pyMaxima-Sitzung

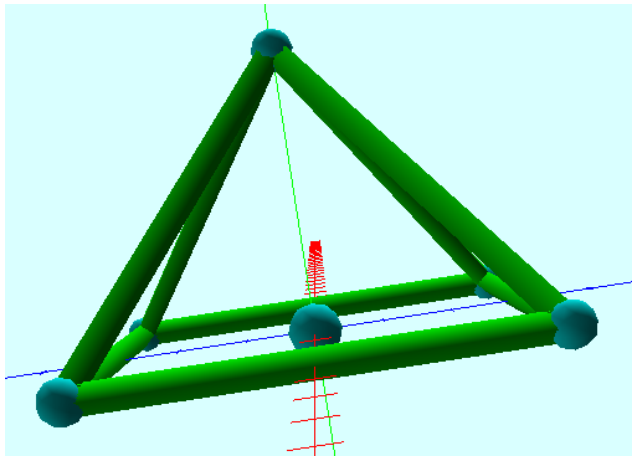
10. Mai 2011, 11:32

```
(%i1) "LS, S. 87, Nr. 10"$

(%i2) "a) Punkt D(-3|-3|0)?"$

(%i3) "Dreieck durch die Punkte A, B, C"$

(%i4) D1_A : transpose(matrix ([3.0,-3.0,0.0]));
                                  [  3.0  ]
                                  [       ]
(%o4)                             [ - 3.0 ]
                                  [       ]
                                  [  0.0  ]

(%i5) D1_B : transpose(matrix ([3.0,3.0,0.0]));
                                   [ 3.0 ]
                                   [     ]
(%o5)                              [ 3.0 ]
                                   [     ]
                                   [ 0.0 ]

(%i6) D1_C : transpose(matrix ([-3.0,3.0,0.0]));
                                  [ - 3.0 ]
                                  [       ]
(%o6)                             [  3.0  ]
                                  [       ]
                                  [  0.0  ]

(%i7) "Punkt D"$

(%i8) D: transpose(matrix ([-3.0,-3.0,0.0]));
                                  [ - 3.0 ]
                                  [       ]
(%o8)                             [ - 3.0 ]
                                  [       ]
                                  [  0.0  ]

(%i9) "b)"$

(%i10) "Gerade durch A und B"$

(%i11) "Zwei Punkte A, B der Gerade g"$

(%i12) A : transpose(matrix ([3.0,-3.0,0.0]));
                                  [  3.0  ]
                                  [       ]
(%o12)                            [ - 3.0 ]
                                  [       ]
                                  [  0.0  ]

(%i13) B : transpose(matrix ([3.0,3.0,0.0]));
                                   [ 3.0 ]
                                   [     ]
(%o13)                             [ 3.0 ]
                                   [     ]
                                   [ 0.0 ]
```



```
(%i14) "Aufpunkt stuetzvec"$

(%i15) stuetzg_AB : transpose(matrix ([3.0,-3.0,0.0]));
                                  [  3.0  ]
                                  [       ]
(%o15)                            [ - 3.0 ]
                                  [       ]
                                  [  0.0  ]

(%i16) "Richtungsvektor uvec"$

(%i17) uvecg_AB : B - A;
                                   [ 0.0 ]
                                   [     ]
(%o17)                             [ 6.0 ]
                                   [     ]
                                   [ 0.0 ]

(%i18) "x-Vektor xvec"$

(%i19) xvec : transpose(matrix ([x,y,z]));
                                    [ x ]
                                    [   ]
(%o19)                              [ y ]
                                    [   ]
                                    [ z ]

(%i20) "Gerade durch S und C"$

(%i21) "Zwei Punkte S, C der Gerade g"$

(%i22) S : transpose(matrix ([0.0,0.0,4.0]));
                                   [ 0.0 ]
                                   [     ]
(%o22)                             [ 0.0 ]
                                   [     ]
                                   [ 4.0 ]

(%i23) C : transpose(matrix ([-3.0,3.0,0.0]));
                                  [ - 3.0 ]
                                  [       ]
(%o23)                            [  3.0  ]
                                  [       ]
                                  [  0.0  ]

(%i24) "Aufpunkt stuetzvec"$

(%i25) stuetzg_SC : transpose(matrix ([0.0,0.0,4.0]));
                                   [ 0.0 ]
                                   [     ]
(%o25)                             [ 0.0 ]
                                   [     ]
                                   [ 4.0 ]

(%i26) "Richtungsvektor uvec"$

(%i27) uvecg_SC : C - S;
                                  [ - 3.0 ]
                                  [       ]
(%o27)                            [  3.0  ]
                                  [       ]
                                  [ - 4.0 ]
```

```
(%i28) "x-Vektor xvec"$

(%i29) xvec : transpose(matrix ([x,y,z]));
                                    [ x ]
                                    [   ]
(%o29)                              [ y ]
                                    [   ]
                                    [ z ]

(%i30) "Die beiden Geraden g_AB und g_SC sind windschief."$

(%i31) "Abstand der beiden Geraden d =   4.800000000000"$

(%i32) "c) Pyramide "$

(%i33) "Pyramide (Punkte A, B, C, D, S)"$

(%i34) Pyl_A : transpose(matrix ([3.0,-3.0,0.0]));
                                   [  3.0  ]
                                   [       ]
(%o34)                             [ - 3.0 ]
                                   [       ]
                                   [  0.0  ]

(%i35) Pyl_B : transpose(matrix ([3.0,3.0,0.0]));
                                    [ 3.0 ]
                                    [     ]
(%o35)                              [ 3.0 ]
                                    [     ]
                                    [ 0.0 ]

(%i36) Pyl_C : transpose(matrix ([-3.0,3.0,0.0]));
                                   [ - 3.0 ]
                                   [       ]
(%o36)                             [  3.0  ]
                                   [       ]
                                   [  0.0  ]

(%i37) Pyl_D : transpose(matrix ([-3.0,-3.0,0.0]));
                                   [ - 3.0 ]
                                   [       ]
(%o37)                             [ - 3.0 ]
                                   [       ]
                                   [  0.0  ]

(%i38) Pyl_S : transpose(matrix ([0.0,0.0,4.0]));
                                    [ 0.0 ]
                                    [     ]
(%o38)                              [ 0.0 ]
                                    [     ]
                                    [ 4.0 ]
```

```
(%i39) "d) Ebenengleichung E_ABS und E_BCS"$

(%i40) "Drei Punkte A, B, S der Ebene"$

(%i41) A : transpose(matrix ([3.0,-3.0,0.0]));
                                   [  3.0  ]
                                   [       ]
(%o41)                             [ - 3.0 ]
                                   [       ]
                                   [  0.0  ]

(%i42) B : transpose(matrix ([3.0,3.0,0.0]));
                                    [ 3.0 ]
                                    [     ]
(%o42)                              [ 3.0 ]
                                    [     ]
                                    [ 0.0 ]

(%i43) C : transpose(matrix ([0.0,0.0,4.0]));
                                    [ 0.0 ]
                                    [     ]
(%o43)                              [ 0.0 ]
                                    [     ]
                                    [ 4.0 ]

(%i44) "Aufpunkt stuetzvec"$

(%i45) stuetzE_ABS : transpose(matrix ([3.0,-3.0,0.0]));
                                   [  3.0  ]
                                   [       ]
(%o45)                             [ - 3.0 ]
                                   [       ]
                                   [  0.0  ]

(%i46) "Richtungsvektoren uvec und vvec"$

(%i47) uvecE_ABS : B - A;
                                    [ 0.0 ]
                                    [     ]
```

```
(%o47)                                [ 6.0 ]
                                      [     ]
                                      [ 0.0 ]

(%i48) vvecE_ABS : C - A;
                                    [ - 3.0 ]
                                    [       ]
(%o48)                              [  3.0  ]
                                    [       ]
                                    [  4.0  ]

(%i49) "Ebenengleichung"$

(%i50) display(stuetzE_ABS +  r * uvecE_ABS +  s * vvecE_ABS)$
         [  3.0  ]   [  0.0  ]   [ - 3.0 s ]   [     3.0 - 3.0 s     ]
         [       ]   [       ]   [         ]   [                     ]
         [ - 3.0 ] + [ 6.0 r ] + [  3.0 s  ] = [ 3.0 s + 6.0 r - 3.0 ]
         [       ]   [       ]   [         ]   [                     ]
         [  0.0  ]   [  0.0  ]   [  4.0 s  ]   [        4.0 s        ]


(%i51) "Punkt stuetzE_ABS"$

(%i52) stuetzE_ABS : transpose(matrix ([3.0,-3.0,0.0]));
                                    [  3.0  ]
                                    [       ]
(%o52)                              [ - 3.0 ]
                                    [       ]
                                    [  0.0  ]

(%i53) "Punkt E_ABSp2"$

(%i54) E_ABSp2 : transpose(matrix ([3.0,3.0,0.0]));
                                     [ 3.0 ]
                                     [     ]
(%o54)                               [ 3.0 ]
                                     [     ]
                                     [ 0.0 ]

(%i55) "Punkt E_ABSp3"$

(%i56) E_ABSp3 : transpose(matrix ([0.0,0.0,4.0]));
                                     [ 0.0 ]
                                     [     ]
(%o56)                               [ 0.0 ]
                                     [     ]
                                     [ 4.0 ]

(%i57) "Vektor uvecE_ABS"$

(%i58) uvecE_ABS : transpose(matrix ([3.0,3.0,0.0])) - transpose(matrix ([3.0,-3.0,0.0]));
                                     [ 0.0 ]
                                     [     ]
(%o58)                               [ 6.0 ]
                                     [     ]
                                     [ 0.0 ]

(%i59) "Vektor vvecE_ABS"$

(%i60) vvecE_ABS : transpose(matrix ([0.0,0.0,4.0])) - transpose(matrix ([3.0,-3.0,0.0]));
                                    [ - 3.0 ]
                                    [       ]
(%o60)                              [  3.0  ]
```



```
                                    [       ]
                                    [  4.0  ]

(%i61) "Ebene E_ABS"$

(%i62) E_ABS : stuetzE_ABS + r * uvecE_ABS + s * vvecE_ABS;
                              [     3.0 - 3.0 s     ]
                              [                     ]
(%o62)                        [ 3.0 s + 6.0 r - 3.0 ]
                              [                     ]
                              [        4.0 s        ]

(%i63) "x-Vektor xvec"$

(%i64) xvec : transpose(matrix ([x,y,z]));
                                     [ x ]
                                     [   ]
(%o64)                               [ y ]
                                     [   ]
                                     [ z ]

(%i65) E_ABS : addcol(matrix([]),xvec - stuetzE_ABS,uvecE_ABS,vvecE_ABS)$

(%i66) detE_ABS : determinant( E_ABS );
(%o66)                      18.0 z + 24.0 (x - 3.0)

(%i67) "Normalenvektor nvecE_ABS"$

(%i68) nvecE_ABS : transpose(coefmatrix([detE_ABS],[x,y,z]));

                                     [ 24 ]
                                     [    ]
(%o68)                               [ 0  ]
                                     [    ]
                                     [ 18 ]

(%i69) dE_ABS : (-1) *determinant( col(augcoefmatrix([detE_ABS],[x,y,z]),4) );

(%o69)                                72.0

(%i70) koordinatenform(x,n,d) := (print( x . n  = d) )$

(%i71) "Koordinatenform"$

(%i72) koordinatenform(xvec,nvecE_ABS,dE_ABS)$
18 z + 24 x = 72.0

(%i73) "-------------------------------"$

(%i74) "Drei Punkte B, C, S der Ebene"$

(%i75) A : transpose(matrix ([-3.0,3.0,0.0]));
                                    [ - 3.0 ]
                                    [       ]
(%o75)                              [  3.0  ]
                                    [       ]
                                    [  0.0  ]

(%i76) B : transpose(matrix ([3.0,3.0,0.0]));
                                     [ 3.0 ]
                                     [     ]
(%o76)                               [ 3.0 ]
                                     [     ]
```

```
                                  [ 0.0 ]

(%i77) C : transpose(matrix ([0.0,0.0,4.0]));
                                  [ 0.0 ]
                                  [     ]
(%o77)                            [ 0.0 ]
                                  [     ]
                                  [ 4.0 ]

(%i78) "Aufpunkt stuetzvec"$

(%i79) stuetzE_BCS : transpose(matrix ([-3.0,3.0,0.0]));
                                 [ - 3.0 ]
                                 [       ]
(%o79)                           [  3.0  ]
                                 [       ]
                                 [  0.0  ]

(%i80) "Richtungsvektoren uvec und vvec"$

(%i81) uvecE_BCS : B - A;
                                  [ 6.0 ]
                                  [     ]
(%o81)                            [ 0.0 ]
                                  [     ]
                                  [ 0.0 ]

(%i82) vvecE_BCS : C - A;
                                 [  3.0  ]
                                 [       ]
(%o82)                           [ - 3.0 ]
                                 [       ]
                                 [  4.0  ]

(%i83) "Ebenengleichung"$

(%i84) display(stuetzE_BCS +  r * uvecE_BCS +  s * vvecE_BCS)$
         [ - 3.0 ]   [ 6.0 r ]   [  3.0 s  ]   [ 3.0 s + 6.0 r - 3.0 ]
         [       ]   [       ]   [         ]   [                     ]
         [  3.0  ] + [  0.0  ] + [ - 3.0 s ] = [     3.0 - 3.0 s     ]
         [       ]   [       ]   [         ]   [                     ]
         [  0.0  ]   [  0.0  ]   [  4.0 s  ]   [        4.0 s        ]


(%i85) "Punkt stuetzE_BCS"$

(%i86) stuetzE_BCS : transpose(matrix ([-3.0,3.0,0.0]));
                                 [ - 3.0 ]
                                 [       ]
(%o86)                           [  3.0  ]
                                 [       ]
                                 [  0.0  ]

(%i87) "Punkt E_BCSp2"$

(%i88) E_BCSp2 : transpose(matrix ([3.0,3.0,0.0]));
                                  [ 3.0 ]
                                  [     ]
(%o88)                            [ 3.0 ]
                                  [     ]
                                  [ 0.0 ]

(%i89) "Punkt E_BCSp3"$
```



```
(%i90) E_BCSp3 : transpose(matrix ([0.0,0.0,4.0]));
                                  [ 0.0 ]
                                  [     ]
(%o90)                            [ 0.0 ]
                                  [     ]
                                  [ 4.0 ]

(%i91) "Vektor uvecE_BCS"$

(%i92) uvecE_BCS : transpose(matrix ([3.0,3.0,0.0])) - transpose(matrix ([-3.0,3.0,0.0]));
                                  [ 6.0 ]
                                  [     ]
(%o92)                            [ 0.0 ]
                                  [     ]
                                  [ 0.0 ]

(%i93) "Vektor vvecE_BCS"$

(%i94) vvecE_BCS : transpose(matrix ([0.0,0.0,4.0])) - transpose(matrix ([-3.0,3.0,0.0]));
                                 [  3.0  ]
                                 [       ]
(%o94)                           [ - 3.0 ]
                                 [       ]
                                 [  4.0  ]

(%i95) "Ebene E_BCS"$

(%i96) E_BCS : stuetzE_BCS + r * uvecE_BCS + s * vvecE_BCS;
                           [ 3.0 s + 6.0 r - 3.0 ]
                           [                     ]
(%o96)                     [     3.0 - 3.0 s     ]
                           [                     ]
                           [        4.0 s        ]

(%i97) "x-Vektor xvec"$

(%i98) xvec : transpose(matrix ([x,y,z]));
                                  [ x ]
                                  [   ]
(%o98)                            [ y ]
                                  [   ]
                                  [ z ]

(%i99) E_BCS : addcol(matrix([]),xvec - stuetzE_BCS,uvecE_BCS,vvecE_BCS)$

(%i100) detE_BCS : determinant( E_BCS );
(%o100)                  - 6.0 (3.0 z + 4.0 (y - 3.0))

(%i101) "Normalenvektor nvecE_BCS"$

(%i102) nvecE_BCS : transpose(coefmatrix([detE_BCS],[x,y,z]));

                                  [  0   ]
                                  [      ]
(%o102)                           [ - 24 ]
                                  [      ]
                                  [ - 18 ]

(%i103) dE_BCS : (-1) *determinant( col(augcoefmatrix([detE_BCS],[x,y,z]),4) );

(%o103)                            - 72.0
```

```
(%i104) koordinatenform(x,n,d) := (print( x . n  = d) )$


(%i105) "Koordinatenform"$

(%i106) koordinatenform(xvec,nvecE_BCS,dE_BCS)$
- 18 z - 24 y = - 72.0

(%i107)
```