

In [4]:

```
t=var('t')
x=function('x')(t)
desolve(diff(x,t)+x==2/sqrt(pi)*exp(-t^2-t),x)
```

Out[4]:

$$(_C + \operatorname{erf}(t))e^{-t}$$

In [7]:

```
integrate(exp(t^2),t)
```

Out[7]:

$$-1/2 I \sqrt{\pi} \operatorname{erf}(I t)$$

In [9]:

```
integrate(2/sqrt(pi)*exp(-t^2),t)
```

Out[9]:

$$\operatorname{erf}(t)$$

Exercitiul 20:

In [27]:

```
t=var('t')
x=function('x')(t)
eqd20=diff(x,t,2)+3*diff(x,t)+x==1
desolve(eqd20,x)
```

Out[27]:

$$_K2 e^{(-1/2 t (\sqrt{5} + 3))} + _K1 e^{(1/2 t (\sqrt{5} - 3))} + 1$$

In [29]:

```
limit(e^{(-1/2*t*(sqrt(5) + 3))} + e^{(1/2*t*(sqrt(5) - 3))} + 1, t=infinity)
```

Out[29]:

1

Exercitiul 21

In [31]:

```
t=var('t')
x=function('x')(t)
eqd21=diff(x,t,2)+4*x==1
desolve(eqd21,x)
desolve(eqd21,x,ics=[0,5/4,0])
```

Out[31]:

$$\cos(2*t) + 1/4$$

In [32]:

```
limit(cos(2*t) + 1/4, t=pi)
```

Out[32]:

$$5/4$$

Exercitiul 22:

In [3]:

```
t=var('t')
x=function('x')(t)
eqd22=diff(x,t)==3*x+t^3
desolve(eqd22,x)
```

Out[3]:

$$-1/27*((9*t^3 + 9*t^2 + 6*t + 2)*e^{(-3*t)} - 27*_C)*e^{(3*t)}$$

Exercitiul 23:

In [4]:

```
f=piecewise([((-infinity,2),t),((2,infinity),(3-t))])
f
```

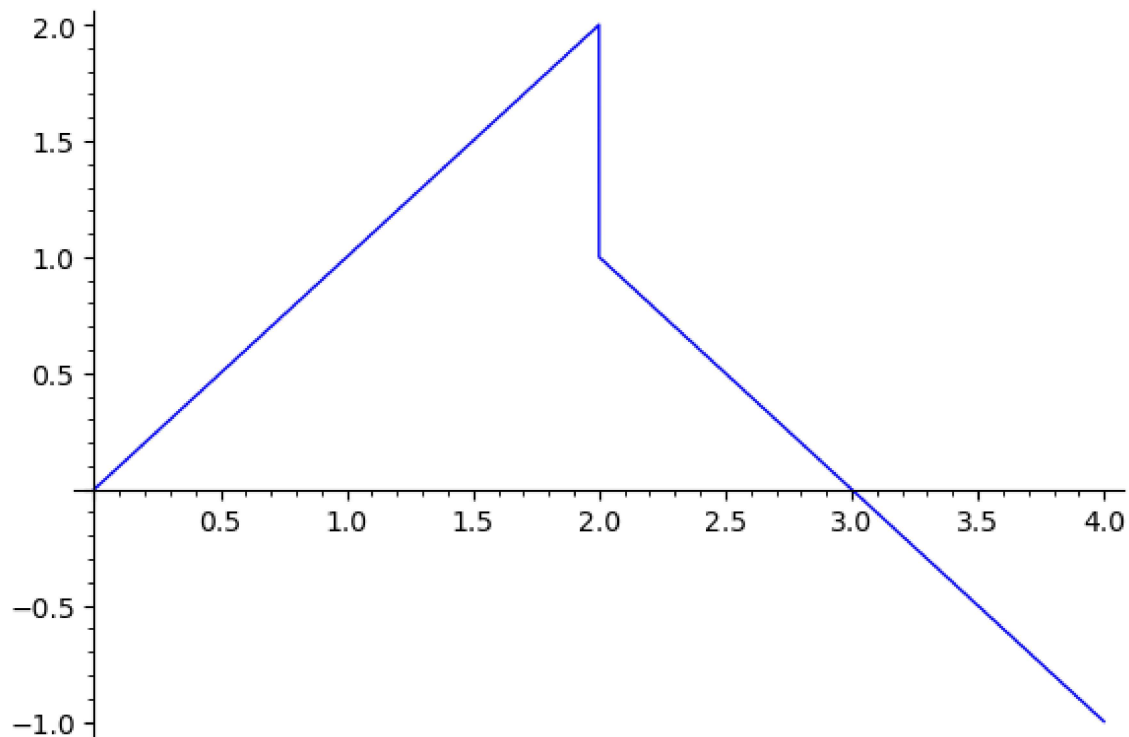
Out[4]:

$$\text{piecewise}(t \mapsto t \text{ on } (-\infty, 2), t \mapsto -t + 3 \text{ on } (2, +\infty); t)$$

In [8]:

```
plot(f,0,4)
```

Out[8]:



Exercitiul 24:

In [47]:

```
f(t)=piecewise([((0,pi),t),((pi,infinity),pi*e^(pi-t))])
f(t)
```

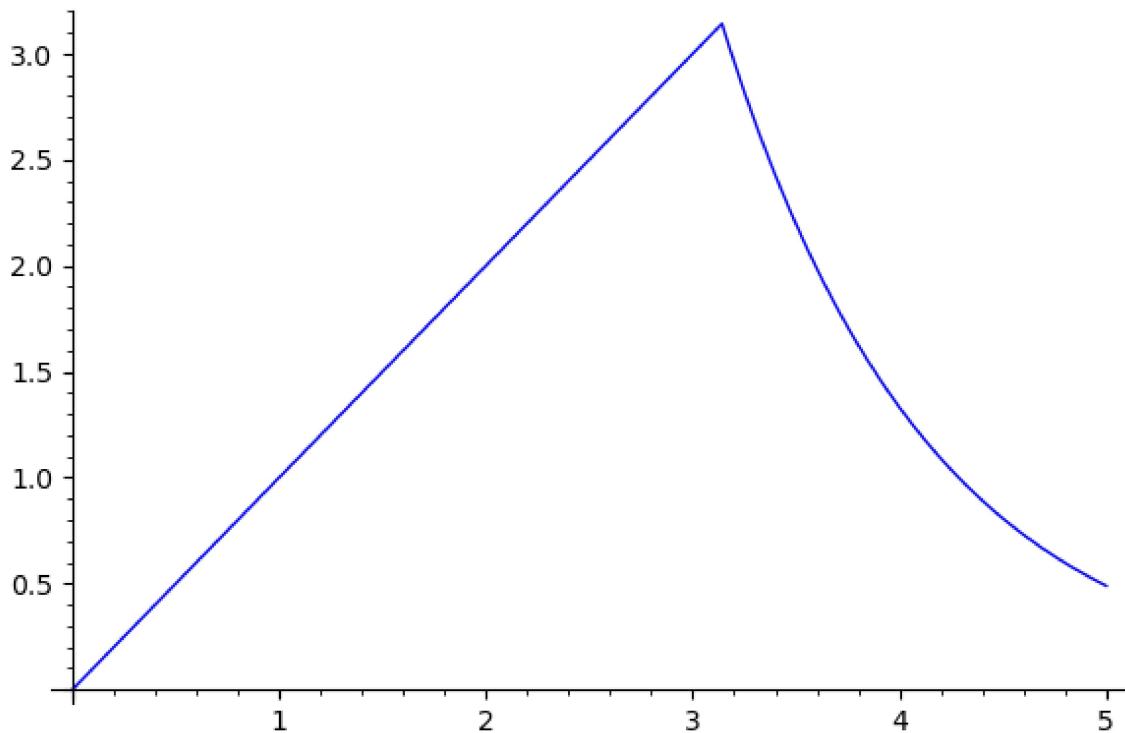
Out[47]:

```
piecewise(t|-->t on (0, pi), t|-->pi*e^(pi - t) on (pi, +oo); t)
```

In [23]:

```
plot(f(t),0,5)
```

Out[23]:



Exercitiul 25:

In [37]:

```
t=var('t')
x=function('x')(t)
eqd25left=diff(x,t,2)+x==t
desolve(eqd25left,x,ics=[0,0,1])
```

Out[37]:

t

In [45]:

```
eqd25right=diff(x,t,2)+x==pi*exp(pi-t)
so=desolve(eqd25right,x,ics=[pi,pi,1])
so
```

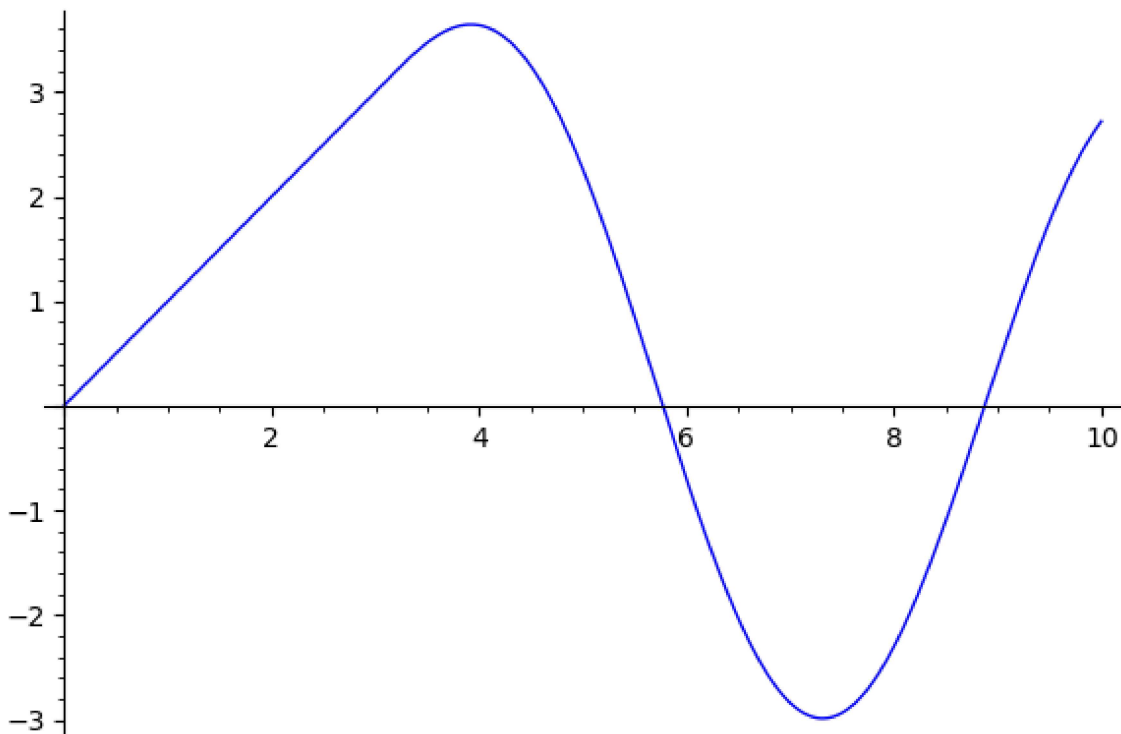
Out[45]:

$$-1/2\pi\cos(t) + 1/2\pi e^{(\pi - t)} - 1/2(\pi + 2)\sin(t)$$

In [51]:

```
sol25=piecewise([((0,pi),t),((pi,infinity),so)])
plot(sol25,0,10)
```

Out[51]:



Exercitul: 26

In [60]:

```
t=var('t')
x=function('x')(t)
ivp26bis=diff(x,t,2)+x==cos(t)
desolve(ivp26bis,x,ics=[0,0,0])
```

Out[60]:

$$\frac{1}{2}t\sin(t)$$

In [61]:

```
t=var('t')
x=function('x')(t)
w=var('w')
ivp26par=diff(x,t,2)+x==cos(w*t)
solw=desolve(ivp26par,x,ics=[0,0,0],ivar=t)
solw
```

Out[61]:

$$-\cos(tw)/(w^2 - 1) + \cos(t)/(w^2 - 1)$$

In [66]:

```
sol1=limit(solw,w=1)
sol1
```

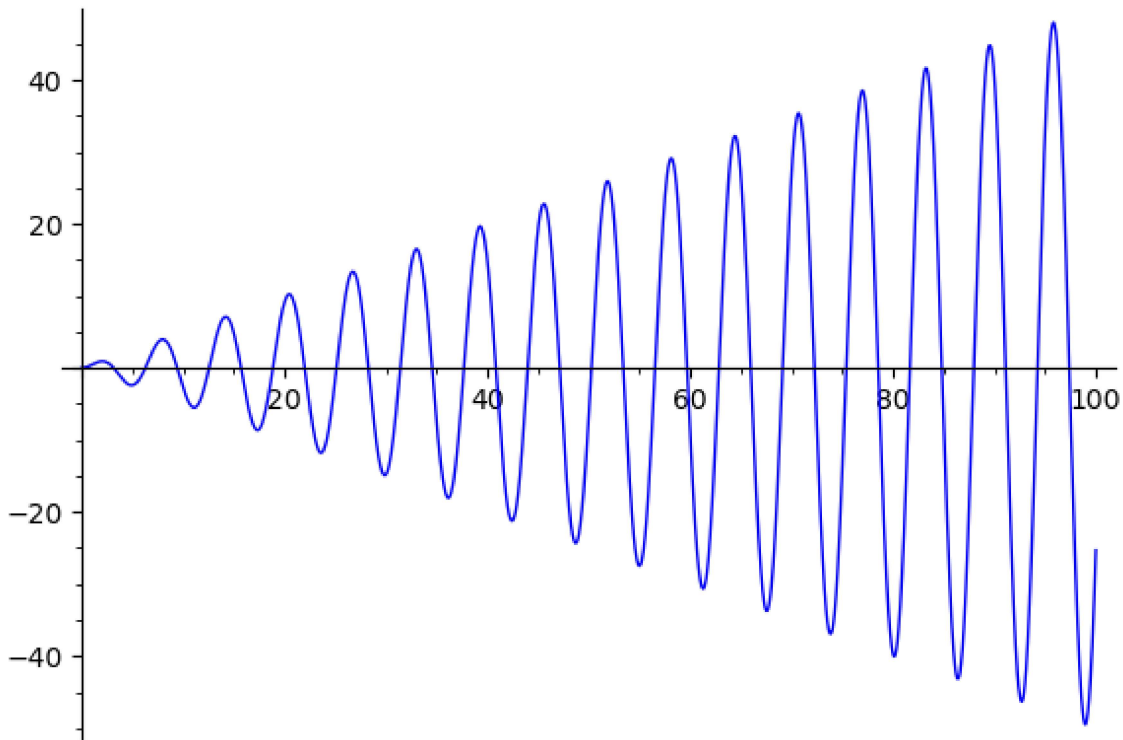
Out[66]:

$$\frac{1}{2}t\sin(t)$$

In [70]:

```
plot(sol1,0,100)
```

Out[70]:



Exercitiul: 27

In [83]:

```
t,a=var('t,a')
x=function('x')(t)
ivp27=diff(x,t,2)-4*x==exp(a*t)
sola=desolve(ivp27,x,ics=[0,0,0],ivar=t)
sola
```

Out[83]:

$$e^{(a*t)} / (a^2 - 4) - \frac{1}{4} e^{(2*t)} / (a - 2) + \frac{1}{4} e^{(-2*t)} / (a + 2)$$

In [76]:

```
ivp272=diff(x,t,2)-4*x==exp(2*t)
sol2=desolve(ivp272,x, ics=[0,0,0])
sol2
```

Out[76]:

$\frac{1}{16}(4t - 1)e^{2t} + \frac{1}{16}e^{-2t}$

In [95]:

```
limit(sola,a=2)
```



```

-----
-
RuntimeError                                Traceback (most recent call las
t)
/opt/sagemath-9.2/local/lib/python3.7/site-packages/sage/interfaces/maxima
_lib.py in sr_limit(self, expr, v, a, dir)
    985         L.append(max_minus)
--> 986         return max_to_sr(maxima_eval([max_limit], L))
    987     except RuntimeError as error:

/opt/sagemath-9.2/local/lib/python3.7/site-packages/sage/libs/ecl.pyx in s
age.libs.ecl.EclObject.__call__ (build/cythonized/sage/libs/ecl.c:8600)()
    851     lispargs = EclObject(list(args))
--> 852     return ecl_wrap(ecl_safe_apply(self.obj, (<EclObject>lisparg
gs).obj))
    853

/opt/sagemath-9.2/local/lib/python3.7/site-packages/sage/libs/ecl.pyx in s
age.libs.ecl.ecl_safe_apply (build/cythonized/sage/libs/ecl.c:5898)()
    364     if error != NULL:
--> 365         raise RuntimeError("ECL says: {}".format(
    366             ecl_string_to_python(error)))

```

RuntimeError: ECL says: Maxima asks: Is $2*_SAGE_VAR_t$ an integer?

During handling of the above exception, another exception occurred:

```

ValueError                                Traceback (most recent call las
t)
<ipython-input-95-e734eed69335> in <module>
----> 1 limit(sola,a=Integer(2))

/opt/sagemath-9.2/local/lib/python3.7/site-packages/sage/calculus/calculu
s.py in limit(ex, dir, taylor, algorithm, **argv)
    1369     if algorithm == 'maxima':
    1370         if dir is None:
-> 1371             l = maxima.sr_limit(ex, v, a)
    1372         elif dir in dir_plus:
    1373             l = maxima.sr_limit(ex, v, a, 'plus')

/opt/sagemath-9.2/local/lib/python3.7/site-packages/sage/interfaces/maxima
_lib.py in sr_limit(self, expr, v, a, dir)
    988         s = str(error)
    989         if "Is" in s: # Maxima asked for a condition
--> 990             self._missing_assumption(s)
    991         else:
    992             raise

/opt/sagemath-9.2/local/lib/python3.7/site-packages/sage/interfaces/maxima
_lib.py in _missing_assumption(self, errstr)
    1033         + errstr[jj+1:k] + ">0)", see `assume?` for more detai
ls)\n" + errstr
    1034         outstr = outstr.replace('_SAGE_VAR_', '')
-> 1035         raise ValueError(outstr)
    1036
    1037 def is_MaximaLibElement(x):

```

ValueError: Computation failed since Maxima requested additional constrain
ts; using the 'assume' command before evaluation *may* help (example of le
gal syntax is 'assume($2*t > 0$)', see `assume?` for more details)
Is $2*t$ an integer?

Exercitiul: 28

In [105]:

```
t=var('t')
x=function('x')(t)
ivp28=diff(x,t)-x==0
sol28=desolve(ivp28,x, ics=[0,1])
sol28
```

Out[105]:

e^t

In [106]:

```
sol28.series(x==0,15)
```

Out[106]:

```
1 + 1*t + 1/2*t^2 + 1/6*t^3 + 1/24*t^4 + 1/120*t^5 + 1/720*t^6 + 1/5040*t^
7 + 1/40320*t^8 + 1/362880*t^9 + 1/3628800*t^10 + 1/39916800*t^11 + 1/4790
01600*t^12 + 1/6227020800*t^13 + 1/87178291200*t^14 + Order(t^15)
```

In [26]:

Exercitiul: 29

In [27]:

```
x=var('x')
u=function('u')(x)
ivp29=x^2*diff(u,x,2)+x*diff(u,x)+x^2*u==0
desolve(ivp29,u)
```

Out[27]:

$$_K1 \cdot \text{bessel_J}(0, x) + _K2 \cdot \text{bessel_Y}(0, x)$$

In [23]:

```
x=var('x')
u=function('u')(x)
ivp29=x^2*diff(u,x,2)+x*diff(u,x)+x^2*u==0
desolve(ivp29,u,ics=[1,bessel_J(0,1),-1/2*bessel_J(1, 1) + 1/2*bessel_J(-1, 1)])
```

Out[23]:

bessel_J(0, x)

In [25]:

```
bessel_J(0,x).series(x==0,15)
```

Out[25]:

```
1 + (-1/4)*x^2 + 1/64*x^4 + (-1/2304)*x^6 + 1/147456*x^8 + (-1/14745600)*x
^10 + 1/2123366400*x^12 + (-1/416179814400)*x^14 + Order(x^15)
```

Exercitiul 30

In [21]:

```
f(x)=diff(bessel_J(0,x),x)
f(1)
```

Out[21]:

```
-1/2*bessel_J(1, 1) + 1/2*bessel_J(-1, 1)
```

Exercitiul 31

In []:

Exercitiul 32

In []:

Exercitiul 33

In []:

Exercitiul 34

In []:

Exercitiul 35

In []:

Exercitiul 36

In []: