

```
> dt:= h/2/((h/2/Pi)*omega);
```

$$dt := \frac{\pi}{\omega} \quad (1)$$

```
> s1:=int(exp(-t)*cos(omega*t),t=0..infinity);
```

$$s1 := \frac{1}{\omega^2 + 1} \quad (2)$$

```
> s2:=int((exp(-t)+exp(-alpha*t))*cos(omega*t),t=0..infinity)
assuming(alpha,positive);
```

$$s2 := \frac{\alpha \omega^2 + \alpha^2 + \omega^2 + \alpha}{(\alpha^2 + \omega^2)(\omega^2 + 1)} \quad (3)$$

```
> ft1:=int(s1*cos(omega*t),omega=0..infinity)*2/Pi assuming(t,
positive);
```

$$ft1 := e^{-t} \quad (4)$$

```
> ft2:=simplify(int(s2*cos(omega*t),omega=0..infinity)*2/Pi assuming
(t,positive) assuming(alpha,positive));
```

$$ft2 := \cosh(t) \operatorname{csgn}(t) + \cosh(\alpha t) \operatorname{csgn}(\alpha t) - \sinh(t) - \sinh(\alpha t) \quad (5)$$

```
> with(plots);
```

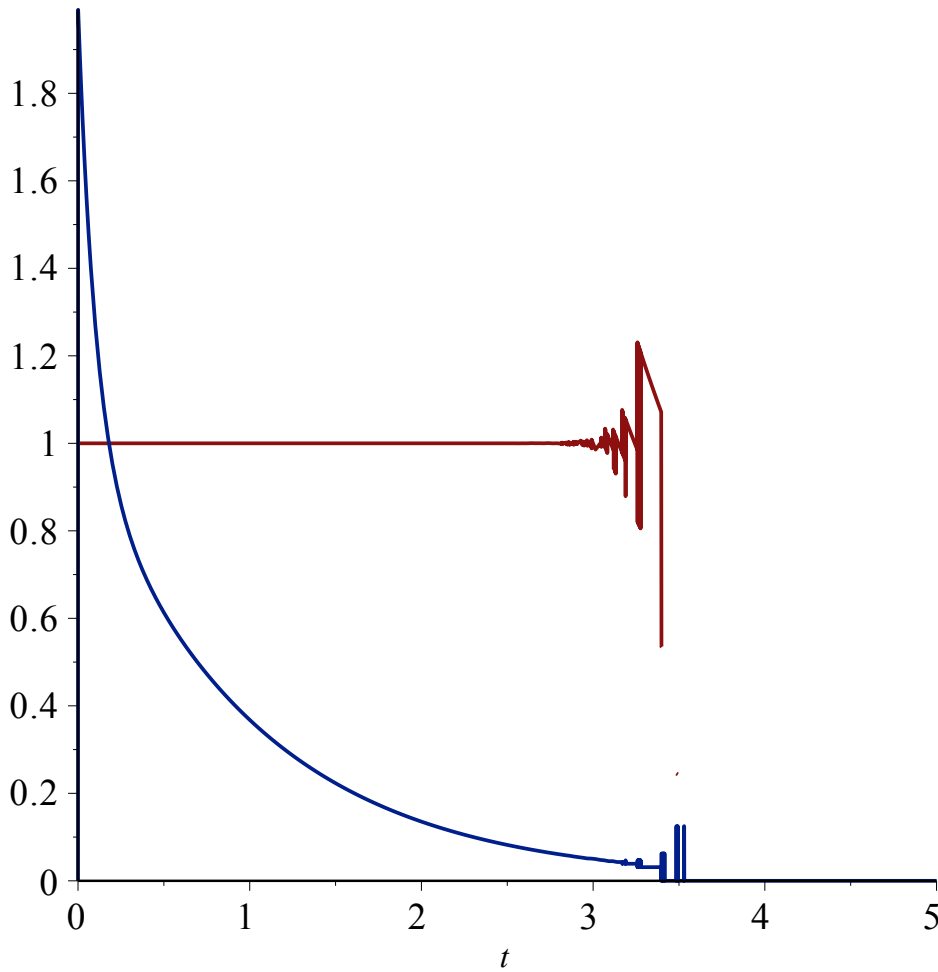
[animate, animate3d, animatecurve, arrow, changecoords, complexplot, complexplot3d, conformal, conformal3d, contourplot, contourplot3d, coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot, fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal, interactive, interactiveparams, 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]

$$(6)$$

```
> simplify((exp(-t)+exp(-alpha*t))-ft1) assuming(t,positive) assuming
(alpha,positive);
```

$$e^{-t} + e^{-\alpha t} - \cosh(t) - \cosh(\alpha t) + \sinh(t) + \sinh(\alpha t) \quad (7)$$

```
> plot([subs(alpha=10,(exp(-t)+exp(-alpha*t))/ft2),subs(alpha=10,ft2)
],t=0..5);
```



```
> ft2a:=evalc(simplify(evalc(int(s2*cos(omega*t),omega=0..T))))*2/Pi
  assuming(t,positive) assuming(alpha,positive) assuming(T,positive);
ft2a := 1/pi (2 ( -1/2 I Ci(T t - I t alpha) cosh(alpha t) + 1/2 I Ci(T t + I t alpha) cosh(alpha t)
```

