In[•]:=
```
dSdteqn[t_] = μE EE[t] + μI II[t] - β S[t] × II[t] - D[S[t], t]
dEEdteqn[t_] = (1 - ϵ) β S[t] × II[t] - δ EE[t] - μE EE[t] - D[EE[t], t]
dIIdteqn[t_] = ϵ β S[t] × II[t] + δ EE[t] - μI II[t] - D[II[t], t]
```

Out[•]= $\mu E\, EE[t] + \mu I\, II[t] - \beta\, II[t] \times S[t] - S'[t]$

Out[•]= $-\delta\, EE[t] - \mu E\, EE[t] + \beta\, (1 - \epsilon)\, II[t] \times S[t] - EE'[t]$

Out[•]= $\delta\, EE[t] - \mu I\, II[t] + \beta\, \epsilon\, II[t] \times S[t] - II'[t]$

In[•]:=
```
yEeqn[t_] = kE EE[t] - yE[t]
yIeqn[t_] = kI (ϵ β S[t] × II[t] + δ EE[t]) - yI[t]
```

Out[•]= $kE\, EE[t] - yE[t]$

Out[•]= $kI\, (\delta\, EE[t] + \beta\, \epsilon\, II[t] \times S[t]) - yI[t]$

In[•]:=
```
yEmap[t_] = Solve[yEeqn[t] == 0, EE[t]][[1]]
yImap[t_] = Solve[yIeqn[t] == 0, II[t]][[1]]
```

Out[•]= $\left\{EE[t] \to \frac{yE[t]}{kE}\right\}$

Out[•]= $\left\{II[t] \to \frac{-kI\, \delta\, EE[t] + yI[t]}{kI\, \beta\, \epsilon\, S[t]}\right\}$

In[•]:=
```
dSdteqn2[t_] = dSdteqn[t] /. yImap[t] /. D[yImap[t], t] /. yEmap[t] /. D[yEmap[t], t]
dEEdteqn2[t_] =
 dEEdteqn[t] /. yImap[t] /. D[yImap[t], t] /. yEmap[t] /. D[yEmap[t], t]
dIIdteqn2[t_] =
 dIIdteqn[t] /. yImap[t] /. D[yImap[t], t] /. yEmap[t] /. D[yEmap[t], t]
dIIdteqn22[t_] =
 dIIdteqn2[t] /. {S'[t] -> μE EE[t] + μI II[t] - β S[t] × II[t]} /. yImap[t] /. yEmap[t]
```

Out[•]=
$$\frac{\mu E\, yE[t]}{kE} - \frac{-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]}{kI\,\epsilon} + \frac{\mu I\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right)}{kI\,\beta\,\epsilon\, S[t]} - S'[t]$$

Out[•]=
$$-\frac{\delta\, yE[t]}{kE} - \frac{\mu E\, yE[t]}{kE} + \frac{(1-\epsilon)\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right)}{kI\,\epsilon} - \frac{yE'[t]}{kE}$$

Out[•]=
$$\frac{\delta\, yE[t]}{kE} + \frac{-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]}{kI} - \frac{\mu I\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right)}{kI\,\beta\,\epsilon\, S[t]} + \frac{\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right) S'[t]}{kI\,\beta\,\epsilon\, S[t]^2} - \frac{-\frac{kI\,\delta\, yE'[t]}{kE} + yI'[t]}{kI\,\beta\,\epsilon\, S[t]}$$

Out[•]=
$$\frac{\delta\, yE[t]}{kE} + \frac{-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]}{kI} - \frac{\mu I\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right)}{kI\,\beta\,\epsilon\, S[t]} + \frac{\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right)\left(\frac{\mu E\, yE[t]}{kE} - \frac{-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]}{kI\,\epsilon} + \frac{\mu I\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right)}{kI\,\beta\,\epsilon\, S[t]}\right)}{kI\,\beta\,\epsilon\, S[t]^2} - \frac{-\frac{kI\,\delta\, yE'[t]}{kE} + yI'[t]}{kI\,\beta\,\epsilon\, S[t]}$$

In[•]:=
```
Smap[t_] = Solve[dIIdteqn22[t] == 0, S[t]][[1]]
```

Out[•]=
$$\Bigg\{S[t] \to -\frac{kE\, kI^2\,\beta\,\delta\,\epsilon\,\mu I\, yE[t] - kE^2\, kI\,\beta\,\epsilon\,\mu I\, yI[t] + kE\, kI^2\,\beta\,\delta\,\epsilon\, yE'[t] - kE^2\, kI\,\beta\,\epsilon\, yI'[t]}{3\, kE^2\, kI\,\beta^2\,\epsilon^2\, yI[t]} - \Big(2^{1/3}\Big(3\, kE^2\, kI\,\beta^2\,\epsilon^2\, yI[t]\,\big(-kI^2\,\beta\,\delta^2\, yE[t]^2 - kI^2\,\beta\,\delta\,\epsilon\,\mu E\, yE[t]^2 + 2\, kE\, kI\,\beta\,\delta\, yE[t] \times yI[t] + kE\, kI\,\beta\,\epsilon\,\mu E\, yE[t] \times yI[t] - kE^2\,\beta\, yI[t]^2\big) - \big(kE\, kI^2\,\beta\,\delta\,\epsilon\,\mu I\, yE[t] - kE^2\, kI\,\beta\,\epsilon\,\mu I\, yI[t] + kE\, kI^2\,\beta\,\delta\,\epsilon\, yE'[t] - kE^2\, kI\,\beta\,\epsilon\, yI'[t]\big)^2\Big)\Big) \Big/ \Big(3\, kE^2\, kI\,\beta^2\,\epsilon^2\, yI[t]\,\Big(-2\, kE^3\, kI^6\,\beta^3\,\delta^3\,\epsilon^3\,\mu I^3\, yE[t]^3 + 6\, kE^4\, kI^5\,\beta^3\,\delta^2\,\epsilon^3\,\mu I^3\, yE[t]^2\, yI[t] - 9\, kE^3\, kI^5\,\beta^4\,\delta^3\,\epsilon^3\,\mu I\, yE[t]^3\, yI[t] - 9\, kE^3\, kI^5\,\beta^4\,\delta^2\,\epsilon^4\,\mu E\,\mu I\, yE[t]^3\, yI[t] - 6\, kE^5\, kI^4\,\beta^3\,\delta\,\epsilon^3\,\mu I^3\, yE[t]\, yI[t]^2 + 27\, kE^4\, kI^4\,\beta^4\,\delta^2\,\epsilon^3\,\mu I\, yE[t]^2\, yI[t]^2 - 27\, kE^4\, kI^4\,\beta^4\,\delta^2\,\epsilon^4\,\mu I\, yE[t]^2\, yI[t]^2 + 18\, kE^4\, kI^4\,\beta^4\,\delta\,\epsilon^4\,\mu E\,\mu I\, yE[t]^2\, yI[t]^2 + 2\, kE^6\, kI^3\,\beta^3\,\epsilon^3\,\mu I^3\, yI[t]^3 - 27\, kE^5\, kI^3\,\beta^4\,\delta\,\epsilon^3\,\mu I\, yE[t]\, yI[t]^3 + 54\, kE^5\, kI^3\,\beta^4\,\delta\,\epsilon^4\,\mu I\, yE[t]\, yI[t]^3 - 9\, kE^5\, kI^3\,\beta^4\,\epsilon^4\,\mu E\,\mu I\, yE[t]\, yI[t]^3 + 9\, kE^6\, kI^2\,\beta^4\,\epsilon^3\,\mu I\, yI[t]^4 - 27\, kE^6\, kI^2\,\beta^4\,\epsilon^4\,\mu I\, yI[t]^4 - 6\, kE^3\, kI^6\,\beta^3\,\delta^3\,\epsilon^3\,\mu I^2\, yE[t]^2\, yE'[t] + 12\, kE^4\, kI^5\,\beta^3\,\delta^2\,\epsilon^3\,\mu I^2\, yE[t] \times yI[t]\, yE'[t] - 9\, kE^3\, kI^5\,\beta^4\,\delta^3\,\epsilon^3\, yE[t]^2\, yI[t]\, yE'[t] - 9\, kE^3\, kI^5\,\beta^4\,\delta^2\,\epsilon^4\,\mu E\, yE[t]^2\, yI[t]\, yE'[t] -$$

```
6 kE^5 kI^4 β^3 δ ϵ^3 μI^2 yI[t]^2 yE′[t] + 18 kE^4 kI^4 β^4 δ^2 ϵ^3 yE[t] yI[t]^2 yE′[t] +
9 kE^4 kI^4 β^4 δ ϵ^4 μE yE[t] yI[t]^2 yE′[t] - 9 kE^5 kI^3 β^4 δ ϵ^3 yI[t]^3 yE′[t] -
6 kE^3 kI^6 β^3 δ^3 ϵ^3 μI yE[t] yE′[t]^2 + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI yI[t] yE′[t]^2 -
2 kE^3 kI^6 β^3 δ^3 ϵ^3 yE′[t]^3 + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^2 yE[t]^2 yI′[t] -
12 kE^5 kI^4 β^3 δ ϵ^3 μI^2 yE[t] × yI[t] yI′[t] + 9 kE^4 kI^4 β^4 δ^2 ϵ^3 yE[t]^2 yI[t] yI′[t] +
9 kE^4 kI^4 β^4 δ ϵ^4 μE yE[t]^2 yI[t] yI′[t] + 6 kE^6 kI^3 β^3 ϵ^3 μI^2 yI[t]^2 yI′[t] -
18 kE^5 kI^3 β^4 δ ϵ^3 yE[t] yI[t]^2 yI′[t] - 9 kE^5 kI^3 β^4 ϵ^4 μE yE[t] yI[t]^2 yI′[t] +
9 kE^6 kI^2 β^4 ϵ^3 yI[t]^3 yI′[t] + 12 kE^4 kI^5 β^3 δ^2 ϵ^3 μI yE[t] yE′[t] yI′[t] -
12 kE^5 kI^4 β^3 δ ϵ^3 μI yI[t] yE′[t] yI′[t] + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 yE′[t]^2 yI′[t] -
6 kE^5 kI^4 β^3 δ ϵ^3 μI yE[t] yI′[t]^2 + 6 kE^6 kI^3 β^3 ϵ^3 μI yI[t] yI′[t]^2 -
6 kE^5 kI^4 β^3 δ ϵ^3 yE′[t] yI′[t]^2 + 2 kE^6 kI^3 β^3 ϵ^3 yI′[t]^3 +
√((-2 kE^3 kI^6 β^3 δ^3 ϵ^3 μI^3 yE[t]^3 + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^3 yE[t]^2 yI[t] -
    9 kE^3 kI^5 β^4 δ^3 ϵ^3 μI yE[t]^3 yI[t] - 9 kE^3 kI^5 β^4 δ^2 ϵ^4 μE μI yE[t]^3 yI[t] -
    6 kE^5 kI^4 β^3 δ ϵ^3 μI^3 yE[t] yI[t]^2 + 27 kE^4 kI^4 β^4 δ^2 ϵ^3 μI yE[t]^2 yI[t]^2 -
    27 kE^4 kI^4 β^4 δ^2 ϵ^4 μI yE[t]^2 yI[t]^2 + 18 kE^4 kI^4 β^4 δ ϵ^4 μE μI yE[t]^2
     yI[t]^2 + 2 kE^6 kI^3 β^3 ϵ^3 μI^3 yI[t]^3 - 27 kE^5 kI^3 β^4 δ ϵ^3 μI yE[t] yI[t]^3 +
    54 kE^5 kI^3 β^4 δ ϵ^4 μI yE[t] yI[t]^3 - 9 kE^5 kI^3 β^4 ϵ^4 μE μI yE[t] yI[t]^3 +
    9 kE^6 kI^2 β^4 ϵ^3 μI yI[t]^4 - 27 kE^6 kI^2 β^4 ϵ^4 μI yI[t]^4 - 6 kE^3 kI^6 β^3 δ^3
     ϵ^3 μI^2 yE[t]^2 yE′[t] + 12 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^2 yE[t] × yI[t] yE′[t] -
    9 kE^3 kI^5 β^4 δ^3 ϵ^3 yE[t]^2 yI[t] yE′[t] - 9 kE^3 kI^5 β^4 δ^2 ϵ^4 μE yE[t]^2
     yI[t] yE′[t] - 6 kE^5 kI^4 β^3 δ ϵ^3 μI^2 yI[t]^2 yE′[t] + 18 kE^4 kI^4 β^4 δ^2
     ϵ^3 yE[t] yI[t]^2 yE′[t] + 9 kE^4 kI^4 β^4 δ ϵ^4 μE yE[t] yI[t]^2 yE′[t] -
    9 kE^5 kI^3 β^4 δ ϵ^3 yI[t]^3 yE′[t] - 6 kE^3 kI^6 β^3 δ^3 ϵ^3 μI yE[t] yE′[t]^2 +
    6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI yI[t] yE′[t]^2 - 2 kE^3 kI^6 β^3 δ^3 ϵ^3 yE′[t]^3 +
    6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^2 yE[t]^2 yI′[t] - 12 kE^5 kI^4 β^3 δ ϵ^3 μI^2 yE[t] × yI[t]
     yI′[t] + 9 kE^4 kI^4 β^4 δ^2 ϵ^3 yE[t]^2 yI[t] yI′[t] + 9 kE^4 kI^4 β^4 δ ϵ^4 μE
     yE[t]^2 yI[t] yI′[t] + 6 kE^6 kI^3 β^3 ϵ^3 μI^2 yI[t]^2 yI′[t] - 18 kE^5 kI^3
     β^4 δ ϵ^3 yE[t] yI[t]^2 yI′[t] - 9 kE^5 kI^3 β^4 ϵ^4 μE yE[t] yI[t]^2 yI′[t] +
    9 kE^6 kI^2 β^4 ϵ^3 yI[t]^3 yI′[t] + 12 kE^4 kI^5 β^3 δ^2 ϵ^3 μI yE[t] yE′[t] yI′[t] -
    12 kE^5 kI^4 β^3 δ ϵ^3 μI yI[t] yE′[t] yI′[t] + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 yE′[t]^2 yI′[t] -
    6 kE^5 kI^4 β^3 δ ϵ^3 μI yE[t] yI′[t]^2 + 6 kE^6 kI^3 β^3 ϵ^3 μI yI[t] yI′[t]^2 -
    6 kE^5 kI^4 β^3 δ ϵ^3 yE′[t] yI′[t]^2 + 2 kE^6 kI^3 β^3 ϵ^3 yI′[t]^3)^2 +
  4 (3 kE^2 kI β^2 ϵ^2 yI[t] (-kI^2 β δ^2 yE[t]^2 - kI^2 β δ ϵ μE yE[t]^2 +
        2 kE kI β δ yE[t] × yI[t] + kE kI β ϵ μE yE[t] × yI[t] - kE^2 β yI[t]^2) -
     (kE kI^2 β δ ϵ μI yE[t] - kE^2 kI β ϵ μI yI[t] + kE kI^2 β δ
        ϵ yE′[t] - kE^2 kI β ϵ yI′[t])^2)^3))^(1/3)) +
(-2 kE^3 kI^6 β^3 δ^3 ϵ^3 μI^3 yE[t]^3 + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^3 yE[t]^2 yI[t] -
    9 kE^3 kI^5 β^4 δ^3 ϵ^3 μI yE[t]^3 yI[t] -
    9 kE^3 kI^5 β^4 δ^2 ϵ^4 μE μI yE[t]^3 yI[t] -
    6 kE^5 kI^4 β^3 δ ϵ^3 μI^3 yE[t] yI[t]^2 +
    27 kE^4 kI^4 β^4 δ^2 ϵ^3 μI yE[t]^2 yI[t]^2 -
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27 kE^4 kI^4 β^4 δ^2 ϵ^4 μI yE[t]^2 yI[t]^2 +
18 kE^4 kI^4 β^4 δ ϵ^4 μE μI yE[t]^2 yI[t]^2 +
2 kE^6 kI^3 β^3 ϵ^3 μI^3 yI[t]^3 -
27 kE^5 kI^3 β^4 δ ϵ^3 μI yE[t] yI[t]^3 +
54 kE^5 kI^3 β^4 δ ϵ^4 μI yE[t] yI[t]^3 -
9 kE^5 kI^3 β^4 ϵ^4 μE μI yE[t] yI[t]^3 +
9 kE^6 kI^2 β^4 ϵ^3 μI yI[t]^4 -
27 kE^6 kI^2 β^4 ϵ^4 μI yI[t]^4 -
6 kE^3 kI^6 β^3 δ^3 ϵ^3 μI^2 yE[t]^2 yE′[t] +
12 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^2 yE[t] × yI[t] yE′[t] -
9 kE^3 kI^5 β^4 δ^3 ϵ^3 yE[t]^2 yI[t] yE′[t] -
9 kE^3 kI^5 β^4 δ^2 ϵ^4 μE yE[t]^2 yI[t] yE′[t] -
6 kE^5 kI^4 β^3 δ ϵ^3 μI^2 yI[t]^2 yE′[t] +
18 kE^4 kI^4 β^4 δ^2 ϵ^3 yE[t] yI[t]^2 yE′[t] +
9 kE^4 kI^4 β^4 δ ϵ^4 μE yE[t] yI[t]^2 yE′[t] -
9 kE^5 kI^3 β^4 δ ϵ^3 yI[t]^3 yE′[t] -
6 kE^3 kI^6 β^3 δ^3 ϵ^3 μI yE[t] yE′[t]^2 +
6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI yI[t] yE′[t]^2 -
2 kE^3 kI^6 β^3 δ^3 ϵ^3 yE′[t]^3 +
6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^2 yE[t]^2 yI′[t] -
12 kE^5 kI^4 β^3 δ ϵ^3 μI^2 yE[t] × yI[t] yI′[t] +
9 kE^4 kI^4 β^4 δ^2 ϵ^3 yE[t]^2 yI[t] yI′[t] +
9 kE^4 kI^4 β^4 δ ϵ^4 μE yE[t]^2 yI[t] yI′[t] +
6 kE^6 kI^3 β^3 ϵ^3 μI^2 yI[t]^2 yI′[t] -
18 kE^5 kI^3 β^4 δ ϵ^3 yE[t] yI[t]^2 yI′[t] -
9 kE^5 kI^3 β^4 ϵ^4 μE yE[t] yI[t]^2 yI′[t] +
9 kE^6 kI^2 β^4 ϵ^3 yI[t]^3 yI′[t] +
12 kE^4 kI^5 β^3 δ^2 ϵ^3 μI yE[t] yE′[t] yI′[t] -
12 kE^5 kI^4 β^3 δ ϵ^3 μI yI[t] yE′[t] yI′[t] +
6 kE^4 kI^5 β^3 δ^2 ϵ^3 yE′[t]^2 yI′[t] -
6 kE^5 kI^4 β^3 δ ϵ^3 μI yE[t] yI′[t]^2 +
6 kE^6 kI^3 β^3 ϵ^3 μI yI[t] yI′[t]^2 -
6 kE^5 kI^4 β^3 δ ϵ^3 yE′[t] yI′[t]^2 + 2 kE^6 kI^3 β^3 ϵ^3 yI′[t]^3 +
√((-2 kE^3 kI^6 β^3 δ^3 ϵ^3 μI^3 yE[t]^3 + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^3 yE[t]^2 yI[t] - 9 kE^3 kI^5 β^4
    δ^3 ϵ^3 μI yE[t]^3 yI[t] - 9 kE^3 kI^5 β^4 δ^2 ϵ^4 μE μI yE[t]^3 yI[t] - 6 kE^5 kI^4
    β^3 δ ϵ^3 μI^3 yE[t] yI[t]^2 + 27 kE^4 kI^4 β^4 δ^2 ϵ^3 μI yE[t]^2 yI[t]^2 - 27 kE^4
    kI^4 β^4 δ^2 ϵ^4 μI yE[t]^2 yI[t]^2 + 18 kE^4 kI^4 β^4 δ ϵ^4 μE μI yE[t]^2 yI[t]^2 + 2
    kE^6 kI^3 β^3 ϵ^3 μI^3 yI[t]^3 - 27 kE^5 kI^3 β^4 δ ϵ^3 μI yE[t] yI[t]^3 + 54 kE^5 kI^3
    β^4 δ ϵ^4 μI yE[t] yI[t]^3 - 9 kE^5 kI^3 β^4 ϵ^4 μE μI yE[t] yI[t]^3 + 9 kE^6 kI^2 β^4
    ϵ^3 μI yI[t]^4 - 27 kE^6 kI^2 β^4 ϵ^4 μI yI[t]^4 - 6 kE^3 kI^6 β^3 δ^3 ϵ^3 μI^2 yE[t]^2
    yE′[t] + 12 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^2 yE[t] × yI[t] yE′[t] - 9 kE^3 kI^5 β^4 δ^3 ϵ^3
    yE[t]^2 yI[t] yE′[t] - 9 kE^3 kI^5 β^4 δ^2 ϵ^4 μE yE[t]^2 yI[t] yE′[t] - 6 kE^5
    kI^4 β^3 δ ϵ^3 μI^2 yI[t]^2 yE′[t] + 18 kE^4 kI^4 β^4 δ^2 ϵ^3 yE[t] yI[t]^2 yE′[t] + 9
```

```
kE^4 kI^4 β^4 δ ϵ^4 μE yE[t] yI[t]^2 yE′[t] - 9 kE^5 kI^3 β^4 δ ϵ^3 yI[t]^3 yE′[t] - 6
kE^3 kI^6 β^3 δ^3 ϵ^3 μI yE[t] yE′[t]^2 + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI yI[t] yE′[t]^2 - 2
kE^3 kI^6 β^3 δ^3 ϵ^3 yE′[t]^3 + 6 kE^4 kI^5 β^3 δ^2 ϵ^3 μI^2 yE[t]^2 yI′[t] - 12 kE^5
kI^4 β^3 δ ϵ^3 μI^2 yE[t] × yI[t] yI′[t] + 9 kE^4 kI^4 β^4 δ^2 ϵ^3 yE[t]^2 yI[t]
yI′[t] + 9 kE^4 kI^4 β^4 δ ϵ^4 μE yE[t]^2 yI[t] yI′[t] + 6 kE^6 kI^3 β^3 ϵ^3 μI^2 yI[t]^2
yI′[t] - 18 kE^5 kI^3 β^4 δ ϵ^3 yE[t] yI[t]^2 yI′[t] - 9 kE^5 kI^3 β^4 ϵ^4 μE yE[t]
yI[t]^2 yI′[t] + 9 kE^6 kI^2 β^4 ϵ^3 yI[t]^3 yI′[t] + 12 kE^4 kI^5 β^3 δ^2 ϵ^3 μI yE[t]
yE′[t] yI′[t] - 12 kE^5 kI^4 β^3 δ ϵ^3 μI yI[t] yE′[t] yI′[t] + 6 kE^4 kI^5 β^3 δ^2
ϵ^3 yE′[t]^2 yI′[t] - 6 kE^5 kI^4 β^3 δ ϵ^3 μI yE[t] yI′[t]^2 + 6 kE^6 kI^3 β^3 ϵ^3 μI
yI[t] yI′[t]^2 - 6 kE^5 kI^4 β^3 δ ϵ^3 yE′[t] yI′[t]^2 + 2 kE^6 kI^3 β^3 ϵ^3 yI′[t]^3)^2 +
4 (3 kE^2 kI β^2 ϵ^2 yI[t] (-kI^2 β δ^2 yE[t]^2 - kI^2 β δ ϵ μE yE[t]^2 +
    2 kE kI β δ yE[t] × yI[t] + kE kI β ϵ μE yE[t] × yI[t] - kE^2 β yI[t]^2) -
  (kE kI^2 β δ ϵ μI yE[t] - kE^2 kI β ϵ μI yI[t] + kE kI^2 β δ ϵ yE′[t] -
    kE^2 kI β ϵ yI′[t])^2)^3))^(1/3) / (3 × 2^(1/3) kE^2 kI β^2 ϵ^2 yI[t])}
```

In[•]:=
```
s2map[t_] = {S[t] → (p1[t] - Sqrt[p2[t]]) / p3[t]}
```

Out[•]=
$$\left\{S[t] \to \frac{p1[t] - \sqrt{p2[t]}}{p3[t]}\right\}$$

In[•]:=
```
dSdteqn3[t_] = dSdteqn2[t] /. s2map[t] /. D[s2map[t], t]
dEEdteqn3[t_] = dEEdteqn2[t]
```

Out[•]=
$$\frac{\mu E\, yE[t]}{kE} - \frac{-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]}{kI\,\epsilon} + \frac{\mu I\, p3[t]\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right)}{kI\,\beta\,\epsilon\left(p1[t] - \sqrt{p2[t]}\right)} - \frac{p1'[t] - \frac{p2'[t]}{2\sqrt{p2[t]}}}{p3[t]} + \frac{\left(p1[t] - \sqrt{p2[t]}\right) p3'[t]}{p3[t]^2}$$

Out[•]=
$$-\frac{\delta\, yE[t]}{kE} - \frac{\mu E\, yE[t]}{kE} + \frac{(1-\epsilon)\left(-\frac{kI\,\delta\, yE[t]}{kE} + yI[t]\right)}{kI\,\epsilon} - \frac{yE'[t]}{kE}$$

In[•]:=
```
s2thing[t_] =
 Collect[Together[dSdteqn3[t]] × Denominator[Together[dSdteqn3[t]]], Sqrt[p2[t]]]
```

Out[•]=
```
kE kI β ϵ p1[t] × p3[t] p2′[t] + 2 kE kI β ϵ p2[t]^(3/2) p3′[t] +
 p2[t] (-2 kI β δ p3[t]^2 yE[t] - 2 kI β ϵ μE p3[t]^2 yE[t] +
    2 kE β p3[t]^2 yI[t] + 2 kE kI β ϵ p3[t] p1′[t] - 4 kE kI β ϵ p1[t] p3′[t]) +
 Sqrt[p2[t]] (2 kI β δ p1[t] p3[t]^2 yE[t] + 2 kI β ϵ μE p1[t] p3[t]^2 yE[t] -
    2 kI δ μI p3[t]^3 yE[t] - 2 kE β p1[t] p3[t]^2 yI[t] + 2 kE μI p3[t]^3 yI[t] -
    2 kE kI β ϵ p1[t] × p3[t] p1′[t] - kE kI β ϵ p3[t] p2′[t] + 2 kE kI β ϵ p1[t]^2 p3′[t])
```

In[•]:=
```
part2[t_] =
 Coefficient[s2thing[t], Sqrt[p2[t]]] + p2[t] × Coefficient[s2thing[t], p2[t]^(3/2)]
```

Out[•]=
```
2 kI β δ p1[t] p3[t]^2 yE[t] + 2 kI β ∈ μE p1[t] p3[t]^2 yE[t] - 2 kI δ μI p3[t]^3 yE[t] -
 2 kE β p1[t] p3[t]^2 yI[t] + 2 kE μI p3[t]^3 yI[t] - 2 kE kI β ∈ p1[t] × p3[t] p1′[t] -
 kE kI β ∈ p3[t] p2′[t] + 2 kE kI β ∈ p1[t]^2 p3′[t] + 2 kE kI β ∈ p2[t] p3′[t]
```

In[•]:=
```
part1[t_] = Simplify[s2thing[t] - part2[t] Sqrt[p2[t]]]
```

Out[•]=
```
β (kE kI ∈ p1[t] × p3[t] p2′[t] - 2 p2[t]
    (p3[t]^2 (kI (δ + ∈ μE) yE[t] - kE yI[t]) - kE kI ∈ p3[t] p1′[t] + 2 kE kI ∈ p1[t] p3′[t]))
```

In[∘]:=
```
s2thing2[t_] = Expand[s2thing[t] (part1[t] - Sqrt[p2[t]] part2[t])]
```

Out[∘]=
```
-4 kI^2 β^2 δ^2 p1[t]^2 p2[t] p3[t]^4 yE[t]^2 - 8 kI^2 β^2 δ ϵ μE p1[t]^2 p2[t] p3[t]^4 yE[t]^2 -
4 kI^2 β^2 ϵ^2 μE^2 p1[t]^2 p2[t] p3[t]^4 yE[t]^2 + 4 kI^2 β^2 δ^2 p2[t]^2 p3[t]^4 yE[t]^2 +
8 kI^2 β^2 δ ϵ μE p2[t]^2 p3[t]^4 yE[t]^2 + 4 kI^2 β^2 ϵ^2 μE^2 p2[t]^2 p3[t]^4 yE[t]^2 +
8 kI^2 β δ^2 μI p1[t] × p2[t] p3[t]^5 yE[t]^2 + 8 kI^2 β δ ϵ μE μI p1[t] × p2[t] p3[t]^5 yE[t]^2 -
4 kI^2 δ^2 μI^2 p2[t] p3[t]^6 yE[t]^2 + 8 kE kI β^2 δ p1[t]^2 p2[t] p3[t]^4 yE[t] × yI[t] +
8 kE kI β^2 ϵ μE p1[t]^2 p2[t] p3[t]^4 yE[t] × yI[t] -
8 kE kI β^2 δ p2[t]^2 p3[t]^4 yE[t] × yI[t] - 8 kE kI β^2 ϵ μE p2[t]^2 p3[t]^4 yE[t] × yI[t] -
16 kE kI β δ μI p1[t] × p2[t] p3[t]^5 yE[t] × yI[t] -
8 kE kI β ϵ μE μI p1[t] × p2[t] p3[t]^5 yE[t] × yI[t] +
8 kE kI δ μI^2 p2[t] p3[t]^6 yE[t] × yI[t] - 4 kE^2 β^2 p1[t]^2 p2[t] p3[t]^4 yI[t]^2 +
4 kE^2 β^2 p2[t]^2 p3[t]^4 yI[t]^2 + 8 kE^2 β μI p1[t] × p2[t] p3[t]^5 yI[t]^2 -
4 kE^2 μI^2 p2[t] p3[t]^6 yI[t]^2 + 8 kE kI^2 β^2 δ ϵ p1[t]^2 p2[t] p3[t]^3 yE[t] p1'[t] +
8 kE kI^2 β^2 ϵ^2 μE p1[t]^2 p2[t] p3[t]^3 yE[t] p1'[t] -
8 kE kI^2 β^2 δ ϵ p2[t]^2 p3[t]^3 yE[t] p1'[t] - 8 kE kI^2 β^2 ϵ^2 μE p2[t]^2 p3[t]^3 yE[t] p1'[t] -
8 kE kI^2 β δ ϵ μI p1[t] × p2[t] p3[t]^4 yE[t] p1'[t] -
8 kE^2 kI β^2 ϵ p1[t]^2 p2[t] p3[t]^3 yI[t] p1'[t] + 8 kE^2 kI β^2 ϵ p2[t]^2 p3[t]^3 yI[t] p1'[t] +
8 kE^2 kI β ϵ μI p1[t] × p2[t] p3[t]^4 yI[t] p1'[t] - 4 kE^2 kI^2 β^2 ϵ^2 p1[t]^2 p2[t] p3[t]^2 p1'[t]^2 +
4 kE^2 kI^2 β^2 ϵ^2 p2[t]^2 p3[t]^2 p1'[t]^2 - 4 kE kI^2 β δ ϵ μI p2[t] p3[t]^4 yE[t] p2'[t] +
4 kE^2 kI β ϵ μI p2[t] p3[t]^4 yI[t] p2'[t] + kE^2 kI^2 β^2 ϵ^2 p1[t]^2 p3[t]^2 p2'[t]^2 -
kE^2 kI^2 β^2 ϵ^2 p2[t] p3[t]^2 p2'[t]^2 - 8 kE kI^2 β^2 δ ϵ p1[t]^3 p2[t] p3[t]^2 yE[t] p3'[t] -
8 kE kI^2 β^2 ϵ^2 μE p1[t]^3 p2[t] p3[t]^2 yE[t] p3'[t] +
8 kE kI^2 β^2 δ ϵ p1[t] p2[t]^2 p3[t]^2 yE[t] p3'[t] +
8 kE kI^2 β^2 ϵ^2 μE p1[t] p2[t]^2 p3[t]^2 yE[t] p3'[t] +
8 kE kI^2 β δ ϵ μI p1[t]^2 p2[t] p3[t]^3 yE[t] p3'[t] +
8 kE kI^2 β δ ϵ μI p2[t]^2 p3[t]^3 yE[t] p3'[t] + 8 kE^2 kI β^2 ϵ p1[t]^3 p2[t] p3[t]^2 yI[t] p3'[t] -
8 kE^2 kI β^2 ϵ p1[t] p2[t]^2 p3[t]^2 yI[t] p3'[t] -
8 kE^2 kI β ϵ μI p1[t]^2 p2[t] p3[t]^3 yI[t] p3'[t] - 8 kE^2 kI β ϵ μI p2[t]^2 p3[t]^3 yI[t] p3'[t] +
8 kE^2 kI^2 β^2 ϵ^2 p1[t]^3 p2[t] × p3[t] p1'[t] p3'[t] -
8 kE^2 kI^2 β^2 ϵ^2 p1[t] p2[t]^2 p3[t] p1'[t] p3'[t] -
4 kE^2 kI^2 β^2 ϵ^2 p1[t]^2 p2[t] × p3[t] p2'[t] p3'[t] +
4 kE^2 kI^2 β^2 ϵ^2 p2[t]^2 p3[t] p2'[t] p3'[t] - 4 kE^2 kI^2 β^2 ϵ^2 p1[t]^4 p2[t] p3'[t]^2 +
8 kE^2 kI^2 β^2 ϵ^2 p1[t]^2 p2[t]^2 p3'[t]^2 - 4 kE^2 kI^2 β^2 ϵ^2 p2[t]^3 p3'[t]^2
```

In[∘]:=

```
p1[t] = -kE kI^2 δ ϵ μI yE[t] - kE kI^2 δ ϵ μS yE[t] +
  kE^2 kI ϵ μI yI[t] + kE^2 kI ϵ μS yI[t] - kE kI^2 δ ϵ yE'[t] + kE^2 kI ϵ yI'[t]
p2[t] = -4 kE^2 kI β ϵ^2 yI[t] (-c kE kI^2 δ ϵ yE[t] - kI^2 δ^2 yE[t]^2 +
      c kE^2 kI ϵ yI[t] + 2 kE kI δ yE[t] × yI[t] - kE^2 yI[t]^2) +
  (kE kI^2 δ ϵ μI yE[t] + kE kI^2 δ ϵ μS yE[t] - kE^2 kI ϵ μI yI[t] -
      kE^2 kI ϵ μS yI[t] + kE kI^2 δ ϵ yE'[t] - kE^2 kI ϵ yI'[t])^2
p3[t] = 2 kE^2 kI β ϵ^2 yI[t]
```

Out[∘]= $-kE\,kI^2\,\delta\,\epsilon\,\mu I\,yE[t] - kE\,kI^2\,\delta\,\epsilon\,\mu S\,yE[t] + kE^2\,kI\,\epsilon\,\mu I\,yI[t] + kE^2\,kI\,\epsilon\,\mu S\,yI[t] - kE\,kI^2\,\delta\,\epsilon\,yE'[t] + kE^2\,kI\,\epsilon\,yI'[t]$

Out[∘]= $-4\,kE^2\,kI\,\beta\,\epsilon^2\,yI[t]\left(-c\,kE\,kI^2\,\delta\,\epsilon\,yE[t] - kI^2\,\delta^2\,yE[t]^2 + c\,kE^2\,kI\,\epsilon\,yI[t] + 2\,kE\,kI\,\delta\,yE[t]\times yI[t] - kE^2\,yI[t]^2\right) + \left(kE\,kI^2\,\delta\,\epsilon\,\mu I\,yE[t] + kE\,kI^2\,\delta\,\epsilon\,\mu S\,yE[t] - kE^2\,kI\,\epsilon\,\mu I\,yI[t] - kE^2\,kI\,\epsilon\,\mu S\,yI[t] + kE\,kI^2\,\delta\,\epsilon\,yE'[t] - kE^2\,kI\,\epsilon\,yI'[t]\right)^2$

Out[∘]= $2\,kE^2\,kI\,\beta\,\epsilon^2\,yI[t]$

In[•]:=
```
p1'[t] = D[p1[t], t]
p2'[t] = D[p2[t], t]
p3'[t] = D[p3[t], t]
```

Out[•]=
$$-kE\,kI^2\,\delta\,\epsilon\,\mu I\,yE'[t] - kE\,kI^2\,\delta\,\epsilon\,\mu S\,yE'[t] + kE^2\,kI\,\epsilon\,\mu I\,yI'[t] + kE^2\,kI\,\epsilon\,\mu S\,yI'[t] - kE\,kI^2\,\delta\,\epsilon\,yE''[t] + kE^2\,kI\,\epsilon\,yI''[t]$$

Out[•]=
$$-4\,kE^2\,kI\,\beta\,\epsilon^2\left(-c\,kE\,kI^2\,\delta\,\epsilon\,yE[t] - kI^2\,\delta^2\,yE[t]^2 + c\,kE^2\,kI\,\epsilon\,yI[t] + 2\,kE\,kI\,\delta\,yE[t]\times yI[t] - kE^2\,yI[t]^2\right) yI'[t] - 4\,kE^2\,kI\,\beta\,\epsilon^2\,yI[t]\left(-c\,kE\,kI^2\,\delta\,\epsilon\,yE'[t] - 2\,kI^2\,\delta^2\,yE[t]\,yE'[t] + 2\,kE\,kI\,\delta\,yI[t]\,yE'[t] + c\,kE^2\,kI\,\epsilon\,yI'[t] + 2\,kE\,kI\,\delta\,yE[t]\,yI'[t] - 2\,kE^2\,yI[t]\,yI'[t]\right) + 2\left(kE\,kI^2\,\delta\,\epsilon\,\mu I\,yE[t] + kE\,kI^2\,\delta\,\epsilon\,\mu S\,yE[t] - kE^2\,kI\,\epsilon\,\mu I\,yI[t] - kE^2\,kI\,\epsilon\,\mu S\,yI[t] + kE\,kI^2\,\delta\,\epsilon\,yE'[t] - kE^2\,kI\,\epsilon\,yI'[t]\right)\left(kE\,kI^2\,\delta\,\epsilon\,\mu I\,yE'[t] + kE\,kI^2\,\delta\,\epsilon\,\mu S\,yE'[t] - kE^2\,kI\,\epsilon\,\mu I\,yI'[t] - kE^2\,kI\,\epsilon\,\mu S\,yI'[t] + kE\,kI^2\,\delta\,\epsilon\,yE''[t] - kE^2\,kI\,\epsilon\,yI''[t]\right)$$

Out[•]=
$$2\,kE^2\,kI\,\beta\,\epsilon^2\,yI'[t]$$

In[•]:=
```
s2thing2[t]
```

Out[•]=
$$-256\,kE^{12}\,kI^8\,\beta^6\,\delta^2\,\epsilon^{12}\,\mu I^2\,yE[t]^2\,yI[t]^6\left(-4\,kE^2\,kI\,\beta\,\epsilon^2\,yI[t]\left(-c\,kE\,kI^2\,\delta\,\epsilon\,yE[t] - kI^2\,\delta^2\,yE[t]^2 + c\,kE^2\,kI\,\epsilon\,yI[t] + 2\,kE\,kI\,\delta\,yE[t]\times yI[t] - kE^2\,yI[t]^2\right) + \left(kE\,kI^2\,\delta\,\epsilon\,\mu I\,yE[t] + \cdots 5 \cdots + \cdots 1 \cdots - kE^2\,kI\,\epsilon\,yI'[t]\right)^2\right) + \cdots 75 \cdots$$

large output | show less | show more | show all | set size limit...

In[•]:=
```
IPOPish1[t_] = Denominator[Together[s2thing2[t]]] × Together[s2thing2[t]]
IPOPish2[t_] = Denominator[Together[dEEdteqn3[t]]] × Together[dEEdteqn3[t]]
```

Out[•]=
$$256\left(c\,kE^{13}\,kI^{13}\,\beta^7\,\delta^5\,\epsilon^{13}\,\mu I^2\,yE[t]^5\,yI[t]^5 + 2\,c\,kE^{13}\,kI^{13}\,\beta^7\,\delta^4\,\epsilon^{14}\,\mu E\,\mu I^2\,yE[t]^5\,yI[t]^5 + \cdots 3130 \cdots + kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}\,yI[t]^8\,yI''[t]^2\right)$$

large output | show less | show more | show all | set size limit...

Out[•]=
$$-kI\,\delta\,yE[t] - kI\,\epsilon\,\mu E\,yE[t] + kE\,yI[t] - kE\,\epsilon\,yI[t] - kI\,\epsilon\,yE'[t]$$

In[∘]:=
```
Monos1 = Sort[
  MonomialList[IPOPish1[t], {yI[t], yI'[t], yI''[t], yE[t], yE'[t], yE''[t]}]]
Monos2 = Sort[MonomialList[IPOPish2[t],
   {yI[t], yI'[t], yI''[t], yE[t], yE'[t], yE''[t]}]]
```

Out[∘]=

$$\{(256\,c\,kE^{13}\,kI^{13}\,\beta^7\,\delta^5\,\epsilon^{13}\,\mu I^2 + 512\,c\,kE^{13}\,kI^{13}\,\beta^7\,\delta^4\,\epsilon^{14}\,\mu E\,\mu I^2 + \cdots 23 \cdots)\,yE[t]^5\,yI[t]^5,$$
$$(256\,kE^{12}\,kI^{13}\,\beta^7\,\delta^6\,\epsilon^{12}\,\mu I^2 + 512\,kE^{12}\,kI^{13}\,\beta^7\,\delta^5\,\epsilon^{13}\,\mu E\,\mu I^2 + \cdots 5 \cdots +$$
$$512\,kE^{12}\,kI^{13}\,\beta^7\,\delta^5\,\epsilon^{13}\,\mu E\,\mu S^2 + 256\,kE^{12}\,kI^{13}\,\beta^7\,\delta^4\,\epsilon^{14}\,\mu E^2\,\mu S^2)\,yE[t]^6\,yI[t]^5,$$
$$\cdots 403 \cdots, -1024\,\cdots 7 \cdots\,\cdots 1 \cdots^2, 256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}\,yI[t]^8\,yI''[t]^2\}$$

large output | show less | show more | show all | set size limit...

Out[∘]=

$$\{(-kI\,\delta - kI\,\epsilon\,\mu E)\,yE[t],\ (kE - kE\,\epsilon)\,yI[t],\ -kI\,\epsilon\,yE'[t]\}$$

In[∘]:=
```
MonicMonos1 = Monos1 / (Last[Monos1] /.
    {yI[t] → 1, yI'[t] → 1, yI''[t] → 1, yE[t] → 1, yE'[t] → 1, yE''[t] → 1})
MonicMonos2 = Monos2 / (Last[Monos2] /. {yI[t] → 1, yI'[t] → 1,
     yI''[t] → 1, yE[t] → 1, yE'[t] → 1, yE''[t] → 1})
```

Out[∘]=

$$\left\{\frac{(256\,c\,kE^{13}\,kI^{13}\,\beta^7\,\delta^5\,\epsilon^{13}\,\mu I^2 + 512\,c\,kE^{13}\,kI^{13}\,\beta^7\,\delta^4\,\epsilon^{14}\,\mu E\,\mu I^2 + \cdots 23 \cdots)\,yE[t]^5\,yI[t]^5}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\right.$$
$$\frac{\cdots 1 \cdots}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\ \frac{(\cdots 1 \cdots)\,yE[t]^4\,yI[t]^6}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\ \frac{\cdots 1 \cdots}{256\,\cdots 3 \cdots\,\epsilon^{12}},\ \cdots 399 \cdots,\ \cdots 1 \cdots,$$
$$\left.-2\,c\,kI\,\epsilon\,yI[t]^7\,yI''[t]^2,\ -\frac{4\,kI\,\delta\,yE[t]\,yI[t]^7\,yI''[t]^2}{kE},\ yI[t]^8\,yI''[t]^2\right\}$$

large output | show less | show more | show all | set size limit...

Out[∘]=

$$\left\{-\frac{(-kI\,\delta - kI\,\epsilon\,\mu E)\,yE[t]}{kI\,\epsilon},\ -\frac{(kE - kE\,\epsilon)\,yI[t]}{kI\,\epsilon},\ yE'[t]\right\}$$

In[∘]:=
```
Coeffs1 = MonicMonos1 /.
  {yI[t] → 1, yI'[t] → 1, yI''[t] → 1, yE[t] → 1, yE'[t] → 1, yE''[t] → 1}
Coeffs2 = MonicMonos2 /. {yI[t] → 1, yI'[t] → 1,
   yI''[t] → 1, yE[t] → 1, yE'[t] → 1, yE''[t] → 1}
```

Out[∘]=

$$\left\{\frac{256\,c\,kE^{13}\,kI^{13}\,\beta^7\,\delta^5\,\epsilon^{13}\,\mu I^2+512\,c\,kE^{13}\,kI^{13}\,\beta^7\,\delta^4\,\epsilon^{14}\,\mu E\,\mu I^2+\cdots 23 \cdots}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\ \frac{256\,kE^{12}\,kI^{13}\,\beta^7\,\delta^6\,\epsilon^{12}\,\mu I^2+\cdots 7 \cdots+256\,kE^{12}\,kI^{13}\,\beta^7\,\delta^4\,\epsilon^{14}\,\mu E^2\,\mu S^2}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\ \frac{1024\,c^2\,kE^{14}\,kI^{12}\,\beta^8\,\delta^4\,\epsilon^{14}+\cdots 41 \cdots+\cdots 1 \cdots}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\ \cdots 401 \cdots,\ -2\,c\,kI\,\epsilon,\ -\frac{4\,kI\,\delta}{kE},\ 1\right\}$$

large output | show less | show more | show all | set size limit...

Out[∘]=

$$\left\{-\frac{-kI\,\delta-kI\,\epsilon\,\mu E}{kI\,\epsilon},\ -\frac{kE-kE\,\epsilon}{kI\,\epsilon},\ 1\right\}$$

In[∘]:=
```
Coeffs = Union[Coeffs1, Coeffs2]
```

Out[∘]=

$$\left\{-2,\ 1,\ -\frac{4\,\beta}{kI},\ \frac{4\,\beta}{kI},\ \frac{4\,\beta^2}{kI^2},\ \cdots 363 \cdots,\ \frac{\cdots 1 \cdots}{\cdots 1 \cdots},\ \frac{\cdots 1 \cdots}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\ \frac{\cdots 1 \cdots}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\ \frac{256\,c\,kE^{13}\,kI^{14}\,\beta^6\,\delta^5\,\epsilon^{13}\,\mu I^3+\cdots 17 \cdots}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}},\ \frac{-256\,c\,kE^{13}\,kI^{14}\,\beta^6\,\delta^5\,\epsilon^{13}\,\mu I^3-256\,c\,kE^{13}\,kI^{14}\,\beta^6\,\delta^4\,\epsilon^{14}\,\mu E\,\mu I^3+\cdots 16 \cdots+256\,kE^{13}\,kI^{14}\,\beta^5\,\delta^5\,\epsilon^{13}\,\mu I\,\mu S^4}{256\,kE^{18}\,kI^8\,\beta^6\,\epsilon^{12}}\right\}$$

large output | show less | show more | show all | set size limit...

In[∘]:=
```
xCoeffs =
 Coeffs /. {β → a1, δ → a2, ϵ → a3, μS → a4, μE → a5, μI → a6, c → a7, kE → a8, kI → a9}
```

Out[∘]=

$$\left\{-2,\ 1,\ -\frac{4\,a1}{a9},\ \frac{4\,a1}{a9},\ \frac{4\,a1^2}{a9^2},\ \cdots 363 \cdots,\ \frac{\cdots 1 \cdots}{\cdots 1 \cdots},\ \frac{\cdots 1 \cdots}{256\,a1^6\,a3^{12}\,a8^{18}\,a9^8},\ \frac{\cdots 1 \cdots}{256\,a1^6\,a3^{12}\,a8^{18}\,a9^8},\ \frac{\cdots 16 \cdots+256\,a1^6\,a2^4\,a3^{14}\,a5\,a6^3\,a7\,a8^{13}\,a9^{14}}{256\,a1^6\,a3^{12}\,a8^{18}\,a9^8},\ \frac{256\,a1^5\,a2^5\,a3^{13}\,a4^4\,a6\,a8^{13}\,a9^{14}+1024\,a1^5\,a2^5\,a3^{13}\,a4^3\,a6^2\,a8^{13}\,a9^{14}+\cdots 19 \cdots}{256\,a1^6\,a3^{12}\,a8^{18}\,a9^8}\right\}$$

large output | show less | show more | show all | set size limit...

In[∘]:=
```
Solve[Coeffs == xCoeffs, {β, δ, ϵ, μS, μE, μI, c, kE, kI}]
```

Solve: Equations may not give solutions for all "solve" variables.

Out[∘]=

$$\left\{\left\{\beta\to\frac{a1\,kI}{a9},\ \delta\to a2,\ \epsilon\to a3,\ \mu S\to a4,\ \mu E\to a5,\ \mu I\to a6,\ c\to\frac{a7\,a9}{kI},\ kE\to\frac{a8\,kI}{a9}\right\}\right\}$$

```
(* extra junk *)
GroebnerBasis[Coeffs - xCoeffs, {β, δ, ϵ, μS, μE, μI, c, kE, kI}]
```

Out[ ]= $\left\{-kE + kE\,\epsilon - \frac{a8\,kI\,\epsilon}{a9} + \frac{a8\,kI\,\epsilon}{a3\,a9},\ -kE + \frac{a8\,kI}{a9} - \frac{a8\,kI}{a3\,a9} + \frac{kE}{\epsilon},\ -a2 - a4 + \delta + \mu S\right\}$