In[212]:=
```
SetDirectory[
 "D:\\cygwin64\\home\\koust\\Code\\Trophic_Maelstorm\\simulations\\Analytics\\Rietkerk 3
   Sp"]
```

Out[212]=
```
D:\cygwin64\home\koust\Code\Trophic_Maelstorm\simulations\Analytics\Rietkerk 3 Sp
```

Now evaluating numerically for different values of constants.

In[229]:=
```
ClearAll[r_w, c, K_1, a_ij, h_ij, d, R, ξ, G*]
(*Constants*)
r_w = 0.2 / 24.0;
c = 10000; d = 0.25 / 24.0;
K_1 = 5;
a_ij = 3.6 * 10.0^-6.08 * 20.0^-0.37;
h_ij = 1; ξ = 0.25 / 24; (* ξ is Kappa from analytical notation*)
e_j = 0.45; m_j = 0.061609 * 20.0^-0.25 / 8760.0;
a_jm = 3.6 * 10.0^-6.08 * 40.0^-0.37; h_jm = 1;
e_m = 0.85; m_m = 0.061609 * 40.0^-0.25 / 8760.0;
G* = m_m / ((e_m - m_m * h_jm) * a_jm);
(*Define the equation*)
equation[R_] := c * r_w * K_1 * (a_ij G* + d * (1 + a_ij * h_ij * V*)) * (1 + a_ij * h_ij * V*) ==
  (c * R - d * V*) * (1 + a_ij * h_ij * V*) * (ξ * (1 + a_ij * h_ij * V*) - a_ij * G*) -
   a_ij * V* * G* * (ξ * (1 + a_ij * h_ij * V*) - a_ij * G*)
(*Numerical Solution*)
numericalSolutions[R_] := NSolve[equation[R], V*]
analyticalSolutions[R_] := Solve[equation[R], V*]

Rrange = Range[0, 0.3, 0.01]
numericalResults = numericalSolutions /@ Rrange;

(*Display the Numerical Results*)
Grid[Join[{{"R", "Numerical Solutions"}},
  Transpose[{Rrange, numericalResults}]], Dividers → All]
analResults = analyticalSolutions /@ Rrange;
(*Display the Analytical Results*)
Grid[Join[{{"R", "Analytical Solutions"}},
  Transpose[{Rrange, analResults}]], Dividers → All]

anaResults = Flatten /@ Transpose[{Rrange, V* /. analResults}];
numResults = Flatten /@ Transpose[{Rrange, V* /. numericalResults}];



(*Export Analytical Solutions to CSV with headers*)
Export["Trial_Analytical_solutions.csv", anaResults,
 "CSV", "TableHeadings" → {"R", "Soln1", "Soln2", "Soln3"}]

(*Export Numerical Solutions to CSV with headers*)
Export["Trial_Numerical_solutions.csv", numResults,
 "CSV", "TableHeadings" → {"R", "Soln1", "Soln2", "Soln3"}]
```

••• ClearAll: r_w is not a symbol or a string.

ClearAll: K_1 is not a symbol or a string.

ClearAll: a_{ij} is not a symbol or a string.

General: Further output of ClearAll::ssym will be suppressed during this calculation.

Out[240]= {0., 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1, 0.11, 0.12, 0.13, 0.14, 0.15, 0.16, 0.17, 0.18, 0.19, 0.2, 0.21, 0.22, 0.23, 0.24, 0.25, 0.26, 0.27, 0.28, 0.29, 0.3}

Out[242]=

R	Numerical Solutions
0.	$\{\{V^* \to -1.01218 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -40017.\}\}$
0.01	$\{\{V^* \to -1.01217 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -30420.9\}\}$
0.02	$\{\{V^* \to -1.01217 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -20824.7\}\}$
0.03	$\{\{V^* \to -1.01216 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -11228.4\}\}$
0.04	$\{\{V^* \to -1.01216 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -1632.05\}\}$
0.05	$\{\{V^* \to -1.01216 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 7964.36\}\}$
0.06	$\{\{V^* \to -1.01215 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 17560.8\}\}$
0.07	$\{\{V^* \to -1.01215 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 27157.4\}\}$
0.08	$\{\{V^* \to -1.01215 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 36754.\}\}$
0.09	$\{\{V^* \to -1.01214 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 46350.7\}\}$
0.1	$\{\{V^* \to -1.01214 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 55947.4\}\}$
0.11	$\{\{V^* \to -1.01214 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 65544.2\}\}$
0.12	$\{\{V^* \to -1.01213 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 75141.\}\}$
0.13	$\{\{V^* \to -1.01213 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 84737.9\}\}$
0.14	$\{\{V^* \to -1.01213 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 94334.9\}\}$
0.15	$\{\{V^* \to -1.01212 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 103932.\}\}$
0.16	$\{\{V^* \to -1.01212 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 113529.\}\}$
0.17	$\{\{V^* \to -1.01212 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 123126.\}\}$
0.18	$\{\{V^* \to -1.01211 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 132723.\}\}$
0.19	$\{\{V^* \to -1.01211 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 142320.\}\}$
0.2	$\{\{V^* \to -1.01211 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 151918.\}\}$
0.21	$\{\{V^* \to -1.01211 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 161515.\}\}$
0.22	$\{\{V^* \to -1.0121 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 171112.\}\}$
0.23	$\{\{V^* \to -1.0121 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 180710.\}\}$
0.24	$\{\{V^* \to -1.0121 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 190307.\}\}$
0.25	$\{\{V^* \to -1.0121 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 199905.\}\}$
0.26	$\{\{V^* \to -1.01209 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 209502.\}\}$
0.27	$\{\{V^* \to -1.01209 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 219100.\}\}$
0.28	$\{\{V^* \to -1.01209 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 228697.\}\}$
0.29	$\{\{V^* \to -1.01209 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 238295.\}\}$
0.3	$\{\{V^* \to -1.01208 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 247892.\}\}$

Out[244]=

R	Analytical Solutions
0.	$\{\{V^* \to -1.01218 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -40017.\}\}$
0.01	$\{\{V^* \to -1.01217 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -30420.9\}\}$
0.02	$\{\{V^* \to -1.01217 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -20824.7\}\}$
0.03	$\{\{V^* \to -1.01216 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -11228.4\}\}$
0.04	$\{\{V^* \to -1.01216 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to -1632.05\}\}$
0.05	$\{\{V^* \to -1.01216 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 7964.36\}\}$
0.06	$\{\{V^* \to -1.01215 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 17560.8\}\}$
0.07	$\{\{V^* \to -1.01215 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 27157.4\}\}$
0.08	$\{\{V^* \to -1.01215 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 36754.\}\}$
0.09	$\{\{V^* \to -1.01214 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 46350.7\}\}$
0.1	$\{\{V^* \to -1.01214 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 55947.4\}\}$
0.11	$\{\{V^* \to -1.01214 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 65544.2\}\}$
0.12	$\{\{V^* \to -1.01213 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 75141.\}\}$
0.13	$\{\{V^* \to -1.01213 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 84737.9\}\}$
0.14	$\{\{V^* \to -1.01213 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 94334.9\}\}$
0.15	$\{\{V^* \to -1.01212 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 103932.\}\}$
0.16	$\{\{V^* \to -1.01212 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 113529.\}\}$
0.17	$\{\{V^* \to -1.01212 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 123126.\}\}$
0.18	$\{\{V^* \to -1.01211 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 132723.\}\}$
0.19	$\{\{V^* \to -1.01211 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 142320.\}\}$
0.2	$\{\{V^* \to -1.01211 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 151918.\}\}$
0.21	$\{\{V^* \to -1.01211 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 161515.\}\}$
0.22	$\{\{V^* \to -1.0121 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 171112.\}\}$
0.23	$\{\{V^* \to -1.0121 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 180710.\}\}$
0.24	$\{\{V^* \to -1.0121 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 190307.\}\}$
0.25	$\{\{V^* \to -1.0121 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 199905.\}\}$
0.26	$\{\{V^* \to -1.01209 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 209502.\}\}$
0.27	$\{\{V^* \to -1.01209 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 219100.\}\}$
0.28	$\{\{V^* \to -1.01209 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 228697.\}\}$
0.29	$\{\{V^* \to -1.01209 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 238295.\}\}$
0.3	$\{\{V^* \to -1.01208 \times 10^6\}, \{V^* \to -1.01133 \times 10^6\}, \{V^* \to 247892.\}\}$

Out[247]= Trial_Analytical_solutions.csv

Out[248]= Trial_Numerical_solutions.csv