(8)

$$\begin{aligned}
 & - \frac{1}{2} I \operatorname{Ci}(T t - I t) \cosh(t) + \frac{1}{2} I \operatorname{Ci}(T t + I t) \cosh(t) - \frac{1}{2} \operatorname{Si}(T t - I t) \sinh(t) \\
 & - \frac{1}{2} \operatorname{Si}(T t - I t \alpha) \sinh(\alpha t) - \frac{1}{2} \operatorname{Si}(T t + I t \alpha) \sinh(\alpha t) - \frac{1}{2} \operatorname{Si}(T t \\
 & + I t) \sinh(t) + \frac{1}{2} \pi \cosh(t) + \frac{1}{2} \pi \cosh(\alpha t) \Big) \Big)
 \end{aligned}$$

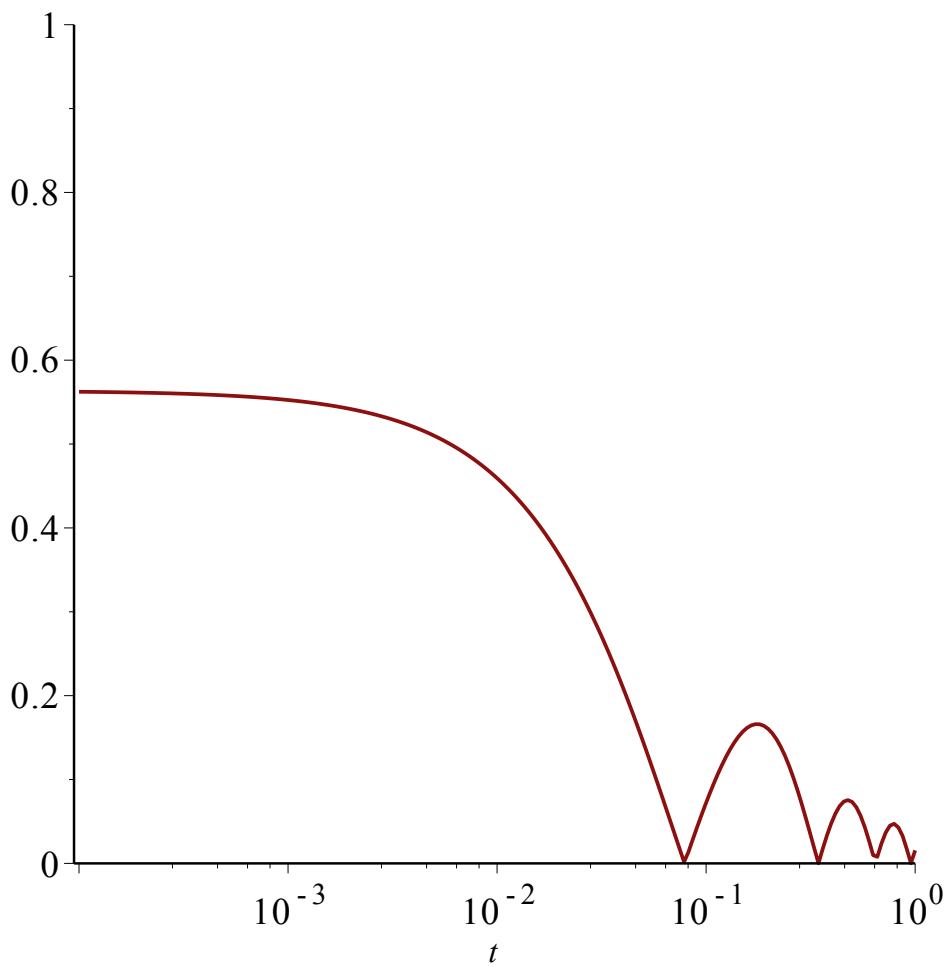
```
> ft1a:=simplify(int(s1*cos(omega*t),omega=0..T)*2/Pi) assuming(t,
  positive) assuming(T,positive);
```

```
ft1a := -1/pi (I cosh(t) Ci(T t - I t) - I cosh(t) Ci(T t + I t) - pi cosh(t) + Si(T t
```

(9)

$$- I t) \sinh(t) + \operatorname{Si}(T t + I t) \sinh(t))$$

```
> semilogplot(subs(alpha=10,T=10,abs(ft2a-ft2)),t=0.0001..1,0..1);
```

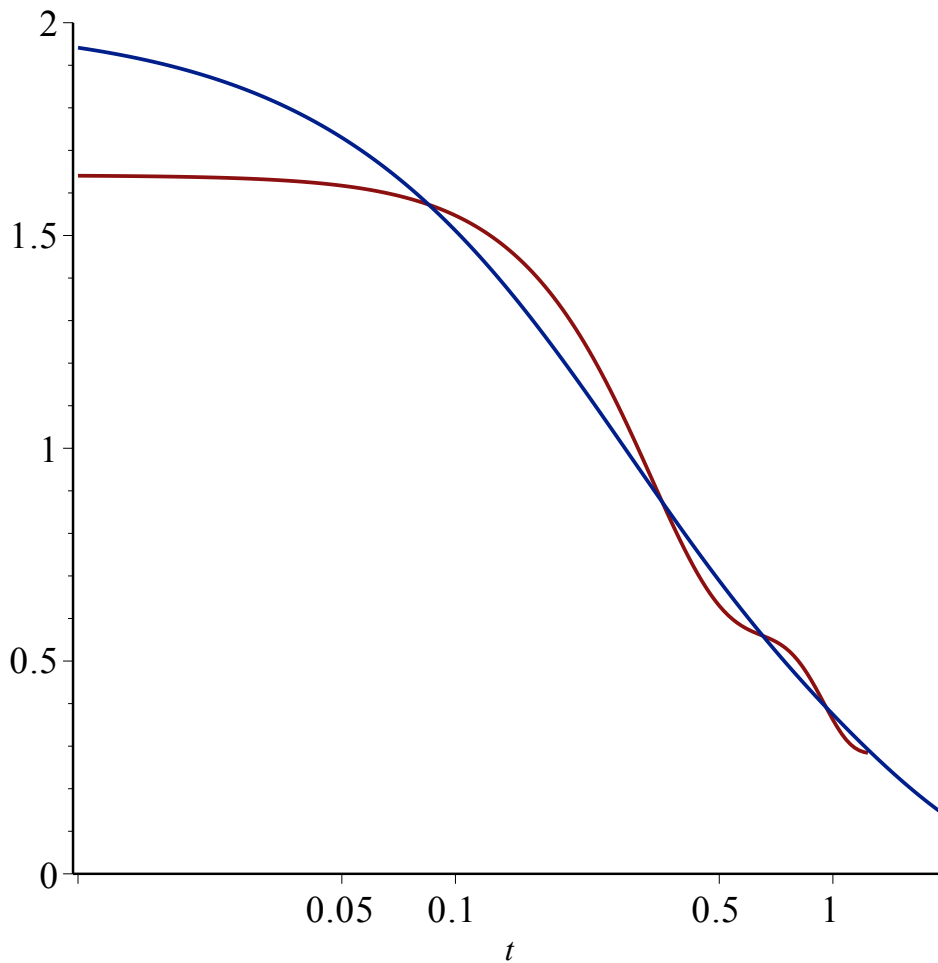


```
> digits:=50;
```

```
digits := 50
```

(10)

```
> semilogplot([subs(alpha=5,T=10,ft2a),subs(alpha=5,T=10,ft2)],t=
0.01..2,0..2);
```



```
> s3:=int((exp(-t)+exp(-alpha*t*t))*cos(omega*t),t=0..infinity)
    assuming(alpha,positive);
```

$$s3 := \frac{1}{2} \frac{\sqrt{\pi} e^{-\frac{1}{4} \frac{\omega^2}{\alpha}} \omega^2 + \sqrt{\pi} e^{-\frac{1}{4} \frac{\omega^2}{\alpha}} + 2 \sqrt{\alpha}}{(\omega^2 + 1) \sqrt{\alpha}} \quad (11)$$

```
> ft3:=evalc(simplify(evalc(int(s3*cos(omega*t),omega=0..infinity))))
    *2/Pi assuming(t,positive) assuming(alpha,positive) assuming(T,
    positive);
```

$$ft3 := e^{-t} + e^{-\alpha t^2} \quad (12)$$

```
> ft3a:=evalc(simplify(evalc(int(s3*cos(omega*t),omega=0..T))))*2/Pi
    assuming(t,positive) assuming(alpha,positive) assuming(T,positive);
```

$$ft3a := \frac{\int_0^T \left(\frac{\sqrt{\pi} e^{-\frac{1}{4} \frac{\omega^2}{\alpha}} \omega^2 + \sqrt{\pi} e^{-\frac{1}{4} \frac{\omega^2}{\alpha}} + 2 \sqrt{\alpha}}{\omega^2 + 1} \right) \cos(\omega t) d\omega}{\sqrt{\alpha} \pi} \quad (13)$$

```
> semilogplot([subs(alpha=5,T=10,ft3a),subs(alpha=5,T=10,ft3)],t=
```

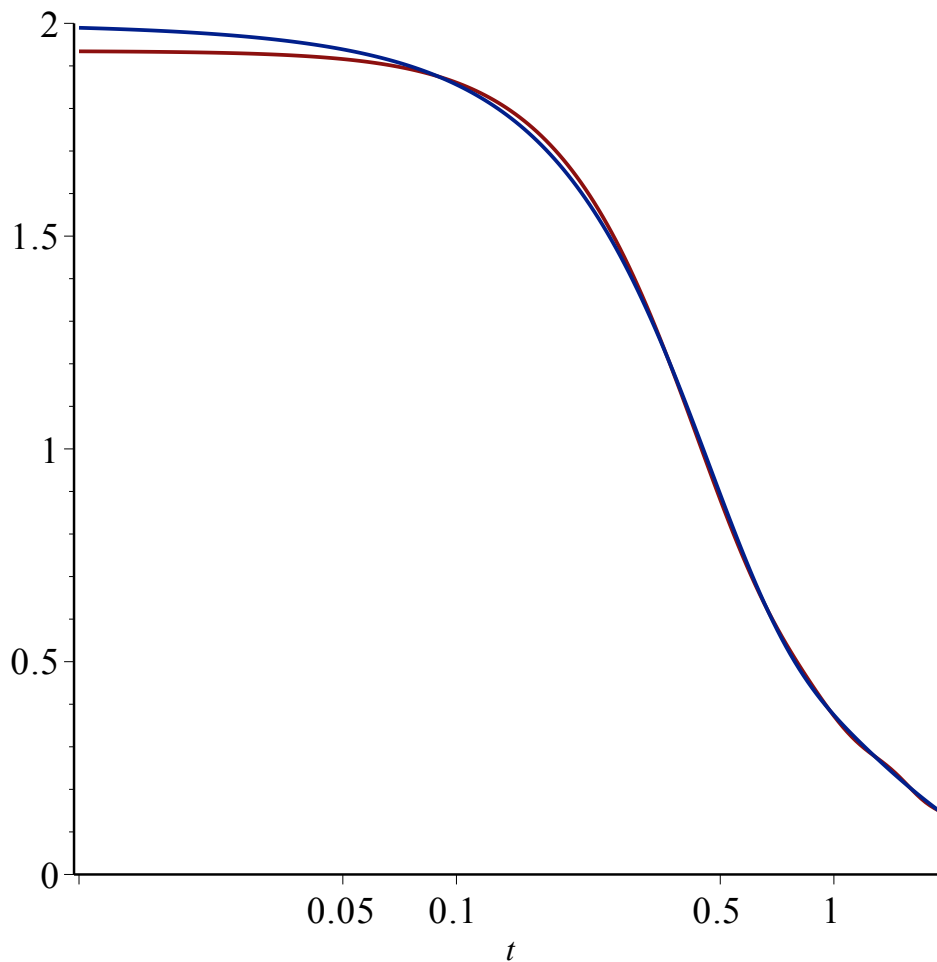
```
0.01..2,0..2);  
Warning, computation interrupted
```

```
> digits:=8;
```

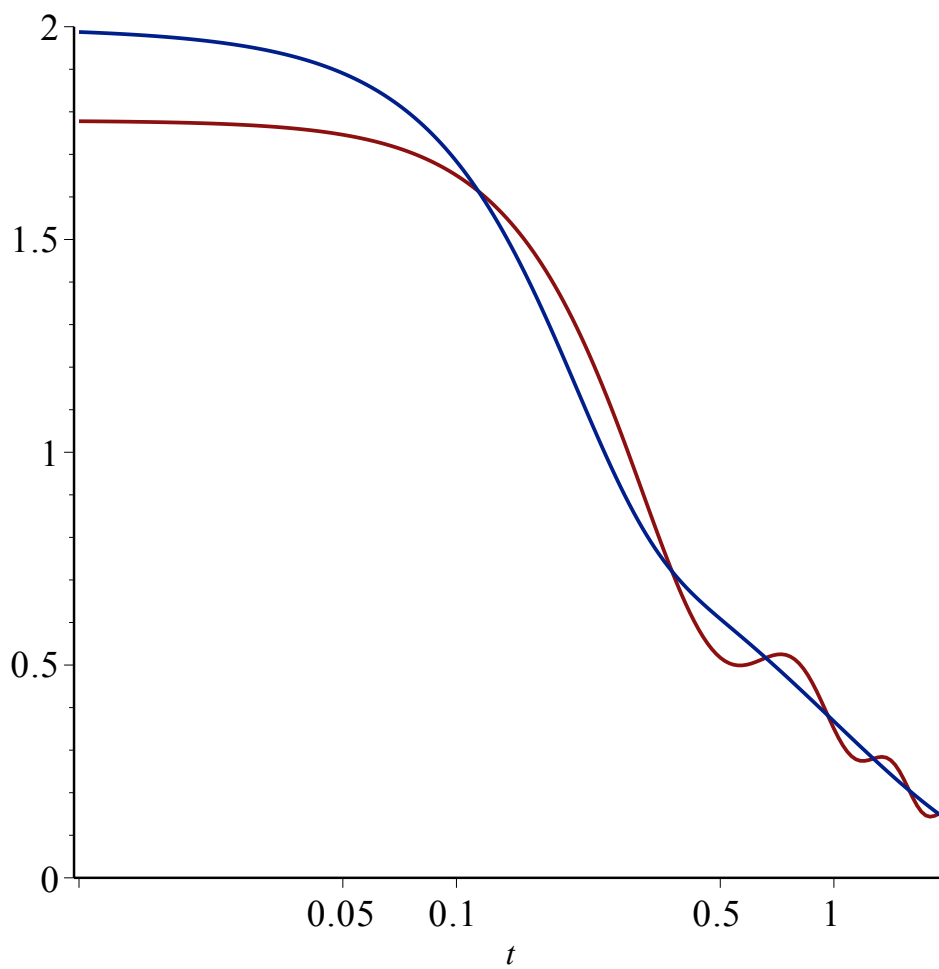
digits := 8

(14)

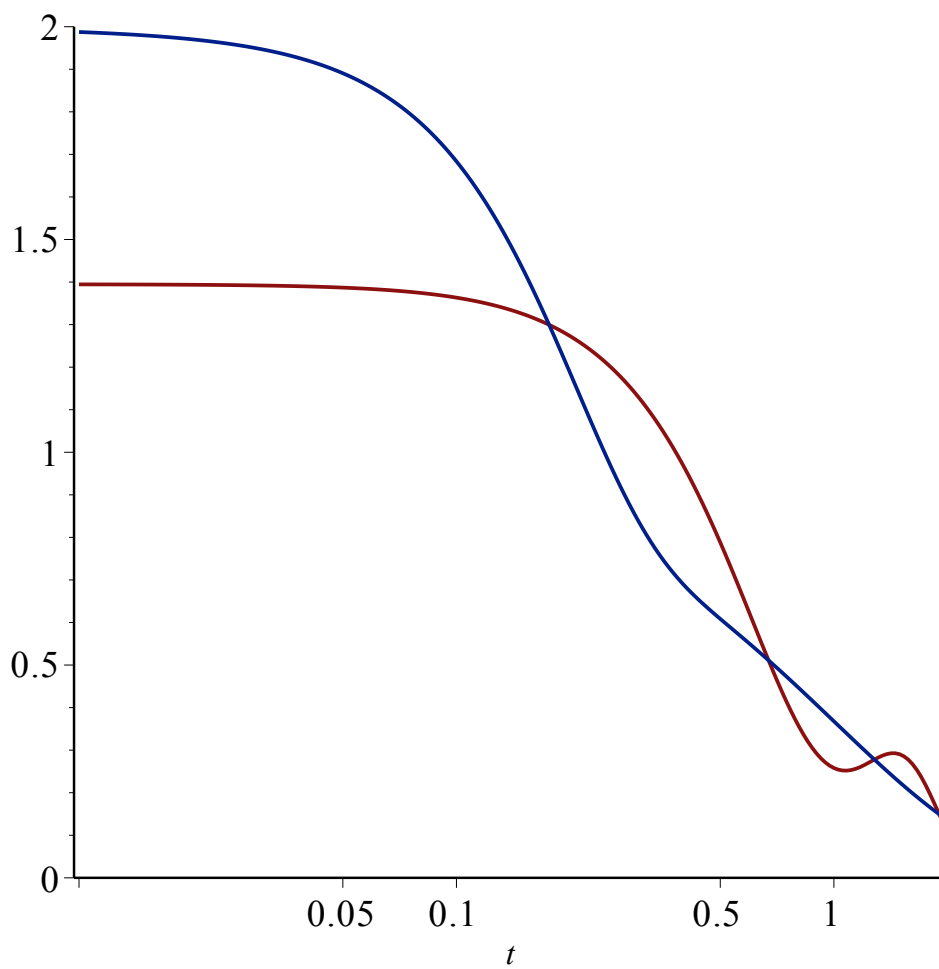
```
> semilogplot([subs(alpha=5,T=10,ft3a),subs(alpha=5,T=10,ft3)],t=  
0.01..2,0..2);
```



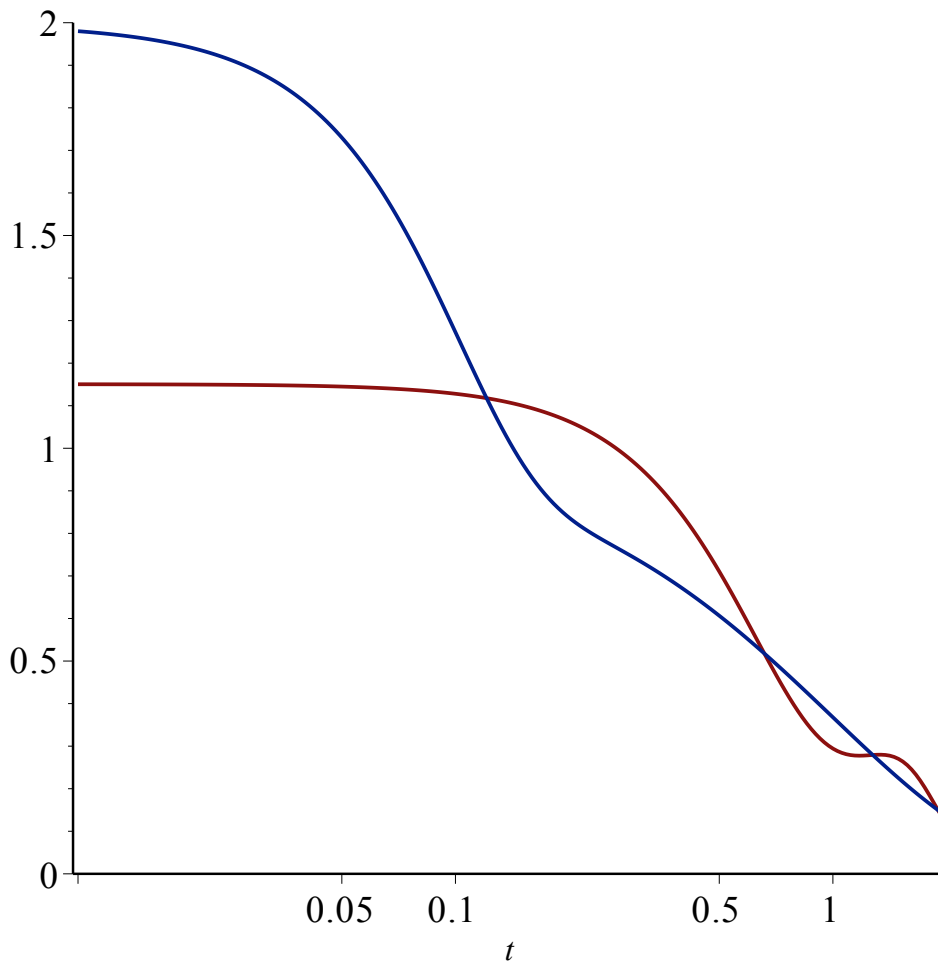
```
> semilogplot([subs(alpha=25,T=10,ft3a),subs(alpha=25,T=10,ft3)],t=  
0.01..2,0..2);
```



```
> semilogplot([subs(alpha=25,T=5,ft3a),subs(alpha=25,T=5,ft3)],t=
0.01..2,0..2);
```



```
> semilogplot([subs(alpha=100,T=5,ft3a),subs(alpha=100,T=5,ft3)],t=
0.01..2,0..2);
```



```
> s4:=int((exp(-t)+exp(-alpha*t*t)/3)*cos(omega*t),t=0..infinity)
    assuming(alpha,positive);
```

$$s4 := \frac{1}{6} \frac{\sqrt{\pi} e^{-\frac{1}{4} \frac{\omega^2}{\alpha}} \omega^2 + \sqrt{\pi} e^{-\frac{1}{4} \frac{\omega^2}{\alpha}} + 6 \sqrt{\alpha}}{(\omega^2 + 1) \sqrt{\alpha}} \quad (15)$$

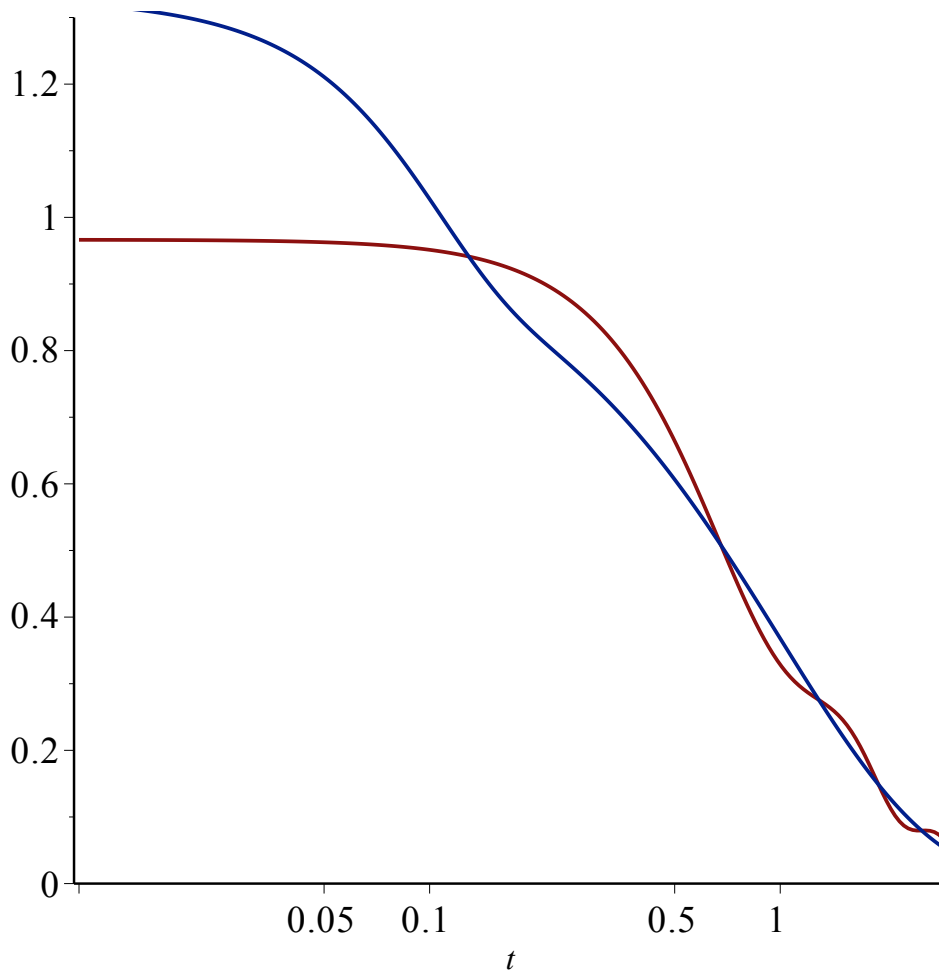
```
> ft4:=evalc(simplify(evalc(int(s4*cos(omega*t),omega=0..infinity))))
    *2/Pi assuming(t,positive) assuming(alpha,positive) assuming(T,
    positive);
```

$$ft4 := e^{-t} + \frac{1}{3} e^{-\alpha t^2} \quad (16)$$

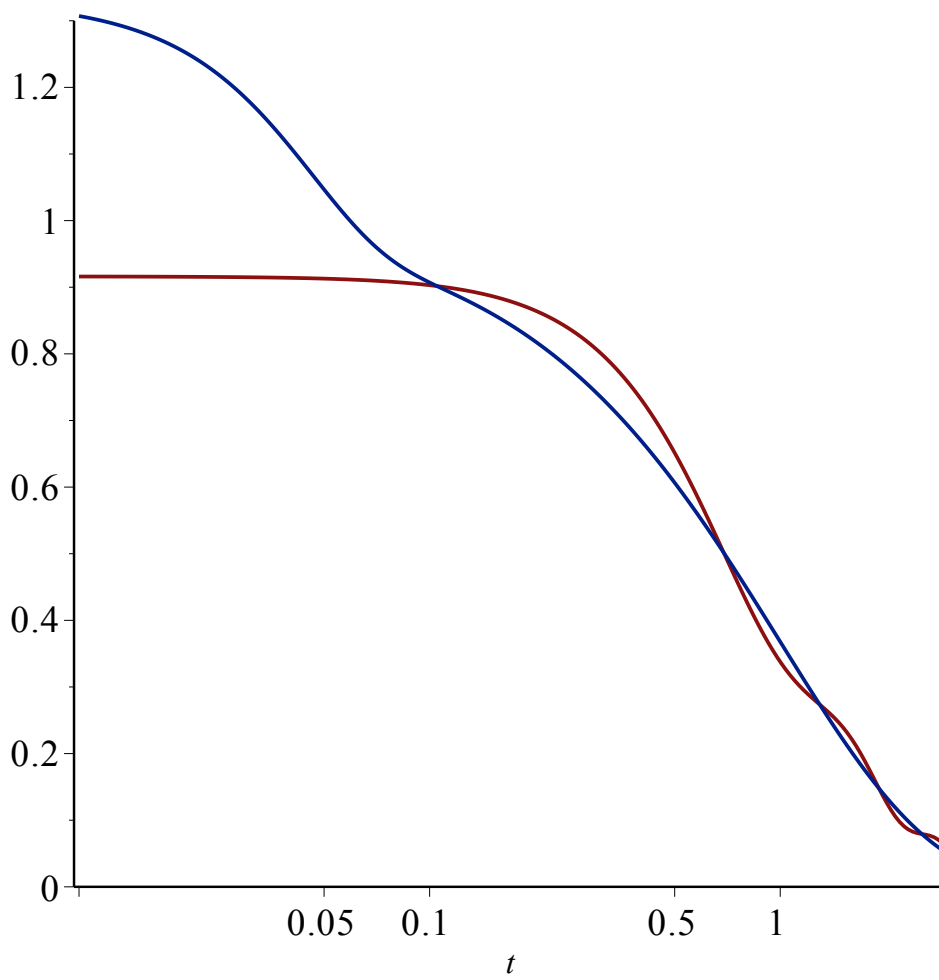
```
> ft4a:=evalc(simplify(evalc(int(s4*cos(omega*t),omega=0..T))))*2/Pi
    assuming(t,positive) assuming(alpha,positive) assuming(T,positive);
```

$$ft4a := \frac{1}{3} \frac{\int_0^T \left(\frac{\sqrt{\pi} e^{-\frac{1}{4} \frac{\omega^2}{\alpha}} \omega^2 + \sqrt{\pi} e^{-\frac{1}{4} \frac{\omega^2}{\alpha}} + 6 \sqrt{\alpha}}{\omega^2 + 1} \right) \cos(\omega t) d\omega}{\sqrt{\alpha} \pi} \quad (17)$$

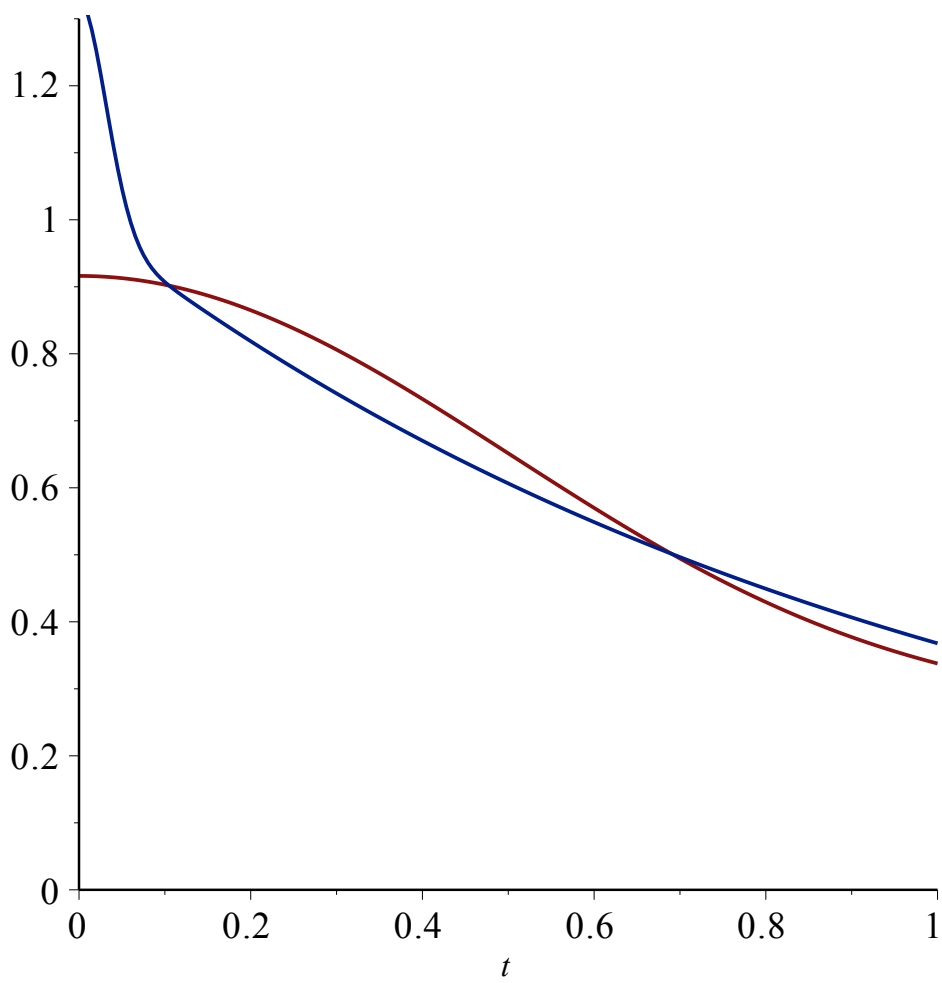

```
> semilogplot([subs(alpha=100,T=5,ft4a),subs(alpha=100,T=5,ft4)],t=0.01..3,0..1.3);
```



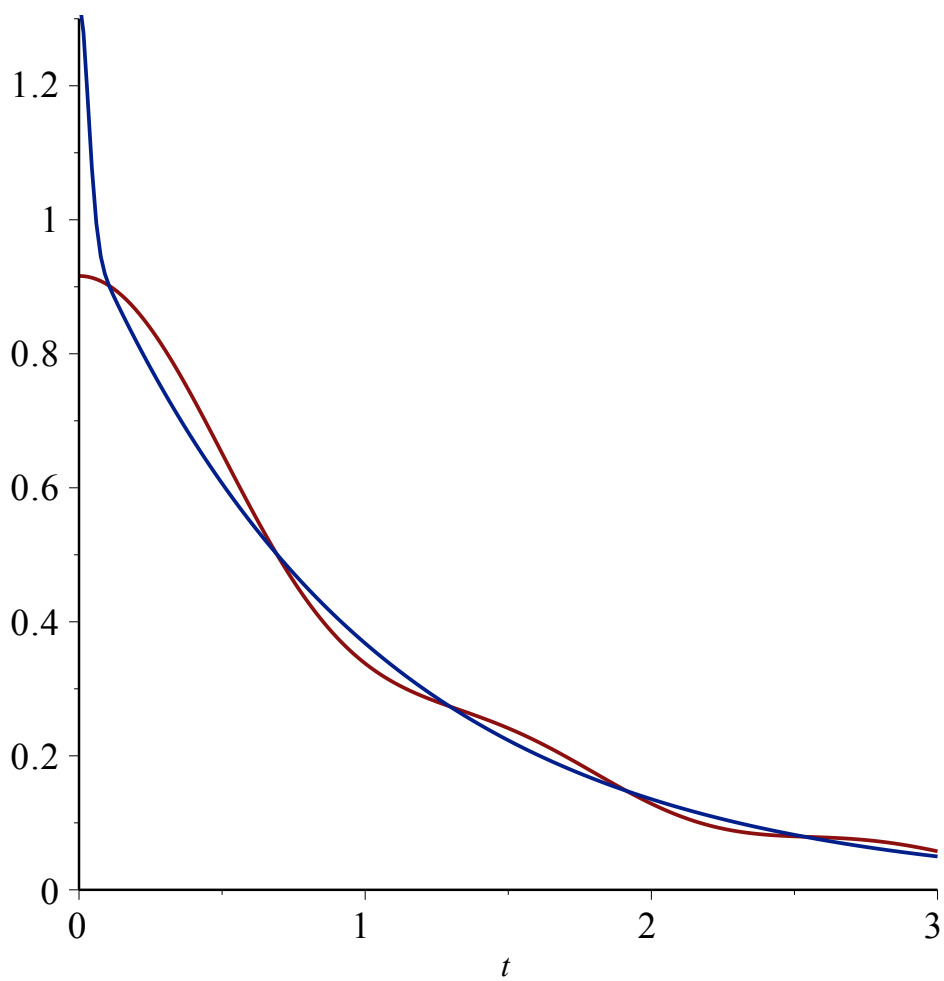
```
> semilogplot([subs(alpha=500,T=5,ft4a),subs(alpha=500,T=5,ft4)],t=0.01..3,0..1.3);
```



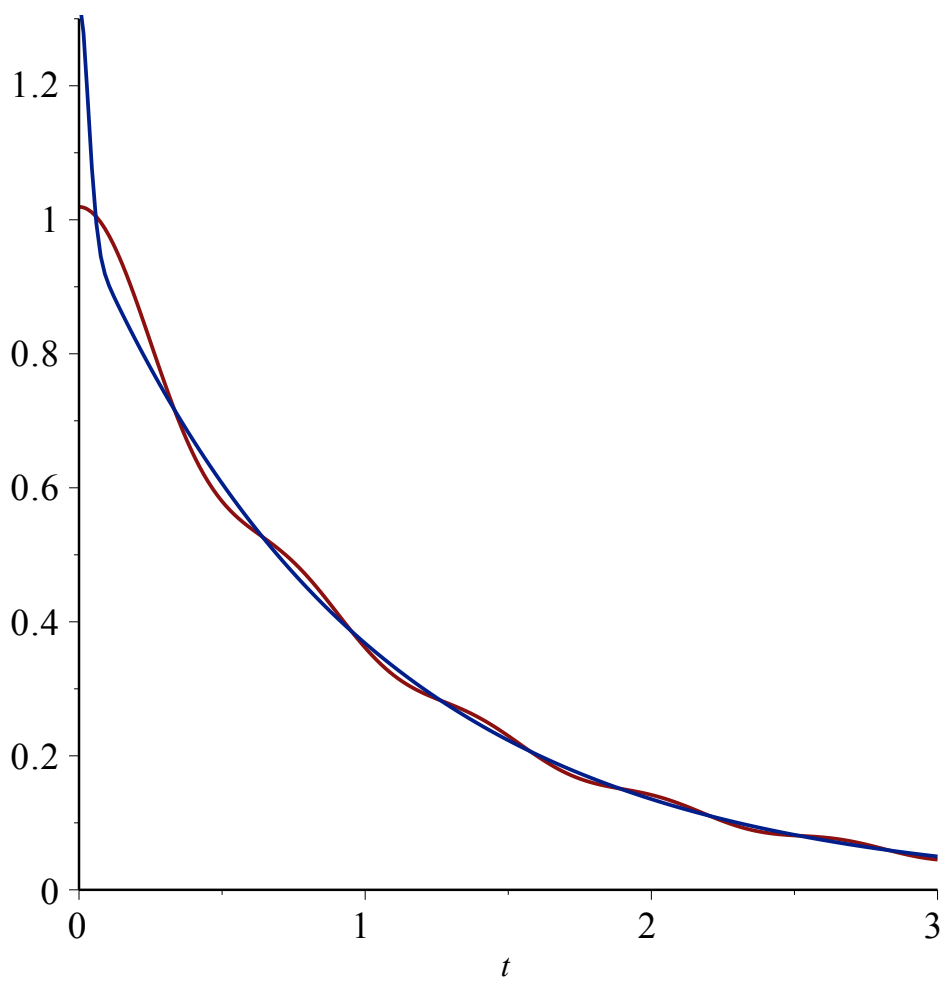
```
> plot([subs(alpha=500,T=5,ft4a),subs(alpha=500,T=5,ft4)],t=0.0..1,0.  
.1.3);
```



```
> plot([subs(alpha=500,T=5,ft4a),subs(alpha=500,T=5,ft4)],t=0.0..3,0.  
.1.3);
```



```
> plot([subs(alpha=500,T=10,ft4a),subs(alpha=500,T=10,ft4)],t=0.0..3,  
0..1.3);
```



```
> plot([subs(alpha=500,T=20,ft4a),subs(alpha=500,T=20,ft4)],t=0.0..3,  
0..1.3);
```

