

[> restart

R11

```

[> restart
> Req := eq =  $\frac{Vr1}{Is}$  :
> r1 := Is =  $\frac{Vr1 - Vc1}{R11} + \frac{Vr1 - Vc2}{R12} + \frac{Vr1 - Vc3}{R13}$  :
> r2 := 0 =  $\frac{Vr2 - Vc1}{R21} + \frac{Vr2 - Vc2}{R22} + \frac{Vr2 - Vc3}{R23}$  :
> r3 := 0 =  $\frac{Vr3 - Vc1}{R31} + \frac{Vr3 - Vc2}{R32} + \frac{Vr3 - Vc3}{R33}$  :
>
> c2 := 0 =  $\frac{Vc2 - Vr1}{R12} + \frac{Vc2 - Vr2}{R22} + \frac{Vc2 - Vr3}{R32}$  :
> c3 := 0 =  $\frac{Vc3 - Vr1}{R13} + \frac{Vc3 - Vr2}{R23} + \frac{Vc3 - Vr3}{R33}$  :
> Vc1 := 0 :
>
> L := solve( {Req, r1, r2, r3, c2, c3}, [eq, Vr1, Vr2, Vr3, Vc2, Vc3])[[1][1]
L := eq = ((R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33
           + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R23 R31
           + R12 R13 R23 R32 + R32 R31 R13 R12 + R33 R31 R13 R12 + R12 R13 R32 R33
           + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 + R12 R21 R23 R33
           + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 + R12 R22 R23 R31
           + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33
           + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 + R13 R21 R23 R32
           + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 + R13 R22 R23 R31
           + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 + R13 R22 R32 R33
           + R21 R22 R31 R32 + R21 R22 R31 R33 + R21 R22 R32 R33 + R21 R23 R31 R32
           + R21 R23 R31 R33 + R21 R23 R32 R33 + R22 R23 R31 R32 + R22 R23 R31 R33
           + R22 R23 R32 R33) R11) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32
           + R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33
           + R11 R12 R23 R31 + R11 R12 R23 R32 + R32 R31 R12 R11 + R11 R12 R31 R33
           + R33 R32 R12 R11 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32
           + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33
           + R11 R13 R23 R31 + R11 R13 R23 R32 + R32 R31 R13 R11 + R33 R31 R13 R11
           + R33 R32 R13 R11 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32
           + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32
           + R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33
           + R11 R23 R32 R33) (1.1)

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$$\begin{aligned}
& + R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 \\
& + R12 R13 R21 R33 + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 \\
& + R12 R13 R23 R31 + R12 R13 R23 R32 + R32 R31 R13 R12 + R33 R31 R13 R12 \\
& + R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 \\
& + R12 R21 R23 R33 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 \\
& + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 \\
& + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 \\
& + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 \\
& + R13 R22 R32 R33 + R21 R22 R31 R32 + R21 R22 R31 R33 + R21 R22 R32 R33 \\
& + R21 R23 R31 R32 + R21 R23 R31 R33 + R21 R23 R32 R33 + R22 R23 R31 R32 \\
& + R22 R23 R31 R33 + R22 R23 R32 R33)
\end{aligned}$$

> $Req11 := eq = \frac{R11 \cdot Rx11}{R11 + Rx11} :$

> $solve(\{L, Req11\}, [Rx11, eq])[1][1]$

$$\begin{aligned}
Rx11 = & (R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33 \\
& + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R23 R31 \\
& + R12 R13 R23 R32 + R32 R31 R13 R12 + R33 R31 R13 R12 + R12 R13 R32 R33 \\
& + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 + R12 R21 R23 R33 \\
& + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 + R12 R22 R23 R31 \\
& + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33 \\
& + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 + R13 R21 R23 R32 \\
& + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 + R13 R22 R23 R31 \\
& + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 + R13 R22 R32 R33 \\
& + R21 R22 R31 R32 + R21 R22 R31 R33 + R21 R22 R32 R33 + R21 R23 R31 R32 \\
& + R21 R23 R31 R33 + R21 R23 R32 R33 + R22 R23 R31 R32 + R22 R23 R31 R33 \\
& + R22 R23 R32 R33) / (R12 R21 R22 + R12 R21 R23 + R12 R21 R32 + R12 R21 R33 \\
& + R12 R22 R23 + R12 R22 R31 + R12 R22 R33 + R12 R23 R31 + R12 R23 R32 \\
& + R32 R31 R12 + R33 R31 R12 + R33 R32 R12 + R13 R21 R22 + R13 R21 R23 \\
& + R13 R21 R32 + R13 R21 R33 + R13 R22 R23 + R13 R22 R31 + R13 R22 R33 \\
& + R13 R23 R31 + R13 R23 R32 + R32 R31 R13 + R33 R31 R13 + R33 R32 R13 \\
& + R21 R22 R32 + R21 R22 R33 + R21 R23 R32 + R21 R23 R33 + R22 R23 R32 \\
& + R22 R23 R33 + R22 R31 R32 + R22 R31 R33 + R22 R32 R33 + R23 R31 R32 \\
& + R23 R31 R33 + R23 R32 R33)
\end{aligned} \tag{1.2}$$

> $assign(1.2)$

> $R11 = \frac{MR11 \cdot Rx11}{Rx11 - MR11}$

$$R11 = (MR11 (R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33)) \tag{1.3}$$

$$\begin{aligned}
& + R_{12}R_{13}R_{22}R_{23} + R_{12}R_{13}R_{22}R_{31} + R_{12}R_{13}R_{22}R_{33} + R_{12}R_{13}R_{23}R_{31} \\
& + R_{12}R_{13}R_{23}R_{32} + R_{32}R_{31}R_{13}R_{12} + R_{33}R_{31}R_{13}R_{12} + R_{12}R_{13}R_{32}R_{33} \\
& + R_{12}R_{21}R_{22}R_{31} + R_{12}R_{21}R_{22}R_{33} + R_{12}R_{21}R_{23}R_{31} + R_{12}R_{21}R_{23}R_{33} \\
& + R_{12}R_{21}R_{31}R_{32} + R_{12}R_{21}R_{31}R_{33} + R_{12}R_{21}R_{32}R_{33} + R_{12}R_{22}R_{23}R_{31} \\
& + R_{12}R_{22}R_{23}R_{33} + R_{12}R_{23}R_{31}R_{32} + R_{12}R_{23}R_{31}R_{33} + R_{12}R_{23}R_{32}R_{33} \\
& + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{22}R_{32} + R_{13}R_{21}R_{23}R_{31} + R_{13}R_{21}R_{23}R_{32} \\
& + R_{13}R_{21}R_{31}R_{32} + R_{13}R_{21}R_{31}R_{33} + R_{13}R_{21}R_{32}R_{33} + R_{13}R_{22}R_{23}R_{31} \\
& + R_{13}R_{22}R_{23}R_{32} + R_{13}R_{22}R_{31}R_{32} + R_{13}R_{22}R_{31}R_{33} + R_{13}R_{22}R_{32}R_{33} \\
& + R_{21}R_{22}R_{31}R_{32} + R_{21}R_{22}R_{31}R_{33} + R_{21}R_{22}R_{32}R_{33} + R_{21}R_{23}R_{31}R_{32} \\
& + R_{21}R_{23}R_{31}R_{33} + R_{21}R_{23}R_{32}R_{33} + R_{22}R_{23}R_{31}R_{32} + R_{22}R_{23}R_{31}R_{33} \\
& + R_{22}R_{23}R_{32}R_{33}) \Big/ ((R_{12}R_{21}R_{22} + R_{12}R_{21}R_{23} + R_{12}R_{21}R_{32} + R_{12}R_{21}R_{33} \\
& + R_{12}R_{22}R_{23} + R_{12}R_{22}R_{31} + R_{12}R_{22}R_{33} + R_{12}R_{23}R_{31} + R_{12}R_{23}R_{32} \\
& + R_{32}R_{31}R_{12} + R_{33}R_{31}R_{12} + R_{33}R_{32}R_{12} + R_{13}R_{21}R_{22} + R_{13}R_{21}R_{23} \\
& + R_{13}R_{21}R_{32} + R_{13}R_{21}R_{33} + R_{13}R_{22}R_{23} + R_{13}R_{22}R_{31} + R_{13}R_{22}R_{33} \\
& + R_{13}R_{23}R_{31} + R_{13}R_{23}R_{32} + R_{32}R_{31}R_{13} + R_{33}R_{31}R_{13} + R_{33}R_{32}R_{13} \\
& + R_{21}R_{22}R_{32} + R_{21}R_{22}R_{33} + R_{21}R_{23}R_{32} + R_{21}R_{23}R_{33} + R_{22}R_{23}R_{32} \\
& + R_{22}R_{23}R_{33} + R_{22}R_{31}R_{32} + R_{22}R_{31}R_{33} + R_{22}R_{32}R_{33} + R_{23}R_{31}R_{32} \\
& + R_{23}R_{31}R_{33} + R_{23}R_{32}R_{33}) ((R_{12}R_{13}R_{21}R_{22} + R_{12}R_{13}R_{21}R_{23} \\
& + R_{12}R_{13}R_{21}R_{32} + R_{12}R_{13}R_{21}R_{33} + R_{12}R_{13}R_{22}R_{23} + R_{12}R_{13}R_{22}R_{31} \\
& + R_{12}R_{13}R_{22}R_{33} + R_{12}R_{13}R_{23}R_{31} + R_{12}R_{13}R_{23}R_{32} + R_{32}R_{31}R_{13}R_{12} \\
& + R_{33}R_{31}R_{13}R_{12} + R_{12}R_{13}R_{32}R_{33} + R_{12}R_{21}R_{22}R_{31} + R_{12}R_{21}R_{22}R_{33} \\
& + R_{12}R_{21}R_{23}R_{31} + R_{12}R_{21}R_{23}R_{33} + R_{12}R_{21}R_{31}R_{32} + R_{12}R_{21}R_{31}R_{33} \\
& + R_{12}R_{21}R_{32}R_{33} + R_{12}R_{22}R_{23}R_{31} + R_{12}R_{22}R_{23}R_{33} + R_{12}R_{23}R_{31}R_{32} \\
& + R_{12}R_{23}R_{31}R_{33} + R_{12}R_{23}R_{32}R_{33} + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{22}R_{32} \\
& + R_{13}R_{21}R_{23}R_{31} + R_{13}R_{21}R_{23}R_{32} + R_{13}R_{21}R_{31}R_{32} + R_{13}R_{21}R_{31}R_{33} \\
& + R_{13}R_{21}R_{32}R_{33} + R_{13}R_{22}R_{23}R_{31} + R_{13}R_{22}R_{23}R_{32} + R_{13}R_{22}R_{31}R_{32} \\
& + R_{13}R_{22}R_{31}R_{33} + R_{13}R_{22}R_{32}R_{33} + R_{21}R_{22}R_{31}R_{32} + R_{21}R_{22}R_{31}R_{33} \\
& + R_{21}R_{22}R_{32}R_{33} + R_{21}R_{23}R_{31}R_{32} + R_{21}R_{23}R_{31}R_{33} + R_{21}R_{23}R_{32}R_{33} \\
& + R_{22}R_{23}R_{31}R_{32} + R_{22}R_{23}R_{31}R_{33} + R_{22}R_{23}R_{32}R_{33}) \Big/ ((R_{12}R_{21}R_{22} \\
& + R_{12}R_{21}R_{23} + R_{12}R_{21}R_{32} + R_{12}R_{21}R_{33} + R_{12}R_{22}R_{23} + R_{12}R_{22}R_{31} \\
& + R_{12}R_{22}R_{33} + R_{12}R_{23}R_{31} + R_{12}R_{23}R_{32} + R_{32}R_{31}R_{12} + R_{33}R_{31}R_{12} \\
& + R_{33}R_{32}R_{12} + R_{13}R_{21}R_{22} + R_{13}R_{21}R_{23} + R_{13}R_{21}R_{32} + R_{13}R_{21}R_{33})
\end{aligned}$$

$$\begin{aligned}
& + R13 R22 R23 + R13 R22 R31 + R13 R22 R33 + R13 R23 R31 + R13 R23 R32 \\
& + R32 R31 R13 + R33 R31 R13 + R33 R32 R13 + R21 R22 R32 + R21 R22 R33 \\
& + R21 R23 R32 + R21 R23 R33 + R22 R23 R32 + R22 R23 R33 + R22 R31 R32 \\
& + R22 R31 R33 + R22 R32 R33 + R23 R31 R32 + R23 R31 R33 + R23 R32 R33) - MR11) \\
&)
\end{aligned}$$

> *simplify(1.3)*

$$\begin{aligned}
R11 = & (MR11 (((R22 + R23 + R32 + R33) R21 + (R22 + R23 + R32 + R33) R31 + (R23 \\
& + R33) (R22 + R32)) R13 + ((R22 + R23 + R32 + R33) R31 + R33 (R22 + R23 \\
& + R32)) R21 + R23 ((R22 + R32 + R33) R31 + R33 (R22 + R32))) R12 + (((R22 \\
& + R23 + R32 + R33) R31 + R32 (R22 + R23 + R33)) R21 + R22 ((R23 + R32 \\
& + R33) R31 + R32 (R23 + R33))) R13 + ((R22 + R23) R21 + R22 R23) ((R32 \\
& + R33) R31 + R33 R32))) / (((((R22 + R23 + R32 + R33) R21 + (R22 + R23 + R32 \\
& + R33) R31 + (R23 + R33) (R22 + R32)) R13 + ((R22 + R23 + R32 + R33) R31 \\
& + (R33 - MR11) R22 + (R33 - MR11) R23 + (R33 - MR11) R32 - R33 MR11) R21 \\
& + ((R23 - MR11) R22 + (R32 + R33 - MR11) R23 - MR11 (R32 + R33)) R31 + (R22 \\
& + R32) ((R33 - MR11) R23 - R33 MR11)) R12 + (((R22 + R23 + R32 + R33) R31 \\
& + (R32 - MR11) R22 + (R32 - MR11) R23 + (R33 - MR11) R32 - R33 MR11) R21 \\
& + ((R23 + R32 + R33 - MR11) R22 - MR11 (R23 + R32 + R33)) R31 + (R23 \\
& + R33) ((R32 - MR11) R22 - R32 MR11)) R13 + (R22 + R23) ((R32 + R33) R31 \\
& + (R33 - MR11) R32 - R33 MR11) R21 + (R32 + R33) ((R23 - MR11) R22 \\
& - R23 MR11) R31 + (((R33 - MR11) R32 - R33 MR11) R23 - R32 R33 MR11) R22 \\
& - MR11 R23 R32 R33)
\end{aligned} \quad (1.4)$$

R12

$$\begin{aligned}
& > \text{restart} \\
& > Req := eq = \frac{Vr1}{Is} : \\
& > r1 := Is = \frac{Vr1 - Vc1}{R11} + \frac{Vr1 - Vc2}{R12} + \frac{Vr1 - Vc3}{R13} : \\
& > r2 := 0 = \frac{Vr2 - Vc2}{R22} + \frac{Vr2 - Vc1}{R21} + \frac{Vr2 - Vc3}{R23} : \\
& > r3 := 0 = \frac{Vr3 - Vc2}{R32} + \frac{Vr3 - Vc1}{R31} + \frac{Vr3 - Vc3}{R33} : \\
& > \\
& > c1 := 0 = \frac{Vc1 - Vr1}{R11} + \frac{Vc1 - Vr2}{R21} + \frac{Vc1 - Vr3}{R31} : \\
& > c3 := 0 = \frac{Vc3 - Vr1}{R13} + \frac{Vc3 - Vr2}{R23} + \frac{Vc3 - Vr3}{R33} : \\
& > Vc2 := 0 :
\end{aligned}$$

>

> $L := \text{solve}(\{\text{Req}, r1, r2, r3, c1, c3\}, [\text{eq}, \text{Vr1}, \text{Vr2}, \text{Vr3}, \text{Vc1}, \text{Vc3}])[1][1]$
 $L := \text{eq} = ((R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33 + R11 R13 R23 R31 + R11 R13 R23 R32 + R32 R31 R13 R11 + R11 R13 R31 R33 + R33 R32 R13 R11 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 + R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 + R13 R22 R31 R32 + R13 R22 R31 R33 + R13 R22 R32 R33 + R21 R22 R31 R32 + R21 R22 R31 R33 + R21 R22 R32 R33 + R21 R23 R31 R32 + R21 R23 R31 R33 + R21 R23 R32 R33 + R22 R23 R31 R32 + R22 R23 R31 R33 + R22 R23 R32 R33) R12) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33 + R11 R12 R23 R31 + R11 R12 R23 R32 + R32 R31 R12 R11 + R33 R31 R12 R11 + R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R22 R31 + R11 R13 R22 R33 + R11 R13 R23 R31 + R11 R13 R23 R32 + R32 R31 R13 R11 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 + R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33 + R12 R13 R22 R31 + R12 R13 R22 R32 + R12 R13 R23 R31 + R12 R13 R23 R32 + R32 R31 R13 R12 + R33 R31 R13 R12 + R33 R32 R13 R12 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 + R12 R21 R23 R32 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 + R13 R21 R23 R33 + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 + R13 R22 R32 R33 + R21 R22 R31 R32 + R21 R22 R31 R33 + R21 R22 R32 R33 + R21 R23 R31 R32 + R21 R23 R31 R33 + R21 R23 R32 R33 + R22 R23 R31 R32 + R22 R23 R31 R33 + R22 R23 R32 R33)$

> $\text{Req12} := \text{eq} = \frac{R12 \cdot Rx12}{R12 + Rx12} :$

> $\text{solve}(\{\text{L}, \text{Req12}\}, [\text{Rx12}, \text{eq}])[1][1]$

$Rx12 = (R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33 + R22 R23 R31 R32 + R22 R23 R31 R33 + R22 R23 R32 R33)$

(2.2)

$$\begin{aligned}
& + R_{11}R_{13}R_{22}R_{23} + R_{11}R_{13}R_{22}R_{31} + R_{11}R_{13}R_{22}R_{33} + R_{11}R_{13}R_{23}R_{31} \\
& + R_{11}R_{13}R_{23}R_{32} + R_{32}R_{31}R_{13}R_{11} + R_{11}R_{13}R_{31}R_{33} + R_{33}R_{32}R_{13}R_{11} \\
& + R_{11}R_{21}R_{22}R_{32} + R_{11}R_{21}R_{22}R_{33} + R_{11}R_{21}R_{23}R_{32} + R_{11}R_{21}R_{23}R_{33} \\
& + R_{11}R_{22}R_{23}R_{32} + R_{11}R_{22}R_{23}R_{33} + R_{11}R_{22}R_{31}R_{32} + R_{11}R_{22}R_{31}R_{33} \\
& + R_{11}R_{22}R_{32}R_{33} + R_{11}R_{23}R_{31}R_{32} + R_{11}R_{23}R_{31}R_{33} + R_{11}R_{23}R_{32}R_{33} \\
& + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{22}R_{32} + R_{13}R_{21}R_{23}R_{31} + R_{13}R_{21}R_{23}R_{32} \\
& + R_{13}R_{21}R_{31}R_{32} + R_{13}R_{21}R_{31}R_{33} + R_{13}R_{21}R_{32}R_{33} + R_{13}R_{22}R_{23}R_{31} \\
& + R_{13}R_{22}R_{23}R_{32} + R_{13}R_{22}R_{31}R_{32} + R_{13}R_{22}R_{31}R_{33} + R_{13}R_{22}R_{32}R_{33} \\
& + R_{21}R_{22}R_{31}R_{32} + R_{21}R_{22}R_{31}R_{33} + R_{21}R_{22}R_{32}R_{33} + R_{21}R_{23}R_{31}R_{32} \\
& + R_{21}R_{23}R_{31}R_{33} + R_{21}R_{23}R_{32}R_{33} + R_{22}R_{23}R_{31}R_{32} + R_{22}R_{23}R_{31}R_{33} \\
& + R_{22}R_{23}R_{32}R_{33}) / (R_{11}R_{21}R_{22} + R_{11}R_{21}R_{23} + R_{11}R_{21}R_{32} + R_{11}R_{21}R_{33} \\
& + R_{11}R_{22}R_{23} + R_{11}R_{22}R_{31} + R_{11}R_{22}R_{33} + R_{11}R_{23}R_{31} + R_{11}R_{23}R_{32} \\
& + R_{32}R_{31}R_{11} + R_{33}R_{31}R_{11} + R_{33}R_{32}R_{11} + R_{13}R_{21}R_{22} + R_{13}R_{21}R_{23} \\
& + R_{13}R_{21}R_{32} + R_{13}R_{21}R_{33} + R_{13}R_{22}R_{23} + R_{13}R_{22}R_{31} + R_{13}R_{22}R_{33} \\
& + R_{13}R_{23}R_{31} + R_{13}R_{23}R_{32} + R_{32}R_{31}R_{13} + R_{33}R_{31}R_{13} + R_{33}R_{32}R_{13} \\
& + R_{21}R_{22}R_{31} + R_{21}R_{22}R_{33} + R_{21}R_{23}R_{31} + R_{21}R_{23}R_{33} + R_{21}R_{31}R_{32} \\
& + R_{21}R_{31}R_{33} + R_{21}R_{32}R_{33} + R_{22}R_{23}R_{31} + R_{22}R_{23}R_{33} + R_{23}R_{31}R_{32} \\
& + R_{23}R_{31}R_{33} + R_{23}R_{32}R_{33})
\end{aligned}$$

> assign((2.2))

$$R12 = \frac{MR12 \cdot Rx12}{Rx12 - MR12}$$

$$R12 = (MR12 (R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33) \quad (2.3)$$

$$\begin{aligned}
& + R_{11}R_{13}R_{22}R_{23} + R_{11}R_{13}R_{22}R_{31} + R_{11}R_{13}R_{22}R_{33} + R_{11}R_{13}R_{23}R_{31} \\
& + R_{11}R_{13}R_{23}R_{32} + R_{32}R_{31}R_{13}R_{11} + R_{11}R_{13}R_{31}R_{33} + R_{33}R_{32}R_{13}R_{11} \\
& + R_{11}R_{21}R_{22}R_{32} + R_{11}R_{21}R_{22}R_{33} + R_{11}R_{21}R_{23}R_{32} + R_{11}R_{21}R_{23}R_{33} \\
& + R_{11}R_{22}R_{23}R_{32} + R_{11}R_{22}R_{23}R_{33} + R_{11}R_{22}R_{31}R_{32} + R_{11}R_{22}R_{31}R_{33} \\
& + R_{11}R_{22}R_{32}R_{33} + R_{11}R_{23}R_{31}R_{32} + R_{11}R_{23}R_{31}R_{33} + R_{11}R_{23}R_{32}R_{33} \\
& + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{22}R_{32} + R_{13}R_{21}R_{23}R_{31} + R_{13}R_{21}R_{23}R_{32} \\
& + R_{13}R_{21}R_{31}R_{32} + R_{13}R_{21}R_{31}R_{33} + R_{13}R_{21}R_{32}R_{33} + R_{13}R_{22}R_{23}R_{31} \\
& + R_{13}R_{22}R_{23}R_{32} + R_{13}R_{22}R_{31}R_{32} + R_{13}R_{22}R_{31}R_{33} + R_{13}R_{22}R_{32}R_{33} \\
& + R_{21}R_{22}R_{31}R_{32} + R_{21}R_{22}R_{31}R_{33} + R_{21}R_{22}R_{32}R_{33} + R_{21}R_{23}R_{31}R_{32} \\
& + R_{21}R_{23}R_{31}R_{33} + R_{21}R_{23}R_{32}R_{33} + R_{22}R_{23}R_{31}R_{32} + R_{22}R_{23}R_{31}R_{33} \\
& + R_{22}R_{23}R_{32}R_{33}) \Big) \left((R_{11}R_{21}R_{22} + R_{11}R_{21}R_{23} + R_{11}R_{21}R_{32} + R_{11}R_{21}R_{33} \right. \\
& \quad \left. + R_{11}R_{22}R_{23} + R_{11}R_{22}R_{31} + R_{11}R_{22}R_{33} + R_{11}R_{23}R_{31} + R_{11}R_{23}R_{32} \right. \\
& \quad \left. + R_{32}R_{31}R_{11} + R_{33}R_{31}R_{11} + R_{33}R_{32}R_{11} + R_{13}R_{21}R_{22} + R_{13}R_{21}R_{23} \right)
\end{aligned}$$

$$\begin{aligned}
& + R13 R21 R32 + R13 R21 R33 + R13 R22 R23 + R13 R22 R31 + R13 R22 R33 \\
& + R13 R23 R31 + R13 R23 R32 + R32 R31 R13 + R33 R31 R13 + R33 R32 R13 \\
& + R21 R22 R31 + R21 R22 R33 + R21 R23 R31 + R21 R23 R33 + R21 R31 R32 \\
& + R21 R31 R33 + R21 R32 R33 + R22 R23 R31 + R22 R23 R33 + R23 R31 R32 \\
& + R23 R31 R33 + R23 R32 R33) ((R11 R13 R21 R22 + R11 R13 R21 R23 \\
& + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 \\
& + R11 R13 R22 R33 + R11 R13 R23 R31 + R11 R13 R23 R32 + R32 R31 R13 R11 \\
& + R11 R13 R31 R33 + R33 R32 R13 R11 + R11 R21 R22 R32 + R11 R21 R22 R33 \\
& + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 \\
& + R11 R22 R31 R32 + R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 \\
& + R11 R23 R31 R33 + R11 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 \\
& + R13 R21 R23 R31 + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 \\
& + R13 R21 R32 R33 + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 \\
& + R13 R22 R31 R33 + R13 R22 R32 R33 + R21 R22 R31 R32 + R21 R22 R31 R33 \\
& + R21 R22 R32 R33 + R21 R23 R31 R32 + R21 R23 R31 R33 + R21 R23 R32 R33 \\
& + R22 R23 R31 R32 + R22 R23 R31 R33 + R22 R23 R32 R33) / (R11 R21 R22 \\
& + R11 R21 R23 + R11 R21 R32 + R11 R21 R33 + R11 R22 R23 + R11 R22 R31 \\
& + R11 R22 R33 + R11 R23 R31 + R11 R23 R32 + R32 R31 R11 + R33 R31 R11 \\
& + R33 R32 R11 + R13 R21 R22 + R13 R21 R23 + R13 R21 R32 + R13 R21 R33 \\
& + R13 R22 R23 + R13 R22 R31 + R13 R22 R33 + R13 R23 R31 + R13 R23 R32 \\
& + R32 R31 R13 + R33 R31 R13 + R33 R32 R13 + R21 R22 R31 + R21 R22 R33 \\
& + R21 R23 R31 + R21 R23 R33 + R21 R31 R32 + R21 R31 R33 + R21 R32 R33 \\
& + R22 R23 R31 + R22 R23 R33 + R23 R31 R32 + R23 R31 R33 + R23 R32 R33) - MR12) \\
&)
\end{aligned}$$

> *simplify(2.3)*

$$\begin{aligned}
R12 = & (MR12 (((((R21 + R23 + R31 + R33) R22 + (R21 + R23 + R31 + R33) R32 + (R23 \\
& + R33) (R21 + R31)) R13 + ((R21 + R23 + R31 + R33) R32 + R33 (R21 + R23 \\
& + R31)) R22 + R23 (((R21 + R31 + R33) R32 + R33 (R21 + R31))) R11 + (((R21 \\
& + R23 + R31 + R33) R32 + R31 (R21 + R23 + R33)) R22 + ((R23 + R31 + R33) R32 \\
& + R31 (R23 + R33)) R21) R13 + ((R31 + R33) R32 + R33 R31) ((R21 + R23) R22 \\
& + R21 R23))) / (((((R21 + R23 + R31 + R33) R22 + (R21 + R23 + R31 + R33) R32 \\
& + (R23 + R33) (R21 + R31)) R13 + ((R21 + R23 + R31 + R33) R32 + (R33 \\
& - MR12) R21 + (R33 - MR12) R23 + (R33 - MR12) R31 - R33 MR12) R22 + ((R23 \\
& - MR12) R21 + (R31 + R33 - MR12) R23 - MR12 (R31 + R33)) R32 + ((R33
\end{aligned} \tag{2.4}$$

$$\begin{aligned}
& - MR12) R23 - R33 MR12) (R21 + R31)) R11 + (((R21 + R23 + R31 + R33) R32 \\
& + (R31 - MR12) R21 + (R31 - MR12) R23 + (R33 - MR12) R31 - R33 MR12) R22 \\
& + ((R23 + R31 + R33 - MR12) R21 - MR12 (R23 + R31 + R33)) R32 + ((R31 \\
& - MR12) R21 - R31 MR12) (R23 + R33)) R13 + ((R31 + R33) R32 + (R33 \\
& - MR12) R31 - R33 MR12) (R21 + R23) R22 + ((R23 - MR12) R21 \\
& - R23 MR12) (R31 + R33) R32 + (((R33 - MR12) R31 - R33 MR12) R23 \\
& - R31 R33 MR12) R21 - MR12 R23 R31 R33)
\end{aligned}$$

>

R13

```

> restart
> Req := eq =  $\frac{Vr1}{Is}$  :
> r1 := Is =  $\frac{Vr1 - Vc1}{R11} + \frac{Vr1 - Vc2}{R12} + \frac{Vr1 - Vc3}{R13}$  :
> r2 := 0 =  $\frac{Vr2 - Vc3}{R23} + \frac{Vr2 - Vc1}{R21} + \frac{Vr2 - Vc2}{R22}$  :
> r3 := 0 =  $\frac{Vr3 - Vc3}{R33} + \frac{Vr3 - Vc1}{R31} + \frac{Vr3 - Vc2}{R32}$  :
>
> c1 := 0 =  $\frac{Vc1 - Vr1}{R11} + \frac{Vc1 - Vr2}{R21} + \frac{Vc1 - Vr3}{R31}$  :
> c2 := 0 =  $\frac{Vc2 - Vr1}{R12} + \frac{Vc2 - Vr2}{R22} + \frac{Vc2 - Vr3}{R32}$  :
> Vc3 := 0 :
>
> L := solve( {Req, r1, r2, r3, c1, c2}, [eq, Vr1, Vr2, Vr3, Vc1, Vc2])[1][1]
L := eq = ((R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33
+ R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33 + R11 R12 R23 R31
+ R11 R12 R23 R32 + R11 R12 R31 R32 + R33 R31 R12 R11 + R33 R32 R12 R11
+ R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33
+ R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 + R11 R22 R31 R33
+ R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33
+ R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 + R12 R21 R23 R33
+ R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 + R12 R22 R23 R31
+ R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33
+ R21 R22 R31 R32 + R21 R22 R31 R33 + R21 R22 R32 R33 + R21 R23 R31 R32
+ R21 R23 R31 R33 + R21 R23 R32 R33 + R22 R23 R31 R32 + R22 R23 R31 R33
+ R22 R23 R32 R33) R13) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32
+ R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33)

```

(3.1)

$$\begin{aligned}
& + R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 + R33 R31 R12 R11 \\
& + R33 R32 R12 R11 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 \\
& + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33 \\
& + R11 R13 R23 R31 + R11 R13 R23 R32 + R32 R31 R13 R11 + R33 R31 R13 R11 \\
& + R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 \\
& + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 \\
& + R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 \\
& + R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 \\
& + R12 R13 R21 R33 + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 \\
& + R12 R13 R23 R31 + R12 R13 R23 R32 + R32 R31 R13 R12 + R33 R31 R13 R12 \\
& + R33 R32 R13 R12 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 \\
& + R12 R21 R23 R33 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 \\
& + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 \\
& + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 \\
& + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 \\
& + R13 R22 R32 R33 + R21 R22 R31 R32 + R21 R22 R31 R33 + R21 R22 R32 R33 \\
& + R21 R23 R31 R32 + R21 R23 R31 R33 + R21 R23 R32 R33 + R22 R23 R31 R32 \\
& + R22 R23 R31 R33 + R22 R23 R32 R33)
\end{aligned}$$

> $Req13 := eq = \frac{R13 \cdot Rx13}{R13 + Rx13} :$

> $solve(\{L, Req13\}, [Rx13, eq])[1][1]$

$$\begin{aligned}
Rx13 = & (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33 \\
& + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33 + R11 R12 R23 R31 \\
& + R11 R12 R23 R32 + R11 R12 R31 R32 + R33 R31 R12 R11 + R33 R32 R12 R11 \\
& + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 \\
& + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 + R11 R22 R31 R33 \\
& + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33 \\
& + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 + R12 R21 R23 R33 \\
& + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 + R12 R22 R23 R31 \\
& + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33 \\
& + R21 R22 R31 R32 + R21 R22 R31 R33 + R21 R22 R32 R33 + R21 R23 R31 R32 \\
& + R21 R23 R31 R33 + R21 R23 R32 R33 + R22 R23 R31 R32 + R22 R23 R31 R33 \\
& + R22 R23 R32 R33) / (R11 R21 R22 + R11 R21 R23 + R11 R21 R32 + R11 R21 R33 \\
& + R11 R22 R23 + R11 R22 R31 + R11 R22 R33 + R11 R23 R31 + R11 R23 R32 \\
& + R32 R31 R11 + R33 R31 R11 + R33 R32 R11 + R12 R21 R22 + R12 R21 R23 \\
& + R12 R21 R32 + R12 R21 R33 + R12 R22 R23 + R12 R22 R31 + R12 R22 R33 \\
& + R12 R23 R31 + R12 R23 R32 + R32 R31 R12 + R33 R31 R12 + R33 R32 R12
\end{aligned} \tag{3.2}$$

$$\begin{aligned}
& + R_{21} R_{22} R_{31} + R_{21} R_{22} R_{32} + R_{21} R_{23} R_{31} + R_{21} R_{23} R_{32} + R_{21} R_{31} R_{32} \\
& + R_{21} R_{31} R_{33} + R_{21} R_{32} R_{33} + R_{22} R_{23} R_{31} + R_{22} R_{23} R_{32} + R_{22} R_{31} R_{32} \\
& + R_{22} R_{31} R_{33} + R_{22} R_{32} R_{33})
\end{aligned}$$

> assign((3.2))

$$R_{13} = \frac{MR_{13} \cdot Rx_{13}}{Rx_{13} - MR_{13}}$$

$$R_{13} = (MR_{13} (R_{11} R_{12} R_{21} R_{22} + R_{11} R_{12} R_{21} R_{23} + R_{11} R_{12} R_{21} R_{32} + R_{11} R_{12} R_{21} R_{33} \quad (3.3)$$

$$\begin{aligned}
& + R_{11} R_{12} R_{22} R_{23} + R_{11} R_{12} R_{22} R_{31} + R_{11} R_{12} R_{22} R_{33} + R_{11} R_{12} R_{23} R_{31} \\
& + R_{11} R_{12} R_{23} R_{32} + R_{11} R_{12} R_{31} R_{32} + R_{33} R_{31} R_{12} R_{11} + R_{33} R_{32} R_{12} R_{11} \\
& + R_{11} R_{21} R_{22} R_{32} + R_{11} R_{21} R_{22} R_{33} + R_{11} R_{21} R_{23} R_{32} + R_{11} R_{21} R_{23} R_{33} \\
& + R_{11} R_{22} R_{23} R_{32} + R_{11} R_{22} R_{23} R_{33} + R_{11} R_{22} R_{31} R_{32} + R_{11} R_{22} R_{31} R_{33} \\
& + R_{11} R_{22} R_{32} R_{33} + R_{11} R_{23} R_{31} R_{32} + R_{11} R_{23} R_{31} R_{33} + R_{11} R_{23} R_{32} R_{33} \\
& + R_{12} R_{21} R_{22} R_{31} + R_{12} R_{21} R_{22} R_{33} + R_{12} R_{21} R_{23} R_{31} + R_{12} R_{21} R_{23} R_{33} \\
& + R_{12} R_{21} R_{31} R_{32} + R_{12} R_{21} R_{31} R_{33} + R_{12} R_{21} R_{32} R_{33} + R_{12} R_{22} R_{23} R_{31} \\
& + R_{12} R_{22} R_{23} R_{33} + R_{12} R_{23} R_{31} R_{32} + R_{12} R_{23} R_{31} R_{33} + R_{12} R_{23} R_{32} R_{33} \\
& + R_{21} R_{22} R_{31} R_{32} + R_{21} R_{22} R_{31} R_{33} + R_{21} R_{22} R_{32} R_{33} + R_{21} R_{23} R_{31} R_{32} \\
& + R_{21} R_{23} R_{31} R_{33} + R_{21} R_{23} R_{32} R_{33} + R_{22} R_{23} R_{31} R_{32} + R_{22} R_{23} R_{31} R_{33} \\
& + R_{22} R_{23} R_{32} R_{33})) / ((R_{11} R_{21} R_{22} + R_{11} R_{21} R_{23} + R_{11} R_{21} R_{32} + R_{11} R_{21} R_{33}
\end{aligned}$$

$$+ R_{11} R_{22} R_{23} + R_{11} R_{22} R_{31} + R_{11} R_{22} R_{33} + R_{11} R_{23} R_{31} + R_{11} R_{23} R_{32}$$

$$+ R_{32} R_{31} R_{11} + R_{33} R_{31} R_{11} + R_{33} R_{32} R_{11} + R_{12} R_{21} R_{22} + R_{12} R_{21} R_{23}$$

$$+ R_{12} R_{21} R_{32} + R_{12} R_{21} R_{33} + R_{12} R_{22} R_{23} + R_{12} R_{22} R_{31} + R_{12} R_{22} R_{33}$$

$$+ R_{12} R_{23} R_{31} + R_{12} R_{23} R_{32} + R_{32} R_{31} R_{12} + R_{33} R_{31} R_{12} + R_{33} R_{32} R_{12}$$

$$+ R_{21} R_{22} R_{31} + R_{21} R_{22} R_{32} + R_{21} R_{23} R_{31} + R_{21} R_{23} R_{32} + R_{21} R_{31} R_{32}$$

$$+ R_{21} R_{31} R_{33} + R_{21} R_{32} R_{33} + R_{22} R_{23} R_{31} + R_{22} R_{23} R_{32} + R_{22} R_{31} R_{32}$$

$$+ R_{22} R_{31} R_{33} + R_{22} R_{32} R_{33}) ((R_{11} R_{12} R_{21} R_{22} + R_{11} R_{12} R_{21} R_{23}$$

$$+ R_{11} R_{12} R_{21} R_{32} + R_{11} R_{12} R_{21} R_{33} + R_{11} R_{12} R_{22} R_{23} + R_{11} R_{12} R_{22} R_{31}$$

$$+ R_{11} R_{12} R_{22} R_{33} + R_{11} R_{12} R_{23} R_{31} + R_{11} R_{12} R_{23} R_{32} + R_{11} R_{12} R_{31} R_{32}$$

$$+ R_{33} R_{31} R_{12} R_{11} + R_{33} R_{32} R_{12} R_{11} + R_{11} R_{21} R_{22} R_{32} + R_{11} R_{21} R_{22} R_{33}$$

$$+ R_{11} R_{21} R_{23} R_{32} + R_{11} R_{21} R_{23} R_{33} + R_{11} R_{22} R_{23} R_{32} + R_{11} R_{22} R_{23} R_{33}$$

$$+ R_{11} R_{22} R_{31} R_{32} + R_{11} R_{22} R_{31} R_{33} + R_{11} R_{22} R_{32} R_{33} + R_{11} R_{23} R_{31} R_{32}$$

$$+ R_{11} R_{23} R_{31} R_{33} + R_{11} R_{23} R_{32} R_{33} + R_{12} R_{21} R_{22} R_{31} + R_{12} R_{21} R_{22} R_{33}$$

$$+ R_{12} R_{21} R_{23} R_{31} + R_{12} R_{21} R_{23} R_{33} + R_{12} R_{21} R_{31} R_{32} + R_{12} R_{21} R_{31} R_{33}$$

$$\begin{aligned}
& + R12 R21 R32 R33 + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 \\
& + R12 R23 R31 R33 + R12 R23 R32 R33 + R21 R22 R31 R32 + R21 R22 R31 R33 \\
& + R21 R22 R32 R33 + R21 R23 R31 R32 + R21 R23 R31 R33 + R21 R23 R32 R33 \\
& + R22 R23 R31 R32 + R22 R23 R31 R33 + R22 R23 R32 R33) / (R11 R21 R22 \\
& + R11 R21 R23 + R11 R21 R32 + R11 R21 R33 + R11 R22 R23 + R11 R22 R31 \\
& + R11 R22 R33 + R11 R23 R31 + R11 R23 R32 + R32 R31 R11 + R33 R31 R11 \\
& + R33 R32 R11 + R12 R21 R22 + R12 R21 R23 + R12 R21 R32 + R12 R21 R33 \\
& + R12 R22 R23 + R12 R22 R31 + R12 R22 R33 + R12 R23 R31 + R12 R23 R32 \\
& + R32 R31 R12 + R33 R31 R12 + R33 R32 R12 + R21 R22 R31 + R21 R22 R32 \\
& + R21 R23 R31 + R21 R23 R32 + R21 R31 R32 + R21 R31 R33 + R21 R32 R33 \\
& + R22 R23 R31 + R22 R23 R32 + R22 R31 R32 + R22 R31 R33 + R22 R32 R33) - MR13) \\
&)
\end{aligned}$$

> *simplify(3.3)*

$$R13 = (((((R21 + R22 + R31 + R32) R23 + (R21 + R22 + R31 + R32) R33 + (R22 + R32) (R21 + R31)) R12 + ((R21 + R22 + R31 + R32) R33 + R32 (R21 + R22 + R31)) R23 + ((R21 + R31 + R32) R33 + R32 (R21 + R31)) R22) R11 + (((R21 + R22 + R31 + R32) R33 + R31 (R21 + R22 + R32)) R23 + ((R22 + R31 + R32) R33 + R31 (R22 + R32)) R21) R12 + ((R21 + R22) R23 + R21 R22) ((R31 + R32) R33 + R32 R31)) MR13) / (((((R21 + R22 + R31 + R32) R23 + (R21 + R22 + R31 + R32) R33 + (R22 + R32) (R21 + R31)) R12 + ((R21 + R22 + R31 + R32) R33 + (R22 + R32) (R21 + R31)) R23 + (R21 + R22 + R31 + R32) R31 + (R32 - MR13) R21 + (R32 - MR13) R22 + (R32 - MR13) R31 - R32 MR13) R23 + ((R22 - MR13) R21 + (R31 + R32 - MR13) R22 - MR13 (R31 + R32)) R33 + (R21 + R31) ((R32 - MR13) R22 - R32 MR13)) R11 + (((R21 + R22 + R31 + R32) R33 + (R31 - MR13) R21 + (R31 - MR13) R22 + (R32 - MR13) R31 - R32 MR13) R23 + ((R22 + R31 + R32 - MR13) R21 - MR13 (R22 + R31 + R32)) R33 + (R22 + R32) ((R31 - MR13) R21 - R31 MR13)) R12 + (R21 + R22) ((R31 + R32) R33 + (R32 - MR13) R31 - R32 MR13) R21 - R22 MR13) R33 + (((R32 - MR13) R31 - R32 MR13) R22 - R31 R32 MR13) R21 - MR13 R22 R31 R32)$$
 (3.4)

R21

```

> restart
> Req := eq =  $\frac{Vr2}{Is}$  :
> r1 := 0 =  $\frac{Vr1 - Vc1}{R11} + \frac{Vr1 - Vc2}{R12} + \frac{Vr1 - Vc3}{R13}$  :
> r2 := Is =  $\frac{Vr2 - Vc1}{R21} + \frac{Vr2 - Vc2}{R22} + \frac{Vr2 - Vc3}{R23}$  :

```

```

> r3 := 0 =  $\frac{Vr3 - Vc1}{R31} + \frac{Vr3 - Vc2}{R32} + \frac{Vr3 - Vc3}{R33}$  :
>
> c2 := 0 =  $\frac{Vc2 - Vr2}{R22} + \frac{Vc2 - Vr1}{R12} + \frac{Vc2 - Vr3}{R32}$  :
> c3 := 0 =  $\frac{Vc3 - Vr2}{R23} + \frac{Vc3 - Vr1}{R13} + \frac{Vc3 - Vr3}{R33}$  :
> Vc1 := 0 :
>
> L := solve( {Req, r1, r2, r3, c2, c3}, [eq, Vr1, Vr2, Vr3, Vc2, Vc3])[1][1]
L := eq = ((R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33 + R11 R12 R23 R31
+ R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 + R11 R12 R32 R33
+ R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33 + R11 R13 R23 R31
+ R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 + R11 R13 R32 R33
+ R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 + R11 R22 R31 R33
+ R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33
+ R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R23 R31
+ R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 + R12 R13 R32 R33
+ R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33
+ R12 R23 R32 R33 + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32
+ R13 R22 R31 R33 + R13 R22 R32 R33 + R32 R31 R23 R22 + R33 R31 R23 R22
+ R22 R23 R32 R33) R21) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32
+ R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33
+ R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33
+ R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32
+ R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33
+ R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33
+ R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32
+ R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32
+ R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33
+ R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32
+ R12 R13 R21 R33 + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33
+ R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33
+ R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31
+ R12 R21 R23 R33 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33
+ R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33
+ R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31
+ R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33
+ R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 (4.1)

```

$$\begin{aligned}
& + R13 R22 R32 R33 + R32 R31 R22 R21 + R21 R22 R31 R33 + R33 R32 R22 R21 \\
& + R32 R31 R23 R21 + R33 R31 R23 R21 + R33 R32 R23 R21 + R32 R31 R23 R22 \\
& + R33 R31 R23 R22 + R22 R23 R32 R33)
\end{aligned}$$

> $\text{Req21} := \text{eq} = \frac{R21 \cdot Rx21}{R21 + Rx21} :$

> $\text{solve}(\{L, \text{Req21}\}, [Rx21, \text{eq}])[1][1]$

$$\begin{aligned}
Rx21 = & (R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33 + R11 R12 R23 R31 \\
& + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 + R11 R12 R32 R33 \\
& + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33 + R11 R13 R23 R31 \\
& + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 + R11 R13 R32 R33 \\
& + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 + R11 R22 R31 R33 \\
& + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33 \\
& + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R23 R31 \\
& + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 + R12 R13 R32 R33 \\
& + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 \\
& + R13 R22 R31 R33 + R13 R22 R32 R33 + R32 R31 R23 R22 + R33 R31 R23 R22 \\
& + R22 R23 R32 R33) / (R11 R12 R22 + R11 R12 R23 + R11 R12 R32 + R11 R12 R33 \\
& + R11 R13 R22 + R11 R13 R23 + R11 R13 R32 + R11 R13 R33 + R11 R22 R32 \\
& + R11 R22 R33 + R11 R23 R32 + R11 R23 R33 + R12 R13 R22 + R12 R13 R23 \\
& + R12 R13 R32 + R12 R13 R33 + R12 R22 R31 + R12 R22 R33 + R12 R23 R31 \\
& + R12 R23 R33 + R12 R31 R32 + R12 R31 R33 + R12 R32 R33 + R13 R22 R31 \\
& + R13 R22 R32 + R23 R13 R31 + R13 R23 R32 + R13 R31 R32 + R13 R31 R33 \\
& + R13 R32 R33 + R32 R31 R22 + R33 R31 R22 + R33 R32 R22 + R32 R31 R23 \\
& + R33 R31 R23 + R33 R32 R23)
\end{aligned} \tag{4.2}$$

> $\text{assign}(4.2)$

> $R21 = \frac{MR21 \cdot Rx21}{Rx21 - MR21}$

$$\begin{aligned}
R21 = & (MR21 (R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33 + R11 R12 R23 R31 \\
& + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 + R11 R12 R32 R33 \\
& + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33 + R11 R13 R23 R31 \\
& + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 + R11 R13 R32 R33 \\
& + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 + R11 R22 R31 R33 \\
& + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33 \\
& + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R23 R31 \\
& + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 + R12 R13 R32 R33 \\
& + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32)
\end{aligned} \tag{4.3}$$

$$\begin{aligned}
& + R13 R22 R31 R33 + R13 R22 R32 R33 + R32 R31 R23 R22 + R33 R31 R23 R22 \\
& + R22 R23 R32 R33)) \Big/ \left((R11 R12 R22 + R11 R12 R23 + R11 R12 R32 + R11 R12 R33 \right. \\
& \quad \left. + R11 R13 R22 + R11 R13 R23 + R11 R13 R32 + R11 R13 R33 + R11 R22 R32 \right. \\
& \quad \left. + R11 R22 R33 + R11 R23 R32 + R11 R23 R33 + R12 R13 R22 + R12 R13 R23 \right. \\
& \quad \left. + R12 R13 R32 + R12 R13 R33 + R12 R22 R31 + R12 R22 R33 + R12 R23 R31 \right. \\
& \quad \left. + R12 R23 R33 + R12 R31 R32 + R12 R31 R33 + R12 R32 R33 + R13 R22 R31 \right. \\
& \quad \left. + R13 R22 R32 + R23 R13 R31 + R13 R23 R32 + R13 R31 R32 + R13 R31 R33 \right. \\
& \quad \left. + R13 R32 R33 + R32 R31 R22 + R33 R31 R22 + R33 R32 R22 + R32 R31 R23 \right. \\
& \quad \left. + R33 R31 R23 + R33 R32 R23) ((R11 R12 R22 R23 + R11 R12 R22 R31 \right. \\
& \quad \left. + R11 R12 R22 R33 + R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 \right. \\
& \quad \left. + R11 R12 R31 R33 + R11 R12 R32 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 \right. \\
& \quad \left. + R11 R13 R22 R33 + R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 \right. \\
& \quad \left. + R11 R13 R31 R33 + R11 R13 R32 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 \right. \\
& \quad \left. + R11 R22 R31 R32 + R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 \right. \\
& \quad \left. + R11 R23 R31 R33 + R11 R23 R32 R33 + R12 R13 R22 R23 + R12 R13 R22 R31 \right. \\
& \quad \left. + R12 R13 R22 R33 + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 \right. \\
& \quad \left. + R12 R13 R31 R33 + R12 R13 R32 R33 + R12 R22 R23 R31 + R12 R22 R23 R33 \right. \\
& \quad \left. + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33 + R13 R22 R23 R31 \right. \\
& \quad \left. + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 + R13 R22 R32 R33 \right. \\
& \quad \left. + R32 R31 R23 R22 + R33 R31 R23 R22 + R22 R23 R32 R33) / (R11 R12 R22 \right. \\
& \quad \left. + R11 R12 R23 + R11 R12 R32 + R11 R12 R33 + R11 R13 R22 + R11 R13 R23 \right. \\
& \quad \left. + R11 R13 R32 + R11 R13 R33 + R11 R22 R32 + R11 R22 R33 + R11 R23 R32 \right. \\
& \quad \left. + R11 R23 R33 + R12 R13 R22 + R12 R13 R23 + R12 R13 R32 + R12 R13 R33 \right. \\
& \quad \left. + R12 R22 R31 + R12 R22 R33 + R12 R23 R31 + R12 R23 R33 + R12 R31 R32 \right. \\
& \quad \left. + R12 R31 R33 + R12 R32 R33 + R13 R22 R31 + R13 R22 R32 + R23 R13 R31 \right. \\
& \quad \left. + R13 R23 R32 + R13 R31 R32 + R13 R31 R33 + R13 R32 R33 + R32 R31 R22 \right. \\
& \quad \left. + R33 R31 R22 + R33 R32 R22 + R32 R31 R23 + R33 R31 R23 + R33 R32 R23) - MR21) \right) \\
&)
\end{aligned}$$

> *simplify*((4.3))

$$\begin{aligned}
R21 = & (((((R12 + R13 + R32 + R33) R23 + (R12 + R13 + R32 + R33) R31 + R33 (R12 \\
& + R13 + R32)) R22 + ((R12 + R13 + R32 + R33) R31 + R32 (R12 + R13 + R33)) R23 \\
& + ((R32 + R33) R31 + R33 R32) (R12 + R13)) R11 + (((R12 + R13 + R32
\end{aligned} \tag{4.4}$$

$$\begin{aligned}
& + R33) R31 + (R13 + R33) (R12 + R32)) R23 + ((R12 + R32 + R33) R31 + R33 (R12 \\
& + R32)) R13) R22 + (((R13 + R32 + R33) R31 + R32 (R13 + R33)) R23 + R13 ((R32 \\
& + R33) R31 + R33 R32)) R12) MR21) / (((R12 + R13 + R32 + R33) R23 + (R12 \\
& + R13 + R32 + R33) R31 + (R33 - MR21) R12 + (R33 - MR21) R13 + (R33 \\
& - MR21) R32 - R33 MR21) R22 + ((R12 + R13 + R32 + R33) R31 + (R32 \\
& - MR21) R12 + (R32 - MR21) R13 + (R33 - MR21) R32 - R33 MR21) R23 + ((R32 \\
& + R33) R31 + (R33 - MR21) R32 - R33 MR21) (R12 + R13)) R11 + (((R12 + R13 \\
& + R32 + R33) R31 + (R13 + R33) (R12 + R32)) R23 + ((R13 - MR21) R12 + (R32 \\
& + R33 - MR21) R13 - MR21 (R32 + R33)) R31 + (R12 + R32) ((R33 - MR21) R13 \\
& - R33 MR21)) R22 + (((R13 + R32 + R33 - MR21) R12 - MR21 (R13 + R32 \\
& + R33)) R31 + ((R32 - MR21) R12 - R32 MR21) (R13 + R33)) R23 + (R32 \\
& + R33) ((R13 - MR21) R12 - R13 MR21) R31 + (((R33 - MR21) R32 \\
& - R33 MR21) R13 - R32 R33 MR21) R12 - MR21 R13 R32 R33)
\end{aligned}$$

R22

```

> restart
> Req := eq =  $\frac{Vr2}{Is}$  :
> r1 := 0 =  $\frac{Vr1 - Vc2}{R12} + \frac{Vr1 - Vc1}{R11} + \frac{Vr1 - Vc3}{R13}$  :
> r2 := Is =  $\frac{Vr2 - Vc1}{R21} + \frac{Vr2 - Vc2}{R22} + \frac{Vr2 - Vc3}{R23}$  :
> r3 := 0 =  $\frac{Vr3 - Vc2}{R32} + \frac{Vr3 - Vc1}{R31} + \frac{Vr3 - Vc3}{R33}$  :
>
> c1 := 0 =  $\frac{Vc1 - Vr2}{R21} + \frac{Vc1 - Vr1}{R11} + \frac{Vc1 - Vr3}{R31}$  :
> c3 := 0 =  $\frac{Vc3 - Vr2}{R23} + \frac{Vc3 - Vr1}{R13} + \frac{Vc3 - Vr3}{R33}$  :
> Vc2 := 0 :
>
> L := solve({Req, r1, r2, r3, c1, c3}, [eq, Vr1, Vr2, Vr3, Vc1, Vc3])[1][1]
L := eq = ((R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33 + R11 R12 R23 R31
+ R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 + R11 R12 R32 R33
+ R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R23 R31
+ R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 + R11 R13 R32 R33
+ R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R23 R31 R32 + R11 R23 R31 R33
+ R11 R23 R32 R33 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33
+ R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33
+ R12 R13 R32 R33 + R12 R21 R23 R31 + R12 R21 R23 R33 + R12 R21 R31 R32)      (5.1)

```

$$\begin{aligned}
& + R12 R21 R31 R33 + R12 R21 R32 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R23 R31 + R13 R21 R23 R32 + R13 R21 R31 R32 \\
& + R13 R21 R31 R33 + R13 R21 R32 R33 + R32 R31 R23 R21 + R21 R23 R31 R33 \\
& + R33 R32 R23 R21) R22) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 \\
& + R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33 \\
& + R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 \\
& + R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 \\
& + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33 \\
& + R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 \\
& + R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 \\
& + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 \\
& + R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 \\
& + R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 \\
& + R12 R13 R21 R33 + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 \\
& + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 \\
& + R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 \\
& + R12 R21 R23 R33 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 \\
& + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 \\
& + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 \\
& + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 \\
& + R13 R22 R32 R33 + R21 R22 R31 R32 + R33 R31 R22 R21 + R21 R22 R32 R33 \\
& + R32 R31 R23 R21 + R21 R23 R31 R33 + R33 R32 R23 R21 + R32 R31 R23 R22 \\
& + R33 R31 R23 R22 + R33 R32 R23 R22)
\end{aligned}$$

> $\text{Req22} := \text{eq} = \frac{R22 \cdot Rx22}{R22 + Rx22} :$

> $\text{solve}(\{\text{L}, \text{Req22}\}, [\text{Rx22}, \text{eq}])[1][1]$

$$\begin{aligned}
Rx22 = & (R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33 + R11 R12 R23 R31) \\
& + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 + R11 R12 R32 R33 \\
& + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R23 R31 \\
& + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 + R11 R13 R32 R33 \\
& + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 \\
& + R11 R23 R32 R33 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33 \\
& + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 \\
& + R12 R13 R32 R33 + R12 R21 R23 R31 + R12 R21 R23 R33 + R12 R21 R31 R32 \\
& + R12 R21 R31 R33 + R12 R21 R32 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R23 R31 + R13 R21 R23 R32 + R13 R21 R31 R32 \\
& + R13 R21 R31 R33 + R13 R21 R32 R33 + R32 R31 R23 R21 + R21 R23 R31 R33
\end{aligned} \tag{5.2}$$

$$\begin{aligned}
& + R33 R32 R23 R21) / (R11 R12 R21 + R11 R12 R23 + R11 R12 R31 + R11 R12 R33 \\
& + R11 R13 R21 + R11 R13 R23 + R11 R13 R31 + R11 R13 R33 + R11 R21 R32 \\
& + R11 R21 R33 + R11 R23 R32 + R11 R23 R33 + R11 R31 R32 + R11 R31 R33 \\
& + R11 R32 R33 + R12 R13 R21 + R12 R13 R23 + R12 R13 R31 + R12 R13 R33 \\
& + R12 R21 R31 + R12 R21 R33 + R12 R23 R31 + R12 R23 R33 + R13 R21 R31 \\
& + R13 R21 R32 + R13 R23 R31 + R23 R13 R32 + R13 R31 R32 + R13 R31 R33 \\
& + R13 R32 R33 + R32 R31 R21 + R33 R31 R21 + R33 R32 R21 + R32 R31 R23 \\
& + R33 R31 R23 + R33 R32 R23)
\end{aligned}$$

> assign((5.2))

$$R22 = \frac{MR22 \cdot Rx22}{Rx22 - MR22}$$

$$\begin{aligned}
R22 = & (MR22 (R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33 + R11 R12 R23 R31) \quad (5.3) \\
& + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 + R11 R12 R32 R33 \\
& + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R23 R31 \\
& + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 + R11 R13 R32 R33 \\
& + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 \\
& + R11 R23 R32 R33 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33 \\
& + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 \\
& + R12 R13 R32 R33 + R12 R21 R23 R31 + R12 R21 R23 R33 + R12 R21 R31 R32 \\
& + R12 R21 R31 R33 + R12 R21 R32 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R23 R31 + R13 R21 R23 R32 + R13 R21 R31 R32 \\
& + R13 R21 R31 R33 + R13 R21 R32 R33 + R32 R31 R23 R21 + R21 R23 R31 R33 \\
& + R33 R32 R23 R21)) / ((R11 R12 R21 + R11 R12 R23 + R11 R12 R31 + R11 R12 R33 \\
& + R11 R13 R21 + R11 R13 R23 + R11 R13 R31 + R11 R13 R33 + R11 R21 R32 \\
& + R11 R21 R33 + R11 R23 R32 + R11 R23 R33 + R11 R31 R32 + R11 R31 R33 \\
& + R11 R32 R33 + R12 R13 R21 + R12 R13 R23 + R12 R13 R31 + R12 R13 R33 \\
& + R12 R21 R31 + R12 R21 R33 + R12 R23 R31 + R12 R23 R33 + R13 R21 R31 \\
& + R13 R21 R32 + R13 R23 R31 + R23 R13 R32 + R13 R31 R32 + R13 R31 R33 \\
& + R13 R32 R33 + R32 R31 R21 + R33 R31 R21 + R33 R32 R21 + R32 R31 R23 \\
& + R33 R31 R23 + R33 R32 R23) ((R11 R12 R21 R23 + R11 R12 R21 R32 \\
& + R11 R12 R21 R33 + R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 \\
& + R11 R12 R31 R33 + R11 R12 R32 R33 + R11 R13 R21 R23 + R11 R13 R21 R32
\end{aligned}$$

$$\begin{aligned}
& + R11 R13 R21 R33 + R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 \\
& + R11 R13 R31 R33 + R11 R13 R32 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 \\
& + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33 + R12 R13 R21 R23 \\
& + R12 R13 R21 R32 + R12 R13 R21 R33 + R12 R13 R23 R31 + R12 R13 R23 R32 \\
& + R12 R13 R31 R32 + R12 R13 R31 R33 + R12 R13 R32 R33 + R12 R21 R23 R31 \\
& + R12 R21 R23 R33 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 \\
& + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33 + R13 R21 R23 R31 \\
& + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 \\
& + R32 R31 R23 R21 + R21 R23 R31 R33 + R33 R32 R23 R21) / (R11 R12 R21 \\
& + R11 R12 R23 + R11 R12 R31 + R11 R12 R33 + R11 R13 R21 + R11 R13 R23 \\
& + R11 R13 R31 + R11 R13 R33 + R11 R21 R32 + R11 R21 R33 + R11 R23 R32 \\
& + R11 R23 R33 + R11 R31 R32 + R11 R31 R33 + R11 R32 R33 + R12 R13 R21 \\
& + R12 R13 R23 + R12 R13 R31 + R12 R13 R33 + R12 R21 R31 + R12 R21 R33 \\
& + R12 R23 R31 + R12 R23 R33 + R13 R21 R31 + R13 R21 R32 + R13 R23 R31 \\
& + R23 R13 R32 + R13 R31 R32 + R13 R31 R33 + R13 R32 R33 + R32 R31 R21 \\
& + R33 R31 R21 + R33 R32 R21 + R32 R31 R23 + R33 R31 R23 + R33 R32 R23) - MR22) \\
&)
\end{aligned}$$

> *simplify(5.3)*

$$\begin{aligned}
R22 = & (((((R11 + R13 + R31 + R33) R23 + (R11 + R13 + R31 + R33) R32 + R33 (R11 + R13 + R31 + R33) R21 + ((R11 + R13 + R31 + R33) R32 + R31 (R11 + R13 + R33)) R23 \\
& + (R11 + R13) ((R31 + R33) R32 + R33 R31)) R12 + (((R11 + R13 + R31 + R33) R32 + (R13 + R33) (R11 + R31)) R23 + R13 ((R11 + R31 + R33) R32 + R33 (R11 + R31))) R21 + (((R13 + R31 + R33) R32 + R31 (R13 + R33)) R23 \\
& + R13 ((R31 + R33) R32 + R33 R31)) R11) MR22) / (((((R11 + R13 + R31 + R33) R23 + (R11 + R13 + R31 + R33) R32 + (R33 - MR22) R11 + (R33 - MR22) R13 + (R33 - MR22) R31 - R33 MR22) R21 + ((R11 + R13 + R31 + R33) R32 + (R31 - MR22) R11 + (R31 - MR22) R13 + (R33 - MR22) R31 - R33 MR22) R23 + ((R31 + R33) R32 + (R33 - MR22) R31 - R33 MR22) (R11 + R13)) R12 + (((R11 + R13 + R31 + R33) R32 + (R13 + R33) (R11 + R31)) R23 + ((R13 - MR22) R11 + (R31 + R33 - MR22) R13 - MR22 (R31 + R33)) R32 + (R11 + R31) ((R33 - MR22) R13 - R33 MR22)) R21 + (((R13 + R31 + R33 - MR22) R11 - MR22 (R13 + R31 + R33)) R32 + (R13 + R33) ((R31 - MR22) R11 - R31 MR22)) R23 + ((R13 - MR22) R11 - R13 MR22) (R31 + R33) R32 + (((R33 - MR22) R31 - R33 MR22) R11 - MR22 R13 R31 R33)
\end{aligned} \tag{5.4}$$

R23

[> *restart*

```

> Req := eq =  $\frac{Vr2}{Is}$  :
=
> r1 := 0 =  $\frac{Vr1 - Vc3}{R13} + \frac{Vr1 - Vc2}{R12} + \frac{Vr1 - Vc1}{R11}$  :
=
> r2 := Is =  $\frac{Vr2 - Vc1}{R21} + \frac{Vr2 - Vc2}{R22} + \frac{Vr2 - Vc3}{R23}$  :
=
> r3 := 0 =  $\frac{Vr3 - Vc3}{R33} + \frac{Vr3 - Vc2}{R32} + \frac{Vr3 - Vc1}{R31}$  :
=
>
> c1 := 0 =  $\frac{Vc1 - Vr2}{R21} + \frac{Vc1 - Vr1}{R11} + \frac{Vc1 - Vr3}{R31}$  :
=
> c2 := 0 =  $\frac{Vc2 - Vr2}{R22} + \frac{Vc2 - Vr1}{R12} + \frac{Vc2 - Vr3}{R32}$  :
=
> Vc3 := 0 :
=
> L := solve( {Req, r1, r2, r3, c1, c2}, [eq, Vr1, Vr2, Vr3, Vc1, Vc2]) [1][1]
L := eq = ((R11 R12 R21 R22 + R11 R12 R21 R32 + R11 R12 R21 R33 + R11 R12 R22 R31
+ R11 R12 R22 R33 + R11 R12 R31 R32 + R11 R12 R31 R33 + R11 R12 R32 R33
+ R11 R13 R21 R22 + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R22 R31
+ R11 R13 R22 R33 + R11 R13 R31 R32 + R11 R13 R31 R33 + R11 R13 R32 R33
+ R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R22 R31 R32 + R11 R22 R31 R33
+ R11 R22 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R32 + R12 R13 R21 R33
+ R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R31 R32 + R12 R13 R31 R33
+ R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R31 R32
+ R12 R21 R31 R33 + R12 R21 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32
+ R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 + R13 R22 R31 R32
+ R13 R22 R31 R33 + R13 R22 R32 R33 + R21 R22 R31 R32 + R33 R31 R22 R21
+ R33 R32 R22 R21) R23) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32
+ R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33
+ R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33
+ R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32
+ R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33
+ R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33
+ R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R22 R31 R32
+ R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33
+ R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32
+ R12 R13 R21 R33 + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33
+ R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33
+ R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31)

```

(6.1)

$$\begin{aligned}
& + R12 R21 R23 R33 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 \\
& + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 \\
& + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 \\
& + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 \\
& + R13 R22 R32 R33 + R21 R22 R31 R32 + R33 R31 R22 R21 + R33 R32 R22 R21 \\
& + R32 R31 R23 R21 + R21 R23 R31 R33 + R21 R23 R32 R33 + R32 R31 R23 R22 \\
& + R33 R31 R23 R22 + R33 R32 R23 R22)
\end{aligned}$$

> $\text{Req23} := \text{eq} = \frac{R23 \cdot Rx23}{R23 + Rx23} :$

> $\text{solve}(\{\text{L}, \text{Req23}\}, [\text{Rx23}, \text{eq}])[1][1]$

$$\text{Rx23} = (\text{R11 R12 R21 R22} + \text{R11 R12 R21 R32} + \text{R11 R12 R21 R33} + \text{R11 R12 R22 R31}) \quad (6.2)$$

$$\begin{aligned}
& + \text{R11 R12 R22 R33} + \text{R11 R12 R31 R32} + \text{R11 R12 R31 R33} + \text{R11 R12 R32 R33} \\
& + \text{R11 R13 R21 R22} + \text{R11 R13 R21 R32} + \text{R11 R13 R21 R33} + \text{R11 R13 R22 R31} \\
& + \text{R11 R13 R22 R33} + \text{R11 R13 R31 R32} + \text{R11 R13 R31 R33} + \text{R11 R13 R32 R33} \\
& + \text{R11 R21 R22 R32} + \text{R11 R21 R22 R33} + \text{R11 R22 R31 R32} + \text{R11 R22 R31 R33} \\
& + \text{R11 R22 R32 R33} + \text{R12 R13 R21 R22} + \text{R12 R13 R21 R32} + \text{R12 R13 R21 R33} \\
& + \text{R12 R13 R22 R31} + \text{R12 R13 R22 R33} + \text{R12 R13 R31 R32} + \text{R12 R13 R31 R33} \\
& + \text{R12 R13 R32 R33} + \text{R12 R21 R22 R31} + \text{R12 R21 R22 R33} + \text{R12 R21 R31 R32} \\
& + \text{R12 R21 R31 R33} + \text{R12 R21 R32 R33} + \text{R13 R21 R22 R31} + \text{R13 R21 R22 R32} \\
& + \text{R13 R21 R31 R32} + \text{R13 R21 R31 R33} + \text{R13 R21 R32 R33} + \text{R13 R22 R31 R32} \\
& + \text{R13 R22 R31 R33} + \text{R13 R22 R32 R33} + \text{R21 R22 R31 R32} + \text{R33 R31 R22 R21} \\
& + \text{R33 R32 R22 R21}) / (\text{R11 R12 R21} + \text{R11 R12 R22} + \text{R11 R12 R31} + \text{R11 R12 R32} \\
& + \text{R11 R13 R21} + \text{R11 R13 R22} + \text{R11 R13 R31} + \text{R11 R13 R32} + \text{R11 R21 R32} \\
& + \text{R11 R21 R33} + \text{R11 R22 R32} + \text{R11 R22 R33} + \text{R11 R31 R32} + \text{R11 R31 R33} \\
& + \text{R11 R32 R33} + \text{R12 R13 R21} + \text{R13 R12 R22} + \text{R12 R13 R31} + \text{R12 R13 R32} \\
& + \text{R12 R21 R31} + \text{R12 R21 R33} + \text{R12 R22 R31} + \text{R22 R12 R33} + \text{R12 R31 R32} \\
& + \text{R12 R31 R33} + \text{R12 R32 R33} + \text{R13 R21 R31} + \text{R13 R21 R32} + \text{R13 R22 R31} \\
& + \text{R13 R22 R32} + \text{R32 R31 R21} + \text{R33 R31 R21} + \text{R33 R32 R21} + \text{R32 R31 R22} \\
& + \text{R33 R31 R22} + \text{R33 R32 R22})
\end{aligned}$$

> $\text{assign}(6.2)$

> $R23 = \frac{MR23 \cdot Rx23}{Rx23 - MR23}$

$$\text{R23} = (\text{MR23} (\text{R11 R12 R21 R22} + \text{R11 R12 R21 R32} + \text{R11 R12 R21 R33} + \text{R11 R12 R22 R31}) \quad (6.3)$$

$$\begin{aligned}
& + \text{R11 R12 R22 R33} + \text{R11 R12 R31 R32} + \text{R11 R12 R31 R33} + \text{R11 R12 R32 R33} \\
& + \text{R11 R13 R21 R22} + \text{R11 R13 R21 R32} + \text{R11 R13 R21 R33} + \text{R11 R13 R22 R31} \\
& + \text{R11 R13 R22 R33} + \text{R11 R13 R31 R32} + \text{R11 R13 R31 R33} + \text{R11 R13 R32 R33} \\
& + \text{R11 R21 R22 R32} + \text{R11 R21 R22 R33} + \text{R11 R22 R31 R32} + \text{R11 R22 R31 R33}
\end{aligned}$$

$$\begin{aligned}
& + R_{11}R_{22}R_{32}R_{33} + R_{12}R_{13}R_{21}R_{22} + R_{12}R_{13}R_{21}R_{32} + R_{12}R_{13}R_{21}R_{33} \\
& + R_{12}R_{13}R_{22}R_{31} + R_{12}R_{13}R_{22}R_{33} + R_{12}R_{13}R_{31}R_{32} + R_{12}R_{13}R_{31}R_{33} \\
& + R_{12}R_{13}R_{32}R_{33} + R_{12}R_{21}R_{22}R_{31} + R_{12}R_{21}R_{22}R_{33} + R_{12}R_{21}R_{31}R_{32} \\
& + R_{12}R_{21}R_{31}R_{33} + R_{12}R_{21}R_{32}R_{33} + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{22}R_{32} \\
& + R_{13}R_{21}R_{31}R_{32} + R_{13}R_{21}R_{31}R_{33} + R_{13}R_{21}R_{32}R_{33} + R_{13}R_{22}R_{31}R_{32} \\
& + R_{13}R_{22}R_{31}R_{33} + R_{13}R_{22}R_{32}R_{33} + R_{21}R_{22}R_{31}R_{32} + R_{33}R_{31}R_{22}R_{21} \\
& + R_{33}R_{32}R_{22}R_{21})) \Big/ ((R_{11}R_{12}R_{21} + R_{11}R_{12}R_{22} + R_{11}R_{12}R_{31} + R_{11}R_{12}R_{32} \\
& + R_{11}R_{13}R_{21} + R_{11}R_{13}R_{22} + R_{11}R_{13}R_{31} + R_{11}R_{13}R_{32} + R_{11}R_{21}R_{32} \\
& + R_{11}R_{21}R_{33} + R_{11}R_{22}R_{32} + R_{11}R_{22}R_{33} + R_{11}R_{31}R_{32} + R_{11}R_{31}R_{33} \\
& + R_{11}R_{32}R_{33} + R_{12}R_{13}R_{21} + R_{13}R_{12}R_{22} + R_{12}R_{13}R_{31} + R_{12}R_{13}R_{32} \\
& + R_{12}R_{21}R_{31} + R_{12}R_{21}R_{33} + R_{12}R_{22}R_{31} + R_{22}R_{12}R_{33} + R_{12}R_{31}R_{32} \\
& + R_{12}R_{31}R_{33} + R_{12}R_{32}R_{33} + R_{13}R_{21}R_{31} + R_{13}R_{21}R_{32} + R_{13}R_{22}R_{31} \\
& + R_{13}R_{22}R_{32} + R_{32}R_{31}R_{21} + R_{33}R_{31}R_{21} + R_{33}R_{32}R_{21} + R_{32}R_{31}R_{22} \\
& + R_{33}R_{31}R_{22} + R_{33}R_{32}R_{22})) ((R_{11}R_{12}R_{21}R_{22} + R_{11}R_{12}R_{21}R_{32} \\
& + R_{11}R_{12}R_{21}R_{33} + R_{11}R_{12}R_{22}R_{31} + R_{11}R_{12}R_{22}R_{33} + R_{11}R_{12}R_{31}R_{32} \\
& + R_{11}R_{12}R_{31}R_{33} + R_{11}R_{12}R_{32}R_{33} + R_{11}R_{13}R_{21}R_{22} + R_{11}R_{13}R_{21}R_{32} \\
& + R_{11}R_{13}R_{21}R_{33} + R_{11}R_{13}R_{22}R_{31} + R_{11}R_{13}R_{22}R_{33} + R_{11}R_{13}R_{31}R_{32} \\
& + R_{11}R_{13}R_{31}R_{33} + R_{11}R_{13}R_{32}R_{33} + R_{11}R_{21}R_{22}R_{32} + R_{11}R_{21}R_{22}R_{33} \\
& + R_{11}R_{22}R_{31}R_{32} + R_{11}R_{22}R_{31}R_{33} + R_{11}R_{22}R_{32}R_{33} + R_{12}R_{13}R_{21}R_{22} \\
& + R_{12}R_{13}R_{21}R_{32} + R_{12}R_{13}R_{21}R_{33} + R_{12}R_{13}R_{22}R_{31} + R_{12}R_{13}R_{22}R_{33} \\
& + R_{12}R_{13}R_{31}R_{32} + R_{12}R_{13}R_{31}R_{33} + R_{12}R_{13}R_{32}R_{33} + R_{12}R_{21}R_{22}R_{31} \\
& + R_{12}R_{21}R_{22}R_{33} + R_{12}R_{21}R_{31}R_{32} + R_{12}R_{21}R_{31}R_{33} + R_{12}R_{21}R_{32}R_{33} \\
& + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{22}R_{32} + R_{13}R_{21}R_{31}R_{32} + R_{13}R_{21}R_{31}R_{33} \\
& + R_{13}R_{21}R_{32}R_{33} + R_{13}R_{22}R_{31}R_{32} + R_{13}R_{22}R_{31}R_{33} + R_{13}R_{22}R_{32}R_{33} \\
& + R_{21}R_{22}R_{31}R_{32} + R_{33}R_{31}R_{22}R_{21} + R_{33}R_{32}R_{22}R_{21}) / (R_{11}R_{12}R_{21} \\
& + R_{11}R_{12}R_{22} + R_{11}R_{12}R_{31} + R_{11}R_{12}R_{32} + R_{11}R_{13}R_{21} + R_{11}R_{13}R_{22} \\
& + R_{11}R_{13}R_{31} + R_{11}R_{13}R_{32} + R_{11}R_{21}R_{32} + R_{11}R_{21}R_{33} + R_{11}R_{22}R_{32} \\
& + R_{11}R_{22}R_{33} + R_{11}R_{31}R_{32} + R_{11}R_{31}R_{33} + R_{11}R_{32}R_{33} + R_{12}R_{13}R_{21} \\
& + R_{13}R_{12}R_{22} + R_{12}R_{13}R_{31} + R_{12}R_{13}R_{32} + R_{12}R_{21}R_{31} + R_{12}R_{21}R_{33} \\
& + R_{12}R_{22}R_{31} + R_{22}R_{12}R_{33} + R_{12}R_{31}R_{32} + R_{12}R_{31}R_{33} + R_{12}R_{32}R_{33} \\
& + R_{13}R_{21}R_{31} + R_{13}R_{21}R_{32} + R_{13}R_{22}R_{31} + R_{13}R_{22}R_{32} + R_{32}R_{31}R_{21} \\
& + R_{33}R_{31}R_{21} + R_{33}R_{32}R_{21} + R_{32}R_{31}R_{22} + R_{33}R_{31}R_{22} + R_{33}R_{32}R_{22}) - MR_{23})
\end{aligned}$$

)

> *simplify(6.3)*

$$\begin{aligned} R23 = & (MR23 (((R11 + R12 + R31 + R32) R22 + (R11 + R12 + R31 + R32) R33 \\ & + R32 (R11 + R12 + R31)) R21 + ((R11 + R12 + R31 + R32) R33 + R31 (R11 + R12 \\ & + R32)) R22 + (R11 + R12) ((R31 + R32) R33 + R32 R31)) R13 + (((R11 + R12 \\ & + R31 + R32) R33 + (R12 + R32) (R11 + R31)) R22 + ((R11 + R31 + R32) R33 \\ & + R32 (R11 + R31)) R12) R21 + (((R12 + R31 + R32) R33 + R31 (R12 + R32)) R22 \\ & + R12 ((R31 + R32) R33 + R32 R31)) R11)) / (((((R11 + R12 + R31 + R32) R22 \\ & + (R11 + R12 + R31 + R32) R33 + (R32 - MR23) R11 + (R32 - MR23) R12 + (R32 \\ & - MR23) R31 - R32 MR23) R21 + ((R11 + R12 + R31 + R32) R33 + (R31 \\ & - MR23) R11 + (R31 - MR23) R12 + (R32 - MR23) R31 - R32 MR23) R22 + (R11 \\ & + R12) ((R31 + R32) R33 + (R32 - MR23) R31 - R32 MR23)) R13 + (((R11 + R12 \\ & + R31 + R32) R33 + (R12 + R32) (R11 + R31)) R22 + ((R12 - MR23) R11 + (R31 \\ & + R32 - MR23) R12 - MR23 (R31 + R32)) R33 + (R11 + R31) ((R32 - MR23) R12 \\ & - R32 MR23)) R21 + (((R12 + R31 + R32 - MR23) R11 - MR23 (R12 + R31 \\ & + R32)) R33 + (R12 + R32) ((R31 - MR23) R11 - R31 MR23)) R22 + (R31 \\ & + R32) ((R12 - MR23) R11 - R12 MR23) R33 + (((R32 - MR23) R31 \\ & - R32 MR23) R12 - R31 R32 MR23) R11 - MR23 R12 R31 R32)) \end{aligned} \quad (6.4)$$

R31

> *restart*

> $Req := eq = \frac{Vr3}{Is} :$

> $r1 := 0 = \frac{Vr1 - Vc1}{R11} + \frac{Vr1 - Vc2}{R12} + \frac{Vr1 - Vc3}{R13} :$

> $r2 := 0 = \frac{Vr2 - Vc1}{R21} + \frac{Vr2 - Vc2}{R22} + \frac{Vr2 - Vc3}{R23} :$

> $r3 := Is = \frac{Vr3 - Vc1}{R31} + \frac{Vr3 - Vc2}{R32} + \frac{Vr3 - Vc3}{R33} :$

>

> $c2 := 0 = \frac{Vc2 - Vr3}{R32} + \frac{Vc2 - Vr1}{R12} + \frac{Vc2 - Vr2}{R22} :$

> $c3 := 0 = \frac{Vc3 - Vr3}{R33} + \frac{Vc3 - Vr1}{R13} + \frac{Vc3 - Vr2}{R23} :$

> $Vc1 := 0 :$

>

> $L := solve(\{Req, r1, r2, r3, c2, c3\}, [eq, Vr1, Vr2, Vr3, Vc2, Vc3])[1][1]$

$L := eq = ((R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33 \\ + R11 R12 R22 R23 + R11 R12 R22 R33 + R11 R12 R23 R32 + R11 R12 R32 R33 \\ + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33) \quad (7.1)$

$$\begin{aligned}
& + R11 R13 R22 R23 + R11 R13 R22 R33 + R11 R13 R23 R32 + R11 R13 R32 R33 \\
& + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 \\
& + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R32 R33 + R11 R23 R32 R33 \\
& + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33 \\
& + R12 R13 R22 R23 + R12 R13 R22 R33 + R12 R13 R23 R32 + R12 R13 R32 R33 \\
& + R12 R21 R22 R33 + R12 R21 R23 R33 + R12 R21 R32 R33 + R12 R22 R23 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R32 + R13 R21 R23 R32 + R13 R21 R32 R33 \\
& + R13 R22 R23 R32 + R13 R22 R32 R33 + R33 R32 R22 R21 + R33 R32 R23 R21 \\
& + R22 R23 R32 R33) R31) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 \\
& + R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R22 R33 \\
& + R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 \\
& + R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 \\
& + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R22 R33 \\
& + R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 \\
& + R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 \\
& + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 \\
& + R11 R22 R31 R33 + R11 R22 R32 R33 + R11 R23 R31 R32 + R11 R23 R31 R33 \\
& + R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 \\
& + R12 R13 R21 R33 + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 \\
& + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 \\
& + R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 \\
& + R12 R21 R23 R33 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 \\
& + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 \\
& + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 \\
& + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 \\
& + R13 R22 R32 R33 + R21 R22 R31 R32 + R33 R31 R22 R21 + R33 R32 R22 R21 \\
& + R21 R23 R31 R32 + R33 R31 R23 R21 + R33 R32 R23 R21 + R32 R31 R23 R22 \\
& + R33 R31 R23 R22 + R22 R23 R32 R33)
\end{aligned}$$

> $Req31 := eq = \frac{R31 \cdot Rx31}{R31 + Rx31} :$
> $solve(\{L, Req31\}, [Rx31, eq])[1][1]$
 $Rx31 = (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R33 + R11 R12 R23 R32 + R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R33 + R11 R13 R23 R32 + R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R32 R33) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R33 + R11 R12 R23 R32 + R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R33 + R11 R13 R23 R32 + R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R32 R33)$ (7.2)

$$\begin{aligned}
& + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33 \\
& + R12 R13 R22 R23 + R12 R13 R22 R33 + R12 R13 R23 R32 + R12 R13 R32 R33 \\
& + R12 R21 R22 R33 + R12 R21 R23 R33 + R12 R21 R32 R33 + R12 R22 R23 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R32 + R13 R21 R23 R32 + R13 R21 R32 R33 \\
& + R13 R22 R23 R32 + R13 R22 R32 R33 + R33 R32 R22 R21 + R33 R32 R23 R21 \\
& + R22 R23 R32 R33) / (R11 R12 R22 + R11 R12 R23 + R11 R12 R32 + R11 R12 R33 \\
& + R11 R13 R22 + R11 R13 R23 + R11 R13 R32 + R11 R13 R33 + R11 R22 R32 \\
& + R11 R22 R33 + R11 R23 R32 + R11 R23 R33 + R12 R13 R22 + R12 R13 R23 \\
& + R12 R13 R32 + R12 R13 R33 + R12 R21 R22 + R12 R21 R23 + R12 R21 R32 \\
& + R12 R21 R33 + R12 R22 R23 + R12 R23 R32 + R12 R23 R33 + R13 R21 R22 \\
& + R13 R21 R23 + R13 R21 R32 + R33 R13 R21 + R13 R22 R23 + R13 R22 R32 \\
& + R13 R22 R33 + R32 R22 R21 + R33 R22 R21 + R32 R23 R21 + R33 R23 R21 \\
& + R32 R23 R22 + R33 R23 R22)
\end{aligned}$$

> assign(7.2)

$$R31 = \frac{MR31 \cdot Rx31}{Rx31 - MR31}$$

$$R31 = (MR31 (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R21 R33) \quad (7.3)$$

$$\begin{aligned}
& + R11 R12 R22 R23 + R11 R12 R22 R33 + R11 R12 R23 R32 + R11 R12 R32 R33 \\
& + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R21 R33 \\
& + R11 R13 R22 R23 + R11 R13 R22 R33 + R11 R13 R23 R32 + R11 R13 R32 R33 \\
& + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 \\
& + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R32 R33 + R11 R23 R32 R33 \\
& + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R21 R33 \\
& + R12 R13 R22 R23 + R12 R13 R22 R33 + R12 R13 R23 R32 + R12 R13 R32 R33 \\
& + R12 R21 R22 R33 + R12 R21 R23 R33 + R12 R21 R32 R33 + R12 R22 R23 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R32 + R13 R21 R23 R32 + R13 R21 R32 R33 \\
& + R13 R22 R23 R32 + R13 R22 R32 R33 + R33 R32 R22 R21 + R33 R32 R23 R21 \\
& + R22 R23 R32 R33)) / ((R11 R12 R22 + R11 R12 R23 + R11 R12 R32 + R11 R12 R33
\end{aligned}$$

$$+ R11 R13 R22 + R11 R13 R23 + R11 R13 R32 + R11 R13 R33 + R11 R22 R32$$

$$+ R11 R22 R33 + R11 R23 R32 + R11 R23 R33 + R12 R13 R22 + R12 R13 R23$$

$$+ R12 R13 R32 + R12 R13 R33 + R12 R21 R22 + R12 R21 R23 + R12 R21 R32$$

$$+ R12 R21 R33 + R12 R22 R23 + R12 R23 R32 + R12 R23 R33 + R13 R21 R22$$

$$+ R13 R21 R23 + R13 R21 R32 + R33 R13 R21 + R13 R22 R23 + R13 R22 R32$$

$$\begin{aligned}
& + R13 R22 R33 + R32 R22 R21 + R33 R22 R21 + R32 R23 R21 + R33 R23 R21 \\
& + R32 R23 R22 + R33 R23 R22) ((R11 R12 R21 R22 + R11 R12 R21 R23 \\
& + R11 R12 R21 R32 + R11 R12 R21 R33 + R11 R12 R22 R23 + R11 R12 R22 R33 \\
& + R11 R12 R23 R32 + R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 \\
& + R11 R13 R21 R32 + R11 R13 R21 R33 + R11 R13 R22 R23 + R11 R13 R22 R33 \\
& + R11 R13 R23 R32 + R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 \\
& + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R22 R23 R32 + R11 R22 R23 R33 \\
& + R11 R22 R32 R33 + R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 \\
& + R12 R13 R21 R32 + R12 R13 R21 R33 + R12 R13 R22 R23 + R12 R13 R22 R33 \\
& + R12 R13 R23 R32 + R12 R13 R32 R33 + R12 R21 R22 R33 + R12 R21 R23 R33 \\
& + R12 R21 R32 R33 + R12 R22 R23 R33 + R12 R23 R32 R33 + R13 R21 R22 R32 \\
& + R13 R21 R23 R32 + R13 R21 R32 R33 + R13 R22 R23 R32 + R13 R22 R32 R33 \\
& + R33 R32 R22 R21 + R33 R32 R23 R21 + R22 R23 R32 R33) / (R11 R12 R22 \\
& + R11 R12 R23 + R11 R12 R32 + R11 R12 R33 + R11 R13 R22 + R11 R13 R23 \\
& + R11 R13 R32 + R11 R13 R33 + R11 R22 R32 + R11 R22 R33 + R11 R23 R32 \\
& + R11 R23 R33 + R12 R13 R22 + R12 R13 R23 + R12 R13 R32 + R12 R13 R33 \\
& + R12 R21 R22 + R12 R21 R23 + R12 R21 R32 + R12 R21 R33 + R12 R22 R23 \\
& + R12 R23 R32 + R12 R23 R33 + R13 R21 R22 + R13 R21 R23 + R13 R21 R32 \\
& + R33 R13 R21 + R13 R22 R23 + R13 R22 R32 + R13 R22 R33 + R32 R22 R21 \\
& + R33 R22 R21 + R32 R23 R21 + R33 R23 R21 + R32 R23 R22 + R33 R23 R22) - MR31) \\
&)
\end{aligned}$$

> *simplify(7.3)*

$$\begin{aligned}
R31 = & (((((R12 + R13 + R22 + R23) R32 + (R12 + R13 + R22 + R23) R33 + (R22 & (7.4) \\
& + R23) (R12 + R13)) R21 + ((R12 + R13 + R22 + R23) R33 + R23 (R12 + R13 \\
& + R22)) R32 + ((R12 + R13 + R23) R33 + R23 (R12 + R13)) R22) R11 + (((R12 \\
& + R13 + R22 + R23) R33 + R13 (R12 + R22 + R23)) R32 + ((R13 + R22 + R23) R33 \\
& + R13 (R22 + R23)) R12) R21 + ((R13 + R23) R33 + R13 R23) ((R12 + R22) R32 \\
& + R12 R22)) MR31) / (((((R12 + R13 + R22 + R23) R32 + (R12 + R13 + R22 \\
& + R23) R33 + (R22 + R23) (R12 + R13)) R21 + ((R12 + R13 + R22 + R23) R33 \\
& + (R23 - MR31) R12 + (R23 - MR31) R13 + (R23 - MR31) R22 - R23 MR31) R32 \\
& + ((R22 - MR31) R12 + (R22 - MR31) R13 + (R23 - MR31) R22 - R23 MR31) R33 \\
& + (R12 + R13) ((R23 - MR31) R22 - R23 MR31)) R11 + (((R12 + R13 + R22 \\
& + R23) R33 + (R13 - MR31) R12 + (R22 + R23 - MR31) R13 - MR31 (R22 + R23)) \\
& R32 + ((R13 + R22 + R23 - MR31) R12 - MR31 (R13 + R22 + R23)) R33 + (R22 \\
& + R23) ((R13 - MR31) R12 - R13 MR31)) R21 + ((R13 + R23) R33 + (R23 \\
& - MR31) R13 - R23 MR31) (R12 + R22) R32 + ((R22 - MR31) R12 \\
& - R22 MR31) (R13 + R23) R33 + (((R23 - MR31) R22 - R23 MR31) R13
\end{aligned}$$

$- R_{22} R_{23} M_{R31}) R_{12} - M_{R31} R_{13} R_{22} R_{23})$

R32

```

> restart
> Req := eq =  $\frac{V_{r3}}{I_s}$  :
> r1 :=  $0 = \frac{V_{r1} - V_{c2}}{R_{12}} + \frac{V_{r1} - V_{c1}}{R_{11}} + \frac{V_{r1} - V_{c3}}{R_{13}}$  :
> r2 :=  $0 = \frac{V_{r2} - V_{c2}}{R_{22}} + \frac{V_{r2} - V_{c1}}{R_{21}} + \frac{V_{r2} - V_{c3}}{R_{23}}$  :
> r3 :=  $I_s = \frac{V_{r3} - V_{c1}}{R_{31}} + \frac{V_{r3} - V_{c2}}{R_{32}} + \frac{V_{r3} - V_{c3}}{R_{33}}$  :
>
> c1 :=  $0 = \frac{V_{c1} - V_{r3}}{R_{31}} + \frac{V_{c1} - V_{r1}}{R_{11}} + \frac{V_{c1} - V_{r2}}{R_{21}}$  :
> c3 :=  $0 = \frac{V_{c3} - V_{r3}}{R_{33}} + \frac{V_{c3} - V_{r1}}{R_{13}} + \frac{V_{c3} - V_{r2}}{R_{23}}$  :
> Vc2 := 0 :
>
> L := solve( {Req, r1, r2, r3, c1, c3}, [eq, Vr1, Vr2, Vr3, Vc1, Vc3])[1][1]
L := eq = (( $R_{11} R_{12} R_{21} R_{22} + R_{11} R_{12} R_{21} R_{23} + R_{11} R_{12} R_{21} R_{33} + R_{11} R_{12} R_{22} R_{23}$  (8.1)
 $+ R_{11} R_{12} R_{22} R_{31} + R_{11} R_{12} R_{22} R_{33} + R_{11} R_{12} R_{23} R_{31} + R_{11} R_{12} R_{31} R_{33}$ 
 $+ R_{11} R_{13} R_{21} R_{22} + R_{11} R_{13} R_{21} R_{23} + R_{11} R_{13} R_{21} R_{33} + R_{11} R_{13} R_{22} R_{23}$ 
 $+ R_{11} R_{13} R_{22} R_{31} + R_{11} R_{13} R_{22} R_{33} + R_{11} R_{13} R_{23} R_{31} + R_{11} R_{13} R_{31} R_{33}$ 
 $+ R_{11} R_{21} R_{22} R_{33} + R_{11} R_{21} R_{23} R_{33} + R_{11} R_{22} R_{23} R_{33} + R_{11} R_{22} R_{31} R_{33}$ 
 $+ R_{11} R_{23} R_{31} R_{33} + R_{12} R_{13} R_{21} R_{22} + R_{12} R_{13} R_{21} R_{23} + R_{12} R_{13} R_{21} R_{33}$ 
 $+ R_{12} R_{13} R_{22} R_{23} + R_{12} R_{13} R_{22} R_{31} + R_{12} R_{13} R_{22} R_{33} + R_{12} R_{13} R_{23} R_{31}$ 
 $+ R_{12} R_{13} R_{31} R_{33} + R_{12} R_{21} R_{22} R_{31} + R_{12} R_{21} R_{22} R_{33} + R_{12} R_{21} R_{23} R_{31}$ 
 $+ R_{12} R_{21} R_{23} R_{33} + R_{12} R_{21} R_{31} R_{33} + R_{12} R_{22} R_{23} R_{31} + R_{12} R_{22} R_{23} R_{33}$ 
 $+ R_{12} R_{23} R_{31} R_{33} + R_{13} R_{21} R_{22} R_{31} + R_{13} R_{21} R_{23} R_{31} + R_{13} R_{21} R_{31} R_{33}$ 
 $+ R_{13} R_{22} R_{23} R_{31} + R_{13} R_{22} R_{31} R_{33} + R_{33} R_{31} R_{22} R_{21} + R_{21} R_{23} R_{31} R_{33}$ 
 $+ R_{33} R_{31} R_{23} R_{22}) R_{32}) / (R_{11} R_{12} R_{21} R_{22} + R_{11} R_{12} R_{21} R_{23} + R_{11} R_{12} R_{21} R_{32}$ 
 $+ R_{11} R_{12} R_{21} R_{33} + R_{11} R_{12} R_{22} R_{23} + R_{11} R_{12} R_{22} R_{31} + R_{11} R_{12} R_{22} R_{33}$ 
 $+ R_{11} R_{12} R_{23} R_{31} + R_{11} R_{12} R_{23} R_{32} + R_{11} R_{12} R_{31} R_{32} + R_{11} R_{12} R_{31} R_{33}$ 
 $+ R_{11} R_{12} R_{32} R_{33} + R_{11} R_{13} R_{21} R_{22} + R_{11} R_{13} R_{21} R_{23} + R_{11} R_{13} R_{21} R_{32}$ 
 $+ R_{11} R_{13} R_{21} R_{33} + R_{11} R_{13} R_{22} R_{23} + R_{11} R_{13} R_{22} R_{31} + R_{11} R_{13} R_{22} R_{33}$ 
 $+ R_{11} R_{13} R_{23} R_{31} + R_{11} R_{13} R_{23} R_{32} + R_{11} R_{13} R_{31} R_{32} + R_{11} R_{13} R_{31} R_{33}$ 
 $+ R_{11} R_{13} R_{32} R_{33} + R_{11} R_{21} R_{22} R_{32} + R_{11} R_{21} R_{22} R_{33} + R_{11} R_{21} R_{23} R_{32}$ 
 $+ R_{11} R_{21} R_{23} R_{33} + R_{11} R_{22} R_{23} R_{32} + R_{11} R_{22} R_{23} R_{33} + R_{11} R_{22} R_{31} R_{32}$ 
 $+ R_{11} R_{22} R_{31} R_{33} + R_{11} R_{22} R_{32} R_{33} + R_{11} R_{23} R_{31} R_{32} + R_{11} R_{23} R_{31} R_{33}$ 

```

$$\begin{aligned}
& + R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 \\
& + R12 R13 R21 R33 + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 \\
& + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 \\
& + R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 \\
& + R12 R21 R23 R33 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R21 R32 R33 \\
& + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 \\
& + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 \\
& + R13 R21 R23 R32 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R21 R32 R33 \\
& + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 \\
& + R13 R22 R32 R33 + R32 R31 R22 R21 + R33 R31 R22 R21 + R33 R32 R22 R21 \\
& + R32 R31 R23 R21 + R21 R23 R31 R33 + R33 R32 R23 R21 + R22 R23 R31 R32 \\
& + R33 R31 R23 R22 + R33 R32 R23 R22)
\end{aligned}$$

> $\text{Req32} := \text{eq} = \frac{R32 \cdot Rx32}{R32 + Rx32} :$

> $\text{solve}(\{\text{L}, \text{Req32}\}, [\text{Rx32}, \text{eq}])[1][1]$

$$\begin{aligned}
\text{Rx32} = & (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R33 + R11 R12 R22 R23 \\
& + R11 R12 R22 R31 + R11 R12 R22 R33 + R11 R12 R23 R31 + R11 R12 R31 R33 \\
& + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R33 + R11 R13 R22 R23 \\
& + R11 R13 R22 R31 + R11 R13 R22 R33 + R11 R13 R23 R31 + R11 R13 R31 R33 \\
& + R11 R21 R22 R33 + R11 R21 R23 R33 + R11 R22 R23 R33 + R11 R22 R31 R33 \\
& + R11 R23 R31 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R33 \\
& + R12 R13 R22 R23 + R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R23 R31 \\
& + R12 R13 R31 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 \\
& + R12 R21 R23 R33 + R12 R21 R31 R33 + R12 R22 R23 R31 + R12 R22 R23 R33 \\
& + R12 R23 R31 R33 + R13 R21 R22 R31 + R13 R21 R23 R31 + R13 R21 R31 R33 \\
& + R13 R22 R23 R31 + R13 R22 R31 R33 + R33 R31 R22 R21 + R21 R23 R31 R33 \\
& + R33 R31 R23 R22) / (R11 R12 R21 + R11 R12 R23 + R11 R12 R31 + R11 R12 R33 \\
& + R11 R13 R21 + R11 R13 R23 + R11 R13 R31 + R11 R13 R33 + R11 R21 R22 \\
& + R11 R21 R23 + R11 R22 R23 + R11 R22 R31 + R11 R22 R33 + R11 R23 R31 \\
& + R11 R23 R33 + R12 R13 R21 + R12 R13 R23 + R12 R13 R31 + R12 R13 R33 \\
& + R12 R21 R31 + R12 R21 R33 + R12 R23 R31 + R12 R23 R33 + R13 R21 R22 \\
& + R13 R21 R23 + R13 R21 R31 + R13 R21 R33 + R13 R22 R23 + R13 R22 R31 \\
& + R33 R13 R22 + R31 R22 R21 + R33 R22 R21 + R31 R23 R21 + R33 R23 R21 \\
& + R22 R23 R31 + R33 R23 R22)
\end{aligned} \tag{8.2}$$

> $\text{assign}(8.2)$

> $R32 = \frac{MR32 \cdot Rx32}{Rx32 - MR32}$

$$R32 = (MR32 (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R33 + R11 R12 R22 R23)) \tag{8.3}$$

$$\begin{aligned}
& + R_{11}R_{12}R_{22}R_{31} + R_{11}R_{12}R_{22}R_{33} + R_{11}R_{12}R_{23}R_{31} + R_{11}R_{12}R_{31}R_{33} \\
& + R_{11}R_{13}R_{21}R_{22} + R_{11}R_{13}R_{21}R_{23} + R_{11}R_{13}R_{21}R_{33} + R_{11}R_{13}R_{22}R_{23} \\
& + R_{11}R_{13}R_{22}R_{31} + R_{11}R_{13}R_{22}R_{33} + R_{11}R_{13}R_{23}R_{31} + R_{11}R_{13}R_{31}R_{33} \\
& + R_{11}R_{21}R_{22}R_{33} + R_{11}R_{21}R_{23}R_{33} + R_{11}R_{22}R_{23}R_{33} + R_{11}R_{22}R_{31}R_{33} \\
& + R_{11}R_{23}R_{31}R_{33} + R_{12}R_{13}R_{21}R_{22} + R_{12}R_{13}R_{21}R_{23} + R_{12}R_{13}R_{21}R_{33} \\
& + R_{12}R_{13}R_{22}R_{23} + R_{12}R_{13}R_{22}R_{31} + R_{12}R_{13}R_{22}R_{33} + R_{12}R_{13}R_{23}R_{31} \\
& + R_{12}R_{13}R_{31}R_{33} + R_{12}R_{21}R_{22}R_{31} + R_{12}R_{21}R_{22}R_{33} + R_{12}R_{21}R_{23}R_{31} \\
& + R_{12}R_{21}R_{23}R_{33} + R_{12}R_{21}R_{31}R_{33} + R_{12}R_{22}R_{23}R_{31} + R_{12}R_{22}R_{23}R_{33} \\
& + R_{12}R_{23}R_{31}R_{33} + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{23}R_{31} + R_{13}R_{21}R_{31}R_{33} \\
& + R_{13}R_{22}R_{23}R_{31} + R_{13}R_{22}R_{31}R_{33} + R_{33}R_{31}R_{22}R_{21} + R_{21}R_{23}R_{31}R_{33} \\
& + R_{33}R_{31}R_{23}R_{22})) / ((R_{11}R_{12}R_{21} + R_{11}R_{12}R_{23} + R_{11}R_{12}R_{31} + R_{11}R_{12}R_{33} \\
& + R_{11}R_{13}R_{21} + R_{11}R_{13}R_{23} + R_{11}R_{13}R_{31} + R_{11}R_{13}R_{33} + R_{11}R_{21}R_{22} \\
& + R_{11}R_{21}R_{23} + R_{11}R_{22}R_{23} + R_{11}R_{22}R_{31} + R_{11}R_{22}R_{33} + R_{11}R_{23}R_{31} \\
& + R_{11}R_{23}R_{33} + R_{12}R_{13}R_{21} + R_{12}R_{13}R_{23} + R_{12}R_{13}R_{31} + R_{12}R_{13}R_{33} \\
& + R_{12}R_{21}R_{31} + R_{12}R_{21}R_{33} + R_{12}R_{23}R_{31} + R_{12}R_{23}R_{33} + R_{13}R_{21}R_{22} \\
& + R_{13}R_{21}R_{23} + R_{13}R_{21}R_{31} + R_{13}R_{21}R_{33} + R_{13}R_{22}R_{23} + R_{13}R_{22}R_{31} \\
& + R_{33}R_{13}R_{22} + R_{31}R_{22}R_{21} + R_{33}R_{22}R_{21} + R_{31}R_{23}R_{21} + R_{33}R_{23}R_{21} \\
& + R_{22}R_{23}R_{31} + R_{33}R_{23}R_{22}) ((R_{11}R_{12}R_{21}R_{22} + R_{11}R_{12}R_{21}R_{23} \\
& + R_{11}R_{12}R_{21}R_{33} + R_{11}R_{12}R_{22}R_{23} + R_{11}R_{12}R_{22}R_{31} + R_{11}R_{12}R_{22}R_{33} \\
& + R_{11}R_{12}R_{23}R_{31} + R_{11}R_{12}R_{31}R_{33} + R_{11}R_{13}R_{21}R_{22} + R_{11}R_{13}R_{21}R_{23} \\
& + R_{11}R_{13}R_{21}R_{33} + R_{11}R_{13}R_{22}R_{23} + R_{11}R_{13}R_{22}R_{31} + R_{11}R_{13}R_{22}R_{33} \\
& + R_{11}R_{13}R_{23}R_{31} + R_{11}R_{13}R_{31}R_{33} + R_{11}R_{21}R_{22}R_{33} + R_{11}R_{21}R_{23}R_{33} \\
& + R_{11}R_{22}R_{23}R_{33} + R_{11}R_{22}R_{31}R_{33} + R_{11}R_{23}R_{31}R_{33} + R_{12}R_{13}R_{21}R_{22} \\
& + R_{12}R_{13}R_{21}R_{23} + R_{12}R_{13}R_{21}R_{33} + R_{12}R_{13}R_{22}R_{23} + R_{12}R_{13}R_{22}R_{31} \\
& + R_{12}R_{13}R_{22}R_{33} + R_{12}R_{13}R_{23}R_{31} + R_{12}R_{13}R_{31}R_{33} + R_{12}R_{21}R_{22}R_{31} \\
& + R_{12}R_{21}R_{22}R_{33} + R_{12}R_{21}R_{23}R_{31} + R_{12}R_{21}R_{23}R_{33} + R_{12}R_{21}R_{31}R_{33} \\
& + R_{12}R_{22}R_{23}R_{31} + R_{12}R_{22}R_{23}R_{33} + R_{12}R_{23}R_{31}R_{33} + R_{13}R_{21}R_{22}R_{31} \\
& + R_{13}R_{21}R_{23}R_{31} + R_{13}R_{21}R_{31}R_{33} + R_{13}R_{22}R_{23}R_{31} + R_{13}R_{22}R_{31}R_{33} \\
& + R_{33}R_{31}R_{22}R_{21} + R_{21}R_{23}R_{31}R_{33} + R_{33}R_{31}R_{23}R_{22}) / ((R_{11}R_{12}R_{21} \\
& + R_{11}R_{12}R_{23} + R_{11}R_{12}R_{31} + R_{11}R_{12}R_{33} + R_{11}R_{13}R_{21} + R_{11}R_{13}R_{23} \\
& + R_{11}R_{13}R_{31} + R_{11}R_{13}R_{33} + R_{11}R_{21}R_{22} + R_{11}R_{21}R_{23} + R_{11}R_{22}R_{23} \\
& + R_{11}R_{22}R_{31} + R_{11}R_{22}R_{33} + R_{11}R_{23}R_{31} + R_{11}R_{23}R_{33} + R_{12}R_{13}R_{21})
\end{aligned}$$

$$\begin{aligned}
& + R12 R13 R23 + R12 R13 R31 + R12 R13 R33 + R12 R21 R31 + R12 R21 R33 \\
& + R12 R23 R31 + R12 R23 R33 + R13 R21 R22 + R13 R21 R23 + R13 R21 R31 \\
& + R13 R21 R33 + R13 R22 R23 + R13 R22 R31 + R33 R13 R22 + R31 R22 R21 \\
& + R33 R22 R21 + R31 R23 R21 + R33 R23 R21 + R22 R23 R31 + R33 R23 R22) - MR32) \\
&)
\end{aligned}$$

> *simplify(8.3)*

$$\begin{aligned}
R32 = & (MR32 (((R11 + R13 + R21 + R23) R31 + (R11 + R13 + R21 + R23) R33 + (R21 \\
& + R23) (R11 + R13)) R22 + ((R11 + R13 + R21 + R23) R33 + R23 (R11 + R13 \\
& + R21)) R31 + R21 ((R11 + R13 + R23) R33 + R23 (R11 + R13))) R12 + (((R11 \\
& + R13 + R21 + R23) R33 + R13 (R11 + R21 + R23)) R31 + R11 ((R13 + R21 \\
& + R23) R33 + R13 (R21 + R23))) R22 + ((R11 + R21) R31 + R11 R21) ((R13 \\
& + R23) R33 + R13 R23))) / (((((R11 + R13 + R21 + R23) R31 + (R11 + R13 + R21 \\
& + R23) R33 + (R21 + R23) (R11 + R13)) R22 + ((R11 + R13 + R21 + R23) R33 \\
& + (R23 - MR32) R11 + (R23 - MR32) R13 + (R23 - MR32) R21 - R23 MR32) R31 \\
& + ((R21 - MR32) R11 + (R21 - MR32) R13 + (R23 - MR32) R21 - R23 MR32) R33 \\
& + (R11 + R13) ((R23 - MR32) R21 - R23 MR32)) R12 + (((R11 + R13 + R21 \\
& + R23) R33 + (R13 - MR32) R11 + (R21 + R23 - MR32) R13 - MR32 (R21 + R23)) \\
& R31 + ((R13 + R21 + R23 - MR32) R11 - MR32 (R13 + R21 + R23)) R33 + ((R13 \\
& - MR32) R11 - R13 MR32) (R21 + R23)) R22 + ((R13 + R23) R33 + (R23 \\
& - MR32) R13 - R23 MR32) (R11 + R21) R31 + (R13 + R23) ((R21 - MR32) R11 \\
& - R21 MR32) R33 + (((R23 - MR32) R21 - R23 MR32) R13 - R21 R23 MR32) R11 \\
& - MR32 R13 R21 R23)
\end{aligned} \tag{8.4}$$

R33

$$\begin{aligned}
& > \text{restart} \\
& > Req := eq = \frac{Vr3}{Is} : \\
& > r1 := 0 = \frac{Vr1 - Vc3}{R13} + \frac{Vr1 - Vc1}{R11} + \frac{Vr1 - Vc2}{R12} : \\
& > r2 := 0 = \frac{Vr2 - Vc3}{R23} + \frac{Vr2 - Vc1}{R21} + \frac{Vr2 - Vc2}{R22} : \\
& > r3 := Is = \frac{Vr3 - Vc1}{R31} + \frac{Vr3 - Vc2}{R32} + \frac{Vr3 - Vc3}{R33} : \\
& > \\
& > c1 := 0 = \frac{Vc1 - Vr3}{R31} + \frac{Vc1 - Vr1}{R11} + \frac{Vc1 - Vr2}{R21} : \\
& > c2 := 0 = \frac{Vc2 - Vr3}{R32} + \frac{Vc2 - Vr1}{R12} + \frac{Vc2 - Vr2}{R22} : \\
& > Vc3 := 0 :
\end{aligned}$$

>

> $L := \text{solve}(\{\text{Req}, r1, r2, r3, c1, c2\}, [eq, Vr1, Vr2, Vr3, Vc1, Vc2])[1][1]$
 $L := eq = ((R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R21 R22 R32 + R11 R21 R23 R32 + R11 R22 R23 R32 + R11 R22 R31 R32 + R11 R23 R31 R32 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R22 R23 + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R21 R22 R31 + R12 R21 R23 R31 + R12 R21 R31 R32 + R12 R22 R23 R31 + R12 R23 R31 R32 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R31 R32 + R13 R22 R23 R31 + R13 R22 R31 R32 + R21 R22 R31 R32 + R32 R31 R23 R21 + R32 R31 R23 R22) / (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R22 R31 + R11 R12 R22 R33 + R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R12 R31 R33 + R11 R12 R32 R33 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R22 R31 + R11 R13 R22 R33 + R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R13 R31 R33 + R11 R13 R32 R33 + R11 R21 R22 R32 + R11 R21 R22 R33 + R11 R21 R23 R32 + R11 R21 R23 R33 + R11 R22 R23 R31 + R11 R22 R23 R32 + R11 R22 R23 R33 + R11 R22 R31 R32 + R11 R23 R31 R32 + R11 R23 R31 R33 + R11 R23 R32 R33 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 + R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 + R12 R21 R23 R32 + R12 R21 R31 R32 + R12 R21 R31 R33 + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R22 R33 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 + R13 R22 R32 R33 + R21 R22 R31 R32 + R33 R31 R22 R21 + R33 R32 R22 R21 + R33 R31 R23 R21 + R33 R32 R23 R21 + R32 R31 R23 R22 + R22 R31 R33 + R33 R32 R23 R22)$

>

> $\text{Req33} := eq = \frac{R33 \cdot Rx33}{R33 + Rx33} :$
> $\text{solve}(\{L, \text{Req33}\}, [Rx33, eq])[1][1]$
 $Rx33 = (R11 R12 R21 R22 + R11 R12 R21 R23 + R11 R12 R21 R32 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R23 R31 + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R13 R21 R22 + R11 R13 R21 R23 + R11 R13 R21 R32 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R23 R31 + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R21 R22 R32 + R11 R21 R23 R32 + R11 R22 R23 R32 + R11 R22 R31 R32 + R11 R23 R31 R32 + R12 R13 R21 R22 + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R22 R31 + R12 R13 R22 R33 + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R13 R31 R33 + R12 R13 R32 R33 + R12 R21 R22 R31 + R12 R21 R22 R33 + R12 R21 R23 R31 + R12 R21 R23 R33 + R12 R22 R23 R31 + R12 R22 R23 R33 + R12 R23 R31 R32 + R12 R23 R31 R33 + R12 R23 R32 R33 + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R22 R33 + R13 R21 R31 R32 + R13 R21 R31 R33 + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 + R13 R22 R31 R33 + R13 R22 R32 R33 + R21 R22 R31 R32 + R33 R31 R22 R21 + R33 R32 R22 R21 + R33 R31 R23 R21 + R33 R32 R23 R21 + R32 R31 R23 R22 + R22 R31 R33 + R33 R32 R23 R22)$

(9.2)

$$\begin{aligned}
& + R_{11}R_{12}R_{22}R_{31} + R_{11}R_{12}R_{23}R_{31} + R_{11}R_{12}R_{23}R_{32} + R_{11}R_{12}R_{31}R_{32} \\
& + R_{11}R_{13}R_{21}R_{22} + R_{11}R_{13}R_{21}R_{23} + R_{11}R_{13}R_{21}R_{32} + R_{11}R_{13}R_{22}R_{23} \\
& + R_{11}R_{13}R_{22}R_{31} + R_{11}R_{13}R_{23}R_{31} + R_{11}R_{13}R_{23}R_{32} + R_{11}R_{13}R_{31}R_{32} \\
& + R_{11}R_{21}R_{22}R_{32} + R_{11}R_{21}R_{23}R_{32} + R_{11}R_{22}R_{23}R_{32} + R_{11}R_{22}R_{31}R_{32} \\
& + R_{11}R_{23}R_{31}R_{32} + R_{12}R_{13}R_{21}R_{22} + R_{12}R_{13}R_{21}R_{23} + R_{12}R_{13}R_{21}R_{32} \\
& + R_{12}R_{13}R_{22}R_{23} + R_{12}R_{13}R_{22}R_{31} + R_{12}R_{13}R_{23}R_{31} + R_{12}R_{13}R_{23}R_{32} \\
& + R_{12}R_{13}R_{31}R_{32} + R_{12}R_{21}R_{22}R_{31} + R_{12}R_{21}R_{23}R_{31} + R_{12}R_{21}R_{31}R_{32} \\
& + R_{12}R_{22}R_{23}R_{31} + R_{12}R_{23}R_{31}R_{32} + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{22}R_{32} \\
& + R_{13}R_{21}R_{23}R_{31} + R_{13}R_{21}R_{23}R_{32} + R_{13}R_{21}R_{31}R_{32} + R_{13}R_{22}R_{23}R_{31} \\
& + R_{13}R_{22}R_{23}R_{32} + R_{13}R_{22}R_{31}R_{32} + R_{21}R_{22}R_{31}R_{32} + R_{32}R_{31}R_{23}R_{21} \\
& + R_{32}R_{31}R_{23}R_{22}) / (R_{11}R_{12}R_{21} + R_{11}R_{12}R_{22} + R_{11}R_{12}R_{31} + R_{11}R_{12}R_{32} \\
& + R_{11}R_{13}R_{21} + R_{11}R_{13}R_{22} + R_{11}R_{13}R_{31} + R_{11}R_{13}R_{32} + R_{11}R_{21}R_{22} \\
& + R_{11}R_{21}R_{23} + R_{11}R_{22}R_{23} + R_{11}R_{22}R_{31} + R_{11}R_{22}R_{32} + R_{11}R_{23}R_{31} \\
& + R_{11}R_{23}R_{32} + R_{12}R_{13}R_{21} + R_{12}R_{13}R_{22} + R_{12}R_{13}R_{31} + R_{13}R_{12}R_{32} \\
& + R_{12}R_{21}R_{22} + R_{12}R_{21}R_{23} + R_{12}R_{21}R_{31} + R_{12}R_{21}R_{32} + R_{12}R_{22}R_{23} \\
& + R_{12}R_{23}R_{31} + R_{32}R_{12}R_{23} + R_{13}R_{21}R_{31} + R_{13}R_{21}R_{32} + R_{13}R_{22}R_{31} \\
& + R_{13}R_{22}R_{32} + R_{31}R_{22}R_{21} + R_{32}R_{22}R_{21} + R_{31}R_{23}R_{21} + R_{32}R_{23}R_{21} \\
& + R_{22}R_{23}R_{31} + R_{32}R_{23}R_{22})
\end{aligned}$$

> assign(9.2)

$$R_{33} = \frac{MR_{33} \cdot Rx_{33}}{Rx_{33} - MR_{33}}$$

$$\begin{aligned}
R_{33} = & (MR_{33} (R_{11}R_{12}R_{21}R_{22} + R_{11}R_{12}R_{21}R_{23} + R_{11}R_{12}R_{21}R_{32} + R_{11}R_{12}R_{22}R_{23} \quad (9.3) \\
& + R_{11}R_{12}R_{22}R_{31} + R_{11}R_{12}R_{23}R_{31} + R_{11}R_{12}R_{23}R_{32} + R_{11}R_{12}R_{31}R_{32} \\
& + R_{11}R_{13}R_{21}R_{22} + R_{11}R_{13}R_{21}R_{23} + R_{11}R_{13}R_{21}R_{32} + R_{11}R_{13}R_{22}R_{23} \\
& + R_{11}R_{13}R_{22}R_{31} + R_{11}R_{13}R_{23}R_{31} + R_{11}R_{13}R_{23}R_{32} + R_{11}R_{13}R_{31}R_{32} \\
& + R_{11}R_{21}R_{22}R_{32} + R_{11}R_{21}R_{23}R_{32} + R_{11}R_{22}R_{23}R_{32} + R_{11}R_{22}R_{31}R_{32} \\
& + R_{11}R_{23}R_{31}R_{32} + R_{12}R_{13}R_{21}R_{22} + R_{12}R_{13}R_{21}R_{23} + R_{12}R_{13}R_{21}R_{32} \\
& + R_{12}R_{13}R_{22}R_{23} + R_{12}R_{13}R_{22}R_{31} + R_{12}R_{13}R_{23}R_{31} + R_{12}R_{13}R_{23}R_{32} \\
& + R_{12}R_{13}R_{31}R_{32} + R_{12}R_{21}R_{22}R_{31} + R_{12}R_{21}R_{23}R_{31} + R_{12}R_{21}R_{31}R_{32} \\
& + R_{12}R_{22}R_{23}R_{31} + R_{12}R_{23}R_{31}R_{32} + R_{13}R_{21}R_{22}R_{31} + R_{13}R_{21}R_{22}R_{32} \\
& + R_{13}R_{21}R_{23}R_{31} + R_{13}R_{21}R_{23}R_{32} + R_{13}R_{21}R_{31}R_{32} + R_{13}R_{22}R_{23}R_{31} \\
& + R_{13}R_{22}R_{23}R_{32} + R_{13}R_{22}R_{31}R_{32} + R_{21}R_{22}R_{31}R_{32} + R_{32}R_{31}R_{23}R_{21} \\
& + R_{32}R_{31}R_{23}R_{22})) / ((R_{11}R_{12}R_{21} + R_{11}R_{12}R_{22} + R_{11}R_{12}R_{31} + R_{11}R_{12}R_{32} \\
& + R_{11}R_{13}R_{21} + R_{11}R_{13}R_{22} + R_{11}R_{13}R_{31} + R_{11}R_{13}R_{32} + R_{11}R_{21}R_{22} \\
& + R_{11}R_{21}R_{23} + R_{11}R_{22}R_{23} + R_{11}R_{22}R_{31} + R_{11}R_{22}R_{32} + R_{11}R_{23}R_{31}))
\end{aligned}$$

$$\begin{aligned}
& + R11 R23 R32 + R12 R13 R21 + R12 R13 R22 + R12 R13 R31 + R13 R12 R32 \\
& + R12 R21 R22 + R12 R21 R23 + R12 R21 R31 + R12 R21 R32 + R12 R22 R23 \\
& + R12 R23 R31 + R32 R12 R23 + R13 R21 R31 + R13 R21 R32 + R13 R22 R31 \\
& + R13 R22 R32 + R31 R22 R21 + R32 R22 R21 + R31 R23 R21 + R32 R23 R21 \\
& + R22 R23 R31 + R32 R23 R22) ((R11 R12 R21 R22 + R11 R12 R21 R23 \\
& + R11 R12 R21 R32 + R11 R12 R22 R23 + R11 R12 R22 R31 + R11 R12 R23 R31 \\
& + R11 R12 R23 R32 + R11 R12 R31 R32 + R11 R13 R21 R22 + R11 R13 R21 R23 \\
& + R11 R13 R21 R32 + R11 R13 R22 R23 + R11 R13 R22 R31 + R11 R13 R23 R31 \\
& + R11 R13 R23 R32 + R11 R13 R31 R32 + R11 R21 R22 R32 + R11 R21 R23 R32 \\
& + R11 R22 R23 R32 + R11 R22 R31 R32 + R11 R23 R31 R32 + R12 R13 R21 R22 \\
& + R12 R13 R21 R23 + R12 R13 R21 R32 + R12 R13 R22 R23 + R12 R13 R22 R31 \\
& + R12 R13 R23 R31 + R12 R13 R23 R32 + R12 R13 R31 R32 + R12 R21 R22 R31 \\
& + R12 R21 R23 R31 + R12 R21 R31 R32 + R12 R22 R23 R31 + R12 R23 R31 R32 \\
& + R13 R21 R22 R31 + R13 R21 R22 R32 + R13 R21 R23 R31 + R13 R21 R23 R32 \\
& + R13 R21 R31 R32 + R13 R22 R23 R31 + R13 R22 R23 R32 + R13 R22 R31 R32 \\
& + R21 R22 R31 R32 + R32 R31 R23 R21 + R32 R31 R23 R22) / (R11 R12 R21 \\
& + R11 R12 R22 + R11 R12 R31 + R11 R12 R32 + R11 R13 R21 + R11 R13 R22 \\
& + R11 R13 R31 + R11 R13 R32 + R11 R21 R22 + R11 R21 R23 + R11 R22 R23 \\
& + R11 R22 R31 + R11 R22 R32 + R11 R23 R31 + R11 R23 R32 + R12 R13 R21 \\
& + R12 R13 R22 + R12 R13 R31 + R13 R12 R32 + R12 R21 R22 + R12 R21 R23 \\
& + R12 R21 R31 + R12 R21 R32 + R12 R22 R23 + R12 R23 R31 + R32 R12 R23 \\
& + R13 R21 R31 + R13 R21 R32 + R13 R22 R31 + R13 R22 R32 + R31 R22 R21 \\
& + R32 R22 R21 + R31 R23 R21 + R32 R23 R21 + R22 R23 R31 + R32 R23 R22) - MR33) \\
\end{aligned}$$

> *simplify(9.3)*

$$\begin{aligned}
R33 = & (((((R11 + R12 + R21 + R22) R31 + (R11 + R12 + R21 + R22) R32 + (R21 \\
& + R22) (R11 + R12)) R23 + ((R11 + R12 + R21 + R22) R32 + R22 (R11 + R12 \\
& + R21)) R31 + ((R11 + R12 + R22) R32 + R22 (R11 + R12)) R21) R13 + (((R11 \\
& + R12 + R21 + R22) R32 + R12 (R11 + R21 + R22)) R31 + R11 ((R12 + R21 \\
& + R22) R32 + R12 (R21 + R22))) R23 + ((R11 + R21) R31 + R11 R21) ((R12 \\
& + R22) R32 + R12 R22)) MR33) / (((((R11 + R12 + R21 + R22) R31 + (R11 + R12 \\
& + R21 + R22) R32 + (R21 + R22) (R11 + R12)) R23 + ((R11 + R12 + R21 \\
& + R22) R32 + (R22 - MR33) R11 + (R22 - MR33) R12 + (R22 - MR33) R21 \\
& - R22 MR33) R31 + ((R21 - MR33) R11 + (R21 - MR33) R12 + (R22 - MR33) R21
\end{aligned} \tag{9.4}$$

$$\begin{aligned}
& - R22 MR33) R32 + (R11 + R12) ((R22 - MR33) R21 - R22 MR33)) R13 + (((R11 \\
& + R12 + R21 + R22) R32 + (R12 - MR33) R11 + (R21 + R22 - MR33) R12 \\
& - MR33 (R21 + R22)) R31 + ((R12 + R21 + R22 - MR33) R11 - MR33 (R12 + R21 \\
& + R22)) R32 + ((R12 - MR33) R11 - R12 MR33) (R21 + R22)) R23 + (R11 \\
& + R21) ((R12 + R22) R32 + (R22 - MR33) R12 - R22 MR33) R31 + (R12 \\
& + R22) ((R21 - MR33) R11 - R21 MR33) R32 + (((R22 - MR33) R21 \\
& - R22 MR33) R12 - R21 R22 MR33) R11 - MR33 R12 R21 R22)
\end{aligned}$$

Solve

```

> restart
>
> MR11 := 9658.43 :
> MR12 := 27496.3 :
> MR13 := 194177 :
> MR21 := 27496.3 :
> MR22 := 58406.6 :
> MR23 := 200271 :
> MR31 := 194177 :
> MR32 := 200271 :
> MR33 := 253233 :
>
> eqs := {(1.4), (2.4), (3.4), (4.4), (5.4), (6.4), (7.4), (8.4), (9.4)} :
> vars := {R11, R12, R13, R21, R22, R23, R31, R32, R33} :
>
> fsolve(eqs, vars, 1000..1000000)
{R11 = 9999.998954, R12 = 30000.01364, R13 = 499990.9409, R21 = 30000.01364, R22
= 499998.7695, R23 = 500009.6845, R31 = 499990.9409, R32 = 500009.6845, R33
= 499998.9920}

```

(10.1)