11h. Routines for eigenfunction equations

The computation of the action of the generators of the enveloping algebra takes long.
The results of these computations will be used later on; it is worthwhile to define routines with these results.

The routines do not provide equalities, but a pair of quantities that both have to be zero for all relevant values of the variable r.
The routines depend implicitly on the choice of spectral parameters (j,ν).

N - trivial case

In[ ]:=
```
Clear[efeqt, h, nu, j]
efeqt[h_, p_, r_, f_] =
  {1/12 ((h - 3 r)^2 - 4 × (-12 + 3 nu^2 + j^2)) f[r, t] + t (-3 f^(0,1)[r, t] + t f^(0,2)[r, t]),
   (h - 3 r - 2 j) (h - 3 nu - 3 r + j) (h + 3 nu - 3 r + j) f[r, t]};
```

Abelian case

In[ ]:=
```
Clear[efeqa, h, nu, j]
efeqa[h_, p_, r_, g_, bt_] =
  {-2 ⅈ beta π (p + r) t g[-2 + r, t] + 1/12 × (48 + h^2 - 12 nu^2 - 6 h r + 9 r^2 - 4 j^2 - 48 π^2 t^2 Abs[beta]^2)
     g[r, t] + t (2 ⅈ Conjugate[beta] π (p - r) g[2 + r, t] - 3 g^(0,1)[r, t] + t g^(0,2)[r, t]),
   -9 × (3 ⅈ beta π (-2 + h - 3 r) (p + r) t g[-2 + r, t] -
      1/9 ((h - 3 r - 2 j) (h + 3 nu - 3 r + j) (h - 3 (nu + r) + j) + 216 π^2 r t^2 Abs[beta]^2) g[r, t] +
      3 ⅈ π t (Conjugate[beta] (2 + h - 3 r) (-p + r) g[2 + r, t] +
         2 t (beta (p + r) g^(0,1)[-2 + r, t] + Conjugate[beta] (p - r) g^(0,1)[2 + r, t])))};
```

Non-abelian case

We use the routine
efeqn[h_,p_,r_,f_,ell_,mr_,eps_]
explanation of the parameters:
h and p determine the K-type;
r order of the component under consideration;
ell determines the character of the center of N;
mr order of theta-function;

eps=Sign[ell]

In[ ]:=
```
Clear[efeqn, nu , j]
efeqn[h_, p_, r_, f_, ell_, mr_, 1] =
  {1/12 × ((48 + h^2 - 12 nu^2 + 9 r^2 - 48 ell π t^2 - 24 ell π r t^2 - 48 ell^2 π^2 t^4 - 6 h (r + 4 ell π t^2) -
        4 j^2 - 96 mr π t^2 Abs[ell]) f[r, t] + 12 t (2 ⅈ Sqrt[2 π] Sqrt[Abs[ell]]
         (Sqrt[mr] (p + r) f[-2 + r, t] + Sqrt[1 + mr] (-p + r) f[2 + r, t]) - 3 f^(0,1)[r, t] + t f^(0,2)[r, t])),
   -1/9 (h^3 - 9 h^2 r + 27 nu^2 r - 27 r^3 - 216 ell p π t^2 - 108 ell p^2 π t^2 + 216 ell π r t^2 +
      108 ell π r^2 t^2 + 18 nu^2 j + 9 r j^2 - 2 j^3 - 3 h (3 nu^2 - 9 r^2 + j^2) + 432 mr π r t^2 Abs[ell])
     f[r, t] - 3 ⅈ Sqrt[2 π] t Sqrt[Abs[ell]] (Sqrt[mr] (p + r) (-2 + h - 3 r + 4 ell π t^2) f[-2 + r, t] -
      Sqrt[1 + mr] (p - r) (2 + h - 3 r + 4 ell π t^2) f[2 + r, t] +
      2 t (Sqrt[mr] (p + r) f^(0,1)[-2 + r, t] + Sqrt[1 + mr] (p - r) f^(0,1)[2 + r, t]))};
efeqn[h_, p_, r_, f_, ell_, mr_, -1] = {1/12 ×
    ((48 + h^2 - 12 nu^2 + 9 r^2 - 48 ell π t^2 - 24 ell π r t^2 - 48 ell^2 π^2 t^4 - 6 h (r + 4 ell π t^2) -
        4 j^2 - 96 × (1 + mr) π t^2 Abs[ell]) f[r, t] + 12 t (2 ⅈ Sqrt[2 π] Sqrt[Abs[ell]]
         (- Sqrt[1 + mr] (p + r) f[-2 + r, t] + Sqrt[mr] (p - r) f[2 + r, t]) - 3 f^(0,1)[r, t] + t f^(0,2)[r, t])),
   -1/9 (h^3 - 9 h^2 r + 27 nu^2 r - 27 r^3 - 216 ell p π t^2 - 108 ell p^2 π t^2 + 216 ell π r t^2 +
      108 ell π r^2 t^2 + 18 nu^2 j + 9 r j^2 - 2 j^3 -
      3 h (3 nu^2 - 9 r^2 + j^2) + 432 × (1 + mr) π r t^2 Abs[ell]) f[r, t] -
    3 ⅈ Sqrt[2 π] t Sqrt[Abs[ell]] (Sqrt[1 + mr] (p + r) (2 - h + 3 r - 4 ell π t^2) f[-2 + r, t] +
      Sqrt[mr] (p - r) (2 + h - 3 r + 4 ell π t^2) f[2 + r, t] -
      2 t (Sqrt[1 + mr] (p + r) f^(0,1)[-2 + r, t] + Sqrt[mr] (p - r) f^(0,1)[2 + r, t]))};
```