11b. Substitution rule for the N-trivial case

Preparation for Lemma 3.19.

The following substitution routine **subtriv** is more efficient than the use of **subab** followed by putting β equal to zero,

In[ ]:=
```
Clear[subtriv]
subtriv[xx_] := Module[{x}, x = xx //. subtriv0 // Expand;
  x = x //. subtriv0 //. btsub // Simplify]
subtriv0 :=
  {Rna[XX0, ff_] → 0, Rna[XX1, ff_] → 0, Rna[XX2, ff_] → 0, Rna[HHr, ff_] :→ t D[ff, t]};
```

In[ ]:=
```
Clear[h, p, r, q]
F = f[t] × Phi[h, p, r, p]
R[Z31, F] // subtriv
R[Z32, F] // subtriv
```

Out[ ]= f[t] × Phi[h, p, r, p]

Out[ ]= $\frac{1}{8\times(1+p)}(2+p+r)\,\mathrm{Phi}[3+h,\,1+p,\,1+r,\,1+p]\,((h+2p-r)\,f[t]+2\,t\,f'[t])$

Out[ ]= $\frac{1}{8\times(1+p)}(-f[t]\,(2\,p\,(4-h+2p+r)\,\mathrm{Phi}[3+h,\,-1+p,\,1+r,\,-1+p]+$
$(h+2p-r)\,(2+p+r)\,\mathrm{Phi}[3+h,\,1+p,\,1+r,\,-1+p])+$
$2\,t\,(2\,p\,\mathrm{Phi}[3+h,\,-1+p,\,1+r,\,-1+p]-(2+p+r)\,\mathrm{Phi}[3+h,\,1+p,\,1+r,\,-1+p])\,f'[t])$

In[ ]:=
```
sh[3, 1, F, subtriv]
% == sh[3, 1, F, subab]
sh[-3, 1, F, subtriv]
% == sh[-3, 1, F, subab]
sh[3, -1, F, subtriv]
% == sh[3, -1, F, subab]
sh[-3, -1, F, subtriv]
% == sh[-3, -1, F, subab]
```

Out[ ]= $\frac{1}{8\times(1+p)}(2+p+r)\,\text{Phi}[3+h,\ 1+p,\ 1+r,\ 1+p]\,((h+2\,p-r)\,f[t]+2\,t\,f'[t])$

Out[ ]= True

Out[ ]= $\frac{1}{8\times(1+p)}(2+p-r)\,\text{Phi}[-3+h,\ 1+p,\ -1+r,\ 1+p]\,((-h+2\,p+r)\,f[t]+2\,t\,f'[t])$

Out[ ]= True

Out[ ]= $\frac{1}{4\times(1+p)}p\,\text{Phi}[3+h,\ -1+p,\ 1+r,\ -1+p]\,((-4+h-2\,p-r)\,f[t]+2\,t\,f'[t])$

Out[ ]= True

Out[ ]= $\frac{1}{4\times(1+p)}p\,\text{Phi}[-3+h,\ -1+p,\ -1+r,\ -1+p]\,(-((4+h+2\,p-r)\,f[t])+2\,t\,f'[t])$

Out[ ]= True

Definition of eigenvalues functions on the center of the enveloping algebra

In[ ]:=
```
Clear[ld2, ld3]
ld2[{j_, nu_}] = ld2[j_, nu_] = (nu ^ 2 - 4 + j ^ 2 / 3)
ld3[{j_, nu_}] = ld3[j_, nu_] = (j + 3) (nu ^ 2 - (j - 6) ^ 2 / 9)
```

Out[ ]= $-4+\frac{j^2}{3}+nu^2$

Out[ ]= $(3+j)\times\left(-\frac{1}{9}(-6+j)^2+nu^2\right)$