Laguerre多項式

In [3]:

```
%display typeset
```

In [4]:

```
L(n,a,x)=binomial(a+n,n) * hypergeometric_M(-n , a+1 , x)
L(n,x) = L(n,0,x)
print(L)
L
```

```
(n, x) |--> hypergeometric_M(-n, 1, x)
```

Out[4]:

$$(n, x) \mapsto M\left(-n, 1, x\right)$$

In [5]:

```
L(0,x).simplify_hypergeometric()
```

Out[5]:

$$1$$

In [6]:

```
L(1,x).simplify_hypergeometric()
```

Out[6]:

$$-x + 1$$

In [7]:

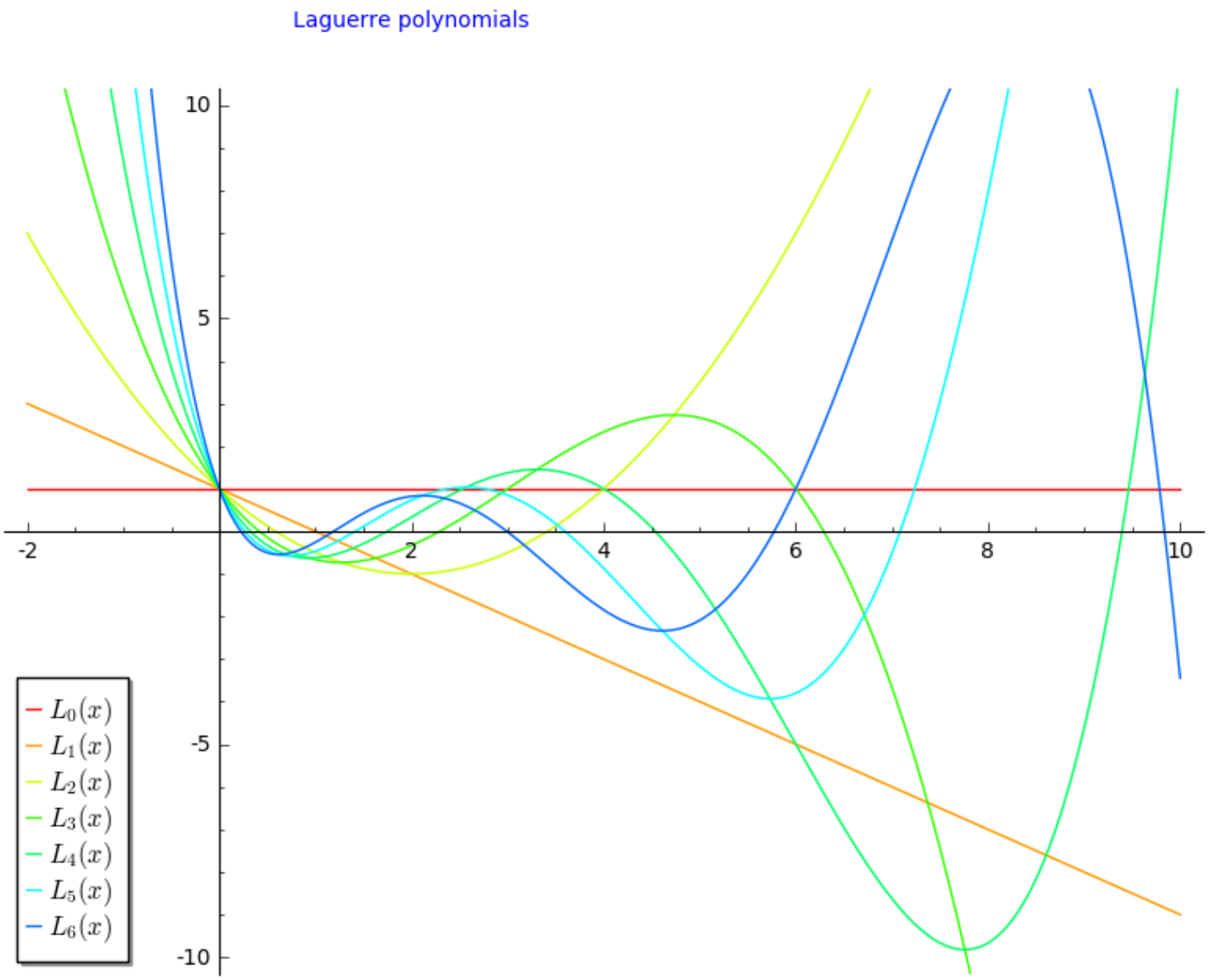
```
L(2,x).simplify_hypergeometric()
```

Out[7]:

$$\frac{1}{2}\,x^{2} - 2\,x + 1$$

In [8]:

```
plot(x, typeset='latex')
t = text("Laguerre polynomials", (2,12))
p0 = plot(L(0,x),(x,-2,10),rgbcolor=hue(0),ymin=-10,ymax=10,legend_label="$L_0
(x)$")
p1 = plot(L(1,x),(x,-2,10),rgbcolor=hue(0.1),ymin=-10,ymax=10,legend_label="$L
_1(x)$")
p2 = plot(L(2,x),(x,-2,10),rgbcolor=hue(0.2),ymin=-10,ymax=10,legend_label="$L
_2(x)$")
p3 = plot(L(3,x),(x,-2,10),rgbcolor=hue(0.3),ymin=-10,ymax=10,legend_label="$L
_3(x)$")
p4 = plot(L(4,x),(x,-2,10),rgbcolor=hue(0.4),ymin=-10,ymax=10,legend_label="$L
_4(x)$")
p5 = plot(L(5,x),(x,-2,10),rgbcolor=hue(0.5),ymin=-10,ymax=10,legend_label="$L
_5(x)$")
p6 = plot(L(6,x),(x,-2,10),rgbcolor=hue(0.6),ymin=-10,ymax=10,legend_label="$L
_6(x)$")
show(t+p0+p1+p2+p3+p4+p5+p6)
```



Laguerre陪多項式

In [9]:

```
L(n,a,x)=binomial(a+n,n) * hypergeometric_M(-n , a+1 , x)
print(L)
L
```

```
(n, a, x) |--> binomial(a + n, n)*hypergeometric_M(-n, a + 1, x)
```

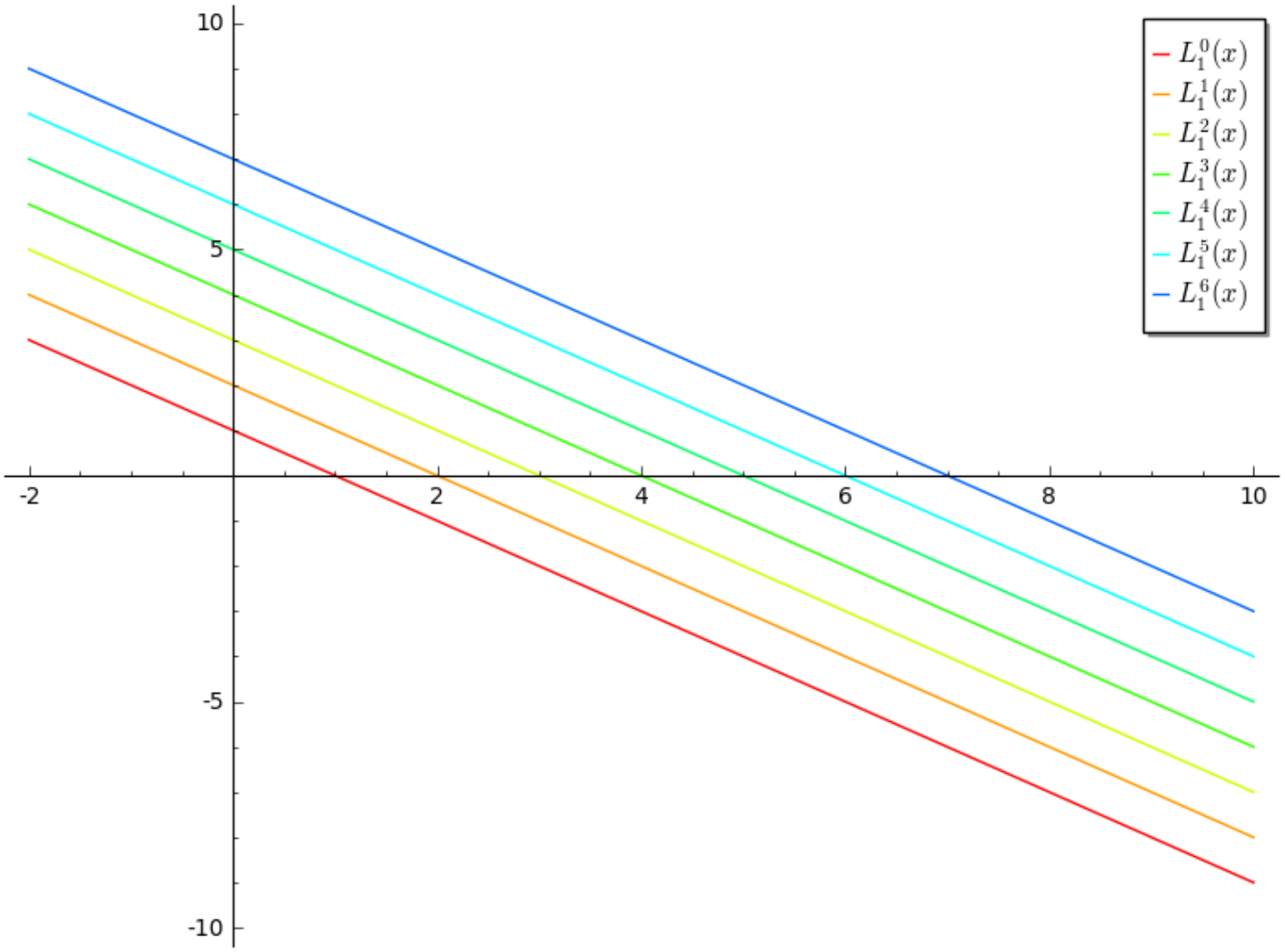
Out[9]:

$$(n, a, x) \mapsto \binom{a+n}{n} M\left(-n, a+1, x\right)$$

In [10]:

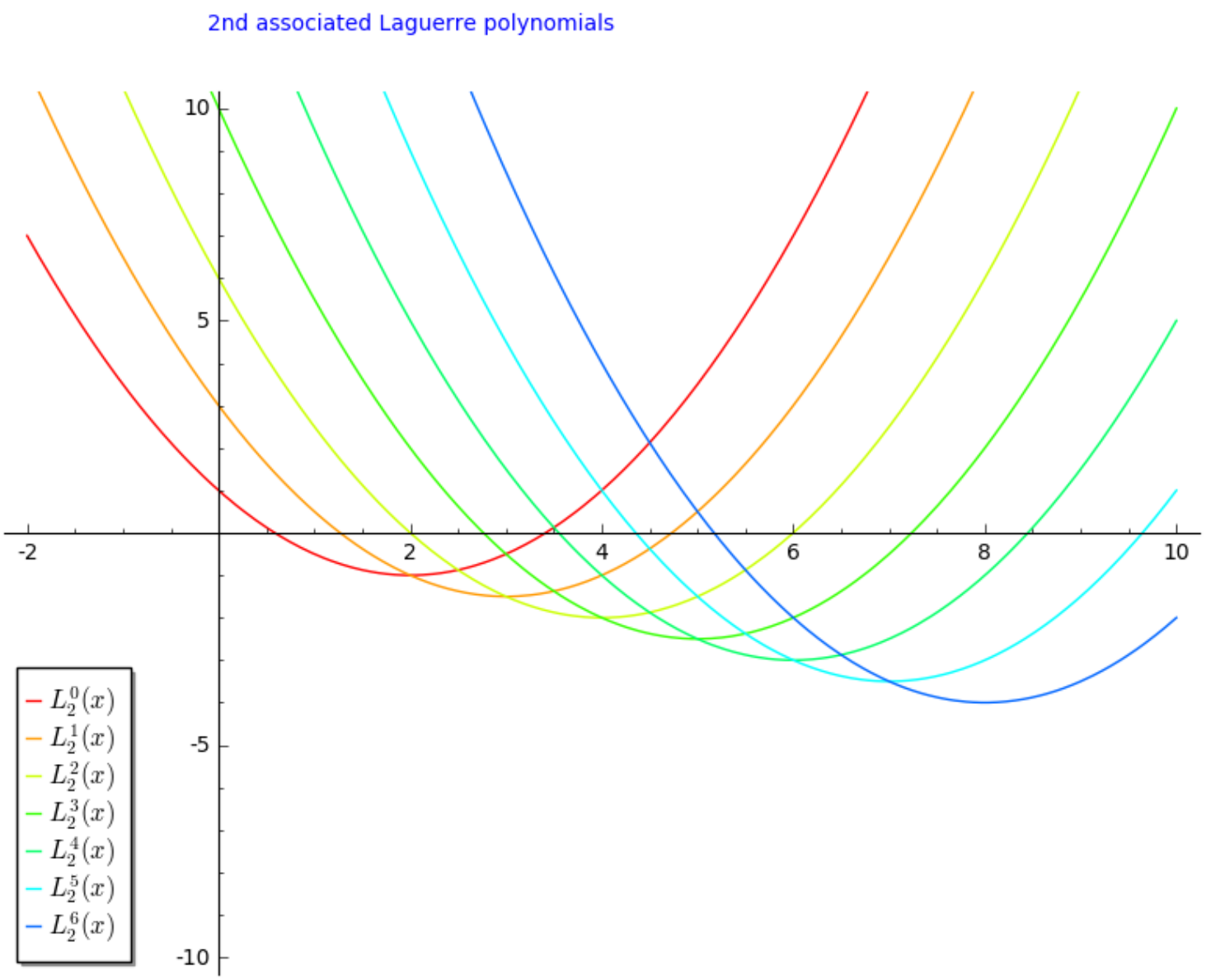
```
t = text("1st associated Laguerre polynomials", (2,12))
p0 = plot(L(1,0,x),(x,-2,10),rgbcolor=hue(0),ymin=-10,ymax=10,legend_label="$L
^0_1(x)$")
p1 = plot(L(1,1,x),(x,-2,10),rgbcolor=hue(0.1),ymin=-10,ymax=10,legend_label="
$L^1_1(x)$")
p2 = plot(L(1,2,x),(x,-2,10),rgbcolor=hue(0.2),ymin=-10,ymax=10,legend_label="
$L^2_1(x)$")
p3 = plot(L(1,3,x),(x,-2,10),rgbcolor=hue(0.3),ymin=-10,ymax=10,legend_label="
$L^3_1(x)$")
p4 = plot(L(1,4,x),(x,-2,10),rgbcolor=hue(0.4),ymin=-10,ymax=10,legend_label="
$L^4_1(x)$")
p5 = plot(L(1,5,x),(x,-2,10),rgbcolor=hue(0.5),ymin=-10,ymax=10,legend_label="
$L^5_1(x)$")
p6 = plot(L(1,6,x),(x,-2,10),rgbcolor=hue(0.6),ymin=-10,ymax=10,legend_label="
$L^6_1(x)$")
show(t+p0+p1+p2+p3+p4+p5+p6)
```

1st associated Laguerre polynomials



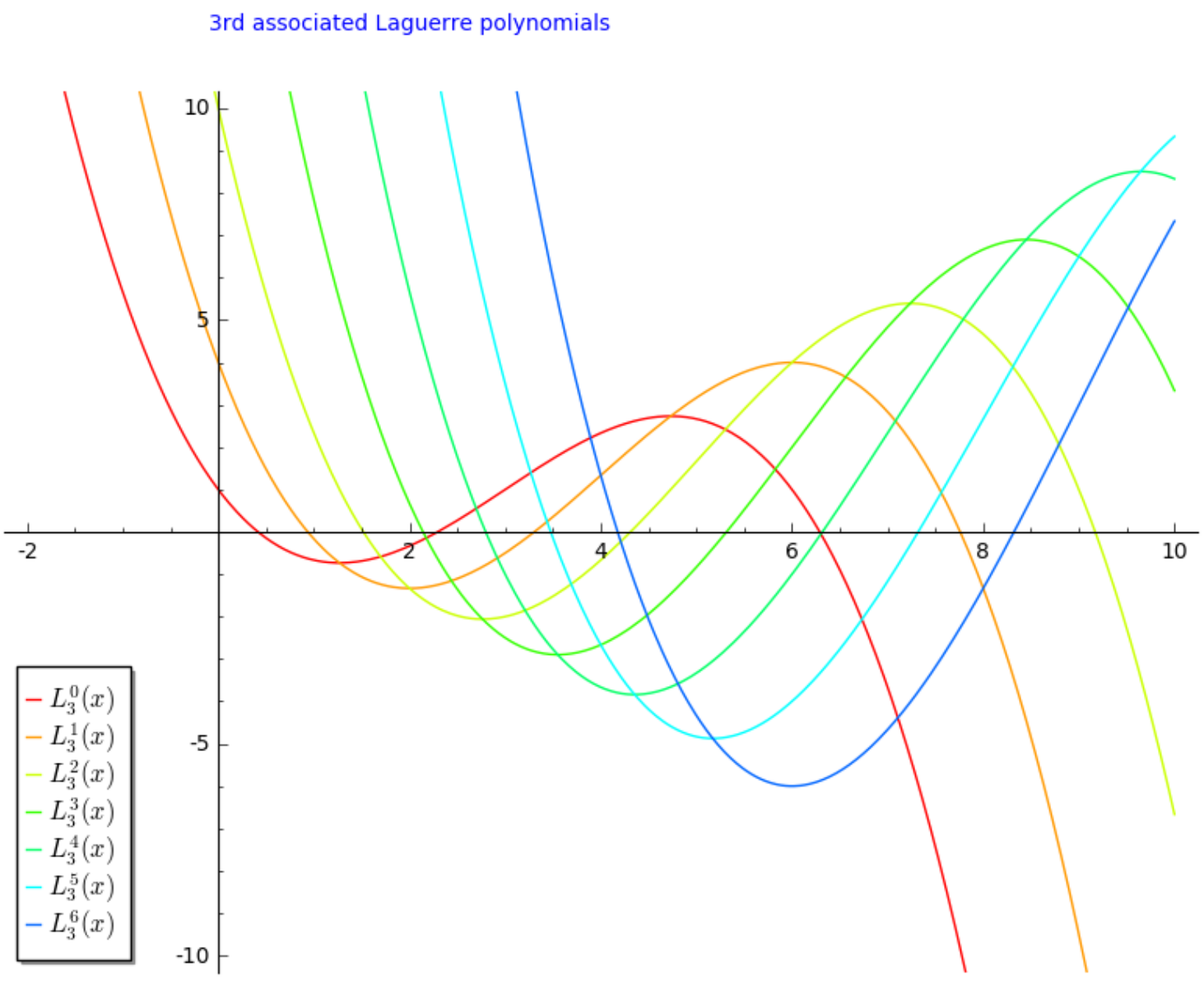
In [11]:

```
t = text("2nd associated Laguerre polynomials", (2,12))
p0 = plot(L(2,0,x),(x,-2,10),rgbcolor=hue(0),ymin=-10,ymax=10,legend_label="$L
^0_2(x)$")
p1 = plot(L(2,1,x),(x,-2,10),rgbcolor=hue(0.1),ymin=-10,ymax=10,legend_label="
$L^1_2(x)$")
p2 = plot(L(2,2,x),(x,-2,10),rgbcolor=hue(0.2),ymin=-10,ymax=10,legend_label="
$L^2_2(x)$")
p3 = plot(L(2,3,x),(x,-2,10),rgbcolor=hue(0.3),ymin=-10,ymax=10,legend_label="
$L^3_2(x)$")
p4 = plot(L(2,4,x),(x,-2,10),rgbcolor=hue(0.4),ymin=-10,ymax=10,legend_label="
$L^4_2(x)$")
p5 = plot(L(2,5,x),(x,-2,10),rgbcolor=hue(0.5),ymin=-10,ymax=10,legend_label="
$L^5_2(x)$")
p6 = plot(L(2,6,x),(x,-2,10),rgbcolor=hue(0.6),ymin=-10,ymax=10,legend_label="
$L^6_2(x)$")
show(t+p0+p1+p2+p3+p4+p5+p6)
```



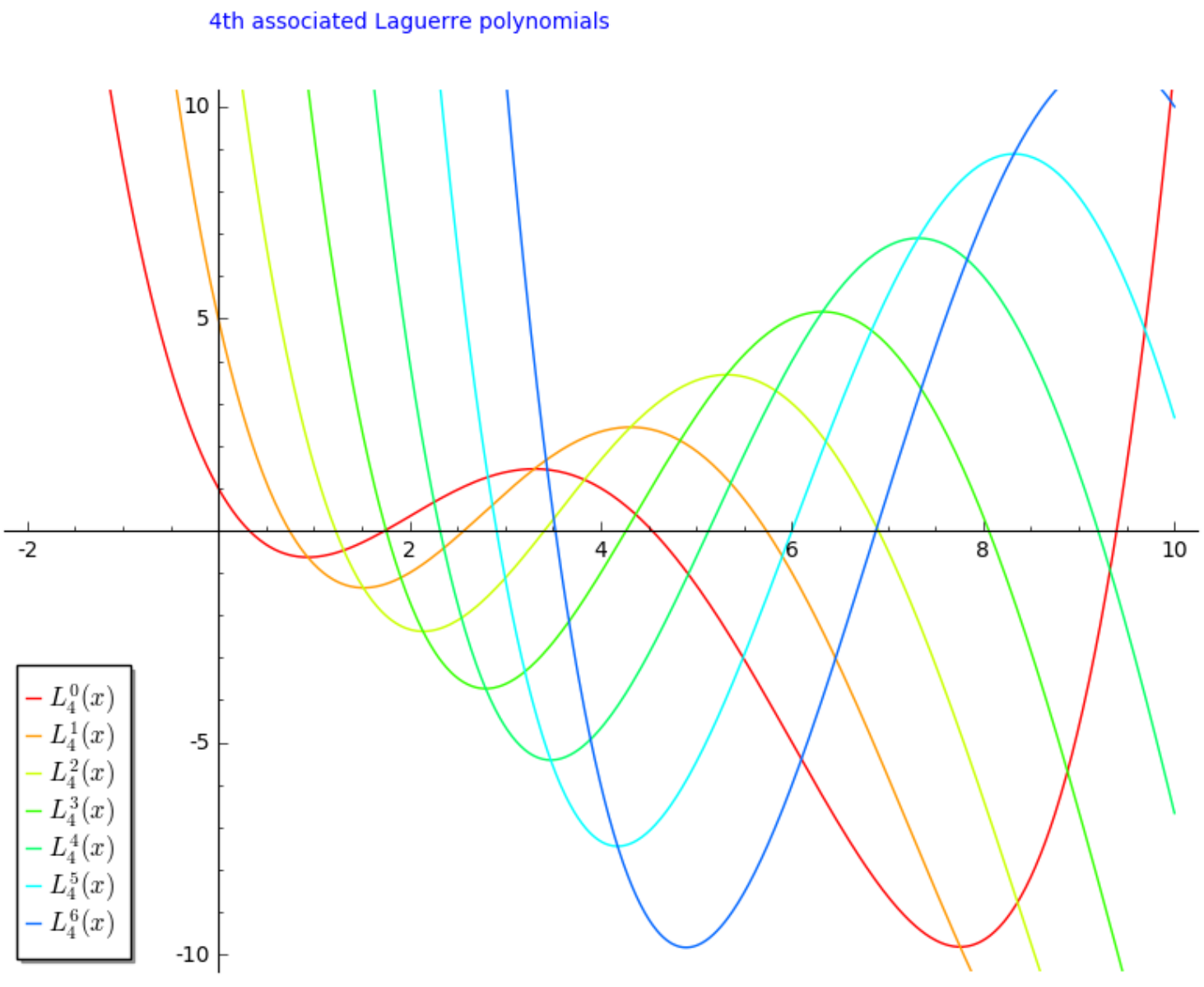
In [15]:

```
t = text("3rd associated Laguerre polynomials", (2,12))
p0 = plot(L(3,0,x),(x,-2,10),rgbcolor=hue(0),ymin=-10,ymax=10,legend_label="$L
^0_3(x)$")
p1 = plot(L(3,1,x),(x,-2,10),rgbcolor=hue(0.1),ymin=-10,ymax=10,legend_label="
$L^1_3(x)$")
p2 = plot(L(3,2,x),(x,-2,10),rgbcolor=hue(0.2),ymin=-10,ymax=10,legend_label="
$L^2_3(x)$")
p3 = plot(L(3,3,x),(x,-2,10),rgbcolor=hue(0.3),ymin=-10,ymax=10,legend_label="
$L^3_3(x)$")
p4 = plot(L(3,4,x),(x,-2,10),rgbcolor=hue(0.4),ymin=-10,ymax=10,legend_label="
$L^4_3(x)$")
p5 = plot(L(3,5,x),(x,-2,10),rgbcolor=hue(0.5),ymin=-10,ymax=10,legend_label="
$L^5_3(x)$")
p6 = plot(L(3,6,x),(x,-2,10),rgbcolor=hue(0.6),ymin=-10,ymax=10,legend_label="
$L^6_3(x)$")
show(t+p0+p1+p2+p3+p4+p5+p6)
```



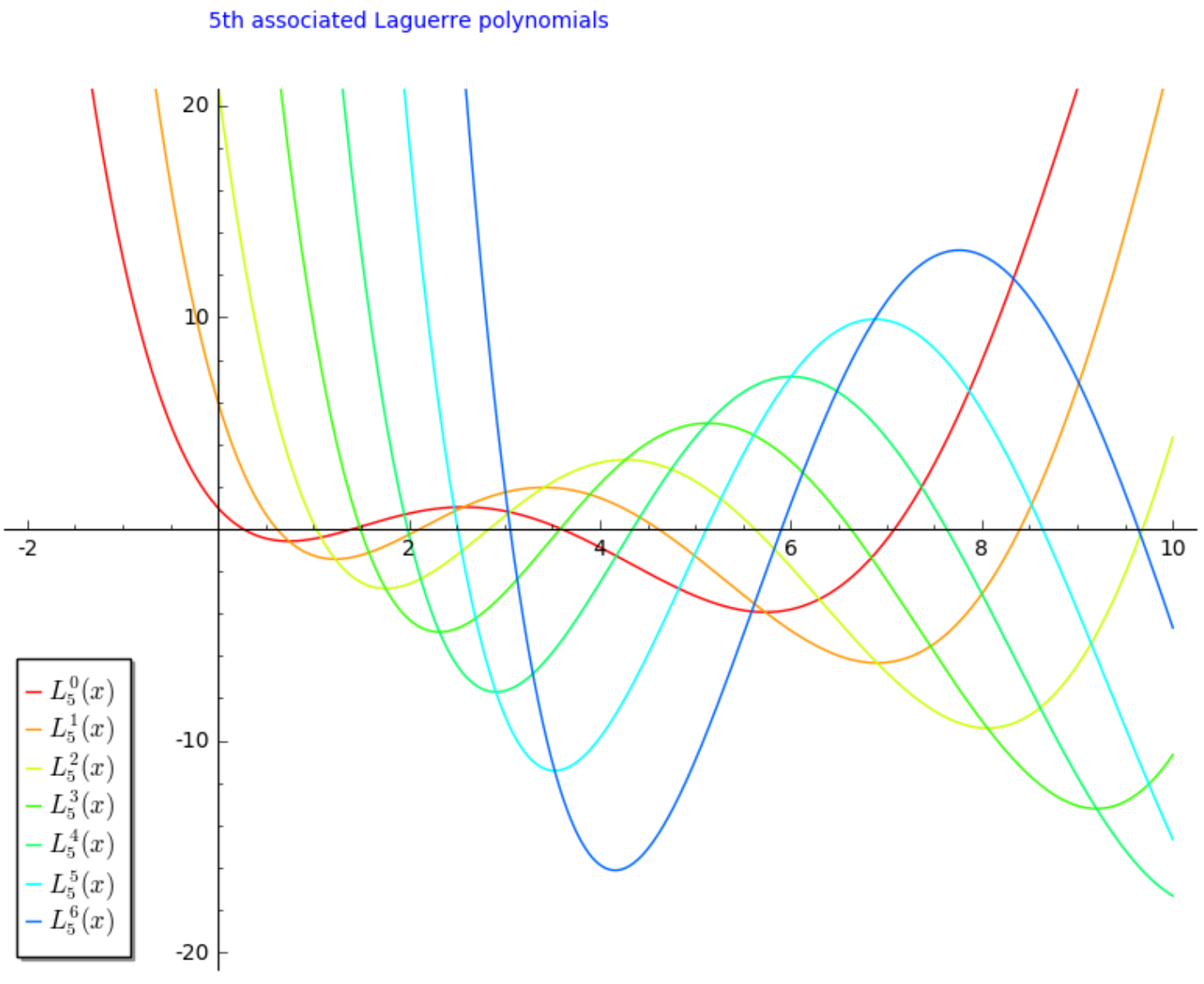
In [13]:

```
t = text("4th associated Laguerre polynomials", (2,12))
p0 = plot(L(4,0,x),(x,-2,10),rgbcolor=hue(0),ymin=-10,ymax=10,legend_label="$L
^0_4(x)$")
p1 = plot(L(4,1,x),(x,-2,10),rgbcolor=hue(0.1),ymin=-10,ymax=10,legend_label="
$L^1_4(x)$")
p2 = plot(L(4,2,x),(x,-2,10),rgbcolor=hue(0.2),ymin=-10,ymax=10,legend_label="
$L^2_4(x)$")
p3 = plot(L(4,3,x),(x,-2,10),rgbcolor=hue(0.3),ymin=-10,ymax=10,legend_label="
$L^3_4(x)$")
p4 = plot(L(4,4,x),(x,-2,10),rgbcolor=hue(0.4),ymin=-10,ymax=10,legend_label="
$L^4_4(x)$")
p5 = plot(L(4,5,x),(x,-2,10),rgbcolor=hue(0.5),ymin=-10,ymax=10,legend_label="
$L^5_4(x)$")
p6 = plot(L(4,6,x),(x,-2,10),rgbcolor=hue(0.6),ymin=-10,ymax=10,legend_label="
$L^6_4(x)$")
show(t+p0+p1+p2+p3+p4+p5+p6)
```



In [14]:

```
t = text("5th associated Laguerre polynomials", (2,24))
p0 = plot(L(5,0,x),(x,-2,10),rgbcolor=hue(0),ymin=-20,ymax=20,legend_label="$L
^0_5(x)$")
p1 = plot(L(5,1,x),(x,-2,10),rgbcolor=hue(0.1),ymin=-20,ymax=20,legend_label="
$L^1_5(x)$")
p2 = plot(L(5,2,x),(x,-2,10),rgbcolor=hue(0.2),ymin=-20,ymax=20,legend_label="
$L^2_5(x)$")
p3 = plot(L(5,3,x),(x,-2,10),rgbcolor=hue(0.3),ymin=-20,ymax=20,legend_label="
$L^3_5(x)$")
p4 = plot(L(5,4,x),(x,-2,10),rgbcolor=hue(0.4),ymin=-20,ymax=20,legend_label="
$L^4_5(x)$")
p5 = plot(L(5,5,x),(x,-2,10),rgbcolor=hue(0.5),ymin=-20,ymax=20,legend_label="
$L^5_5(x)$")
p6 = plot(L(5,6,x),(x,-2,10),rgbcolor=hue(0.6),ymin=-20,ymax=20,legend_label="
$L^6_5(x)$")
show(t+p0+p1+p2+p3+p4+p5+p6)
```



In [ ]: