```
ClearAll["Global`*"];
Nmax = 3;
fSer[η_] := Sum[f[i] η^i, {i, 0, Nmax}];
qSer[η_] := Sum[Q[i] η^i, {i, 0, Nmax}];
(*2) Defining Derivatives *)
fprime[η_] := D[fSer[η], η];
fprimeprime[η_] := D[fprime[η], η];
ξ =.; ɣ =.; ω =.; ϵ =.; cExp =.; gExp =.;
ψ[η_] := fSer[η] - f[0];
powSerXi[η_] := Normal@Series[(f[0] + ψ[η])^ξ, {η, 0, Nmax}];
powSerC[η_] := Normal@Series[(f[0] + ψ[η])^cExp, {η, 0, Nmax}];
powSerG[η_] := Normal@Series[(f[0] + ψ[η])^gExp, {η, 0, Nmax}];
powSerGprime[η_] := Normal@Series[D[(f[0] + ψ[η])^(gExp), η], {η, 0, Nmax}]
(*2) Writing Equation in form Z(q,f,f',f'',eta;
   gamma,omega,xi,Cexp,Gexp) = 0*)
expr = powSerXi[η] * fprime[η] +
   ϵ * powSerC[η] * (powSerG[η] * (ɣ * fprime[η] - ω * fprime[η] - ω * η * fprimeprime[η]) +
      (powSerGprime[η] * (ɣ * fSer[η] - ω * η * fprime[η]))) + qSer[η];
serExpr = Normal@Series[expr, {η, 0, Nmax}];
eqs = Thread[CoefficientList[serExpr, η] == ConstantArray[0, Nmax + 1]];
solq = Solve[eqs, Table[Q[i], {i, 0, Nmax}]];
solq
```

Out[ ]=

$$\left\{\left\{Q[0] \to -\left(\left(\gamma \in f[0]^{\text{cExp}+\text{gExp}} + \text{gExp}\,\gamma \in f[0]^{\text{cExp}+\text{gExp}} - \in \omega\, f[0]^{\text{cExp}+\text{gExp}} + f[0]^{\xi}\right) f[1]\right),\right.\right.$$

$$Q[1] \to -f[0]^{-1+\xi}\left(\xi\, f[1]^2 + 2\, f[0] \times f[2]\right) - \in \left(\text{cExp}\,(\gamma + \text{gExp}\,\gamma - \omega)\, f[0]^{-1+\text{cExp}+\text{gExp}} f[1]^2 + (\gamma + \text{gExp}\,\gamma - 2\,\omega)\, f[0]^{-1+\text{cExp}+\text{gExp}}\left(\text{gExp}\, f[1]^2 + 2\, f[0] \times f[2]\right)\right),$$

$$Q[2] \to -\frac{1}{2} f[0]^{-2+\xi}\left(-\xi\, f[1]^3 + \xi^2 f[1]^3 + 6\,\xi\, f[0] \times f[1] \times f[2] + 6\, f[0]^2 f[3]\right) - \in \left(\frac{1}{2}\text{cExp}\,(\gamma + \text{gExp}\,\gamma - \omega)\, f[0]^{-2+\text{cExp}+\text{gExp}} f[1]\left(-f[1]^2 + \text{cExp}\, f[1]^2 + 2\, f[0] \times f[2]\right) + \text{cExp}\,(\gamma + \text{gExp}\,\gamma - 2\,\omega)\, f[0]^{-2+\text{cExp}+\text{gExp}} f[1]\left(\text{gExp}\, f[1]^2 + 2\, f[0] \times f[2]\right) + \frac{1}{2}(\gamma + \text{gExp}\,\gamma - 3\,\omega)\, f[0]^{-2+\text{cExp}+\text{gExp}}\left(-\text{gExp}\, f[1]^3 + \text{gExp}^2 f[1]^3 + 6\,\text{gExp}\, f[0] \times f[1] \times f[2] + 6\, f[0]^2 f[3]\right)\right),$$

$$Q[3] \to -\frac{1}{6}\xi\, f[0]^{-3+\xi}\left(2\, f[1]^4 - 3\,\xi\, f[1]^4 + \xi^2 f[1]^4 - 12\, f[0]\, f[1]^2 f[2] + 12\,\xi\, f[0]\, f[1]^2 f[2] + 12\, f[0]^2 f[2]^2 + 24\, f[0]^2 f[1] \times f[3]\right) - \in \left(\frac{1}{2}\text{cExp}\,(\gamma + \text{gExp}\,\gamma - 2\,\omega)\, f[0]^{-3+\text{cExp}+\text{gExp}}\left(-f[1]^2 + \text{cExp}\, f[1]^2 + 2\, f[0] \times f[2]\right)\left(\text{gExp}\, f[1]^2 + 2\, f[0] \times f[2]\right) + \frac{1}{6}\text{cExp}\,(\gamma + \text{gExp}\,\gamma - \omega)\, f[0]^{-3+\text{cExp}+\text{gExp}} f[1]\left(2\, f[1]^3 - 3\,\text{cExp}\, f[1]^3 + \text{cExp}^2 f[1]^3 - 6\, f[0] \times f[1] \times f[2] + 6\,\text{cExp}\, f[0] \times f[1] \times f[2] + 6\, f[0]^2 f[3]\right) + \frac{1}{2}\text{cExp}\,(\gamma + \text{gExp}\,\gamma - 3\,\omega)\, f[0]^{-3+\text{cExp}+\text{gExp}} f[1]\left(-\text{gExp}\, f[1]^3 + \text{gExp}^2 f[1]^3 + 6\,\text{gExp}\, f[0] \times f[1] \times f[2] + 6\, f[0]^2 f[3]\right) + \frac{1}{6} f[0]^{-3+\text{cExp}}\left(2\,\text{gExp}\,\gamma\, f[0]^{\text{gExp}} f[1]^4 - \text{gExp}^2\,\gamma\, f[0]^{\text{gExp}} f[1]^4 - 2\,\text{gExp}^3\,\gamma\, f[0]^{\text{gExp}} f[1]^4 + \text{gExp}^4\,\gamma\, f[0]^{\text{gExp}} f[1]^4 - 8\,\text{gExp}\,\omega\, f[0]^{\text{gExp}} f[1]^4 + 12\,\text{gExp}^2\,\omega\, f[0]^{\text{gExp}} f[1]^4 - 4\,\text{gExp}^3\,\omega\, f[0]^{\text{gExp}} f[1]^4 - 12\,\text{gExp}\,\gamma\, f[0]^{1+\text{gExp}} f[1]^2 f[2] + 12\,\text{gExp}^3\,\gamma\, f[0]^{1+\text{gExp}} f[1]^2 f[2] + 48\,\text{gExp}\,\omega\, f[0]^{1+\text{gExp}} f[1]^2 f[2] - 48\,\text{gExp}^2\,\omega\, f[0]^{1+\text{gExp}} f[1]^2 f[2] + 12\,\text{gExp}\,\gamma\, f[0]^{2+\text{gExp}} f[2]^2 + 12\,\text{gExp}^2\,\gamma\, f[0]^{2+\text{gExp}} f[2]^2 - 48\,\text{gExp}\,\omega\, f[0]^{2+\text{gExp}} f[2]^2 + 24\,\text{gExp}\,\gamma\, f[0]^{2+\text{gExp}} f[1] \times f[3] + 24\,\text{gExp}^2\,\gamma\, f[0]^{2+\text{gExp}} f[1] \times f[3] - 96\,\text{gExp}\,\omega\, f[0]^{2+\text{gExp}} f[1] \times f[3]\right)\right)\right\}\right\}$$

In[ ]:=