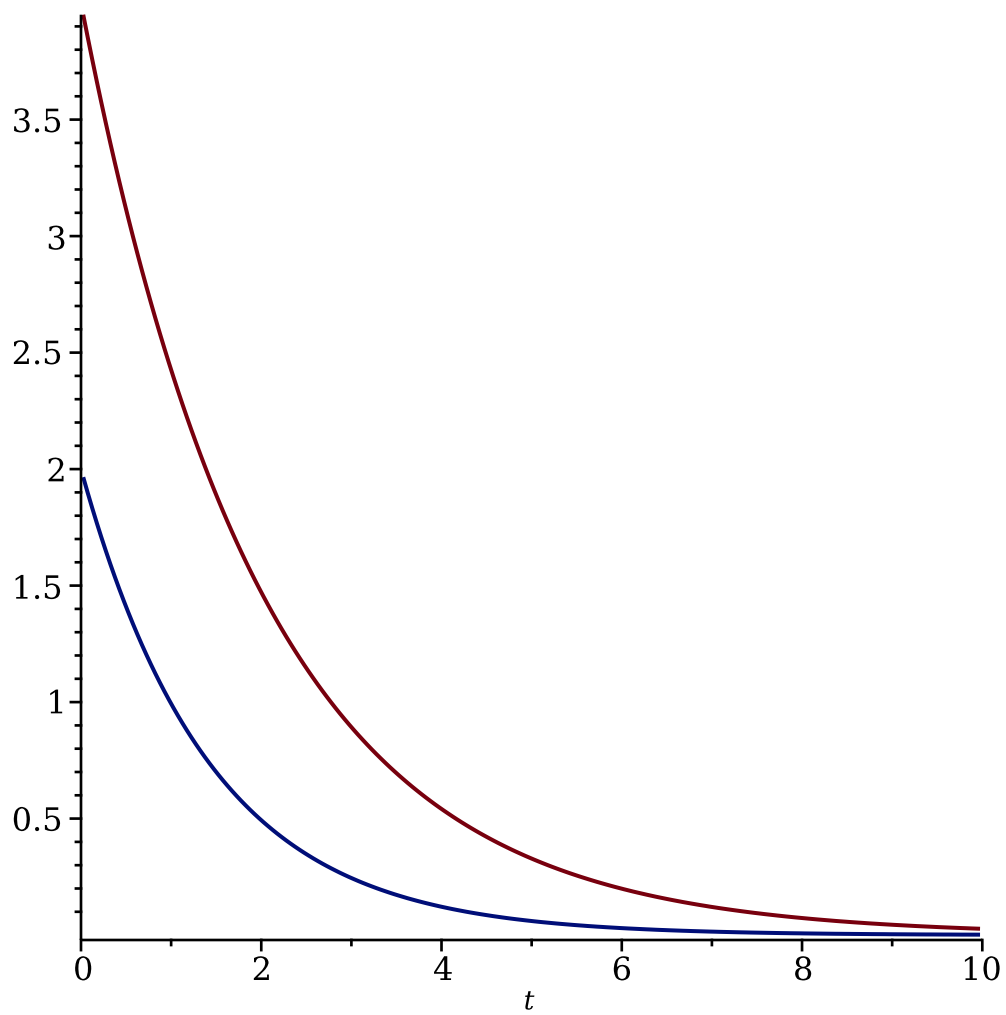
```

$$xs := (t, x0, k) \mapsto x0 \cdot e^{-k \cdot t} \quad (4)$$

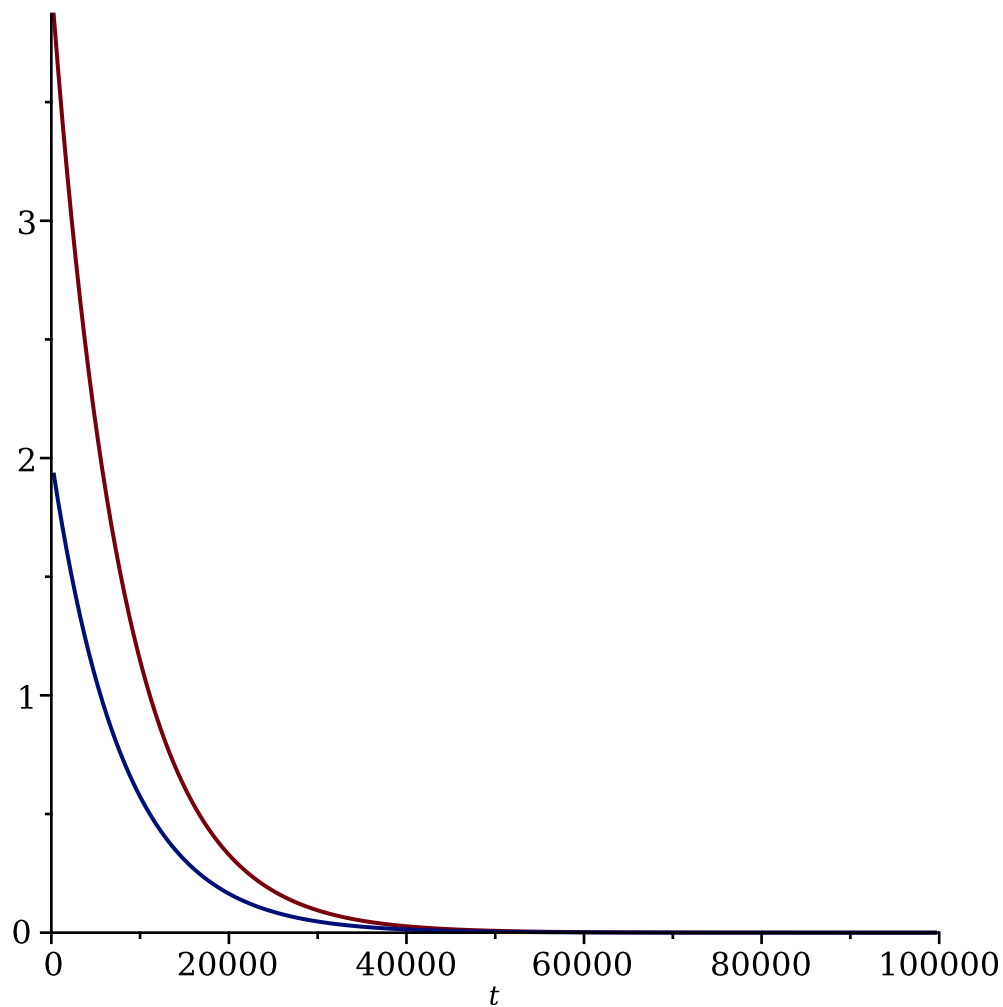
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> plot([xs(t,4,0.5),xs(t,2,0.7)],t=0..10)

```



```
> plot([xs(t,4,1/8000),xs(t,2,1/8000)],t=0..100000)
```



```
> ec2:=xs(5730,x0,k)=1/2*x0
```

$$ec2 := x0 e^{-5730 k} = \frac{x0}{2} \quad (5)$$

```
> kc14:=solve(ec2,k)
```

$$kc14 := \frac{\ln(2)}{5730} \quad (6)$$

```
> ec3:=xs(t,x0,kc14)=x0/5
```

$$ec3 := x0 e^{-\frac{\ln(2) t}{5730}} = \frac{x0}{5} \quad (7)$$

```
> t20:=solve(ec3,t)
```

$$t20 := \frac{5730 \ln(5)}{\ln(2)} \quad (8)$$

```
> ec4:=xs(t,x0,kc14)=x0*91.57/100
```

$$ec4 := x0 e^{-\frac{\ln(2) t}{5730}} = 0.9157000000 x0 \quad (9)$$

```
> tstudii:=solve(ec4,t)
```

$$tstudii := 728.0141045 \quad (10)$$

```
> giulgiu_minim:=1988-tstudii
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.....

$$giulgiu_minim := 1259.985896 \quad (11)$$

> **ec4:=xs(t,x0,kc14)=x0*93.021/100**

$$ec4 := x0 e^{-\frac{\ln(2) t}{5730}} = 0.9302100000 x0 \quad (12)$$

> **tstudii:=solve(ec4,t)**

$$tstudii := 598.0495293 \quad (13)$$

> **giulgiu_maxim:=1988-tstudii**

$$giulgiu_maxim := 1389.950471 \quad (14)$$

> **restart**

> **with(plots)**

[animate, animate3d, animatecurve, arrow, changecoords, complexplot, complexplot3d, conformal, conformal3d, contourplot, contourplot3d, coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot, fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal, interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d, listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot, multiple, odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot, polygonplot, polygonplot3d, polyhedra_supported, polyhedraplot, rootlocus, semilogplot, setcolors, setoptions, setoptions3d, shadebetween, spacecurve, sparsematrixplot, surfdata, textplot, textplot3d, tubeplot] (15)

> **ec1:=diff(T(t),t)=-k*(T(t)-Tm)**

$$ec1 := \frac{d}{dt} T(t) = -k (T(t) - Tm) \quad (16)$$

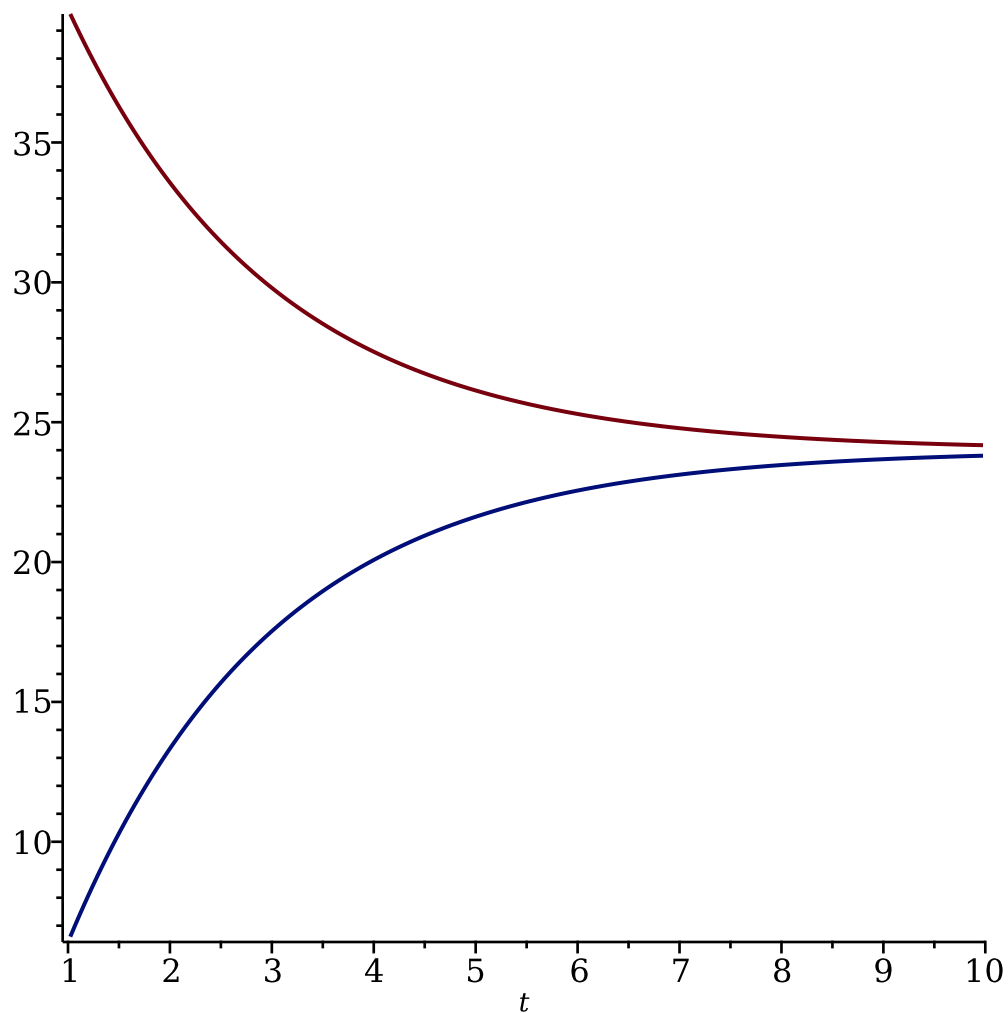
> **cond:=T(0)=T0**

$$cond := T(0) = T0 \quad (17)$$

> **Ts:=unapply(rhs(dsolve({ec1,cond},T(t))),t,T0,k,Tm)**

$$Ts := (t, T0, k, Tm) \mapsto Tm + e^{-k \cdot t} \cdot (T0 - Tm) \quad (18)$$

> **plot([Ts(t,50,0.5,24), Ts(t,-5,0.5,24)],t=1..10)**



```
> ec2:=Ts(t,36,k,21)=34.22
       $ec2 := 21 + 15 e^{-kt} = 34.22$  (19)
```

```
> ec3:=Ts(t+1,36,k,21)=34.11
       $ec3 := 21 + 15 e^{-k(t+1)} = 34.11$  (20)
```

```
> sist:=ec2,ec3
       $sist := 21 + 15 e^{-kt} = 34.22, 21 + 15 e^{-k(t+1)} = 34.11$  (21)
```

```
> solve({sist},{t,k})
       $\{k = 0.008355536648, t = 15.11804352\}$  (22)
```

```
> timp_deces:=11.5-15.11804352+24
       $timp\_deces := 20.38195648$  (23)
```

```
> restart
> with(plots)
[animate, animate3d, animatecurve, arrow, changecoords, complexplot,
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  coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot,
  fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal, (24)
```

interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d, listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot, multiple, odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot, polygonplot, polygonplot3d, polyhedra_supported, polyhedraplot, rootlocus, semilogplot, setcolors, setoptions, setoptions3d, shadebetween, spacecurve, sparsematrixplot, surfdata, textplot, textplot3d, tubeplot]

> ec1:=diff(x(t),t)=r*x(t)

$$ec1 := \frac{d}{dt} x(t) = r x(t) \quad (25)$$

> cond1:=x(0)=x0

$$cond1 := x(0) = x0 \quad (26)$$

> ec2:=diff(x(t),t)=r0*x(t)*(1-x(t)/k)

$$ec2 := \frac{d}{dt} x(t) = r0 x(t) \left(1 - \frac{x(t)}{k} \right) \quad (27)$$

> cond2:=x(0)=x0

$$cond2 := x(0) = x0 \quad (28)$$

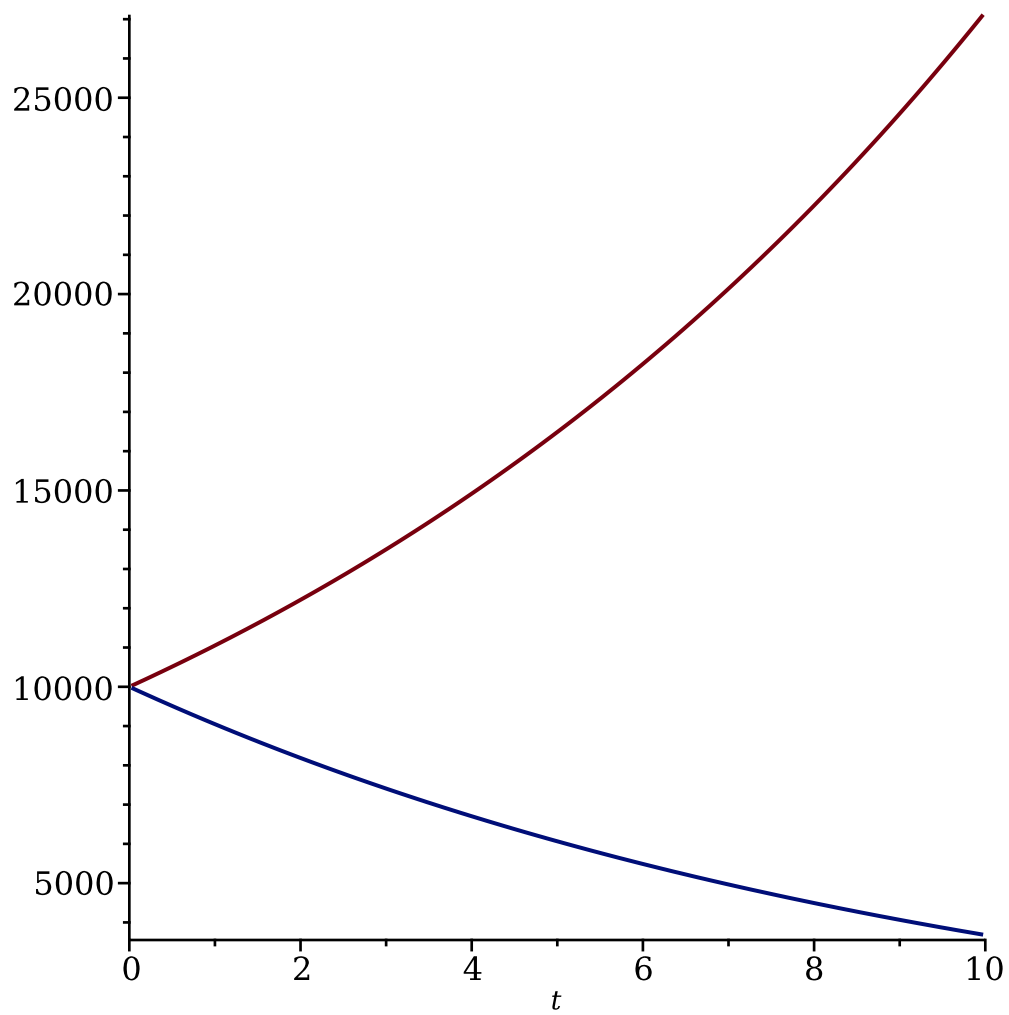
> xms:=unapply(rhs(dsolve({ec1,cond1},x(t))),t,x0,r)

$$xms := (t, x0, r) \mapsto x0 \cdot e^{r \cdot t} \quad (29)$$

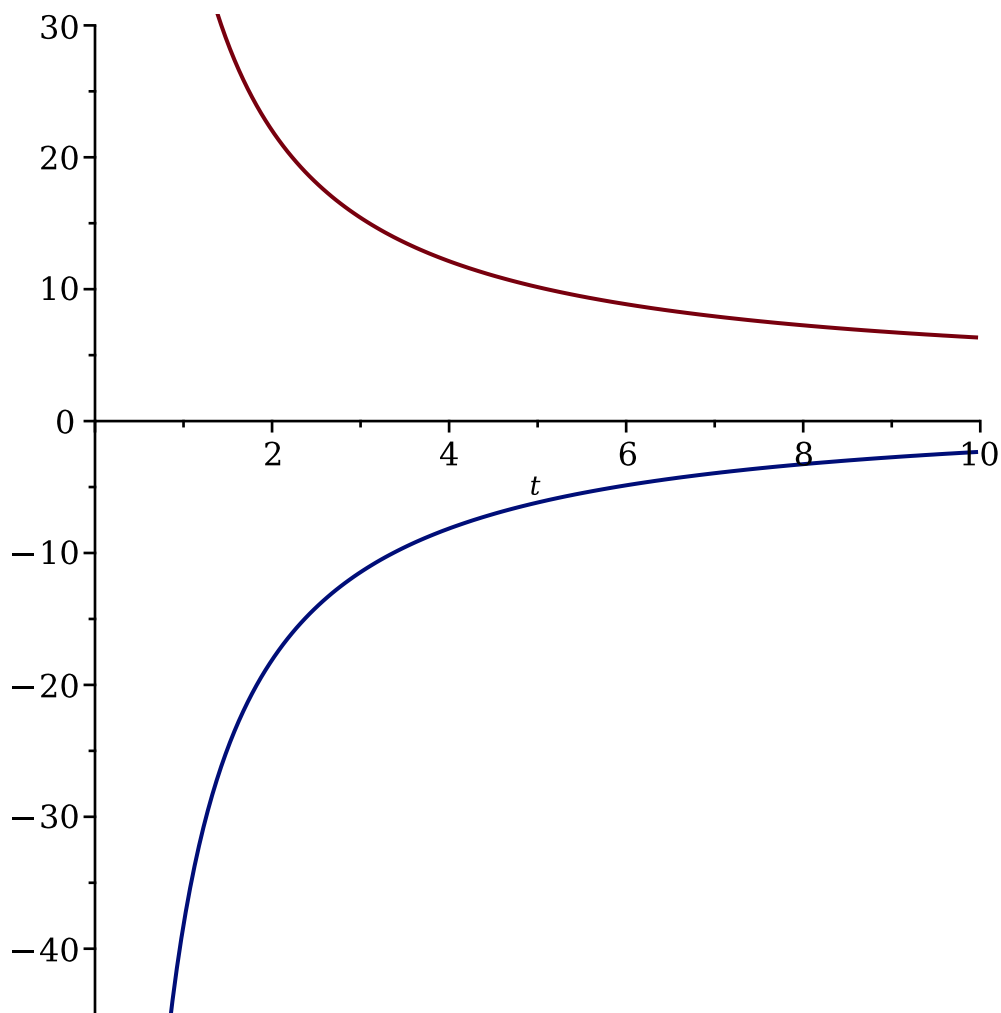
> xvs:=unapply(rhs(dsolve({ec2,cond2},x(t))),t,x0,k,r0)

$$xvs := (t, x0, k, r0) \mapsto \frac{k \cdot x0}{(k - x0) \cdot e^{-r0 \cdot t} + x0} \quad (30)$$

> plot([xms(t,10000,0.1),xms(t,10000,-0.1)],t=0..10)



```
> plot([xvs(t,10000,4,0.1),xvs(t,10000,4,-0.1)],t=0..10)
```



```
> rs:=solve(xms(2,25*10^3,r)=30*10^3,r)
```

$$rs := \frac{\ln\left(\frac{6}{5}\right)}{2}$$

(31)

```
> marime_dupa_5_ani_malthus:=xms(5,25*10^3,rs)
```

$$marime_dupa_5_ani_malthus := 7200\sqrt{30}$$

(32)

```
> ec3:=xvs(2,20*10^3,k,r0)=40*10^3
```

$$ec3 := \frac{20000k}{(k-20000)e^{-2r0} + 20000} = 40000$$

(33)

```
> ec4:=xvs(3,20*10^3,k,r0)=50*10^3
```

$$ec4 := \frac{20000k}{(k-20000)e^{-3r0} + 20000} = 50000$$

(34)

```
> sist:=ec3,ec4
```

$$sist := \frac{20000k}{(k-20000)e^{-2r0} + 20000} = 40000, \frac{20000k}{(k-20000)e^{-3r0} + 20000} = 50000$$

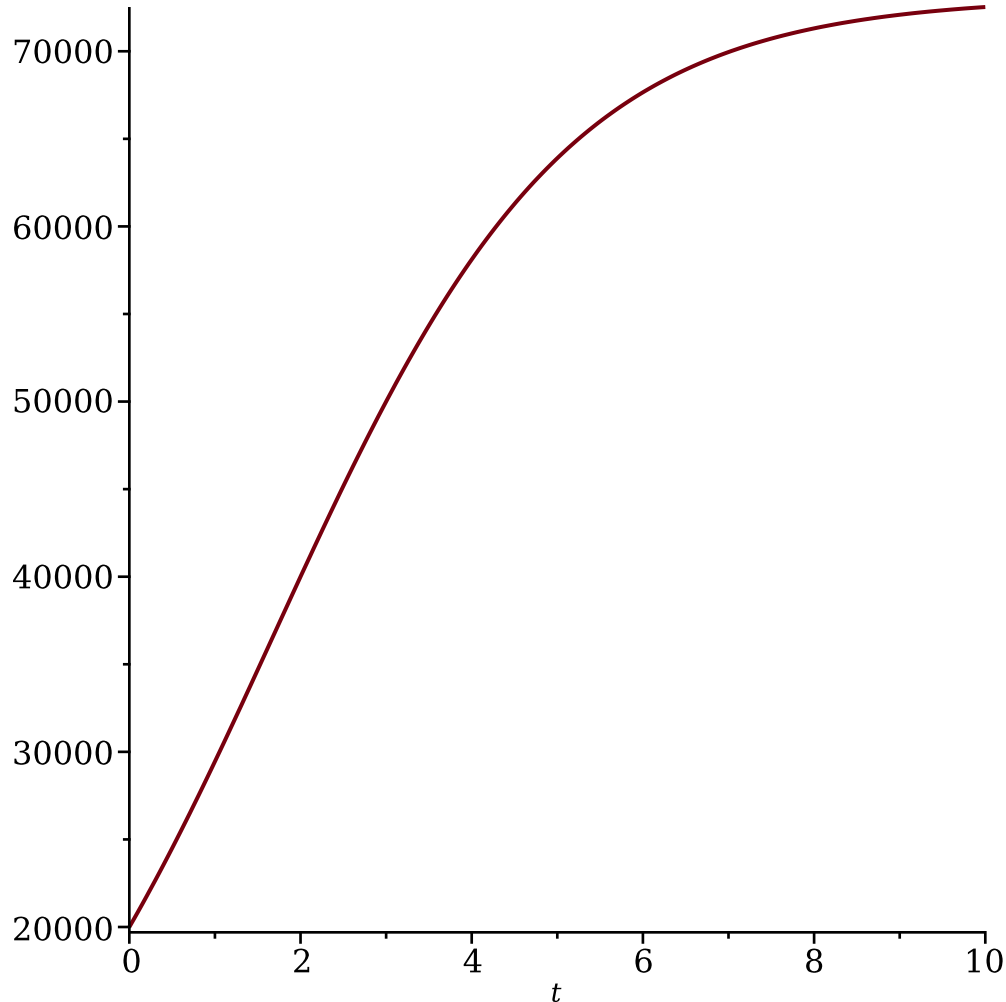
(35)

