

[O19-093

[> **restart:**

[> **P1:=(x,y,z)->l*(x+y-a*sqrt(2))+(z+a);**

P2:=(x,y,z)->l*(x-y+b*sqrt(2))+(z-b);

P3:=(x,y,z)->l*(x)+(z+c);

$$P1 := (x, y, z) \rightarrow l(x + y - a\sqrt{2}) + z + a$$

$$P2 := (x, y, z) \rightarrow l(x - y + b\sqrt{2}) + z - b$$

$$P3 := (x, y, z) \rightarrow lx + z + c$$

[> **s1:=solve(P1(alpha,beta,gamma),{l});pp1:=subs(s1,P1(x,y,z));**

s2:=solve(P2(alpha,beta,gamma),{l});pp2:=subs(s2,P2(x,y,z));

s3:=solve(P3(alpha,beta,gamma),{l});pp3:=subs(s3,P3(x,y,z));

$$s1 := \{l = \frac{\gamma + a}{-\alpha - \beta + a\sqrt{2}}\}$$

$$pp1 := \frac{(\gamma + a)(x + y - a\sqrt{2})}{-\alpha - \beta + a\sqrt{2}} + z + a$$

$$s2 := \{l = \frac{-\gamma + b}{\alpha - \beta + b\sqrt{2}}\}$$

$$pp2 := \frac{(-\gamma + b)(x - y + b\sqrt{2})}{\alpha - \beta + b\sqrt{2}} + z - b$$

$$s3 := \{l = -\frac{\gamma + c}{\alpha}\}$$

$$pp3 := -\frac{(\gamma + c)x}{\alpha} + z + c$$

[> **with(LinearAlgebra):**

[> **ddet:=Matrix([[(gamma+a)/(-alpha-beta+a*sqrt(2)), (gamma+a)/(-alpha-beta+a*sqrt(2)), 1], [(-gamma+b)/(alpha-beta+b*sqrt(2)), -(-gamma+b)/(alpha-beta+b*sqrt(2)), 1], [-(gamma+c)/alpha, 0, 1]]);**

$$ddet := \begin{bmatrix} \frac{\gamma + a}{-\alpha - \beta + a\sqrt{2}} & \frac{\gamma + a}{-\alpha - \beta + a\sqrt{2}} & 1 \\ \frac{-\gamma + b}{\alpha - \beta + b\sqrt{2}} & -\frac{-\gamma + b}{\alpha - \beta + b\sqrt{2}} & 1 \\ -\frac{\gamma + c}{\alpha} & 0 & 1 \end{bmatrix}$$

[> **surf:=Determinant(ddet);**

$$surf := -(\alpha\gamma b - \alpha\gamma a + 2\alpha ab + \gamma^2 b\sqrt{2} - \gamma a\beta + 2\gamma ab\sqrt{2} - \gamma^2 a\sqrt{2} - \gamma b\beta + 2c\gamma\alpha + c\gamma b\sqrt{2} + ca\alpha - ca\beta + 2cab\sqrt{2} - c\gamma a\sqrt{2} - cb\alpha - cb\beta) / (\alpha(-\alpha - \beta + a\sqrt{2})(\alpha - \beta + b\sqrt{2}))$$

[> **ssurf:=simplify(subs({a=1,b=sqrt(6)/2,c=sqrt(2)},surf));nops(ssurf);surff:=op(2,ssurf);**

$$ssurf := -(\alpha\gamma\sqrt{2}\sqrt{3} - 2\alpha\gamma + 2\alpha\sqrt{2}\sqrt{3} + 2\gamma^2\sqrt{3} - 2\gamma\beta + 4\gamma\sqrt{3} - 2\gamma^2\sqrt{2})$$

$$\frac{-\gamma\sqrt{2}\sqrt{3}\beta + 4\sqrt{2}\gamma\alpha + 2\gamma\sqrt{2}\sqrt{3} + 2\sqrt{2}\alpha - 2\sqrt{2}\beta + 4\sqrt{2}\sqrt{3} - 4\gamma - 2\sqrt{3}\alpha - 2\sqrt{3}\beta}{(2\alpha(-\alpha - \beta + \sqrt{2})(\alpha - \beta + \sqrt{3}))}$$

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$$\text{surff} := \alpha\gamma\sqrt{2}\sqrt{3} - 2\alpha\gamma + 2\alpha\sqrt{2}\sqrt{3} + 2\gamma^2\sqrt{3} - 2\gamma\beta + 4\gamma\sqrt{3} - 2\gamma^2\sqrt{2} - \gamma\sqrt{2}\sqrt{3}\beta + 4\sqrt{2}\gamma\alpha + 2\gamma\sqrt{2}\sqrt{3} + 2\sqrt{2}\alpha - 2\sqrt{2}\beta + 4\sqrt{2}\sqrt{3} - 4\gamma - 2\sqrt{3}\alpha - 2\sqrt{3}\beta$$

> with(plots):

> d1:=implicitplot3d(surff,alpha=-5..5,beta=-5..5,gamma=-5..5, numoints=1000):

> m1:=[3*sqrt(2),-2*sqrt(2),-1];m2:=[-2*sqrt(2),3*sqrt(2),-1];d2:=spacecurve([m1,m2],color=red,thickness=5):

n1:=[-3*sqrt(3),-2*sqrt(3),sqrt(6)/2];n2:=[2*sqrt(3),3*sqrt(3),sqrt(6)/2];d3:=spacecurve([n1,n2],color=cyan,thickness=5):

p1:=[0,-3,-sqrt(2)];p2:=[0,3,-sqrt(2)];d4:=spacecurve([p1,p2],color=pink,thickness=5):

display({d1,d2,d3,d4});

$$m1 := [3\sqrt{2}, -2\sqrt{2}, -1]$$

$$m2 := [-2\sqrt{2}, 3\sqrt{2}, -1]$$

$$n1 := \left[-3\sqrt{3}, -2\sqrt{3}, \frac{\sqrt{6}}{2} \right]$$

$$n2 := \left[2\sqrt{3}, 3\sqrt{3}, \frac{\sqrt{6}}{2} \right]$$

$$p1 := [0, -3, -\sqrt{2}]$$

$$p2 := [0, 3, -\sqrt{2}]$$

