Solving ordinary differential equations with SAGE

We have a population that growth exponentially, so at any time it will growh by a small fraction

$$dN/dt = r * N$$

where r is the growth rate and N is the population size N at the beginning

In [1]:

```
t = var('t')
```

In [5]:

```
p =function('p')(t)
```

In [7]:

```
r=0.3
```

In [8]:

```
diffeq = diff(p,t)== r*p
```

In [9]:

```
diffeq
```

Out[9]:

```
diff(p(t), t) == 0.300000000000000*p(t)
```

In [11]:

```
desolve(diffeq,p,[0,10])
```

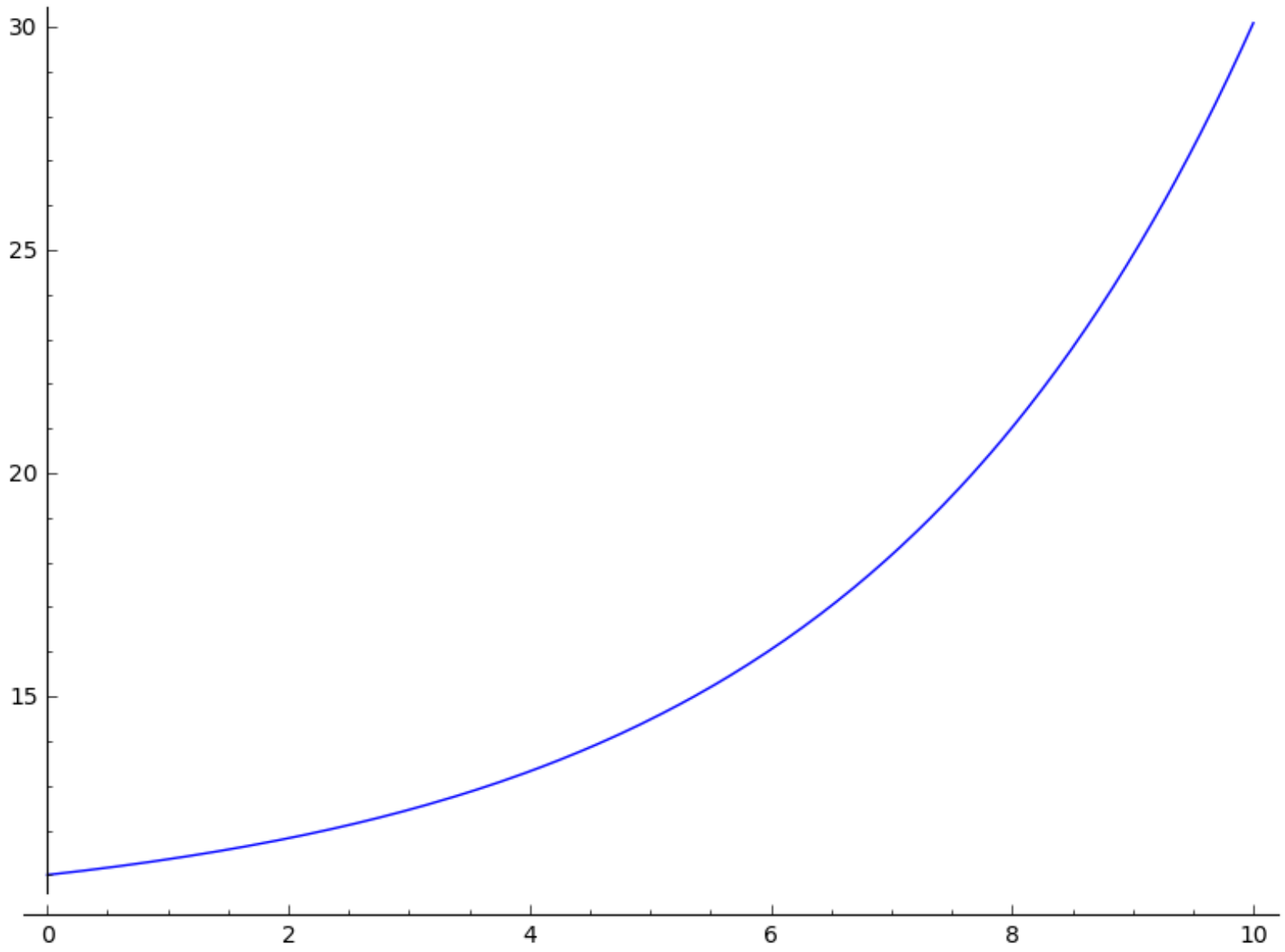
Out[11]:

```
10*e^(3/10*t)
```

In [12]:

```
plot(10+exp(0.3*t),[t,0,10])
```

Out[12]:



In [13]:

```
d= 0.01
```

In [14]:

```
diffeq2 = diff(p,t)== r*p - d * p * (p-1)/2
```

In [15]:

```
diffeq2
```

Out[15]:

```
diff(p(t), t) == -0.005000000000000000*(p(t) - 1)*p(t) + 0.300000000000
000*p(t)
```

In [16]:

```
desolve(diffeq2,p,[0,10])
```

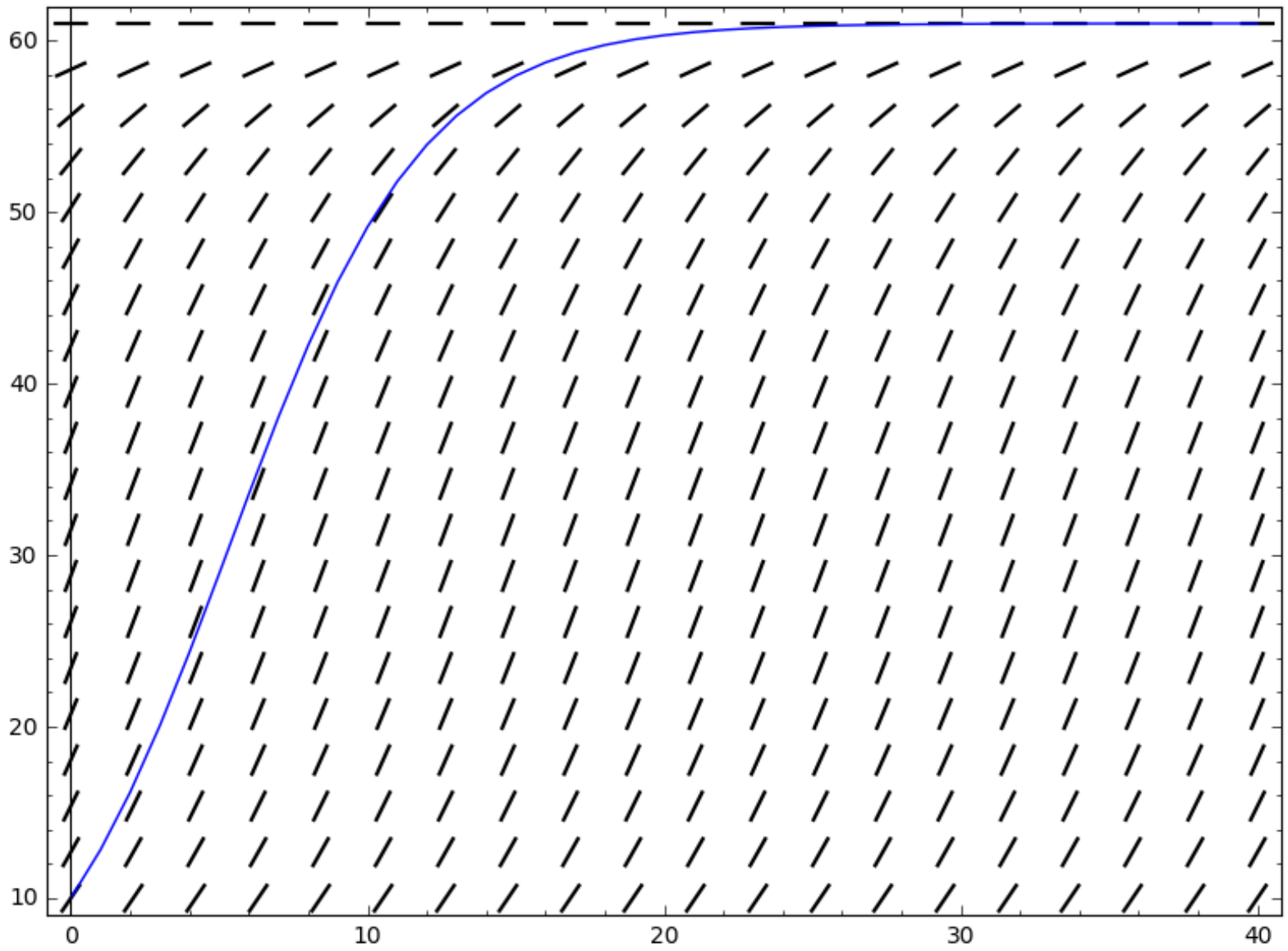
Out[16]:

$$-200/61*\log(p(t) - 61) + 200/61*\log(p(t)) == -200/61*I*pi + t - 200/61*\log(51) + 200/61*\log(10)$$