```
> sol:=solve({sist},{k,r0})
```

(36)

$$sol := \left\{ k = \frac{200000 \operatorname{RootOf}(5_Z^2 - _Z - 1)}{7} + \frac{400000}{7}, r0 = -\ln(\operatorname{RootOf}(5_Z^2 - _Z - 1)) \right\} \quad (36)$$

```
> plot([xvs(t,20*10^3,rhs(sol[1]),rhs(sol[2])),t=0..10)
```



```
> restart
```

```
> with(plots)
```

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textplot3d, tubeplot]

> ec1:=v(x)*diff(v(x),x)=-g*R^2/(x+R)^2

$$ec1 := v(x) \left(\frac{d}{dx} v(x) \right) = -\frac{g R^2}{(x+R)^2} \quad (38)$$

> cond:=v(0)=v0

$$cond := v(0) = v0 \quad (39)$$

> s:=solve(lhs(dsolve({ec1,cond},v(x),implicit))=0,v(x))

$$s := \frac{\sqrt{-(x+R)(2xgR-Rv0^2-v0^2x)}}{x+R}, \quad (40)$$
$$-\frac{\sqrt{-(x+R)(2xgR-Rv0^2-v0^2x)}}{x+R}$$

> vs:=unapply(s[1],x,v0,R,g)

$$vs := (x, v0, R, g) \mapsto \frac{\sqrt{-(x+R) \cdot (2 \cdot R \cdot g \cdot x - R \cdot v0^2 - v0^2 \cdot x)}}{x+R} \quad (41)$$

> b:=vs(75,50,6371000,9.81)

$$b := 32.07050550 \quad (42)$$

> c:=solve(vs(x,50,6371000,9.81)=0,x)

$$c := 127.4235475 \quad (43)$$

> sol_ve:=solve(vs(x,v0,R,g)=0,v0)

$$sol_ve := \frac{\sqrt{2} \sqrt{(x+R) x g R}}{x+R}, -\frac{\sqrt{2} \sqrt{(x+R) x g R}}{x+R} \quad (44)$$

> ve:=unapply(sol_ve[1],x,R,g)

$$ve := (x, R, g) \mapsto \frac{\sqrt{2} \cdot \sqrt{(x+R) \cdot x \cdot g \cdot R}}{x+R} \quad (45)$$

> limit(ve(x,R,g),x=infinity)

$$\sqrt{2} \sqrt{g R} \quad (46)$$

> limit(ve(x,6378160,9.78),x=infinity)

$$11169.45878 \quad (47)$$

> limit(ve(x,6357778,9.832),x=infinity)

$$11181.20506 \quad (48)$$

> limit(ve(x,6371110,9.81),x=infinity)

$$11180.39257 \quad (49)$$