

(* PLACI CURBE COONS *)

In[1]:= $\mathbf{a} = \{0, 0, 1\}$; $\mathbf{b} = \{1, 1, 1\}$; $\mathbf{c} = \{-1, 0, 2\}$; $\mathbf{d} = \{-1, -1, 0\}$;

In[2]:= $\text{Det}[\{\mathbf{b} - \mathbf{a}, \mathbf{c} - \mathbf{a}, \mathbf{d} - \mathbf{a}\}]$

Out[2]= - 1

In[3]:= $\mathbf{Pa} = \text{Graphics3D}[\{\text{PointSize}[\text{Large}], \text{Red}, \text{Point}[\mathbf{a}]\}]$;

$\mathbf{Pb} = \text{Graphics3D}[\{\text{PointSize}[\text{Large}], \text{Red}, \text{Point}[\mathbf{b}]\}]$;

$\mathbf{Pc} = \text{Graphics3D}[\{\text{PointSize}[\text{Large}], \text{Red}, \text{Point}[\mathbf{c}]\}]$;

$\mathbf{Pd} = \text{Graphics3D}[\{\text{PointSize}[\text{Large}], \text{Red}, \text{Point}[\mathbf{d}]\}]$;

In[7]:= $\mathbf{v1a} = \{1, 0, 0\}$; $\mathbf{v1b} = \{1, 0, 0\}$; $\mathbf{v2c} = \{0, 0, 1\}$; $\mathbf{v2d} = \{0, 1, 1\}$;

$\mathbf{v4a} = \{0, 1, 0\}$;

$\mathbf{v3b} = \{1, 1, 0\}$;

$\mathbf{v4c} = \{0, 1, 0\}$;

$\mathbf{v3d} = \{0, 0, 1\}$;

In[9]:= $\mathbf{H0}[t_]:=1-3t^2+2t^3$

$\mathbf{H1}[t_]:=3t^2-2t^3$

In[11]:= $\mathbf{Hb0}[t_]:=t-2t^2+t^3$

$\mathbf{Hb1}[t_]:=t^3-t^2$

In[13]:= $\mathbf{\gamma1}[t_]:= \mathbf{H0}[t] \mathbf{a} + \mathbf{H1}[t] \mathbf{b} + \mathbf{Hb0}[t] \mathbf{v1a} + \mathbf{Hb1}[t] \mathbf{v1b}$

$\mathbf{\gamma2}[t_]:= \mathbf{H0}[t] \mathbf{c} + \mathbf{H1}[t] \mathbf{d} + \mathbf{Hb0}[t] \mathbf{v2c} + \mathbf{Hb1}[t] \mathbf{v2d}$

$\mathbf{\gamma3}[t_]:= \mathbf{H0}[t] \mathbf{b} + \mathbf{H1}[t] \mathbf{d} + \mathbf{Hb0}[t] \mathbf{v3b} + \mathbf{Hb1}[t] \mathbf{v3d}$

$\mathbf{\gamma4}[t_]:= \mathbf{H0}[t] \mathbf{a} + \mathbf{H1}[t] \mathbf{c} + \mathbf{Hb0}[t] \mathbf{v4a} + \mathbf{Hb1}[t] \mathbf{v4c}$

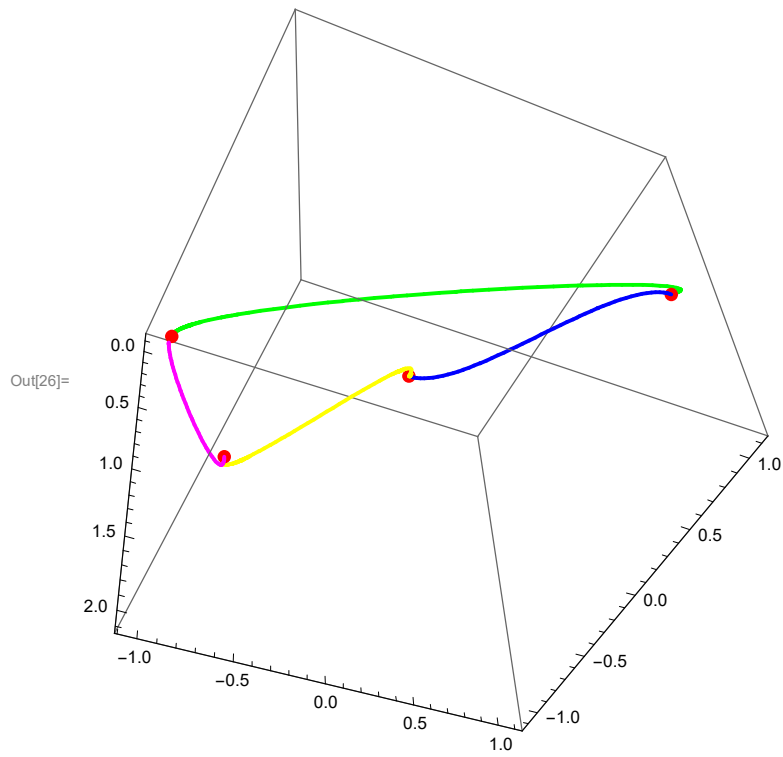
In[17]:= $\mathbf{g1} = \text{ParametricPlot3D}[\mathbf{\gamma1}[t], \{t, 0, 1\}, \text{PlotStyle} \rightarrow \text{Blue}]$;

$\mathbf{g2} = \text{ParametricPlot3D}[\mathbf{\gamma2}[t], \{t, 0, 1\}, \text{PlotStyle} \rightarrow \text{Magenta}]$;

$\mathbf{g3} = \text{ParametricPlot3D}[\mathbf{\gamma3}[t], \{t, 0, 1\}, \text{PlotStyle} \rightarrow \text{Green}]$;

$\mathbf{g4} = \text{ParametricPlot3D}[\mathbf{\gamma4}[t], \{t, 0, 1\}, \text{PlotStyle} \rightarrow \text{Yellow}]$;

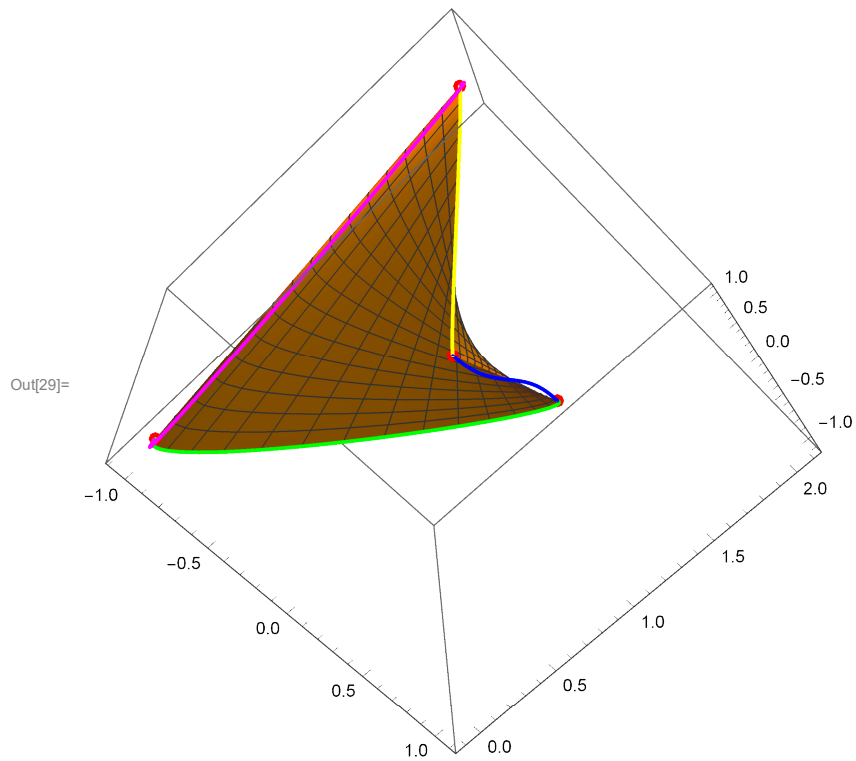
In[26]:= Show[g1, Pa, Pb, g2, Pc, Pd, g3, g4]



In[27]:= $r2[u_, v_] := (1 - v) \gamma_4[u] + v \gamma_3[u]$

In[28]:= S2 = ParametricPlot3D[r2[u, v], {u, 0, 1}, {v, 0, 1}, PlotStyle -> Orange];

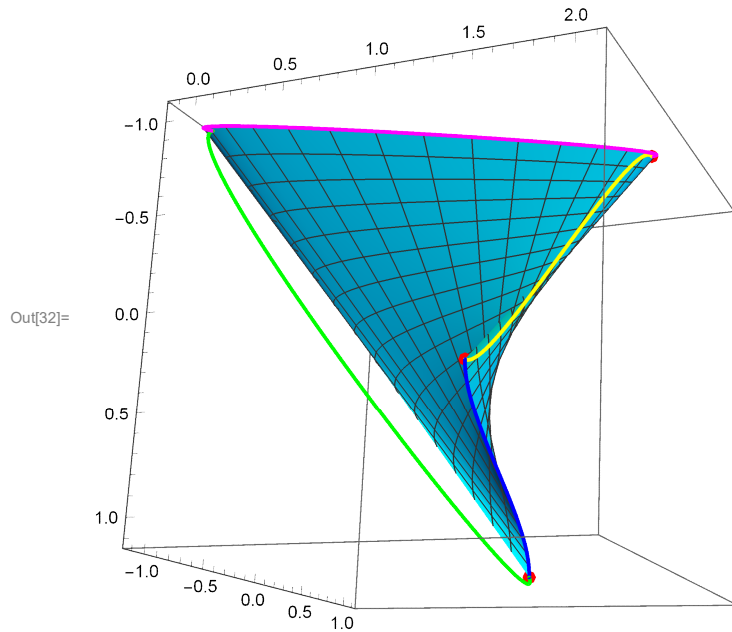
In[29]:= Show[S2, Pa, Pb, Pc, Pd, g1, g2, g3, g4]



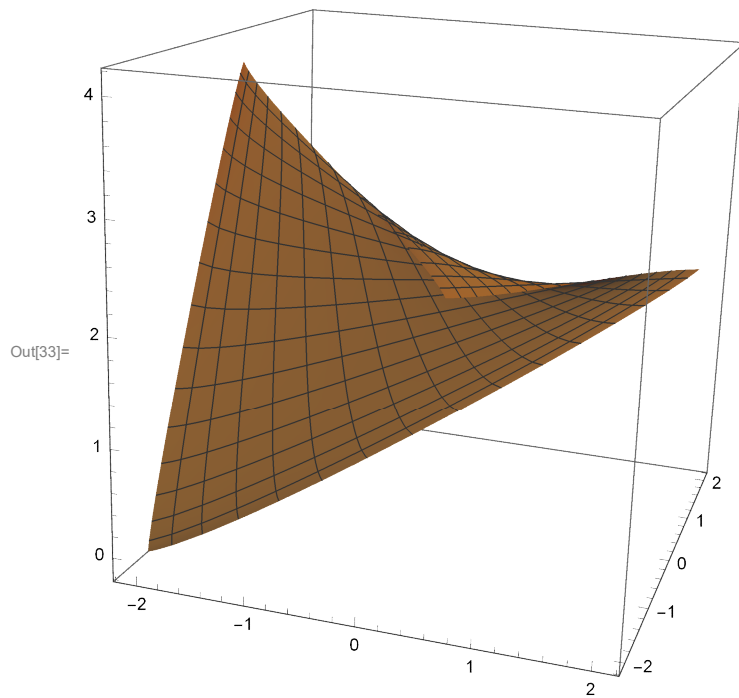
In[30]:= $\mathbf{r1}[u_ , v_] := (1 - u) \mathbf{r1}[v] + u \mathbf{r2}[v]$

In[31]:= S1 = ParametricPlot3D[r1[u, v], {u, 0, 1}, {v, 0, 1}, PlotStyle → Cyan];

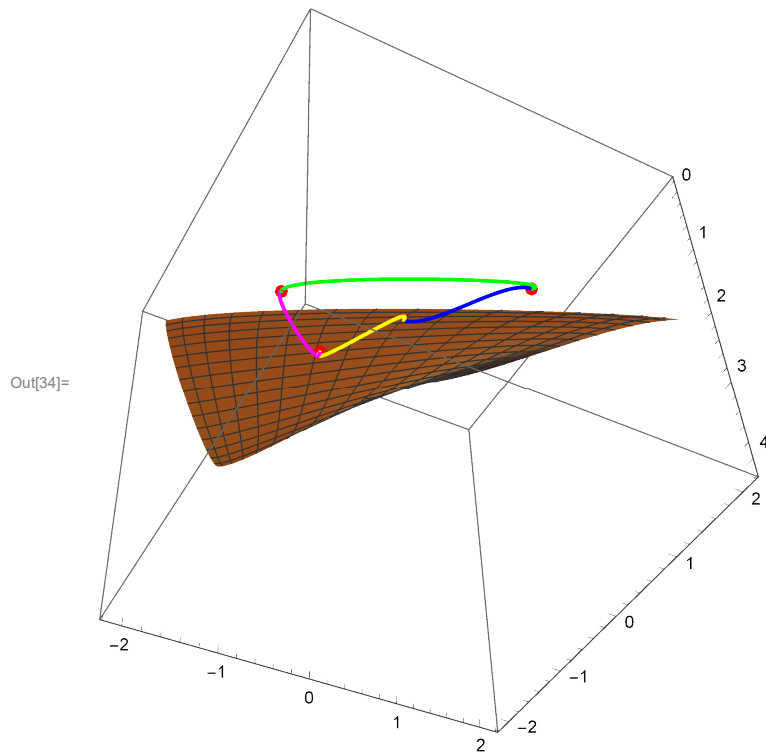
In[32]:= Show[S1, Pa, Pb, Pc, Pd, g1, g2, g3, g4]



In[33]:= **S12 = ParametricPlot3D[r1[u, v] + r2[u, v], {u, 0, 1}, {v, 0, 1}, PlotStyle → Brown]**

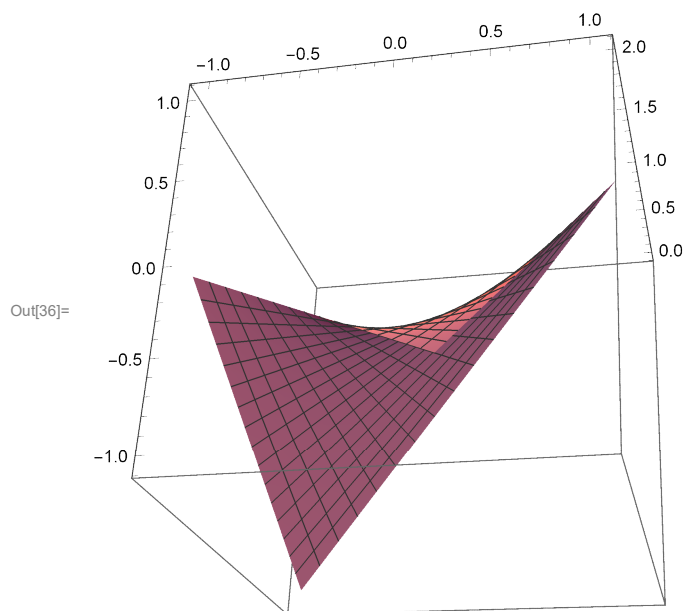


In[34]:= **Show[S12, Pa, Pb, Pc, Pd, g1, g2, g3, g4]**



In[35]:= **r3[u_, v_] := (1 - v) r1[u, 0] + v r1[u, 1]**

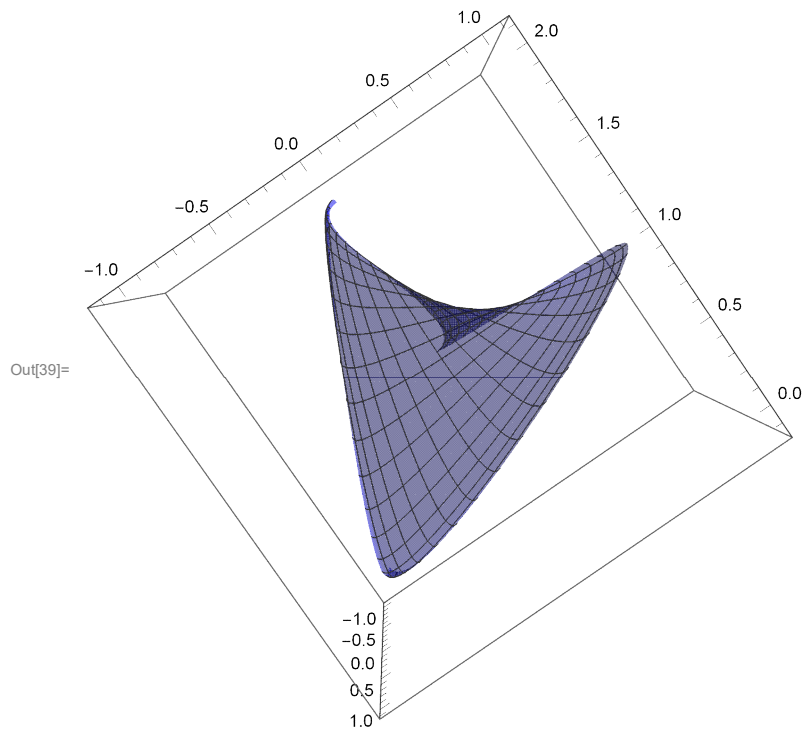
In[36]:= **S03 = ParametricPlot3D[r3[u, v], {u, 0, 1}, {v, 0, 1}, PlotStyle → Pink]**



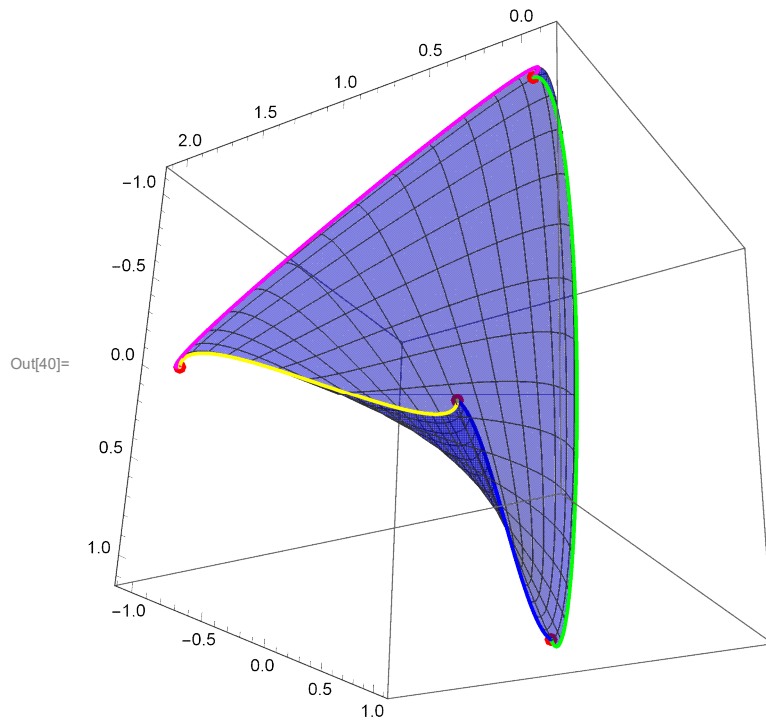
In[37]:= **(***
r3[u, v] - (1 - u) r2[0, v] - u r2[1, v] // Simplify
{0, 0, 0}
***)**

In[38]:= **Coons[u_, v_] := r1[u, v] + r2[u, v] - r3[u, v]**

In[39]:= **S3 = ParametricPlot3D[Coons[u, v], {u, 0, 1}, {v, 0, 1}, PlotStyle → {Blue, Opacity[0.5]}]**



In[40]:= **Show[S3, Pa, Pb, Pc, Pd, g1, g2, g3, g4]**



In[41]:= **Expand[Coons[u, v]]**

Out[41]= $\left\{ -3u^2 + 2u^3 + v + uv - 5u^2v + 3u^3v, u - 3u^2 + 2u^3 + 2uv - 5u^2v + 3u^3v + 3v^2 - 7uv^2 - 2v^3 + 5uv^3, \right.$
 $\left. 1 + 3u^2 - 2u^3 + 3uv - 7u^2v + 5u^3v - 9uv^2 + 6uv^3 \right\}$