```
> restart;
> with(LinearAlgebra):with(plots):
Warning, the name changecoords has been redefined
```

Paramètres

```
>
  M1:= < < -4   | -r        | 0    >,
         < 1    | -(7+2*r)  | 1    >,
         < -1   | 3 + r     | -5   > >;
  omega:= sqrt(r^2 + 2*r + 4);
  a:=(8+3*r)/(32+10*r);
  c:=(8+2*r)/(32+10*r);
  t:=(8+3*r)/(32+10*r);
  g:=(8+2*r)/(32+10*r);
  cg:=2/(32+10*r);
  ca:=(16+7*r)/(8*(32+10*r));
  w:= <<1>, <0>, <-1>>;
  u:= <<r>, <2+r-omega>, <omega-2>>;
  v:= <<r>, <2+r+omega>, <-omega-2>>;
```

$$M1 := \begin{bmatrix} -4 & -r & 0 \\ 1 & -7 - 2\,r & 1 \\ -1 & 3 + r & -5 \end{bmatrix}$$

$$\omega := \sqrt{r^2 + 2\,r + 4}$$

$$a := \frac{8 + 3\,r}{32 + 10\,r}$$

$$c := \frac{8 + 2\,r}{32 + 10\,r}$$

$$t := \frac{8 + 3\,r}{32 + 10\,r}$$

$$g := \frac{8 + 2\,r}{32 + 10\,r}$$

$$cg := \frac{2}{32 + 10\,r}$$

$$ca := \frac{16 + 7\,r}{256 + 80\,r}$$

$$w := \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$$

$$u := \begin{bmatrix} r \\ 2 + r - \sqrt{r^2 + 2r + 4} \\ \sqrt{r^2 + 2r + 4} - 2 \end{bmatrix}$$

$$v := \begin{bmatrix} r \\ 2 + r + \sqrt{r^2 + 2r + 4} \\ -\sqrt{r^2 + 2r + 4} - 2 \end{bmatrix}$$

```
> simplify( Multiply(M1,u) + (6 + r - omega)*u );
  simplify( Multiply(M1,v) + (6 + r + omega)*v );
  simplify( Multiply(M1,w) + 4*w );
```

$$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

Expression de F(C,C) := f11, résolution du système

```
> Y0 := < < c >, < cg >, < 0 >>;
  Yinf := < < c^2 >, < c*cg >, < c*( c -cg ) > >;
```

$$Y0 := \begin{bmatrix} \frac{8 + 2r}{32 + 10r} \\ \frac{2}{32 + 10r} \\ 0 \end{bmatrix}$$

$$Yinf := \begin{bmatrix} \frac{(8+2r)^2}{(32+10r)^2} \\ \frac{2(8+2r)}{(32+10r)^2} \\ \frac{(8+2r)\left(\frac{8+2r}{32+10r} - \frac{2}{32+10r}\right)}{32+10r} \end{bmatrix}$$

```
> Y := simplify(Y0 - Yinf);
```

$$Y := \begin{bmatrix} \frac{4(4+r)(3+r)}{(16+5r)^2} \\ \frac{4(3+r)}{(16+5r)^2} \\ -\frac{(4+r)(3+r)}{(16+5r)^2} \end{bmatrix}$$

```
> eqns := { alpha1*u[1,1] + beta1*v[1,1] + gamm1*w[1,1] = Y[1,1],
            alpha1*u[2,1] + beta1*v[2,1] + gamm1*w[2,1] = Y[2,1],
            alpha1*u[3,1] + beta1*v[3,1] + gamm1*w[3,1] = Y[3,1]
          };
```

$$eqns := \left\{ \alpha 1\, r + \beta 1\, r + gamm1 = \frac{4(4+r)(3+r)}{(16+5r)^2}, \right.$$
$$\alpha 1 \left(2 + r - \sqrt{r^2+2r+4}\right) + \beta 1 \left(2 + r + \sqrt{r^2+2r+4}\right) = \frac{4(3+r)}{(16+5r)^2},$$
$$\left. \alpha 1 \left(\sqrt{r^2+2r+4} - 2\right) + \beta 1 \left(-\sqrt{r^2+2r+4} - 2\right) - gamm1 = -\frac{(4+r)(3+r)}{(16+5r)^2} \right\}$$

```
> solve(eqns,{alpha1,beta1,gamm1});
```

$$\left\{ \alpha 1 = \frac{1}{4(256+160r+25r^2)(r^2+2r+4)\,r} (192 + 31r^3 + 110r^2 + 196r + 3r^4 \right.$$
$$+ 23\sqrt{r^2+2r+4}\, r^2 + 74r\sqrt{r^2+2r+4} + 3\sqrt{r^2+2r+4}\, r^3 + 96\sqrt{r^2+2r+4}), \beta 1 =$$
$$\frac{1}{4r(256+160r+25r^2)(r^2+2r+4)} (-74r\sqrt{r^2+2r+4} - 96\sqrt{r^2+2r+4}$$
$$- 3\sqrt{r^2+2r+4}\, r^3 + 3r^4 + 196r + 192 + 31r^3 + 110r^2 - 23\sqrt{r^2+2r+4}\, r^2),$$

$$gamm1 = \frac{3+r}{2\,(16+5\,r)}\}$$

```
> alpha1 := factor(
1/4*(192+196*r+110*r^2+3*r^4+23*(r^2+2*r+4)^(1/2)*r^2+74*r*(r^2+2*r+4)
(1/2)+96*(r^2+2*r+4)^(1/2)+3*(r^2+2*r+4)^(1/2)*r^3+31*r^3)/((256+160*r
25*r^2)*(r^2+2*r+4)*r) );
gamm1 := 1/2*(3+r)/(16+5*r);
beta1 := factor(
1/4*(-96*(r^2+2*r+4)^(1/2)-3*(r^2+2*r+4)^(1/2)*r^3+192+196*r+3*r^4-74*
*(r^2+2*r+4)^(1/2)+31*r^3-23*(r^2+2*r+4)^(1/2)*r^2+110*r^2)/(r*(256+16
*r+25*r^2)*(r^2+2*r+4)) );
```

$$\alpha 1 := \frac{(3+r)\,(3\,r^3+22\,r^2+3\,\sqrt{r^2+2\,r+4}\;r^2+14\,r\,\sqrt{r^2+2\,r+4}+44\,r+32\,\sqrt{r^2+2\,r+4}+64}{4\,(16+5\,r)^2\,(r^2+2\,r+4)\,r}$$

$$gamm1 := \frac{3+r}{2\,(16+5\,r)}$$

$$\beta 1 := -\frac{(3+r)\,(-3\,r^3+3\,\sqrt{r^2+2\,r+4}\;r^2-22\,r^2-44\,r+14\,r\,\sqrt{r^2+2\,r+4}+32\,\sqrt{r^2+2\,r+4}-64}{4\,(16+5\,r)^2\,(r^2+2\,r+4)\,r}$$

```
> e1 := tau-> exp(-(6+r-omega)*tau);
e2 := tau-> exp(-(6+r+omega)*tau);
e3 := tau-> exp(-4*tau);
```

$$e1 := \tau \to \mathbf{e}^{(-(6+r-\omega)\,\tau)}$$

$$e2 := \tau \to \mathbf{e}^{(-(6+r+\omega)\,\tau)}$$

$$e3 := \tau \to \mathbf{e}^{(-4\,\tau)}$$

```
> f11 := tau-> alpha1*e1(tau)*u[1,1] + beta1*e2(tau)*v[1,1] +
gamm1*e3(tau)*w[1,1] + Yinf[1,1];
f21 := tau-> alpha1*e1(tau)*u[2,1] + beta1*e2(tau)*v[2,1] +
gamm1*e3(tau)*w[2,1] + Yinf[2,1];
f31 := tau-> alpha1*e1(tau)*u[3,1] + beta1*e2(tau)*v[3,1] +
gamm1*e3(tau)*w[3,1] + Yinf[3,1];
```

$$f11 := \tau \to \alpha 1\; e1(\tau)\, u_{1,\,1} + \beta 1\; e2(\tau)\, v_{1,\,1} + gamm1\;\; e3(\tau)\, w_{1,\,1} + Yinf_{1,\,1}$$

$$f21 := \tau \to \alpha 1\; e1(\tau)\, u_{2,\,1} + \beta 1\; e2(\tau)\, v_{2,\,1} + gamm1\;\; e3(\tau)\, w_{2,\,1} + Yinf_{2,\,1}$$

$$f31 := \tau \to \alpha 1\; e1(\tau)\, u_{3,\,1} + \beta 1\; e2(\tau)\, v_{3,\,1} + gamm1\;\; e3(\tau)\, w_{3,\,1} + Yinf_{3,\,1}$$

vérifications

```
> simplify( diff(f11(tau),tau) + 4*f11(tau) + r*f21(tau) - c);
simplify( diff(f21(tau),tau) - f11(tau) + (7+2*r)*f21(tau) - f31(tau)
```

```
);
simplify( diff(f31(tau),tau) + f11(tau) - (3+r)*f21(tau) + 5*f31(tau)
c);
```

$$0$$

$$0$$

$$0$$

```
>
```

Expression de F(A,A) := f0, résolution du système

```
> U0 := < < 0 >, < 0 >, < ca >>;
  Uinf := < < a*g >, < a*cg >, < a*( c -cg ) > >;
```

$$U0 := \begin{bmatrix} 0 \\ 0 \\ \frac{16+7r}{256+80r} \end{bmatrix}$$

$$Uinf := \begin{bmatrix} \frac{(8+3r)(8+2r)}{(32+10r)^2} \\ \frac{2(8+3r)}{(32+10r)^2} \\ \frac{(8+3r)\left(\frac{8+2r}{32+10r} - \frac{2}{32+10r}\right)}{32+10r} \end{bmatrix}$$

```
> U := simplify(U0 - Uinf);
```

$$U := \begin{bmatrix} -\frac{(8+3r)(4+r)}{2(16+5r)^2} \\ -\frac{8+3r}{2(16+5r)^2} \\ \frac{64+56r+11r^2}{16(16+5r)^2} \end{bmatrix}$$

```
> eqns := { alpha2*u[1,1] + beta2*v[1,1] + gamm2*w[1,1] = U[1,1],
            alpha2*u[2,1] + beta2*v[2,1] + gamm2*w[2,1] = U[2,1],
            alpha2*u[3,1] + beta2*v[3,1] + gamm2*w[3,1] = U[3,1]
          };
```

$$eqns := \left\{ \alpha 2\,(2 + r - \sqrt{r^2 + 2\,r + 4}) + \beta 2\,(2 + r + \sqrt{r^2 + 2\,r + 4}) = -\frac{8 + 3\,r}{2\,(16 + 5\,r)^2},\right.$$

$$\alpha 2\,(\sqrt{r^2 + 2\,r + 4} - 2) + \beta 2\,(-\sqrt{r^2 + 2\,r + 4} - 2) - gamm2 = \frac{64 + 56\,r + 11\,r^2}{16\,(16 + 5\,r)^2},$$

$$\left.\alpha 2\,r + \beta 2\,r + gamm2 = -\frac{(8 + 3\,r)\,(4 + r)}{2\,(16 + 5\,r)^2}\right\}$$

```
> solve(eqns,{alpha2,beta2,gamm2});
```

$$\left\{ gamm2 = -\frac{16 + 7\,r}{32\,(16 + 5\,r)},\ \alpha 2 = -\frac{1}{64\,r\,(256 + 160\,r + 25\,r^2)\,(r^2 + 2\,r + 4)}\,(384\,r\,\sqrt{r^2 + 2\,r + 4}\right.$$

$$+ 512\,\sqrt{r^2 + 2\,r + 4} + 1024 + 13\,\sqrt{r^2 + 2\,r + 4}\,r^3 + 13\,r^4 + 1024\,r + 154\,r^3 + 564\,r^2$$

$$+ 106\,\sqrt{r^2 + 2\,r + 4}\,r^2),\ \beta 2 = -\frac{1}{64\,(256 + 160\,r + 25\,r^2)\,(r^2 + 2\,r + 4)\,r}\,(1024$$

$$- 13\,\sqrt{r^2 + 2\,r + 4}\,r^3 + 13\,r^4 + 154\,r^3 + 564\,r^2 + 1024\,r - 106\,\sqrt{r^2 + 2\,r + 4}\,r^2$$

$$\left. - 512\,\sqrt{r^2 + 2\,r + 4} - 384\,r\,\sqrt{r^2 + 2\,r + 4})\right\}$$

```
> alpha2 :=
-1/64*(1024+1024*r+154*r^3+512*(r^2+2*r+4)^(1/2)+106*(r^2+2*r+4)^(1/2)
r^2+384*(r^2+2*r+4)^(1/2)*r+13*(r^2+2*r+4)^(1/2)*r^3+13*r^4+564*r^2)/(
256+160*r+25*r^2)*(r^2+2*r+4)*r);
gamm2 := -1/32*(16+7*r)/(16+5*r);
beta2 :=
-1/64*(1024+564*r^2+13*r^4-384*(r^2+2*r+4)^(1/2)*r-512*(r^2+2*r+4)^(1/
)-13*(r^2+2*r+4)^(1/2)*r^3-106*(r^2+2*r+4)^(1/2)*r^2+1024*r+154*r^3)/(
*(256+160*r+25*r^2)*(r^2+2*r+4));
```

$$\alpha 2 := -\frac{1}{64\,r\,(256 + 160\,r + 25\,r^2)\,(r^2 + 2\,r + 4)}\,(384\,r\,\sqrt{r^2 + 2\,r + 4} + 512\,\sqrt{r^2 + 2\,r + 4} + 1024$$

$$+ 13\,\sqrt{r^2 + 2\,r + 4}\,r^3 + 13\,r^4 + 1024\,r + 154\,r^3 + 564\,r^2 + 106\,\sqrt{r^2 + 2\,r + 4}\,r^2)$$

$$gamm2 := -\frac{16 + 7\,r}{32\,(16 + 5\,r)}$$

$$\beta 2 := -\frac{1}{64\,(256 + 160\,r + 25\,r^2)\,(r^2 + 2\,r + 4)\,r}\,(1024 - 13\,\sqrt{r^2 + 2\,r + 4}\,r^3 + 13\,r^4 + 154\,r^3 + 564\,r$$

$$+ 1024\,r - 106\,\sqrt{r^2 + 2\,r + 4}\,r^2 - 512\,\sqrt{r^2 + 2\,r + 4} - 384\,r\,\sqrt{r^2 + 2\,r + 4})$$

```
> f12 := tau-> alpha2*e1(tau)*u[1,1] + beta2*e2(tau)*v[1,1] +
gamm2*e3(tau)*w[1,1] + Uinf[1,1];
```

```
f22 := tau-> alpha2*e1(tau)*u[2,1] + beta2*e2(tau)*v[2,1] +
gamm2*e3(tau)*w[2,1] + Uinf[2,1];
f32 := tau-> alpha2*e1(tau)*u[3,1] + beta2*e2(tau)*v[3,1] +
gamm2*e3(tau)*w[3,1] + Uinf[3,1];
```

$$f12 := \tau \to \alpha 2\ e1(\tau)\ u_{1,\,1} + \beta 2\ e2(\tau)\ v_{1,\,1} + gamm2\ e3(\tau)\ w_{1,\,1} + Uinf_{1,\,1}$$

$$f22 := \tau \to \alpha 2\ e1(\tau)\ u_{2,\,1} + \beta 2\ e2(\tau)\ v_{2,\,1} + gamm2\ e3(\tau)\ w_{2,\,1} + Uinf_{2,\,1}$$

$$f32 := \tau \to \alpha 2\ e1(\tau)\ u_{3,\,1} + \beta 2\ e2(\tau)\ v_{3,\,1} + gamm2\ e3(\tau)\ w_{3,\,1} + Uinf_{3,\,1}$$

vérifications

```
> simplify( diff(f12(tau),tau) + 4*f12(tau) + r*f22(tau) - a);
simplify( diff(f22(tau),tau) - f12(tau) + (7+2*r)*f22(tau) - f32(tau)
);
simplify( diff(f32(tau),tau) + f12(tau) - (3+r)*f22(tau) + 5*f32(tau)
a);
```

$$0$$

$$0$$

$$0$$

solution particulière pour F(A,A)

```
> fpart := tau -> -r*alpha2*e1(tau) - r*beta2*e2(tau) + r/4*a*cg + a/4;
```

$$fpart := \tau \to -r\ \alpha 2\ e1(\tau) - r\ \beta 2\ e2(\tau) + \frac{1}{4}\ r\ a\ cg + \frac{1}{4}\ a$$

```
> fpart(tau);
```

$$\frac{1}{64\,(256 + 160\,r + 25\,r^2)\,(r^2 + 2\,r + 4)}\Big((384\,r\,\sqrt{r^2 + 2\,r + 4} + 512\,\sqrt{r^2 + 2\,r + 4} + 1024 + 13\,\sqrt{r^2 + 2\,r + 4}\;r^3 + 13\,r^4 + 1024\,r + 154\,r^3 + 564\,r^2 + 106\,\sqrt{r^2 + 2\,r + 4}\;r^2)\,\mathbf{e}^{\left(-\left(6 + r - \sqrt{r^2 + 2\,r + 4}\right)\,\tau\right)}\Big) + \frac{1}{64\,(256 + 160\,r + 25\,r^2)\,(r^2 + 2\,r + 4)}\Big((1024 - 13\,\sqrt{r^2 + 2\,r + 4}\;r^3 + 13\,r^4 + 154\,r^3 + 564\,r^2 + 1024\,r - 106\,\sqrt{r^2 + 2\,r + 4}\;r^2 - 512\,\sqrt{r^2 + 2\,r + 4} - 384\,r\,\sqrt{r^2 + 2\,r + 4})\,\mathbf{e}^{\left(-\left(6 + r + \sqrt{r^2 + 2\,r + 4}\right)\,\tau\right)}\Big) + \frac{r\,(8 + 3\,r)}{2\,(32 + 10\,r)^2} + \frac{8 + 3\,r}{4\,(32 + 10\,r)}$$

```
> simplify( diff( fpart(tau),tau ) + 4*fpart(tau) - r*f22(tau) - a );
```

$$0$$

```
> k := simplify( a - fpart(0) );
```

$$k := \frac{31 r + 80}{32 (16 + 5 r)}$$

```
> f0 := tau -> k*exp(-4*tau) + fpart(tau);
```

$$f0 := \tau \to k\, \mathbf{e}^{(-4\,\tau)} + fpart(\tau)$$

```
> f0(tau);
```

$$\frac{(31 r + 80)\, \mathbf{e}^{(-4\,\tau)}}{32 (16 + 5 r)} + \frac{1}{64 (256 + 160 r + 25 r^2)(r^2 + 2 r + 4)} \Big((384 r \sqrt{r^2 + 2 r + 4} + 512 \sqrt{r^2 + 2 r + 4} + 1024 + 13 \sqrt{r^2 + 2 r + 4}\, r^3 + 13 r^4 + 1024 r + 154 r^3 + 564 r^2 + 106 \sqrt{r^2 + 2 r + 4}\, r^2)\, \mathbf{e}^{\left(-\left(6 + r - \sqrt{r^2 + 2 r + 4}\right) \tau\right)} \Big) + \frac{1}{64 (256 + 160 r + 25 r^2)(r^2 + 2 r + 4)} \Big((1024 - 13 \sqrt{r^2 + 2 r + 4}\, r^3 + 13 r^4 + 154 r^3 + 564 r^2 + 1024 r - 106 \sqrt{r^2 + 2 r + 4}\, r^2 - 512 \sqrt{r^2 + 2 r + 4} - 384 r \sqrt{r^2 + 2 r + 4})\, \mathbf{e}^{\left(-\left(6 + r + \sqrt{r^2 + 2 r + 4}\right) \tau\right)} \Big) + \frac{r (8 + 3 r)}{2 (32 + 10 r)^2} + \frac{8 + 3 r}{4 (32 + 10 r)}$$

```
> simplify( diff( fpart(tau),tau ) + 4*fpart(tau) - r*f22(tau) - a );
```

$$0$$

Convexité de la courbe paramétrée

alpha1 et gamma1 sont srictements positifs, quand est-il de beta1 ? on voit ci dessous que beta1 > 0.

```
> simplify( ( 64 + 44*r + 22*r^2 + 3*r^3 )^2 - omega^2*( 32 + 14*r + 
3*r^2)^2 );
```

$$384 r^2 + 312 r^3 + 156 r^4 + 30 r^5$$

alpha2 est strictement négatif, quand est-il de beta2 ? on voit ci dessous que beta2 < 0

```
> simplify( ( 1024 + 1024*r + 564*r^2 + 154*r^3 + 13*r^4 )^2 - omega^2*( 
512 + 384*r + 106*r^2 + 13*r^3 )^2 );
```

$$910 r^7 + 52152 r^5 + 131072 r^2 + 129792 r^4 + 10972 r^6 + 186368 r^3$$

La courbe est donc régulière, est-elle birégulière ?

```
> simplify( diff( f11(tau),tau )*diff( f0(tau),tau,tau ) - diff( 
f11(tau), tau, tau )*diff( f0(tau), tau) );
```

$$\frac{1}{4 (256 + 160 r + 25 r^2)(r^2 + 2 r + 4)} \Big(\Big(-\mathbf{e}^{(-2\,\tau\,(6 + r))}\, r^3 + 6\, \mathbf{e}^{\left(-\tau \left(10 + r + \sqrt{r^2 + 2 r + 4}\right)\right)}\, r^3$$

$$+ 6\,\mathbf{e}^{\left(\tau\left(-10 - r + \sqrt{r^2 + 2r + 4}\right)\right)} r^3 - 6\,\mathbf{e}^{\left(\tau\left(-10 - r + \sqrt{r^2 + 2r + 4}\right)\right)} \sqrt{r^2 + 2r + 4}\, r^2$$

$$+ 6\,\mathbf{e}^{\left(-\tau\left(10 + r + \sqrt{r^2 + 2r + 4}\right)\right)} \sqrt{r^2 + 2r + 4}\, r^2 + 28\,\mathbf{e}^{\left(-\tau\left(10 + r + \sqrt{r^2 + 2r + 4}\right)\right)} r^2$$

$$+ 28\,\mathbf{e}^{\left(\tau\left(-10 - r + \sqrt{r^2 + 2r + 4}\right)\right)} r^2 - 2\,\mathbf{e}^{(-2\,\tau\,(6 + r))} r^2$$

$$+ 2\,\mathbf{e}^{\left(-\tau\left(10 + r + \sqrt{r^2 + 2r + 4}\right)\right)} r \sqrt{r^2 + 2r + 4}$$

$$- 2\,\mathbf{e}^{\left(\tau\left(-10 - r + \sqrt{r^2 + 2r + 4}\right)\right)} r \sqrt{r^2 + 2r + 4} + 56\,\mathbf{e}^{\left(-\tau\left(10 + r + \sqrt{r^2 + 2r + 4}\right)\right)} r$$

$$+ 56\,\mathbf{e}^{\left(\tau\left(-10 - r + \sqrt{r^2 + 2r + 4}\right)\right)} r - 4\,\mathbf{e}^{(-2\,\tau\,(6 + r))} r$$

$$+ 32\,\mathbf{e}^{\left(\tau\left(-10 - r + \sqrt{r^2 + 2r + 4}\right)\right)} \sqrt{r^2 + 2r + 4}$$

$$- 32\,\mathbf{e}^{\left(-\tau\left(10 + r + \sqrt{r^2 + 2r + 4}\right)\right)} \sqrt{r^2 + 2r + 4} + 64\,\mathbf{e}^{\left(-\tau\left(10 + r + \sqrt{r^2 + 2r + 4}\right)\right)}$$

$$\left. + 64\,\mathbf{e}^{\left(\tau\left(-10 - r + \sqrt{r^2 + 2r + 4}\right)\right)} \right) \Big/ \left(r\,(3 + r) \right)$$

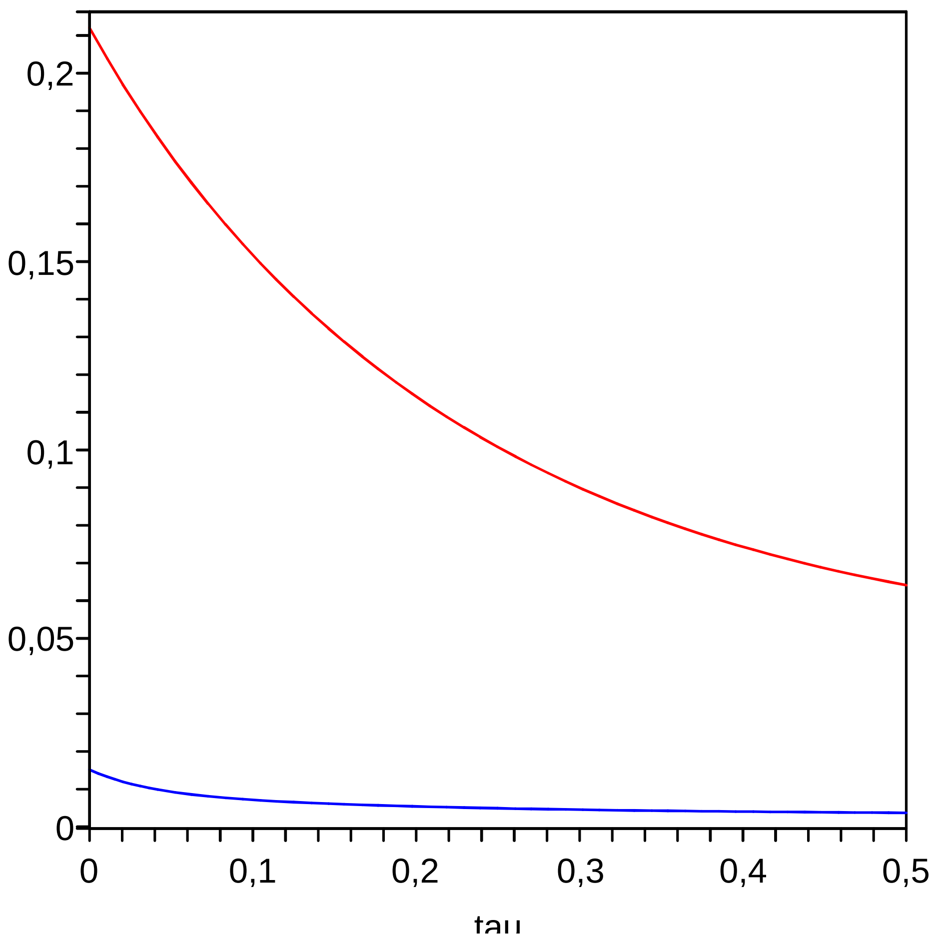
courbe paramétrée, graphique

```
> r:=10;
```

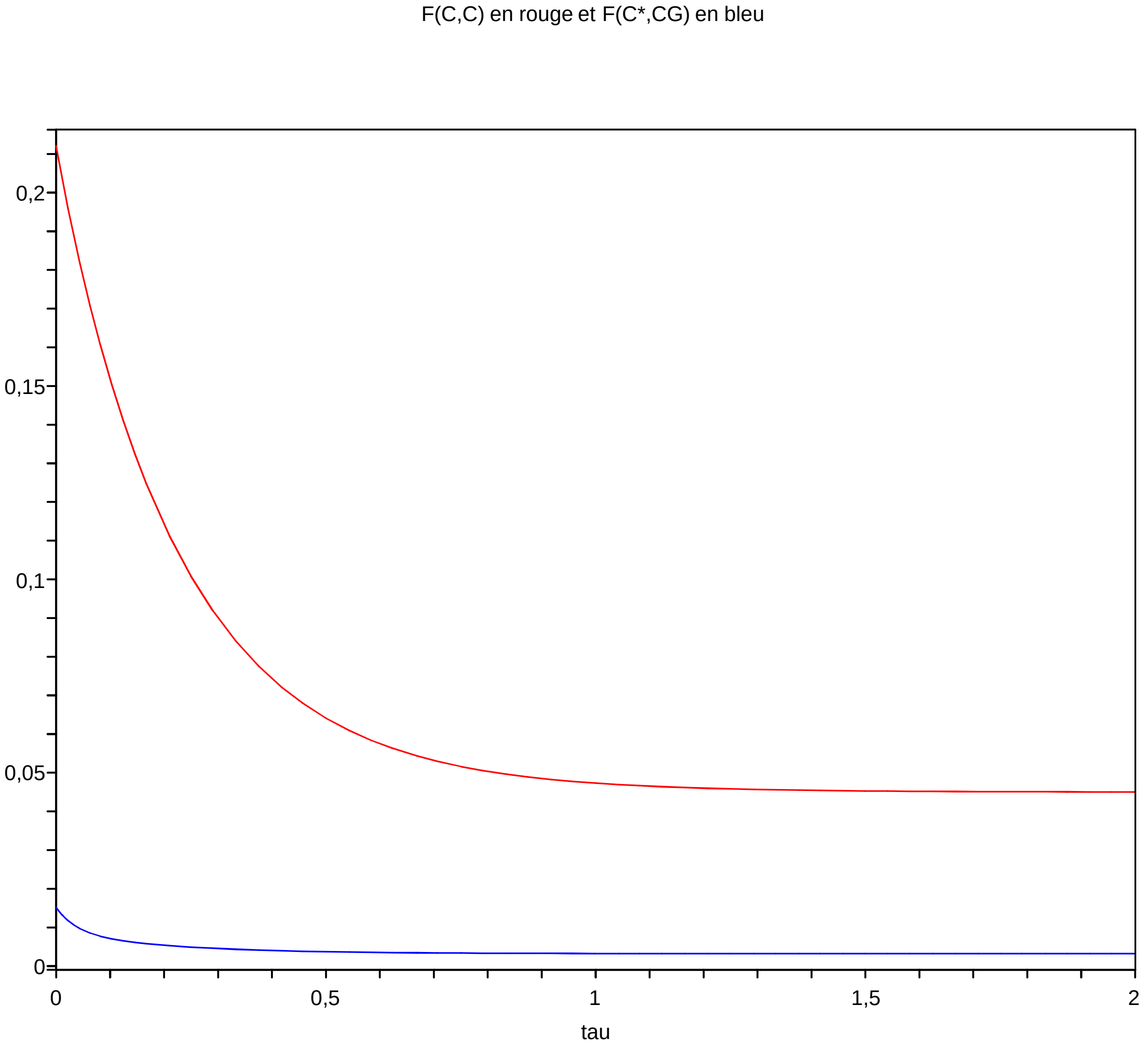
$$r := 10$$

```
> F1:=plot( f11(tau), tau=0..0.5, color=red):
  G1:=plot( f21(tau), tau=0..0.5, color=blue):
  display({F1, G1}, axes=boxed, title=`F(C,C) en rouge and F(C*,CG) en
  bleu `);
```

F(C,C) en rouge and F(C*,CG) en bleu




```
> F2:=plot( f11(tau), tau=0..2, color=red):
  G2:=plot( f21(tau), tau=0..2, color=blue):
  display({F2, G2}, axes=boxed, title=`F(C,C) en rouge et F(C*,CG) en
  bleu `);
```



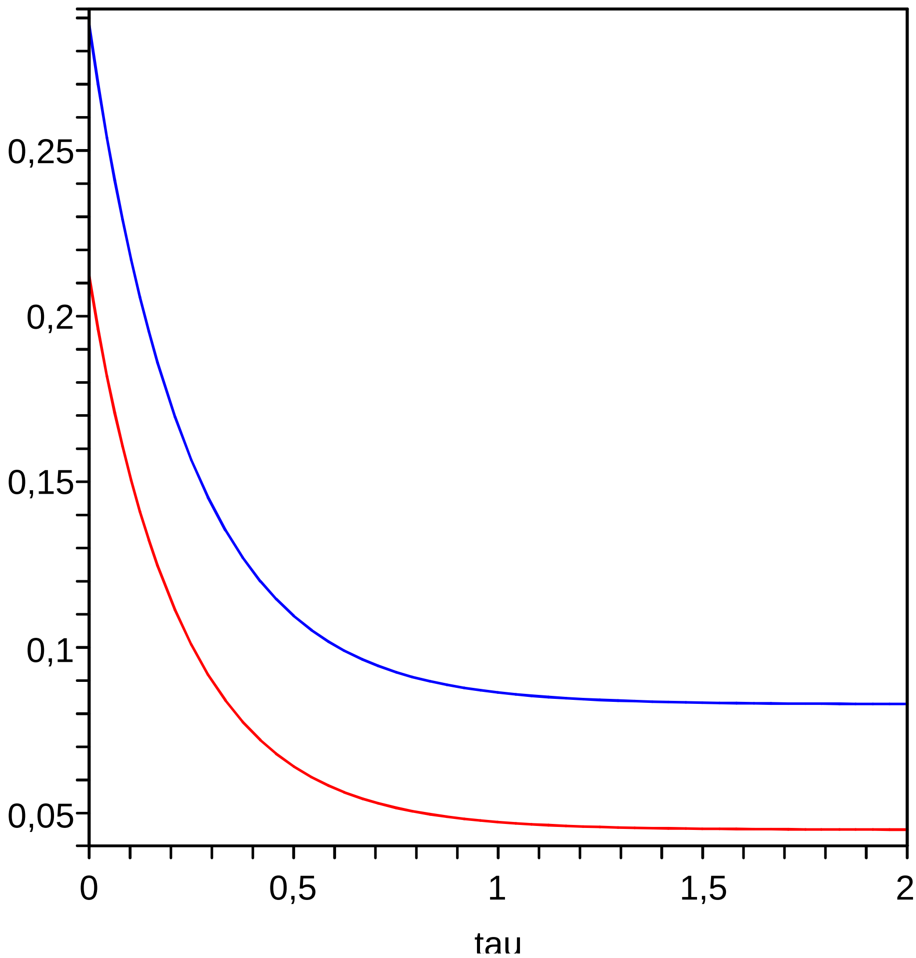

```
> f11(tau);
  f0(tau);
```

$$10\left(\frac{299}{87120}+\frac{767}{2700720}\sqrt{124}\right)e^{(-(16-\sqrt{124})\,\tau)}+10\left(\frac{299}{87120}-\frac{767}{2700720}\sqrt{124}\right)e^{(-(16+\sqrt{124})\,\tau)}+\frac{13}{132}e^{(-4\,\tau)}+\frac{49}{1089}$$

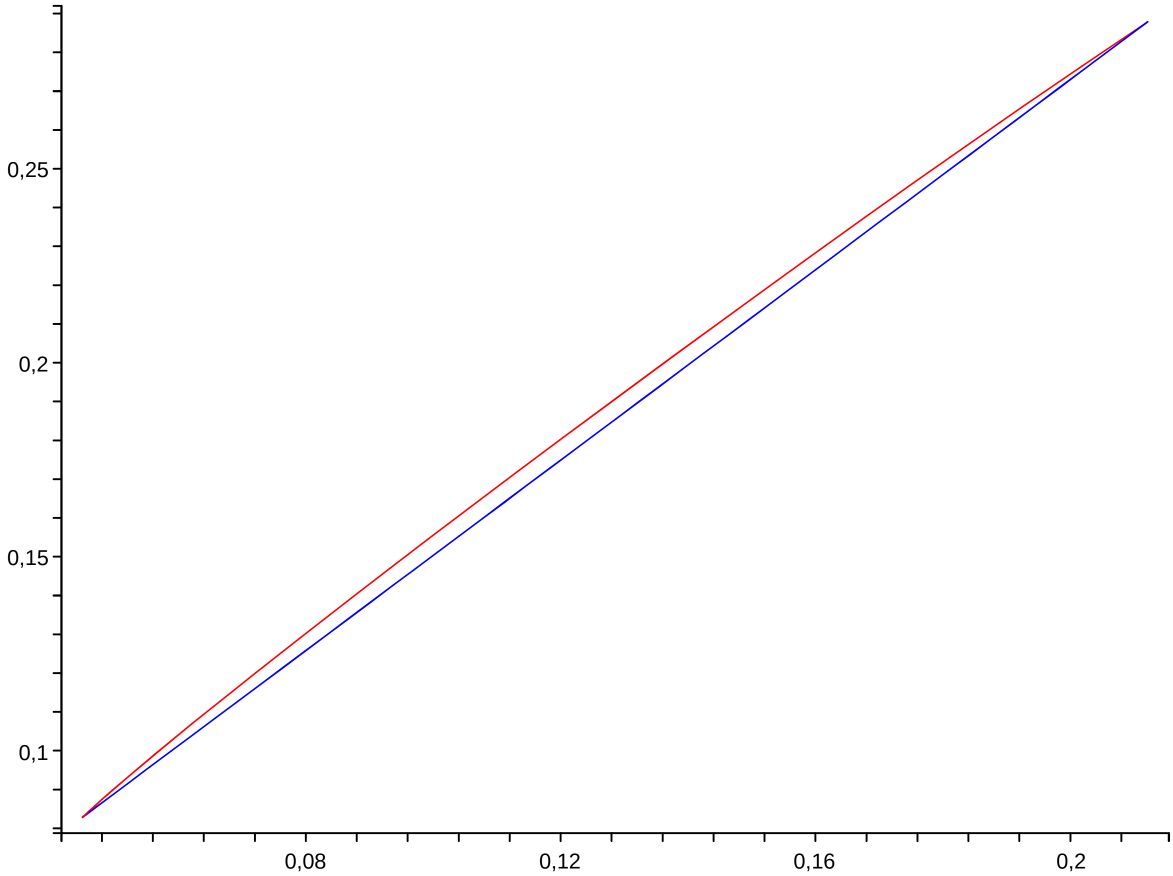
$$\frac{65}{352}e^{(-4\,\tau)}-10\left(-\frac{1747}{21605760}\sqrt{124}-\frac{709}{696960}\right)e^{(-(16-\sqrt{124})\,\tau)}-10\left(-\frac{709}{696960}+\frac{1747}{21605760}\sqrt{124}\right)e^{(-(16+\sqrt{124})\,\tau)}+\frac{361}{4356}$$

```
> F:=plot( f11(tau), tau=0..2, color=red):
  G:=plot( f0(tau), tau=0..2, color=blue):
  display({F, G}, axes=boxed, title=`F(C,C) en rouge et F(A,A) en bleu`)
```

F(C,C) and F(A,A)




```
> plot([[f11(tau), f0(tau), tau=0..5], [c + s*(c^2 - c), a + s*(a^2 - a)
  s=0..1]], color=[red,blue]);
```



en bleu le segment reliant (F(C,C)(0), F(A,A)(0)) à (F(C,C)(inf), F(A,A)(inf)), en rouge la courbe paramétrée tau -> (F(C,C)(tau), F(A,A)(tau) pour r:= 100

>