Example a = $q3^2\ s_2$

```
DataFile["FinalSingularityA.txt"];
FKin[]; SimplifyTrigNotation[];
J11 = FullSimplify[J[[1 ;; 3]]];
J11 // MatrixForm (*velocity component*)
FullSimplify[Det[J11]]
```

Joint	Type	a	α	d	θ
1	revolute	0	-Pi/2.	0	q1
2	revolute	0	-Pi/2.	0	q2
3	prismatic	0	0	q3	0

Jacobian J(6x3)

$$\begin{pmatrix} q3\ s_1\ s_2 & -q3\ c_1\ c_2 & -c_1\ s_2 \\ -q3\ c_1\ s_2 & -q3\ c_2\ s_1 & -s_1\ s_2 \\ 0 & q3\ s_2 & -c_2 \end{pmatrix}$$

$q3^2\ s_2$

Example E = q2 c_3 AS EXAMPLE

```
DataFile["FinalSingularityE.txt"];
FKin[]; SimplifyTrigNotation[];
J11 = FullSimplify[J[[1 ;; 3]]];
J11 // MatrixForm (*velocity component*)
FullSimplify[Det[J11]]
```

Joint	Type	a	α	d	θ
1	revolute	0	-Pi/2.	0	q1
2	prismatic	0	0	q2	0
3	revolute	1	0	0	q3

Jacobian J(6x3)

$$\begin{pmatrix} -q2\ c_1 - c_3\ s_1 & -s_1 & -c_1\ s_3 \\ c_1\ c_3 - q2\ s_1 & c_1 & -s_1\ s_3 \\ 0 & 0 & -c_3 \end{pmatrix}$$

$q2\ c_3$

Example F = $\text{Cos}\left[\frac{q3}{2}\right]^2 (2\, c_2\, c_3 - 2\, (1 + c_2)\, s_3)$ TOO Hard...

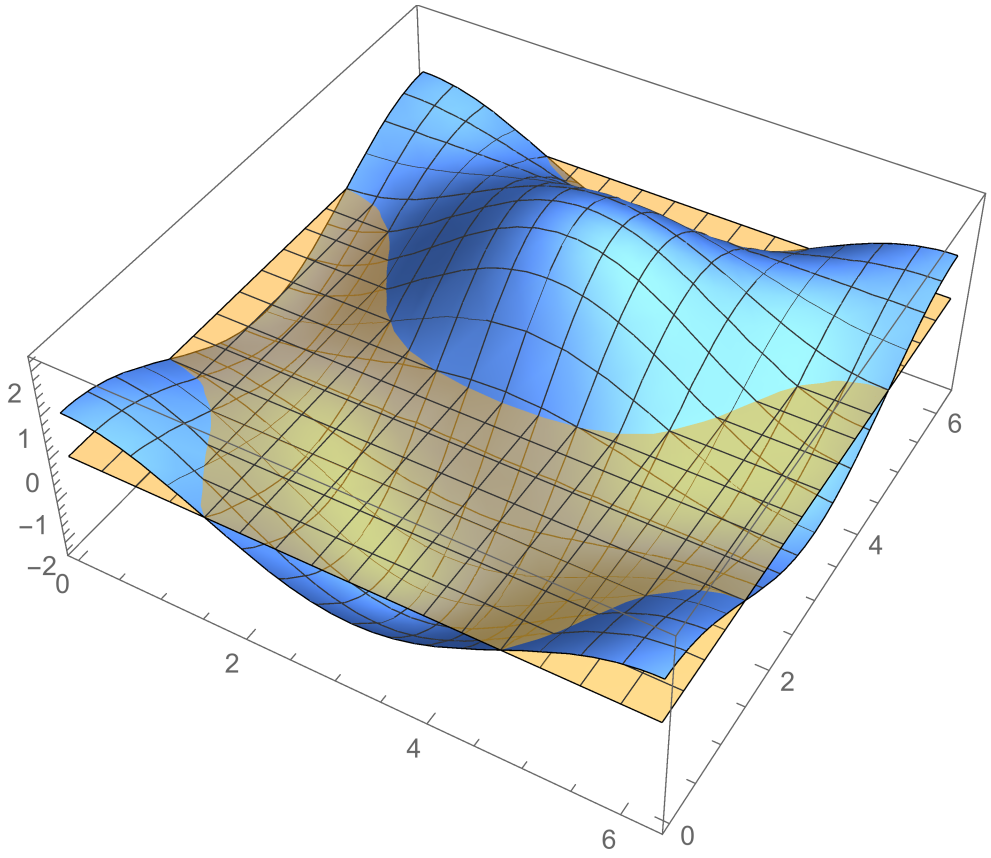
```
DataFile["FinalSingularityF.txt"];
FKin[]; SimplifyTrigNotation[];
J11 = FullSimplify[J[[1 ;; 3]]];
J11 // MatrixForm (*velocity component*)
FullSimplify[Det[J11]]
```

Joint	Type	a	α	d	θ
1	revolute	1	Pi/2.	0	q1
2	revolute	1	Pi/2.	1	q2
3	revolute	1	0	0	q3

Jacobian J(6x3)

$$\begin{pmatrix} -(1 + c_2\,(1 + c_3))\, s_1 + c_1\,(1 + s_3) & -2\, c_1\, \text{Cos}\left[\frac{q3}{2}\right]^2 s_2 & c_3\, s_1 - c_1\, \\ c_1\,(1 + c_2\,(1 + c_3)) + s_1\,(1 + s_3) & -2\, \text{Cos}\left[\frac{q3}{2}\right]^2 s_1\, s_2 & -c_1\, c_3 - c_2 \\ 0 & c_2\,(1 + c_3) & -s_2\, s_3 \end{pmatrix}$$

$$\text{Cos}\left[\frac{q3}{2}\right]^2 (2\, c_2\, c_3 - 2\, (1 + c_2)\, s_3)$$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2
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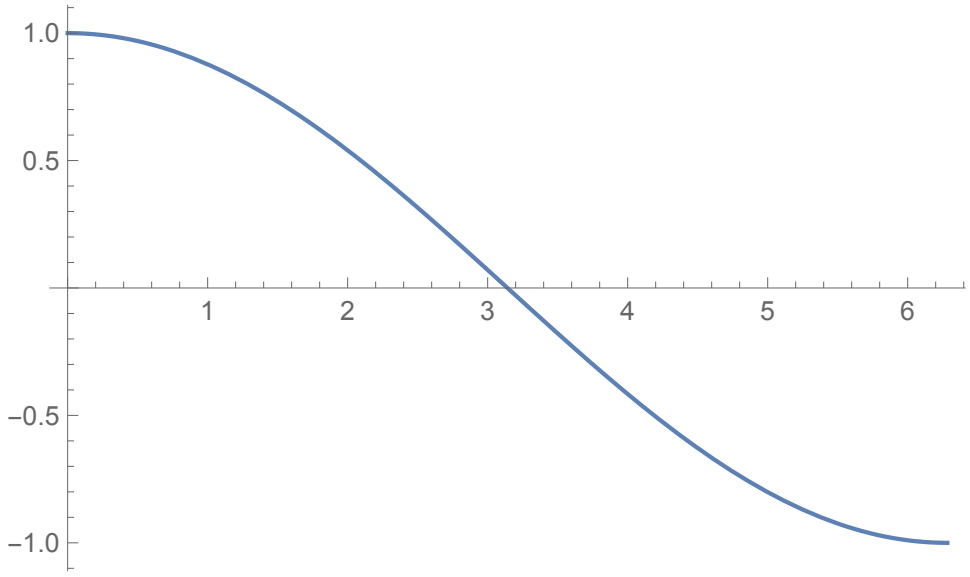
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0.5
−0.5
−1.0
1
2
3
4
5
6