In [20]:

```
desolve_rk4(diffeq2,p,ics=[0,10],step=1,end_points=40,output='slope_field')
```

Out[20]:



In [21]:

```
M=200
diffeq3 = diff(p,t)== r*(1-p/M)*p
```

In [22]:

```
desolve(diffeq3,p,[0,10])
```

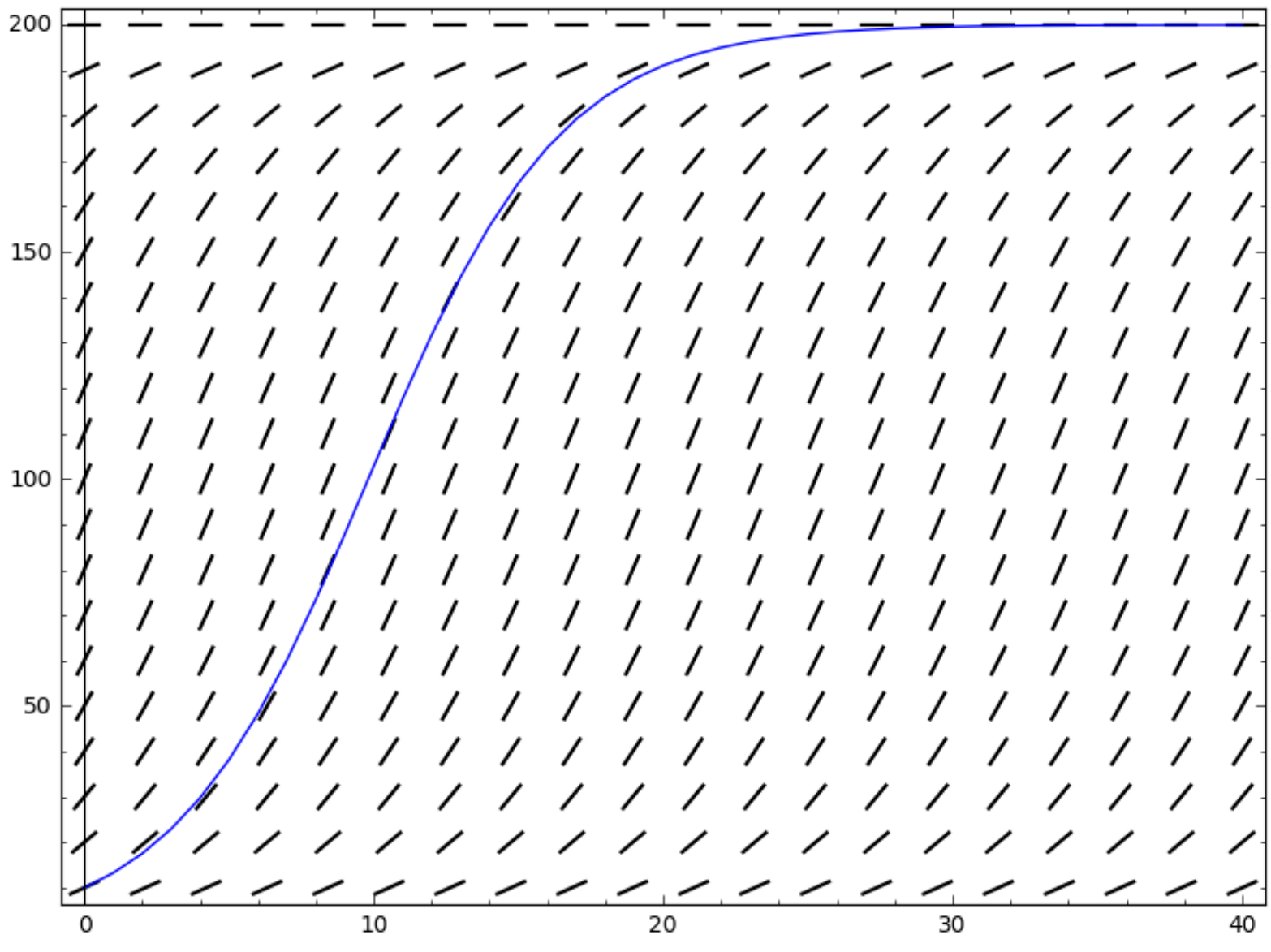
Out[22]:

$$-10/3*\log(p(t) - 200) + 10/3*\log(p(t)) == -10/3*I*\pi + t - 10/3*\log(190) + 10/3*\log(10)$$

In [23]:

```
desolve_rk4(diffeq3,p,ics=[0,10],step=1,end_points=40,output='slope_field')
```

Out[23]:



In [ ]: