In [36]:

```
omega,t,omega0,x0,v0=var('omega,t,omega0,x0,v0')
x=function('x')(t)
print("A:")
eq1=diff(x,t,2)+x*omega0^2==0
show(eq1)
show(desolve(eq1, [x, t]))
print("B:")
assume(omega0 > 0)
sol(t,omega0,x0,v0)=desolve(eq1, [x, t], [0, x0, v0])
show(sol)
print("C:")
omega0=sqrt(981/39.24)
show(omega0)
x0=0.15
sol(t)=sol(t,omega0,x0,0)
show(sol)
plot(sol(t),t,0,10)
```

A:

$$\omega_0^2 x(t) + \frac{\partial^2}{(\partial t)^2} x(t) = 0$$

$$K_2 \cos(\omega_0 t) + K_1 \sin(\omega_0 t)$$

B:

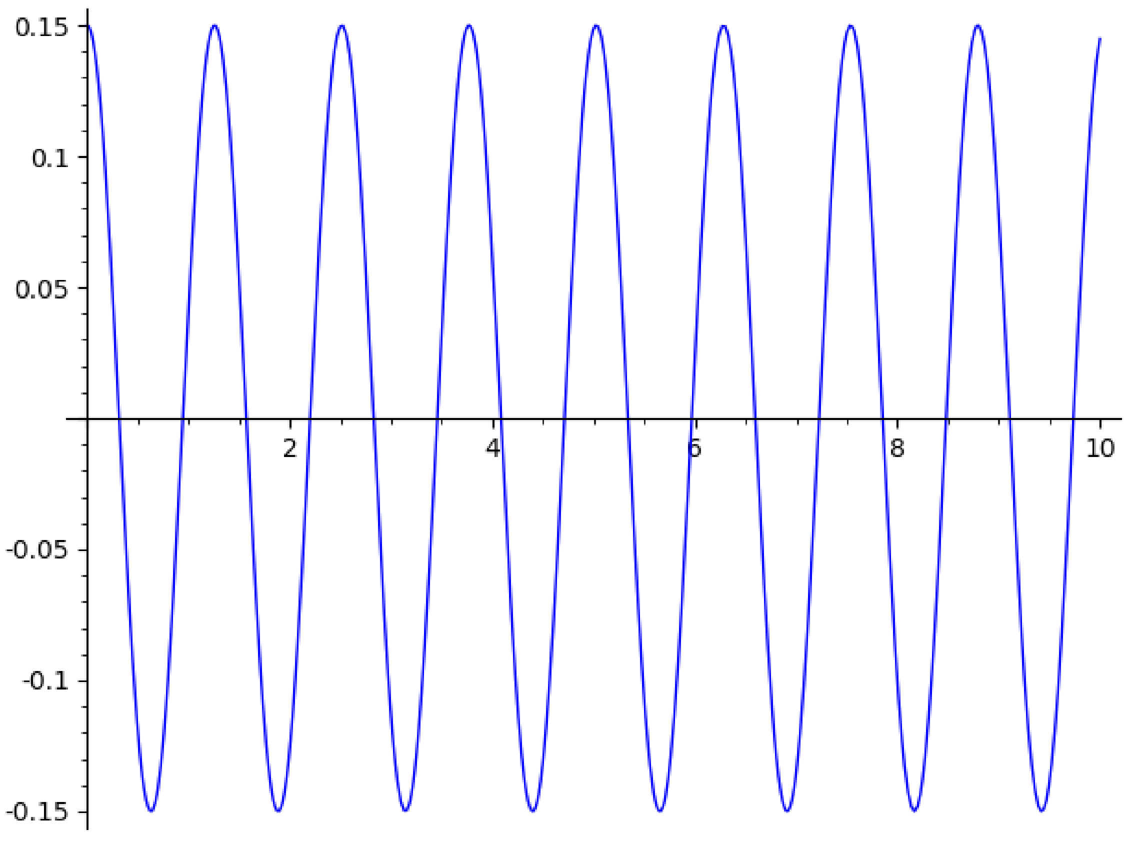
$$(t, \omega_0, x_0, v_0) \mapsto$$

C:

$$5.00000000000000$$

$$t \mapsto$$

Out[36]:



In [6]:

```
forget()
x0,v0,l,omega0,t=var('x0,v0,l,omega0,t')
x=function('x')(t)
print("A:")
eq1=diff(x,t,2)+l*diff(x,t)+x*omega0^2==0
show(eq1)
assume(l^2 > 4*omega0^2)
sol(t,l,omega0,x0,v0)=desolve(eq1, [x, t])
show(sol)
print("B:")
sol(t,l,omega0,x0,v0)=desolve(eq1, [x, t], [0, x0, v0])
show(sol)
sol(t)=sol(t,25,10,1,5)
show(sol)
show(plot(sol(t),t,0,10))
print("C:")
forget()
eq2=diff(x,t,2)+diff(x,t)*2*omega0+x*omega0^2==0
show(eq2)
assume(omega0 > 0)
sol(t,omega0)=desolve(eq2, [x, t])
show(sol)
print("D:")
sol(t,omega0,x0,v0)=desolve(eq2, [x, t], [0, x0, v0])
show(sol)
sol(t)=sol(t,20,10,1,5)
show(sol)
show(plot(sol(t),t,0,10))
print("E:")
assume(l^2 < 4*omega0^2)
sol(t,l,omega0)=desolve(eq1, [x, t])
show(sol)
print("F:")
sol(t,l,omega0,x0,v0)=desolve(eq1, [x, t], [0, x0, v0])
show(sol)
sol(t)=sol(t,5,10,1,5)
show(sol)
show(plot(sol(t),t,0,10))
```

A:

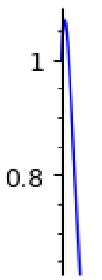
$$\omega_0^2 x(t) + l\frac{\partial}{\partial t}x(t) + \frac{\partial^2}{(\partial t)^2}x(t) = 0$$

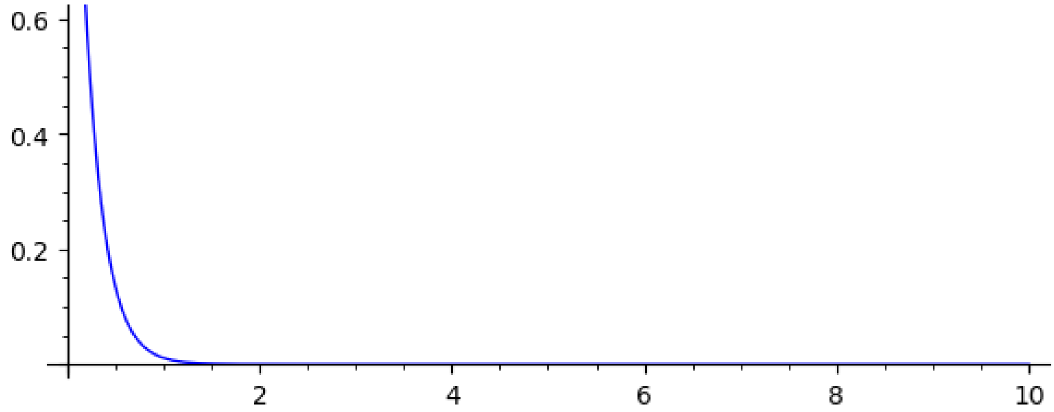
$(t, l, \omega_0, x_0, v_0) \quad \mapsto$

B:

$(t, l, \omega_0, x_0, v_0) \quad \mapsto$

$t \quad \mapsto$





C:

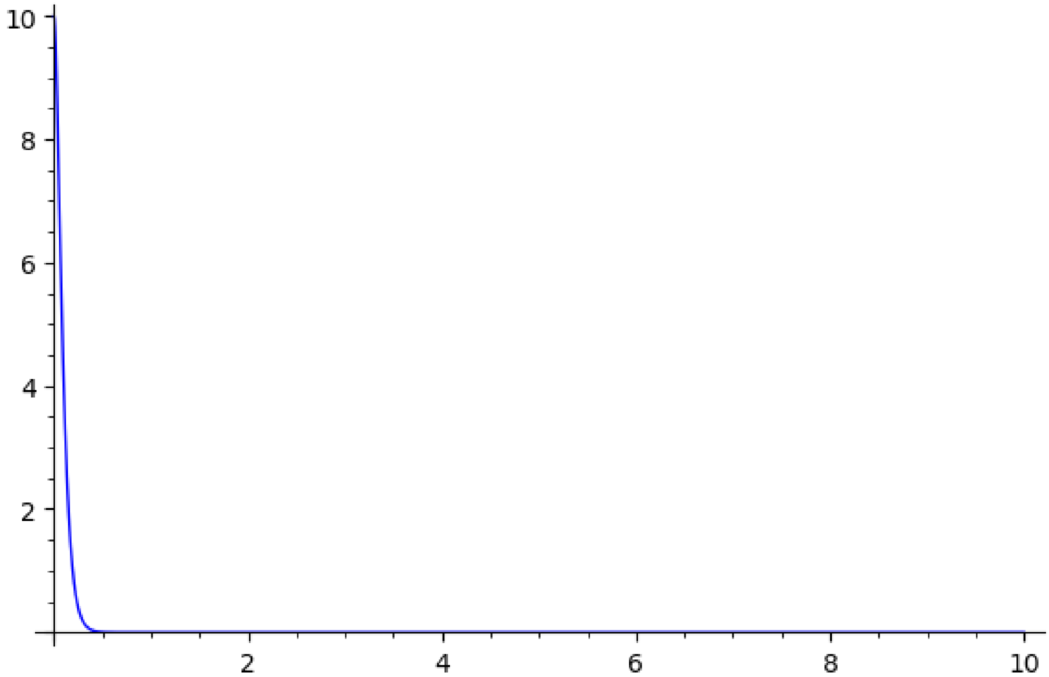
$$\omega_0^2 x(t) + 2\,\omega_0 \frac{\partial}{\partial t} x(t) + \frac{\partial^2}{(\partial t)^2} x(t) = 0$$

$(t, \omega_0) \mapsto$

D:

$(t, \omega_0, x_0, v_0) \mapsto$

$t \mapsto$



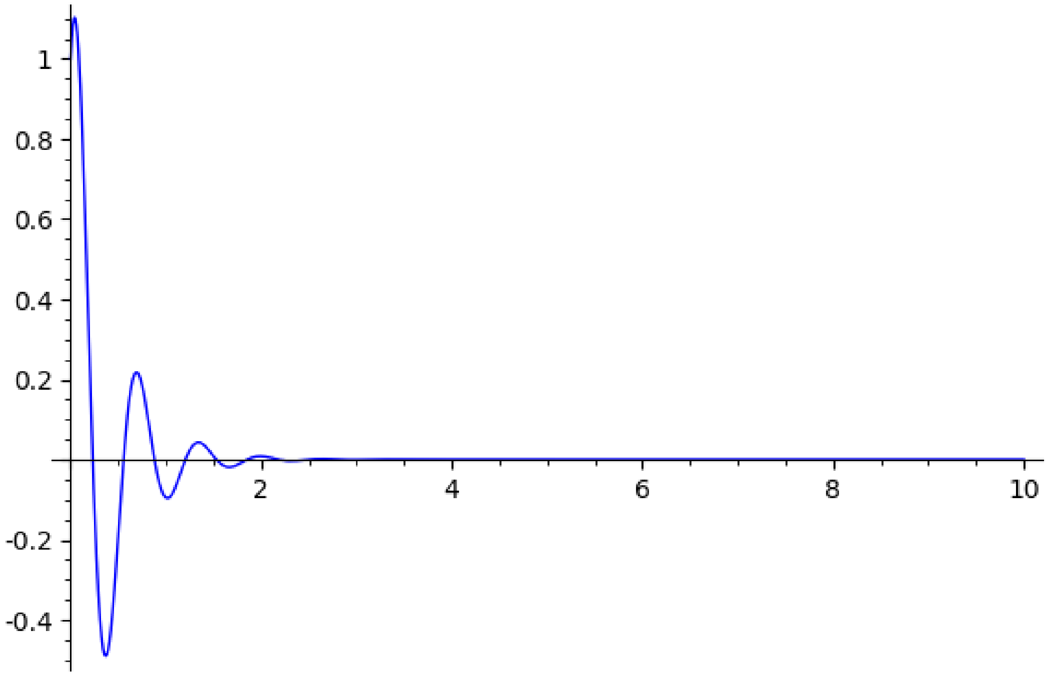
E:

$(t, l, \omega_0) \mapsto$

F:

$(t, l, \omega_0, x_0, v_0) \mapsto$

$t \mapsto$



In [72]:

```
forget()
omega,omega0,t,F0=var('omega,omega0,t,F0')
x=function('x')(t)
eq=diff(x,t,2)+omega0^2*x==F0*cos(omega*t)
show(eq)
print("A:")
assume(omega0 > 0)
sol(omega, omega0, F0, t, K1, K2)=desolve(eq, [x, t])
show(sol)
print("B:")
sol(omega, omega0, F0, t)=desolve(eq, [x, t], [0, 0, 0])
show(sol)
sol(t)=sol(5.5,5,2,t)
show(sol)
show(plot(sol(t),t,0,10))
print("C:")
assume(omega==omega0)
eq=eq.substitute(omega0==omega)
show(eq)
sol(omega, F0, t, K1, K2)=desolve(eq, [x, t])
show(sol)
print("D:")
sol(omega, F0, t)=desolve(eq, [x, t], [0, 0, 0])
show(sol)
sol(t)=sol(5,2,t)
show(sol)
show(plot(sol(t),t,0,10))
print("E:")
eq=diff(x,t,2)+omega0^2*x==F0*cos(omega*t)
y(t,omega)=desolve(eq, [x, t], [0, 0, 0])
show(y)
eq=eq.substitute(omega==omega0)
show(eq)
show(limit(y,omega=omega0)==desolve(eq, [x, t], [0, 0, 0]).simplify_full())
```

$$\omega_0^2 x(t) + \frac{\partial^2}{(\partial t)^2} x(t) = F_0 \cos(\omega t)$$

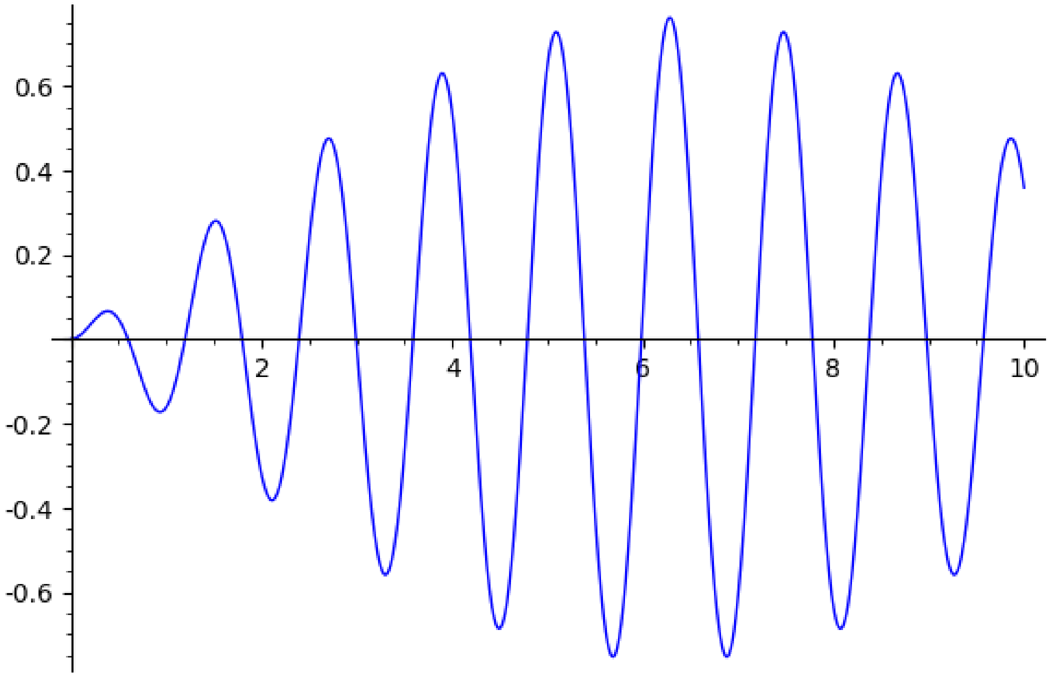
A:

$(\omega, \omega_0, F_0, t, K_1, K_2) \qquad\qquad \mapsto$

B:

$(\omega, \omega_0, F_0, t) \mapsto$

$t \mapsto$



C:

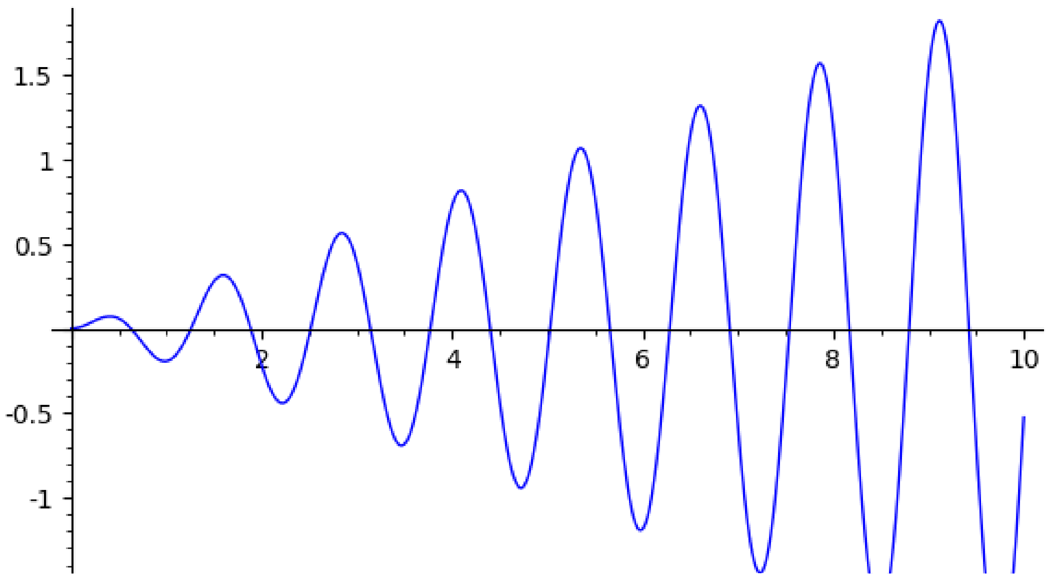
$$\omega^2 x(t) + \frac{\partial^2}{(\partial t)^2} x(t) = F_0 \cos(\omega t)$$

$(\omega, F_0, t, K_1, K_2) \mapsto$

D:

$(\omega, F_0, t) \mapsto$

$t \mapsto$



`E:`

$(t,\omega) \mapsto$

$$\omega_0^2 x\left(t\right) + \frac{\partial^2}{(\partial t)^2} x\left(t\right) = F_0 \cos(\omega_0 t)$$

$(t,\omega) \mapsto$