```
(*Computation for 1.4 b, e, f.*)
```

In[ ]:=
```
Clear[xsol, ysol, x, y, u, v, t]
{xsol, ysol} = DSolveValue[
        {x'[t] == (p + 1) * x[t] + 3 * y[t],
         y'[t] == -2 * x[t] + (p - 1) * y[t],
         x[0] == u, y[0] == v},
        {x, y}, {t, 0, 20}];
xsol;
ysol;
```

$$\text{Function}\left[\{t\}, \frac{1}{5}\ e^{p\,t}\left(v\left(\frac{-1}{2}\right)\text{Cos}\left[\sqrt{5}\ t\right] - \sqrt{5}\ (2\,u + v)\,\text{Sin}\left[\sqrt{5}\ t\right]\right)\right];$$

In[ ]:=
$$\left\{\left\{x \to \text{Function}\left[\{t\}, \frac{1}{5}\ e^{p\,t}\left(5\,u\,\text{Cos}\left[\sqrt{5}\ t\right] + \sqrt{5}\ u\,\text{Sin}\left[\sqrt{5}\ t\right] + 3\,\sqrt{5}\ v\,\text{Sin}\left[\sqrt{5}\ t\right]\right)\right],\right.$$
$$\left.y \to \text{Function}\left[\{t\}, -\frac{1}{5}\ e^{p\,t}\left(-5\,v\,\text{Cos}\left[\sqrt{5}\ t\right] + 2\,\sqrt{5}\ u\,\text{Sin}\left[\sqrt{5}\ t\right] + \sqrt{5}\ v\,\text{Sin}\left[\sqrt{5}\ t\right]\right)\right]\right\}\right\};$$

In[41]:=
```
Clear[u, v, p, r]
u = 1;
v = 1;
p = 0;
```
$$x = v * e^{p*t} * \left(\left(\frac{-1}{2}\right) * \text{Cos}\left[\sqrt{5}\ t\right] - \left(\frac{-\sqrt{5}}{2}\right) * \text{Sin}\left[\sqrt{5}\ t\right]\right) -$$
$$\frac{(2*u+v)}{\sqrt{5}} * e^{p*t} * \left(\left(\frac{-\sqrt{5}}{2}\right) * \text{Cos}\left[\sqrt{5}\ t\right] + \left(\frac{-1}{2}\right) * \text{Sin}\left[\sqrt{5}\ t\right]\right);$$
$$y = v * e^{p*t} * \text{Cos}\left[\sqrt{5}\ t\right] - \frac{(2*u+v)}{\sqrt{5}} * e^{p*t} * \text{Sin}\left[\sqrt{5}\ t\right];$$
```
r = Sqrt[x^2 + y^2] // FullSimplify;
```

In[48]:=
```
Clear[min, max, ratio]
min = MinValue[r, t] // FullSimplify;
max = MaxValue[r, t] // FullSimplify;
ratio = max / min
```

Out[51]=
$$\sqrt{\frac{5 + \sqrt{5}}{5 - \sqrt{5}}}$$

In[52]:=
```
tMax = ArgMax[r, t] // FullSimplify;
```

In[53]:=
```
Clear[u, v, p, r]
u = 1;
v = 1;
p = 0;
```

$$X[t\_] = v * e^{p*t} * \left(\left(\frac{-1}{2} \right) * Cos\left[\sqrt{5}\ t \right] - \left(\frac{-\sqrt{5}}{2} \right) * Sin\left[\sqrt{5}\ t \right] \right) -$$

$$\frac{(2 * u + v)}{\sqrt{5}} * e^{p*t} * \left(\left(\frac{-\sqrt{5}}{2} \right) * Cos\left[\sqrt{5}\ t \right] + \left(\frac{-1}{2} \right) * Sin\left[\sqrt{5}\ t \right] \right);$$

$$Y[t\_] = v * e^{p*t} * Cos\left[\sqrt{5}\ t \right] - \frac{(2 * u + v)}{\sqrt{5}} * e^{p*t} * Sin\left[\sqrt{5}\ t \right];$$

In[68]:=
```
Clear[v]
v = {X[tMax], Y[tMax]} // FullSimplify
norm = Sqrt[ (X[tMax] - 0)^2 + (Y[tMax] - 0)^2 ] // FullSimplify
```

Out[69]=

$$\left\{ \sqrt{\frac{7}{10}\ \left(3 + \sqrt{5}\right)} \ , \ -\sqrt{\frac{7}{5}} \right\}$$

Out[70]=

$$\sqrt{\frac{7}{10}\ \left(5 + \sqrt{5}\right)}$$