```
    |\^/|     Maple 9 (IBM INTEL LINUX)
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 <____ ____>  Waterloo Maple Inc.
      |       Type ? for help.
>  interface(screenwidth=120);
>  with(LinearAlgebra):
>  # On prend une conique passant par (0,0,1)
>  C:=add(add(rand(20)()*x[i]*x[j],i=0..2),j=0..1);
                                      2                                       2
                           C := x[0]  + 13 x[1] x[0] + 17 x[2] x[0] + 16 x[1]  + 18 x[2] x[1]

>  # puis on change de variable.
>  subs({x[0]=x[0]-x[2],x[1]=x[1]-x[2]},C);C:=expand(%);
                                                                                                  2
  (x[0] - x[2])  + 13 (x[1] - x[2]) (x[0] - x[2]) + 17 x[2] (x[0] - x[2]) + 16 (x[1] - x[2])  + 18 x[2] (x[1] - x[2])
               2
                                 2                             2                                         2
                      C := x[0]  + 2 x[2] x[0] - 5 x[2]  + 13 x[1] x[0] - 27 x[2] x[1] + 16 x[1]

>  #fonction associee a l'equation de la conique
>  c:=V->subs({x[0]=V[1],x[1]=V[2],x[2]=V[3]},C);
                              c := V -> subs({x[0] = V[1], x[1] = V[2], x[2] = V[3]}, C)

>  u:='u';v:='v';a:='a';M:=Vector([1,1,1])+a*Vector([u,v,0]);
                                                  u := u

                                                  v := v

                                                  a := a

                                                 [1 + a u]
                                                 [       ]
                                            M := [1 + a v]
                                                 [       ]
                                                 [   1   ]

>  s:=simplify(c(M)/a);s:=solve(s,a);d:=denom(s);
                                                2                           2
                                 s := 17 u + a u  + 18 v + 13 a v u + 16 a v

                                                17 u + 18 v
                                        s := - -------------------
                                                2               2
                                               u  + 13 v u + 16 v

                                                2               2
                                        d := u  + 13 v u + 16 v

>  para:=simplify(d*subs({a=s},M));
                                              [     2                2]
                                              [-16 u  - 5 v u + 16 v ]
                                              [                      ]
                                              [   2              2   ]
                                      para := [  u  - 4 v u - 2 v    ]
                                              [                      ]
                                              [  2               2   ]
                                              [ u  + 13 v u + 16 v   ]

>  # verification:
>  expand(c(para));
                                                      0

>  #la tangente au point para est la droite AB
>   A:=Vector([seq(diff(para[i],u),i=1..3)]);
                                                  [-32 u - 5 v]
                                                  [           ]
                                             A := [ 2 u - 4 v ]
                                                  [           ]
                                                  [2 u + 13 v ]

>   B:=Vector([seq(diff(para[i],v),i=1..3)]);
                                                  [-5 u + 32 v]
                                                  [           ]
                                             B := [-4 u - 4 v ]
                                                  [           ]
                                                  [13 u + 32 v]

>  AB:=simplify(a*A+b*B);
                                        [-32 a u - 5 a v - 5 b u + 32 b v]
                                        [                                ]
                                  AB := [ 2 a u - 4 a v - 4 b u - 4 b v  ]
                                        [                                ]
                                        [2 a u + 13 a v + 13 b u + 32 b v]

>   # verification:
>  factor(c(AB));
                                                                2
                                             970 (a v - b u)

>  tgte:=add(subs({x[0]=para[1],x[1]=para[2],x[2]=para[3]},diff(C,x[i]))*x[i],i=0..2);
                    2                2                2                2                2                2
      tgte := (-17 u  - 36 v u + 38 v ) x[0] + (-203 u  - 544 v u - 288 v ) x[1] + (-69 u  - 32 v u - 74 v ) x[2]

>   #verification:
>   simplify(subs({seq(x[i]=A[i+1],i=0..2)},tgte));
                                                      0

>   simplify(subs({seq(x[i]=B[i+1],i=0..2)},tgte));
                                                      0

> E:=(x+3)^2+y^2-1;
                                                              2    2
                                                E := (x + 3)  + y  - 1

>  # une droite non verticale passant par My. (NB: x=cte ne coupe pas
>  #E) sinon il faut travailler sur P1
>  du:=(x-t^2)+u*(y-t);
                                                                2
                                                    du := x - t  + u (y - t)

>  T:=subs({x=t^2-u*(y-t)},E);
                                                    2                  2    2
                                              T := (t  - u (y - t) + 3)  + y  - 1

>  delta:=coeff(T,y,1)^2-4*coeff(T,y,0)*coeff(T,y,2);
                                         2           2  2         2              2            2
                              delta := 4 (t  + u t + 3)  u  - 4 ((t  + u t + 3)  - 1) (u  + 1)

>  U:=solve(delta=0,u);
                                       3          2    4     1/2             3          2    4     1/2
                            -6 t - 2 t  + 2 (7 t  + t  + 8)     -6 t - 2 t  - 2 (7 t  + t  + 8)
                      U := --------------------------------, ---------------------------------
                                         2                                     2
                                   2 (t  - 1)                            2 (t  - 1)

>  Ty:={expand(subs({u=U[1]},du)),expand(subs({u=U[2]},du))};
                                2        3          4       1/2        1/2
          2   3 t y     3 t      t  y      t      %1    y   %1    t
Ty := {x - t  - ------ + ------ - ------ + ------ + ------- - -------,
                2        2        2        2        2        2
               t  - 1   t  - 1   t  - 1   t  - 1   t  - 1    t  - 1

                              2       3          4       1/2        1/2
        2   3 t y     3 t      t  y      t      %1    y   %1    t
    x - t  - ------ + ------ - ------ + ------ - ------- + -------}
              2        2        2        2        2         2
             t  - 1   t  - 1   t  - 1   t  - 1   t  - 1    t  - 1

       2    4
%1 := 7 t  + t  + 8

>  f:=proc(t,tang)
>  tt:=simplify(subs({x=y^2},tang)/(y-t));
>  subs(y=0,-1*tt);
>  end proc;
        f := proc(t, tang) local tt; tt := simplify(subs({x = y^2}, tang)/(y - t)); subs(y = 0, -tt) end proc

>  f(t,Ty[1]);
                                                            2    4     1/2
                                                  -4 t + (7 t  + t  + 8)
                                                - -------------------------
                                                              2
                                                             t  - 1

>  # C est parametree par (t^2,t), E par (u,u^2)
>  E:=x^2-y;C:=y^2-x;
                                                                 2
                                                         E := x  - y

                                                                 2
                                                         C := y  - x

>  EU:=u->[u,u^2];CT:=t->[t^2,t];#des parametrisations de E et C
                                                                     2
                                                      EU := u -> [u, u ]

                                                                     2
                                                      CT := t -> [t , t]

>  tangente:=(M,F)->(x-M[1])*subs(x=M[1],diff(F,x))+(y-M[2])*subs(y=M[2],diff(F,y));
                                                      d                                           d
              tangente := (M, F) -> (x - M[1]) subs(x = M[1], -- F) + (y - M[2]) subs(y = M[2], -- F)
                                                      dx                                          dy

#t le parametre de mt, u le parametre d'une tangente a EU passant par mt
>  f:=proc(t,u)
>  tang:=tangente(EU(u),E);
>  nt:=simplify(subs({x=CT(tt)[1],y=CT(tt)[2]},tang)/(tt-t));
>  newt:=subs(tt=0,-1*nt);
>  #d droite EU,CT
>  dir:=EU(uu)-CT(newt);
>  d:=-(x-CT(newt)[1])*dir[2]+(y-CT(newt)[2])*dir[1];
>  delta:=subs({x=EU(uuu)[1],y=EU(uuu)[2]},d);
>  discrim(delta,uuu)/(uu-u);
>  end proc;
f := proc(t, u)
local tang, nt, newt, dir, d, delta;
    tang := tangente(EU(u), E);
    nt := simplify(subs({x = CT(tt)[1], y = CT(tt)[2]}, tang)/(tt - t));
    newt := subs(tt = 0, -nt);
    dir := EU(uu) - CT(newt);
    d := -(x - CT(newt)[1])*dir[2] + (y - CT(newt)[2])*dir[1];
    delta := subs({x = EU(uuu)[1], y = EU(uuu)[2]}, d);
    discrim(delta, uuu)/(uu - u);
end proc

>
> quit
bytes used=2733504, alloc=2227816, time=0.06
```