```
> restart: #1324,1423
> rr:=proc(n,i,j) option remember: local s: if n=2 then if i=3 and
  j=1 then return(p^2*q): fi: if i=3 and j=0 then return(p): fi:
  return(0): fi: if n=3 then if i=4 and j=0 then return(p): fi: if
  i=4 and j=1 then return(p*q+p^2*q): fi: if i=4 and j=2 then
  return(p^3*q^2): fi: if i=3 and j=0 then return(p^2*q+p^3*q): fi:
  fi: if i=j+3 and j>-1 and j<n-2 then
  s:=p*q*rr(n-1,j+2,j-1)+p*q*add(rr(n-1,ii,j),ii=j+3..n)+p*add(add(r
  r(n-1,ii,kk),ii=kk+2..n),kk=j+1..n-2):  return(simplify(s)): fi:
  if 3<j+4 and j+4<i+1 and i<n+1 then
  s:=p*q*rr(n-1,i-1,j-1)+p*rr(n-1,i-1,j)+p*q*add(rr(n-1,ll,j),ll=i..
  n): return(simplify(s)): fi: if i=j+2 and j>-1 and j<n then if
  j=n-1 then return(p^n*q^(n-1)): fi: return(0): fi: if i=n+1 and
  j>-1 and j<n-1 then
  s:=add(p^ll*q^j*binomial(n-ll-1,n-j-2),ll=1..n-1):
  return(simplify(s)): fi: return(0): end:
> NN:=14:  ##AAp=R^+, CC=C,  EE=E, DD=D,
> AAP:=(x,v,w)->add(add(add(rr(n,i,j)*v^i*w^j*x^n,j=0..i-4),i=4..n),
  n=4..NN):
  CC:=(x,v)->add(add(rr(n,i+2,i)*v^i*x^n,i=0..n-1),n=2..NN):
  DD:=(x,v)->add(add(rr(n,i+3,i)*v^i*x^n,i=0..n-3),n=3..NN):
  EE:=(x,v)->add(add(rr(n,n+1,j)*v^j*x^n,j=0..n-2),n=2..NN):
>
> #EQ4
> simplify(taylor(-EE(x,v)+add(add(add(p^ll*q^j*binomial(n-ll-1,n-j-
  2)*v^j*x^n,ll=1..n-1),j=0..n-2),n=2..NN),x,14));
  simplify(taylor(-EE(x,v)+add(add(add(p^ll*q^j*binomial(n,j+1-ll)*v
  ^j*x^(n+1+ll),j=0..n+ll-1),n=0..NN),ll=1..NN),x,14));
  simplify(taylor(-EE(x,v)+add(add(add(p^ll*q^(j+ll)*binomial(n,j+1)
  *v^(j+ll)*x^(n+1+ll),n=j+1..NN),j=0..NN),ll=1..NN)+add(add(add(p^l
  l*q^j*binomial(n,j+1-ll)*v^j*x^(n+1+ll),n=0..NN),j=0..ll-1),ll=1..
  NN),x,14));
  simplify(taylor(-EE(x,v)+add(add(p^ll*q^(j+ll)*v^(j+ll)*x^(j+2+ll)
  /(1-x)^(j+2),j=0..NN),ll=1..NN)+add(add(add(p^ll*q^j*binomial(n,j+
  1-ll)*v^j*x^(n+1+ll),n=0..NN),j=0..ll-1),ll=1..NN),x,14));
  simplify(taylor(-EE(x,v)+add(p^ll*q^(ll)*v^(ll)*x^(2+ll)/(1-x)/(1-
  x-q*v*x),ll=1..NN)+add(add(add(p^ll*q^j*binomial(n,j+1-ll)*v^j*x^(
  n+1+ll),n=0..NN),j=0..ll-1),ll=1..NN),x,14));
  simplify(taylor(-EE(x,v)+p*q*v*x^3/(1-x)/(1-x-q*v*x)/(1-p*q*v*x)+a
  dd(add(add(p^ll*q^j*binomial(n,j+1-ll)*v^j*x^(n+1+ll),n=0..NN),j=0
  ..ll-1),ll=1..NN),x,14));
  simplify(taylor(-EE(x,v)+p*q*v*x^3/(1-x)/(1-x-q*v*x)/(1-p*q*v*x)+a
  dd(add(p^(1+j)*q^j*v^j*x^(n+2+j),n=0..NN),j=0..NN),x,14));
```

```
simplify(taylor(-EE(x,v)+p*q*v*x^3/(1-x)/(1-x-q*v*x)/(1-p*q*v*x)+a
dd(p^(1+j)*q^j*v^j*x^(2+j)/(1-x),j=0..NN),x,14));
simplify(taylor(-EE(x,v)+p*q*v*x^3/(1-x)/(1-x-q*v*x)/(1-p*q*v*x)+p
*x^2/(1-x)/(1-p*q*v*x),x,14));
```

$$O(x^{14})$$
$$O(x^{14})$$
$$O(x^{14})$$
$$O(x^{14})$$
$$O(x^{14})$$
$$O(x^{14})$$
$$O(x^{14})$$
$$O(x^{14})$$
$$O(x^{14})$$

```
> #EQ3
> simplify(taylor(-CC(x,v)+p^2*q*v*x^2/(1-p*q*v*x),x,14));
```

$$O(x^{14})$$

```
> #EQ1;
> simplify(taylor(-DD(x,v)+add(add(p*q*rr(n-1,i+2,i-1)*v^i*x^n,i=0..
n-3),n=3..NN)+add(add(add(p*q*rr(n-1,j,i)*v^i*x^n,j=i+3..n),i=0..n
-3),n=3..NN)+p*add(add(add(add(rr(n-1,ii,k)*v^i*x^n,ii=k+2..n),k=i
+1..n-2),i=0..n-3),n=3..NN),x,14));
simplify(taylor(-DD(x,v)+p*q*v*x*add(add(rr(n,i+3,i)*v^i*x^n,i=0..
n-3),n=2..NN)+p*q*x*add(add(add(rr(n,j,i)*v^i*x^n,j=i+3..n+1),i=0.
.n-2),n=2..NN)+p*x*add(add(add(add(rr(n,ii,k)*v^i*x^n,ii=k+2..n+1)
,k=i+1..n-1),i=0..n-2),n=2..NN),x,14));
simplify(taylor(-DD(x,v)+p*q*v*x*DD(x,v)+p*q*x*AAP(x,1,v)+p*q*x*EE
(x,v)+p*q*x*DD(x,v)
+p*x*add(add(add(add(rr(n,ii,k)*v^i*x^n,ii=k+2..n+1),k=i+1..n-1),i
=0..n-2),n=2..NN),x,14));
simplify(taylor(-DD(x,v)+p*q*v*x*DD(x,v)+p*q*x*AAP(x,1,v)+p*q*x*EE
(x,v)+p*q*x*DD(x,v)
+p*x*add(add(add(add(rr(n,ii,k)*v^i*x^n,i=0..k-1),ii=k+2..n+1),k=1
..n-1),n=2..NN),x,14));
simplify(taylor(-DD(x,v)+p*q*v*x*DD(x,v)+p*q*x*AAP(x,1,v)+p*q*x*EE
(x,v)+p*q*x*DD(x,v)
+p*x/(1-v)*add(add(add(rr(n,ii,k)*(1-v^k)*x^n,k=1..ii-2),ii=3..n+1
),n=2..NN),x,14));
simplify(taylor(-DD(x,v)+p*q*v*x*DD(x,v)+p*q*x*AAP(x,1,v)+p*q*x*EE
(x,v)+p*q*x*DD(x,v)
+p*x/(1-v)*(AAP(x,1,1)-AAP(x,1,v))+p*x/(1-v)*(EE(x,1)-EE(x,v))+x^4
```

```
*q*p^2*(p*q*v*x+p*q*x-p-1)/(q*x-1)/(q*v*x-1)/(p*q*x-1)/(p*q*v*x-1)
+p*x/(1-v)*add(add(rr(n,ii+3,ii)*(1-v^ii)*x^n,ii=0..n-2),n=2..NN)+
p*x/(1-v)*add(add(rr(n,ii+2,ii)*(1-v^ii)*x^n,ii=1..n-1),n=2..NN),x
,14));
simplify(taylor(-DD(x,v)+p*q*v*x*DD(x,v)+p*q*x*AAP(x,1,v)+p*q*x*EE
(x,v)+p*q*x*DD(x,v)
+p*x/(1-v)*(AAP(x,1,1)-AAP(x,1,v))+p*x/(1-v)*(EE(x,1)-EE(x,v))+p*x
/(1-v)*(DD(x,1)-DD(x,v))+p*x/(1-v)*(CC(x,1)-CC(x,v)),x,14));
```

$$O(x^{14})$$

$$O(x^{14})$$

$$O(x^{14})$$

$$O(x^{14})$$

$$O(x^{14})$$

$$O(x^{14})$$

$$O(x^{14})$$

```
> #EQ2
> simplify(taylor(-AAP(x,v,w)+p*q*v*w*x*add(add(add(rr(n,i,j)*v^i*w^
j*x^n,j=0..i-4),i=4..n),n=3..NN)+p*v*x*add(add(add(rr(n,i,j)*v^i*w
^j*x^n,j=0..i-3),i=3..n),n=3..NN)+p*q*x*add(add(add(add(rr(n,ll,j)
*v^i*w^j*x^n,ll=i..n+1),j=0..i-4),i=4..n+1),n=3..NN),x,14));
simplify(taylor(-AAP(x,v,w)+p*q*v*w*x*AAP(x,v,w)+p*v*x*AAP(x,v,w)+
p*v^4*x*DD(x,v*w)+p*q*x*add(add(add(add(rr(n,ll,j)*v^i*w^j*x^n,ll=
i..n+1),j=0..i-4),i=4..n+1),n=3..NN),x,14));
simplify(taylor(-AAP(x,v,w)+p*q*v*w*x*AAP(x,v,w)+p*v*x*AAP(x,v,w)+
p*v^4*x*DD(x,v*w)+p*q*x*add(add(add(add(rr(n,ll,j)*v^i*w^j*x^n,i=j
+4..ll),ll=j+4..n+1),j=0..n-3),n=3..NN),x,14));
simplify(taylor(-AAP(x,v,w)+p*q*v*w*x*AAP(x,v,w)+p*v*x*AAP(x,v,w)+
p*v^4*x*DD(x,v*w)+p*q*v*x/(1-v)*add(add(add(rr(n,ll,j)*(v^(j+3)-v^
(ll))*w^j*x^n,j=0..ll-4),ll=4..n),n=3..NN)+p*q*v*x/(1-v)*add(add(a
dd(rr(n,ll,j)*(v^(j+3)-v^(ll))*w^j*x^n,j=0..ll-4),ll=n+1..n+1),n=3
..NN),x,14));
simplify(taylor(-AAP(x,v,w)+p*q*v*w*x*AAP(x,v,w)+p*v*x*AAP(x,v,w)+
p*v^4*x*DD(x,v*w)+p*q*v*x/(1-v)*(v^3*AAP(x,1,v*w)-AAP(x,v,w))
+p*q*v^2*x/(1-v)*(EE(x,v*w)*v^2-EE(v*x,w)),x,14));
```

$$O(x^{14})$$

$$O(x^{14})$$

$$O(x^{14})$$

$$O(x^{14})$$

$$O(x^{14})$$

```
> #all equations
> eq3:=-FCC(x,v)+p^2*q*v*x^2/(1-p*q*v*x);
```

$$eq3 := -\mathrm{FCC}(x, v) + \frac{p^2\, q\, v\, x^2}{-p\, q\, v\, x + 1}$$

```
> eq4:=-FEE(x,v)+factor(p*q*v*x^3/(1-x)/(1-x-q*v*x)/(1-p*q*v*x)+p*x^
  2/(1-x)/(1-p*q*v*x));
```

$$eq4 := -\mathrm{FEE}(x, v) + \frac{p\, x^2}{(p\, q\, v\, x - 1)\,(q\, v\, x + x - 1)}$$

```
> eq1:=-FDD(x,v)+p*q*v*x*FDD(x,v)+p*q*x*FAAP(x,1,v)+p*q*x*FEE(x,v)+p
  *q*x*FDD(x,v)
  +p*x/(1-v)*(FAAP(x,1,1)-FAAP(x,1,v))+p*x/(1-v)*(FEE(x,1)-FEE(x,v))
  +p*x/(1-v)*(FDD(x,1)-FDD(x,v))+p*x/(1-v)*(FCC(x,1)-FCC(x,v));
```

$$eq1 := -\mathrm{FDD}(x, v) + p\, q\, v\, x\, \mathrm{FDD}(x, v) + p\, q\, x\, \mathrm{FAAP}(x, 1, v) + p\, q\, x\, \mathrm{FEE}(x, v) + p\, q\, x\, \mathrm{FDD}(x, v) + \frac{p\, x\,(\mathrm{FAAP}(x, 1, 1) - \mathrm{FAAP}(x, 1, v))}{1 - v} + \frac{p\, x\,(\mathrm{FEE}(x, 1) - \mathrm{FEE}(x, v))}{1 - v} + \frac{p\, x\,(\mathrm{FDD}(x, 1) - \mathrm{FDD}(x, v))}{1 - v} + \frac{p\, x\,(\mathrm{FCC}(x, 1) - \mathrm{FCC}(x, v))}{1 - v}$$

```
> eq2:=-FAAP(x,v,w)+p*q*v*w*x*FAAP(x,v,w)+p*v*x*FAAP(x,v,w)+p*v^4*x*
  FDD(x,v*w)+p*q*v*x/(1-v)*(v^3*FAAP(x,1,v*w)-FAAP(x,v,w))
  +p*q*v^2*x/(1-v)*(FEE(x,v*w)*v^2-FEE(v*x,w));
```

$$eq2 := -\mathrm{FAAP}(x, v, w) + p\, q\, v\, w\, x\, \mathrm{FAAP}(x, v, w) + p\, v\, x\, \mathrm{FAAP}(x, v, w) + p\, v^4\, x\, \mathrm{FDD}(x, v\, w) + \frac{p\, q\, v\, x\,(v^3\, \mathrm{FAAP}(x, 1, v\, w) - \mathrm{FAAP}(x, v, w))}{1 - v} + \frac{p\, q\, v^2\, x\,(\mathrm{FEE}(x, v\, w)\, v^2 - \mathrm{FEE}(v\, x, w))}{1 - v}$$

```
>
> ##solution
> FFCC:=(x,v)->p^2*q*v*x^2/(-p*q*v*x+1); ##by eq3;
```

$$FFCC := (x, v) \rightarrow \frac{p^2\, q\, v\, x^2}{-p\, q\, v\, x + 1}$$

```
> FFEE:=(x,v)->p*x^2/(p*q*v*x-1)/(q*v*x+x-1); ##by eq4
```

$$FFEE := (x, v) \rightarrow \frac{p\, x^2}{(p\, q\, v\, x - 1)\,(q\, v\, x + x - 1)}$$

```
> (coeff(eq2,FAAP(x,v,w),1))*FAAP(x,v,w)+coeff(coeff(eq2,FAAP(x,v,w)
  ,0),FDD(x,v*w))*FDD(x,v*w)+coeff(coeff(eq2,FAAP(x,v,w),0),FDD(x,v*
  w),0):
> meq2:=(-1+p*q*v*w*x+p*v*x-p*q*v*x/(1-v))*FAAP(x,v,w)+p*v^4*x*FDD(x
  ,v*w)+p*q*v^4*x/(1-v)*FAAP(x,1,v*w)+factor(p*q*v^2*x/(1-v)*(FFEE(x
  ,v*w)*v^2-FFEE(v*x,w)));  ##eq14 in the paper
```

$$meq2 := \left(-1 + p\, q\, v\, w\, x + p\, v\, x - \frac{p\, q\, v\, x}{1 - v}\right) \mathrm{FAAP}(x, v, w) + p\, v^4\, x\, \mathrm{FDD}(x, v\, w)$$

$$+\frac{p\,q\,v^4\,x\,\mathrm{FAAP}(x,1,v\,w)}{1-v}-\frac{x^4\,p^2\,q\,v^4}{(p\,q\,v\,w\,x-1)\,(q\,v\,w\,x+x-1)\,(q\,v\,w\,x+v\,x-1)}$$

```
> coeff(eq1,FDD(x,v))*FDD(x,v)+coeff(coeff(eq1,FDD(x,v),0),FAAP(x,1,
  v))*FAAP(x,1,v)+coeff(coeff(coeff(eq1,FDD(x,v),0),FAAP(x,1,v),0),F
  AAP(x,1,1))*FAAP(x,1,1)+coeff(coeff(coeff(coeff(eq1,FDD(x,v),0),FA
  AP(x,1,v),0),FAAP(x,1,1),0),FDD(x,1))*FDD(x,1)+coeff(coeff(coeff(c
  oeff(eq1,FDD(x,v),0),FAAP(x,1,v),0),FAAP(x,1,1),0),FDD(x,1),0);
```

$$\left(-1+p\,q\,v\,x+p\,q\,x-\frac{p\,x}{1-v}\right)\mathrm{FDD}(x,v)+\left(p\,q\,x-\frac{p\,x}{1-v}\right)\mathrm{FAAP}(x,1,v)+\frac{p\,x\,\mathrm{FAAP}(x,1,1)}{1-v}$$
$$+\frac{p\,x\,\mathrm{FDD}(x,1)}{1-v}+p\,q\,x\,\mathrm{FEE}(x,v)+\frac{p\,x\,(\mathrm{FEE}(x,1)-\mathrm{FEE}(x,v))}{1-v}$$
$$+\frac{p\,x\,(\mathrm{FCC}(x,1)-\mathrm{FCC}(x,v))}{1-v}$$

```
> meq1:=(-1+p*q*v*x+x*q*p-p*x/(1-v))*FDD(x,v)+(x*q*p-p*x/(1-v))*FAAP
  (x,1,v)+p*x/(1-v)*FAAP(x,1,1)+p*x/(1-v)*FDD(x,1)+factor(p*q*x*FFEE
  (x,v)+p*x/(1-v)*(FFEE(x,1)-FFEE(x,v))+p*x/(1-v)*(FFCC(x,1)-FFCC(x,
  v))); ##eq13 in the paper
```

$$meq1:=\left(-1+p\,q\,v\,x+p\,q\,x-\frac{p\,x}{1-v}\right)\mathrm{FDD}(x,v)+\left(p\,q\,x-\frac{p\,x}{1-v}\right)\mathrm{FAAP}(x,1,v)$$
$$+\frac{p\,x\,\mathrm{FAAP}(x,1,1)}{1-v}+\frac{p\,x\,\mathrm{FDD}(x,1)}{1-v}+\frac{(q\,x-1)\,(p\,q\,v\,x+p\,q\,x+p\,x-p-1)\,p^2\,q\,x^3}{(p\,q\,x-1)\,(q\,x+x-1)\,(p\,q\,v\,x-1)\,(q\,v\,x+x-1)}$$

```
> subs(w=w/v,meq2); ##eq below eq 14 in the paper
```

$$\left(-1+p\,q\,w\,x+p\,v\,x-\frac{p\,q\,v\,x}{1-v}\right)\mathrm{FAAP}\left(x,v,\frac{w}{v}\right)+p\,v^4\,x\,\mathrm{FDD}(x,w)+\frac{p\,q\,v^4\,x\,\mathrm{FAAP}(x,1,w)}{1-v}$$
$$-\frac{x^4\,p^2\,q\,v^4}{(p\,q\,w\,x-1)\,(q\,w\,x+x-1)\,(q\,w\,x+v\,x-1)}$$

```
> vvv0:=solve(-1+p*q*w*x+p*v*x-p*q*v*x/(1-v)=0,v);
  VV0:=(1-p*q*w*x-x*q*p+p*x-((1-p*q*w*x-x*q*p+p*x)^2-4*p*x*(1-p*q*w*
  x))^(1/2))/2/p/x;
```

$$vvv0:=(-p\,q\,w\,x-p\,q\,x+p\,x+1+(p^2\,q^2\,w^2\,x^2+2\,p^2\,q^2\,w\,x^2+p^2\,q^2\,x^2+2\,p^2\,q\,w\,x^2-2\,p^2\,q\,x^2$$
$$+p^2\,x^2-2\,p\,q\,w\,x-2\,p\,q\,x-2\,p\,x+1)^{(1/2)})/(2\,p\,x),-(p\,q\,w\,x+p\,q\,x-p\,x+(p^2\,q^2\,w^2\,x^2$$
$$+2\,p^2\,q^2\,w\,x^2+p^2\,q^2\,x^2+2\,p^2\,q\,w\,x^2-2\,p^2\,q\,x^2+p^2\,x^2-2\,p\,q\,w\,x-2\,p\,q\,x-2\,p\,x+1)^{(1/2)}-1$$
$$)/(2\,p\,x)$$

$$VV0:=\frac{1-p\,q\,w\,x-p\,q\,x+p\,x-\sqrt{(-p\,q\,w\,x-p\,q\,x+p\,x+1)^2-4\,p\,x\,(-p\,q\,w\,x+1)}}{2\,p\,x}$$

```
> #solution eq below eq 14 in the paper
> subs(FAAP(x,v,w/v)=0,subs(w=w/v,meq2))=0; ##kernel=0
```

$$p\,v^4\,x\,\mathrm{FDD}(x,w)+\frac{p\,q\,v^4\,x\,\mathrm{FAAP}(x,1,w)}{1-v}-\frac{x^4\,p^2\,q\,v^4}{(p\,q\,w\,x-1)\,(q\,w\,x+x-1)\,(q\,w\,x+v\,x-1)}=0$$

```
> FAAPv1:=subs(v=vv0(w),x^3*p*(1-v)/(p*q*w*x-1)/(q*w*x+x-1)/(q*w*x+v
*x-1)-(1-v)/q*FDD(x,w));
```

$$FAAPv1:=\frac{x^3\,p\,(1-\mathrm{vv0}(w))}{(p\,q\,w\,x-1)\,(q\,w\,x+x-1)\,(q\,w\,x+\mathrm{vv0}(w)\,x-1)}-\frac{(1-\mathrm{vv0}(w))\,\mathrm{FDD}(x,w)}{q}$$

```
> simplify(taylor(-AAP(x,1,w)+x^3*p*(1-VV0)/(p*q*w*x-1)/(q*w*x+x-1)/
(q*w*x+VV0*x-1)+(VV0-1)/q*DD(x,w),x,14)); #checkeing eq 15
```

$$\mathrm{O}(x^{14})$$

```
>
> AAAPv1:=(x,w)->x^3*p*(1-vv0(w))/(p*q*w*x-1)/(q*w*x+x-1)/(q*w*x+vv0
(w)*x-1)+(vv0(w)-1)/q*FDD(x,w);
```

$$AAAPv1:=(x,w)\rightarrow\frac{x^3\,p\,(1-\mathrm{vv0}(w))}{(p\,q\,w\,x-1)\,(q\,w\,x+x-1)\,(q\,w\,x+\mathrm{vv0}(w)\,x-1)}+\frac{(\mathrm{vv0}(w)-1)\,\mathrm{FDD}(x,w)}{q}$$

```
> simplify(taylor(subs(vv0(w)=VV0,FDD(x,w)=DD(x,w),AAAPv1(x,w))-AAP(
x,1,w),x,14)); ##checking formula 15 in the paper
```

$$\mathrm{O}(x^{14})$$

```
>
> meq1;
```

$$\left(-1+p\,q\,v\,x+p\,q\,x-\frac{p\,x}{1-v}\right)\mathrm{FDD}(x,v)+\left(p\,q\,x-\frac{p\,x}{1-v}\right)\mathrm{FAAP}(x,1,v)+\frac{p\,x\,\mathrm{FAAP}(x,1,1)}{1-v}+\frac{p\,x\,\mathrm{FDD}(x,1)}{1-v}+\frac{(q\,x-1)\,(p\,q\,v\,x+p\,q\,x+p\,x-p-1)\,p^2\,q\,x^3}{(p\,q\,x-1)\,(q\,x+x-1)\,(p\,q\,v\,x-1)\,(q\,v\,x+x-1)}$$

```
> Eq16:=(1-v)*q*subs(FAAP(x,1,v)=AAAPv1(x,v),FAAP(x,1,1)=AAAPv1(x,1)
,meq1);
```

$$Eq16:=(1-v)\,q\left(\left(-1+p\,q\,v\,x+p\,q\,x-\frac{p\,x}{1-v}\right)\mathrm{FDD}(x,v)+\left(p\,q\,x-\frac{p\,x}{1-v}\right)\left(\frac{x^3\,p\,(1-\mathrm{vv0}(v))}{(p\,q\,v\,x-1)\,(q\,v\,x+x-1)\,(q\,v\,x+\mathrm{vv0}(v)\,x-1)}+\frac{(\mathrm{vv0}(v)-1)\,\mathrm{FDD}(x,v)}{q}\right)+\frac{p\,x\left(\frac{x^3\,p\,(1-\mathrm{vv0}(1))}{(p\,q\,x-1)\,(q\,x+x-1)\,(q\,x+\mathrm{vv0}(1)\,x-1)}+\frac{(\mathrm{vv0}(1)-1)\,\mathrm{FDD}(x,1)}{q}\right)}{1-v}+\frac{p\,x\,\mathrm{FDD}(x,1)}{1-v}+\frac{(q\,x-1)\,(p\,q\,v\,x+p\,q\,x+p\,x-p-1)\,p^2\,q\,x^3}{(p\,q\,x-1)\,(q\,x+x-1)\,(p\,q\,v\,x-1)\,(q\,v\,x+x-1)}\right)$$

```
>
> Eq16a:=-(q*(1-p*q*x-p*q*v*x)*(1-v)+p*q*x-p*x*(q*(1-v)-1)*(vv0(v)-1
  ))*FDD(x,v)+p*x*(vv0(1)+q-1)*FDD(x,1)+(p*q*x*(1-v)-p*x)*x^3*p*q*(1
  -vv0(v))/(p*q*v*x-1)/(q*v*x+x-1)/(q*v*x+vv0(v)*x-1)+p^2*q*x^4*(1-v
  v0(1))/(p*q*x-1)/(q*x+x-1)/(q*x+vv0(1)*x-1)+(q*x-1)*(1-v)*(p*q*v*x
  +p*q*x+p*x-p-1)*p^2*q^2*x^3/(p*q*x-1)/(q*x+x-1)/(p*q*v*x-1)/(q*v*x
  +x-1);
```

$$Eq16a := -(q(-p\,q\,v\,x - p\,q\,x + 1)(1-v) + p\,q\,x - p\,x(q(1-v)-1)(\mathrm{vv0}(v)-1))\,\mathrm{FDD}(x,v) + p\,x(\mathrm{vv0}(1)-1+q)\,\mathrm{FDD}(x,1) + \frac{(p\,q\,x(1-v)-p\,x)\,x^3\,p\,q\,(1-\mathrm{vv0}(v))}{(p\,q\,v\,x-1)(q\,v\,x+x-1)(q\,v\,x+\mathrm{vv0}(v)\,x-1)} + \frac{p^2\,q\,x^4\,(1-\mathrm{vv0}(1))}{(p\,q\,x-1)(q\,x+x-1)(q\,x+\mathrm{vv0}(1)\,x-1)} + \frac{(q\,x-1)(1-v)(p\,q\,v\,x+p\,q\,x+p\,x-p-1)\,p^2\,q^2\,x^3}{(p\,q\,x-1)(q\,x+x-1)(p\,q\,v\,x-1)(q\,v\,x+x-1)}$$

```
> simplify(Eq16-Eq16a);
```

$$0$$

```
>
> simplify(taylor(subs(FDD(x,v)=DD(x,v),FDD(x,1)=DD(x,1),vv0(1)=subs
  (w=1,VV0),vv0(v)=subs(w=v,VV0),Eq16a),x,14));
```

$$\mathrm{O}(x^{14})$$

```
>
>
> vvv1:=solve(coeff(subs(vv0(v)=subs(w=v,VV0),Eq16a),FDD(x,v))=0,v);
  vv1:=vvv1[3];
```

$$vvv1 := \frac{1}{p\,q\,x}, \frac{2\,p\,q\,x - p\,x + 1 + \sqrt{4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1}}{4\,p\,q\,x}, -\frac{-2\,p\,q\,x + p\,x + \sqrt{4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1} - 1}{4\,p\,q\,x}$$

$$vv1 := -\frac{-2\,p\,q\,x + p\,x + \sqrt{4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1} - 1}{4\,p\,q\,x}$$

```
> FD1:=subs(v=v1,subs(FDD(x,v)=0,Eq16a)):
  Eq17:=-FDD(x,1)+(q*(v1-1)+1)*x^3*p*q*(vv0(v1)-1)/(1-p*q*v1*x)/(1-x
  -q*v1*x)/(1-q*v1*x-vv0(v1)*x)/(vv0(1)-1+q)
  -p*q*x^3*(vv0(1)-1)/(1-p*q*x)/(1-x-q*x)/(1-q*x-vv0(1)*x)/(vv0(1)-1
  +q)-(1-q*x)*(v1-1)*(p*q*v1*x+p*q*x+p*x-p-1)*p*q^2*x^2/(1-p*q*x)/(1
  -x-q*x)/(1-p*q*v1*x)/(1-x-q*v1*x)/(vv0(1)-1+q);
```

$$Eq17 := -\mathrm{FDD}(x,1)$$

$$+\frac{(q(-1+v1)+1)x^3 p q(\mathrm{vv0}(v1)-1)}{(-p q v1 x+1)(-q v1 x-x+1)(1-q v1 x-\mathrm{vv0}(v1) x)(\mathrm{vv0}(1)-1+q)}$$

$$-\frac{p q x^3(\mathrm{vv0}(1)-1)}{(-p q x+1)(-q x-x+1)(1-q x-\mathrm{vv0}(1) x)(\mathrm{vv0}(1)-1+q)}$$

$$-\frac{(-q x+1)(-1+v1)(p q v1 x+p q x+p x-p-1) p q^2 x^2}{(-p q x+1)(-q x-x+1)(-p q v1 x+1)(-q v1 x-x+1)(\mathrm{vv0}(1)-1+q)}$$

```
> simplify(series(subs(FDD(x,1)=DD(x,1),vv0(1)=subs(w=1,VV0),vv0(v1)
=subs(w=vv1,VV0),v1=vv1,Eq17),x,14));
```

$$O(x^{14})$$

```
> #formula for FDD(x,v) and checking
> FFDD:=factor(solve(subs(FDD(x,1)=(q*(-1+v1)+1)*x^3*p*q*(vv0(v1)-1)
/(-p*q*v1*x+1)/(-q*v1*x-x+1)/(1-q*v1*x-vv0(v1)*x)/(vv0(1)-1+q)-p*q
*x^3*(vv0(1)-1)/(-p*q*x+1)/(-q*x-x+1)/(1-q*x-vv0(1)*x)/(vv0(1)-1+q
)-(-q*x+1)*(-1+v1)*(p*q*v1*x+p*q*x+p*x-p-1)*p*q^2*x^2/(-p*q*x+1)/(
-q*x-x+1)/(-p*q*v1*x+1)/(-q*v1*x-x+1)/(vv0(1)-1+q),Eq16a)=0,FDD(x,
v)));
simplify(series(subs(FDD(x,1)=DD(x,1),vv0(1)=subs(w=1,VV0),vv0(v1)
=subs(w=vv1,VV0),v1=vv1,vv0(v)=subs(w=v,VV0),FFDD)-DD(x,v),x,14));
```

$$FFDD := -(p q v x+\mathrm{vv0}(v) x+\mathrm{vv0}(v) p q^2 v x^2-\mathrm{vv0}(v) p q v x^2+p q^3 v^2 x^2-p q^2 v^2 x^2$$
$$-p q^2 v x-\mathrm{vv0}(v1) q v x-\mathrm{vv0}(v) p q v x-q^2 v x-\mathrm{vv0}(v)\,\mathrm{vv0}(v1) p q v1 x^2+q v-\mathrm{vv0}(v) q x$$
$$+p q v+q v x-p q^2 v^2 x+\mathrm{vv0}(v) p q v1 x-\mathrm{vv0}(v1) p q v x+\mathrm{vv0}(v1) p q v1 x$$
$$-\mathrm{vv0}(v) p q^2 v1^2 x^2+\mathrm{vv0}(v1) p q^2 v^2 x^2-\mathrm{vv0}(v1) p q^2 v1 x^2+\mathrm{vv0}(v1) p q v1 x^2-p q v1 x$$
$$-p q^3 v1^2 x^2+p q^2 v1^2 x^2+p q^2 v1 x+q^2 v1 x-q v1 x+\mathrm{vv0}(v1) q x-\mathrm{vv0}(v1) x$$
$$+\mathrm{vv0}(v) q v1 x-q v1+p q^2 v1^2 x-p q v1+\mathrm{vv0}(v)\,\mathrm{vv0}(v1) p q v x^2) p^2 q x^3 \Big/ ((p q v x-1)$$
$$(q v x+\mathrm{vv0}(v) x-1)$$
$$(p q^2 v^2 x+\mathrm{vv0}(v) p q v x-p q^2 x-p q v x-\mathrm{vv0}(v) p q x+2 p q x+\mathrm{vv0}(v) p x-p x-q v+q)$$
$$(p q v1 x-1)(q v1 x+\mathrm{vv0}(v1) x-1))$$

$$O(x^{14})$$

```
> ##formula for R^+(x,1,v)=FFAAPv1 and checking
> FFAAPv1
:=x^3*p*(1-vv0(w))/(p*q*w*x-1)/(q*w*x+x-1)/(q*w*x+vv0(w)*x-1)+fact
or((vv0(w)-1)/q*subs(v=w,FFDD));
simplify(series(subs(FDD(x,1)=DD(x,1),vv0(1)=subs(w=1,VV0),vv0(v1)
=subs(w=vv1,VV0),v1=vv1,vv0(w)=subs(w=w,VV0),FFAAPv1)-AAP(x,1,w),x
,14));
```

$$FFAAPv1 := \frac{x^3 p(1-\mathrm{vv0}(w))}{(p q w x-1)(q w x+x-1)(q w x+\mathrm{vv0}(w) x-1)}+(\mathrm{vv0}(w)-1)($$

$$-\mathrm{vv0}(w)\,p\,q^2\,w\,x^2+\mathrm{vv0}(w)\,p\,q\,w\,x^2+\mathrm{vv0}(w)\,p\,q\,w\,x-\mathrm{vv0}(w)\,p\,q\,v1\,x+\mathrm{vv0}(v1)\,p\,q\,w\,x$$
$$+\mathrm{vv0}(w)\,p\,q^2\,v1^2\,x^2-\mathrm{vv0}(v1)\,p\,q^2\,w^2\,x^2+q^2\,w\,x-p\,q\,w+\mathrm{vv0}(w)\,q\,x-p\,q\,w\,x-\mathrm{vv0}(w)\,x$$
$$-q\,w-q\,w\,x-\mathrm{vv0}(v1)\,p\,q\,v1\,x+\mathrm{vv0}(v1)\,p\,q^2\,v1\,x^2-\mathrm{vv0}(v1)\,p\,q\,v1\,x^2+p\,q\,v1\,x+p\,q^3\,v1^2\,x^2$$
$$-p\,q^2\,v1^2\,x^2-p\,q^2\,v1\,x-q^2\,v1\,x+q\,v1\,x-\mathrm{vv0}(v1)\,q\,x+\mathrm{vv0}(v1)\,x-p\,q^3\,w^2\,x^2+p\,q^2\,w^2\,x^2$$
$$+p\,q^2\,w\,x+\mathrm{vv0}(v1)\,q\,w\,x+p\,q^2\,w^2\,x-\mathrm{vv0}(w)\,q\,v1\,x+q\,v1-p\,q^2\,v1^2\,x+p\,q\,v1$$
$$+\mathrm{vv0}(w)\,\mathrm{vv0}(v1)\,p\,q\,v1\,x^2-\mathrm{vv0}(w)\,\mathrm{vv0}(v1)\,p\,q\,w\,x^2)\,p^2\,x^3\Big/((p\,q\,w\,x-1)$$
$$(q\,w\,x+\mathrm{vv0}(w)\,x-1)\,(p\,q^2\,w^2\,x+\mathrm{vv0}(w)\,p\,q\,w\,x-p\,q^2\,x-p\,q\,w\,x-\mathrm{vv0}(w)\,p\,q\,x+2\,p\,q\,x$$
$$+\mathrm{vv0}(w)\,p\,x-p\,x-q\,w+q)\,(p\,q\,v1\,x-1)\,(q\,v1\,x+\mathrm{vv0}(v1)\,x-1))$$
$$\mathrm{O}(x^{14})$$

```
> ##formula for R^+(x,v,w)=FFAAP and checking
> meq2;
```

$$\left(-1+p\,q\,v\,w\,x+p\,v\,x-\frac{p\,q\,v\,x}{1-v}\right)\mathrm{FAAP}(x,v,w)+p\,v^4\,x\,\mathrm{FDD}(x,v\,w)$$
$$+\frac{p\,q\,v^4\,x\,\mathrm{FAAP}(x,1,v\,w)}{1-v}-\frac{x^4\,p^2\,q\,v^4}{(p\,q\,v\,w\,x-1)\,(q\,v\,w\,x+x-1)\,(q\,v\,w\,x+v\,x-1)}$$

```
> FFAAP:=factor(subs(FDD(x,v*w)=subs(v=v*w,FFDD),FAAP(x,1,v*w)=subs(
  w=v*w,FFAAPv1),solve(meq2=0,FAAP(x,v,w)))));
  simplify(series(subs(FDD(x,1)=DD(x,1),vv0(1)=subs(w=1,VV0),vv0(v1)
  =subs(w=vv1,VV0),v1=vv1,vv0(v*w)=subs(w=v*w,VV0),FFAAP)-AAP(x,v,w)
  ,x,14));
```

$$FFAAP:=-v^4\,q\,p^2\,x^4\,(\mathrm{vv0}(v\,w)-v)\,(2\,p\,q\,x+q-2\,p\,q\,v\,w\,x-v\,\mathrm{vv0}(v\,w)\,p^2\,q^2\,v1^2\,x^3$$
$$+v\,\mathrm{vv0}(v\,w)\,p^2\,q\,v1\,x^2+v\,\mathrm{vv0}(v\,w)\,p\,q\,v1\,x^2-\mathrm{vv0}(v\,w)\,p^2\,q\,v^2\,w\,x^2+\mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,w\,x^3$$
$$+\mathrm{vv0}(v1)\,p^2\,q^2\,v^3\,w^2\,x^3-\mathrm{vv0}(v1)\,p\,q\,v^2\,w\,x^2+\mathrm{vv0}(v\,w)\,p^2\,q\,v\,w\,x^2-p^2\,v^2\,\mathrm{vv0}(v1)\,q\,w\,x^2$$
$$-p^2\,v^2\,\mathrm{vv0}(v\,w)\,q\,w\,x^3+\mathrm{vv0}(v\,w)\,p^2\,q^3\,v^2\,w^2\,x^3+\mathrm{vv0}(v1)\,p^2\,q^3\,v^3\,w^3\,x^3+\mathrm{vv0}(v1)\,p^2\,q\,v\,w\,x$$
$$-\mathrm{vv0}(v\,w)\,p^2\,q^2\,v\,w\,x^2-2\,\mathrm{vv0}(v1)\,p^2\,q^2\,v^2\,w^2\,x^2+p\,\mathrm{vv0}(v1)\,q^2\,x^2\,v\,w$$
$$-\mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,w^2\,x^3-\mathrm{vv0}(v\,w)\,p\,q^2\,v\,w\,x^2+\mathrm{vv0}(v\,w)\,p\,q\,v\,w\,x^2+\mathrm{vv0}(v\,w)\,p\,q\,v\,w\,x$$
$$+\mathrm{vv0}(v1)\,p\,q\,v\,w\,x-2\,\mathrm{vv0}(v1)\,p\,q^2\,v^2\,w^2\,x^2+\mathrm{vv0}(v1)\,p\,x^2-p^2\,q^2\,v1^2\,x^3+p^2\,q\,v1\,x^2$$
$$+p\,q\,v1\,x^2+p\,v\,\mathrm{vv0}(v\,w)\,x^2-p\,\mathrm{vv0}(v1)\,q\,x+v\,\mathrm{vv0}(v1)\,p^2\,q\,v1\,x^3$$
$$-\mathrm{vv0}(v1)\,\mathrm{vv0}(v\,w)\,p^2\,q^2\,v1\,x^3+\mathrm{vv0}(v1)\,\mathrm{vv0}(v\,w)\,p^2\,q\,v1\,x^3+\mathrm{vv0}(v\,w)\,p^2\,q\,v\,w\,x$$
$$+\mathrm{vv0}(v\,w)\,\mathrm{vv0}(v1)\,p^2\,q\,v1\,x^2-\mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,w^2\,x^2-\mathrm{vv0}(v\,w)\,p^2\,q^3\,v1^2\,x^3$$
$$+\mathrm{vv0}(v\,w)\,p^2\,q^2\,v1^2\,x^3+\mathrm{vv0}(v\,w)\,p^2\,q^2\,v1\,x^2-\mathrm{vv0}(v\,w)\,p^2\,q\,v1\,x^2+\mathrm{vv0}(v\,w)\,p\,q^2\,v1\,x^2$$
$$+\mathrm{vv0}(v1)\,\mathrm{vv0}(v\,w)\,p\,q\,x^2-\mathrm{vv0}(v\,w)\,p\,q\,v1\,x^2-\mathrm{vv0}(v\,w)\,p^2\,q\,v1\,x+\mathrm{vv0}(v\,w)\,p^2\,q^2\,v1^2\,x^2$$
$$+p\,q\,v^2\,w\,x-p\,q^2\,x+p^2\,q^3\,x^2\,v1^2-p^2\,q^2\,x\,v1-v\,p\,q\,v1\,x^2+p\,q\,v^2\,w\,x^2-p\,q^2\,v^2\,w\,x^2$$
$$-p^2\,q^2\,v^3\,w^2\,x^2+p^2\,q\,v^2\,w\,x^2+p^2\,q^3\,v^3\,w^2\,x^3-p^2\,q^2\,v^3\,w^2\,x^3-p^2\,q^2\,v^2\,w\,x^2-p\,x+p^2\,q\,v1$$
$$-p^2\,q^3\,v\,v1^2\,x^3+p^2\,q^2\,v\,v1\,x^2+\mathrm{vv0}(v1)\,p\,q\,v\,x^2-\mathrm{vv0}(v1)\,p^2\,q^2\,v\,v1\,x^3-x\,p^2\,q\,v\,w-v\,x\,p^2\,q\,v1$$

$$
\begin{aligned}
&- v\,x\,p\,q\,v1 + v\,x^2\,p^2\,q^2\,v1^2 + v^2\,x\,p^2\,q\,w - \mathrm{vv0}(v1)\,p^2\,q\,v1\,x^3 + p\,q^2\,v\,v1\,x^2 \\
&+ 2\,\mathrm{vv0}(v1)\,p^2\,q^2\,v1\,x^3 - \mathrm{vv0}(v1)\,p^2\,q^3\,v1\,x^3 + \mathrm{vv0}(v1)\,p\,q^2\,v1\,x^2 + p\,q\,v1\,x + \mathrm{vv0}(v1)\,p\,q^2\,x^2 \\
&+ p\,q^3\,v1^2\,x^2 - 2\,p\,q^2\,v1\,x - 2\,\mathrm{vv0}(v1)\,p\,q\,x^2 - p^2\,q^4\,v1^2\,x^3 + 2\,p^2\,q^3\,v1^2\,x^3 + p^2\,q^3\,v1\,x^2 \\
&+ p\,q^3\,v1\,x^2 - 2\,p\,q^2\,v1\,x^2 - 2\,p^2\,q^2\,v1\,x^2 - q^2\,v1\,x - \mathrm{vv0}(v1)\,q\,x - p\,q^3\,v^2\,w^2\,x^2 + p\,q^2\,v^2\,w^2\,x^2 \\
&+ p\,q^2\,v\,w\,x + \mathrm{vv0}(v1)\,q\,v\,w\,x + 2\,p\,q^2\,v^2\,w^2\,x - \mathrm{vv0}(v\,w)\,p\,q\,v1\,x + q^2\,v\,v1\,w\,x - 2\,p^2\,q^3\,v^2\,w^2\,x^2 \\
&+ 2\,p^2\,q^2\,v^2\,w^2\,x^2 + p^2\,q^2\,v\,w\,x + 2\,p^2\,q^2\,v^2\,w^2\,x + p^2\,q^4\,v^3\,w^3\,x^3 - p^2\,q^3\,v^3\,w^3\,x^3 - p^2\,q^3\,v^3\,w^3\,x^2 \\
&- q\,v\,w + p\,q\,v1 + v\,p^2\,q^2\,v1^2\,x^3 - v\,p^2\,q\,v1\,x^2 - \mathrm{vv0}(v1)\,p\,v\,x^2 - \mathrm{vv0}(v1)\,\mathrm{vv0}(v\,w)\,p\,x^2 \\
&+ p^2\,q^3\,v1\,x^2\,v\,w + p^2\,q^4\,v^2\,v1^2\,w^2\,x^3 - p^2\,q^3\,v^2\,v1\,w^2\,x^2 - p\,q^3\,v^2\,v1\,w^2\,x^2 - p\,q^3\,v\,v1^2\,w\,x^2 \\
&+ p\,q^3\,v1\,x^2\,v\,w + p^2\,q^3\,v\,v1^2\,w\,x^2 - p^2\,q^2\,v\,v1\,w\,x - p^2\,q^4\,v1^2\,x^3\,v\,w - p^2\,q^2\,v1^2\,x^2 + x\,p^2\,q\,v1 \\
&+ v\,x^2\,\mathrm{vv0}(v1)\,p^2\,q\,v1 - p\,q\,v\,w + \mathrm{vv0}(v\,w)\,\mathrm{vv0}(v1)\,p^2\,q\,v^2\,w\,x^3 \\
&- v\,\mathrm{vv0}(v1)\,\mathrm{vv0}(v\,w)\,p^2\,q\,v1\,x^3 + \mathrm{vv0}(v1)\,p^2\,q^3\,v^2\,v1\,w^2\,x^3 - \mathrm{vv0}(v1)\,p\,q^2\,v\,v1\,w\,x^2 \\
&+ \mathrm{vv0}(v1)\,p^2\,q^2\,v\,v1\,w\,x^2 - \mathrm{vv0}(v1)\,p^2\,q^3\,v1\,x^3\,v\,w + \mathrm{vv0}(v\,w)\,\mathrm{vv0}(v1)\,p^2\,q^2\,v^2\,w^2\,x^3 \\
&- \mathrm{vv0}(v\,w)\,\mathrm{vv0}(v1)\,p^2\,q\,v\,w\,x^2 - p^2\,q^2\,v1^2\,x - p^2\,q\,v\,w + p\,\mathrm{vv0}(v1)\,x - v\,p\,\mathrm{vv0}(v\,w)\,q\,x^2 \\
&- \mathrm{vv0}(v1)\,p^2\,q\,v1\,x^2 - \mathrm{vv0}(v1)\,p^2\,q\,v1\,x + p^2\,q^2\,x^2\,\mathrm{vv0}(v1)\,v1 - \mathrm{vv0}(v\,w)\,\mathrm{vv0}(v1)\,p\,q\,v\,w\,x^2) \\
&\Big/ ((p\,q\,v^2\,w\,x - p\,q\,v\,w\,x + p\,q\,v\,x + p\,v^2\,x - p\,v\,x - v + 1)\,(q\,v\,w\,x + v\,x - 1)\,(p\,q\,v\,w\,x - 1) \\
&(q\,v\,w\,x + \mathrm{vv0}(v\,w)\,x - 1)\,(p\,q^2\,v^2\,w^2\,x + \mathrm{vv0}(v\,w)\,p\,q\,v\,w\,x - p\,q^2\,x - p\,q\,v\,w\,x \\
&- \mathrm{vv0}(v\,w)\,p\,q\,x + 2\,p\,q\,x + \mathrm{vv0}(v\,w)\,p\,x - p\,x - q\,v\,w + q)\,(p\,q\,v1\,x - 1) \\
&(q\,v1\,x + \mathrm{vv0}(v1)\,x - 1))
\end{aligned}
$$

$$O(x^{14})$$

```
> ##formula for R(x,v,w)=FFRR and checking
```

```
> FFRR:=FFAAP+v^2*FFCC(x,v*w)+v^3*subs(v=v*w,FFDD)+v*FFEE(v*x,w):
simplify(series(subs(FDD(x,1)=DD(x,1),vv0(1)=subs(w=1,VV0),vv0(v1)
=subs(w=vv1,VV0),v1=vv1,vv0(v*w)=subs(w=v*w,VV0),FFRR)-(AAP(x,v,w)
+v^2*CC(x,v*w)+v^3*DD(x,v*w)+v*EE(v*x,w)),x,14));
```

$$O(x^{14})$$

```
> factor(taylor(subs(w=vv1,VV0)-(q*vv1-q+1),x,20));
```

$$O(x^{19})$$

```
> simplify(vv1^2-(1/2*(2*p*q*x-p*x+1)/p/q/x*vv1-1/(2*p*q*x)));
```

$$0$$

```
> simplify(VV0^2-( (1-p*q*w*x-p*q*x+p*x)/p/x*VV0+1/p/x*(p*q*w*x-1) )
);
```

$$0$$

```
> FFRR1:=simplify(subs(vv0(v1)=q*v1-q+1,FFRR)):
simplify(series(subs(FDD(x,1)=DD(x,1),vv0(1)=subs(w=1,VV0),v1=vv1,
vv0(v*w)=subs(w=v*w,VV0),FFRR1)-(AAP(x,v,w)+v^2*CC(x,v*w)+v^3*DD(x
,v*w)+v*EE(v*x,w)),x,14));
```

$$O(x^{14})$$

```
> #better formula for FRR2 where vv0(v*w)=subs(w=v*w,VV0) and v1=vv1
> FFRR2:=simplify(subs(vv0(v*w)^2=((1-p*q*v*w*x-p*q*x+p*x)/p/x*vv0(v
  *w)+1/p/x*(p*q*v*w*x-1)),subs(v1^2=(1/2*(2*p*q*x-p*x+1)/p/q/x*v1-1
  /(2*p*q*x)),FFRR1))):
  simplify(series(subs(FDD(x,1)=DD(x,1),vv0(1)=subs(w=1,VV0),v1=vv1,
  vv0(v*w)=subs(w=v*w,VV0),FFRR2)-(AAP(x,v,w)+v^2*CC(x,v*w)+v^3*DD(x
  ,v*w)+v*EE(v*x,w)),x,14));
```

$$O(x^{14})$$

```
> FFRR2;
```

$$
\begin{aligned}
&-p\,v^3\,x^2\,(2\,p\,q\,x+p\,v\,x-3\,p\,q\,v\,x-2\,p^3\,q^5\,v^6\,w^5\,x^5-p^3\,q^3\,v^2\,w^3\,x^4\,\mathrm{vv0}(v\,w)-q^2\,v\,w\,x+q+x\\
&\quad+q\,x^2+p^3\,q^2\,v^3\,v1\,w\,x^3+3\,p^3\,q^2\,v\,w\,x^3-p^3\,q\,v\,w\,x^3-3\,p^3\,q^3\,v\,w\,x^3-v\,x-2\,p^2\,q^5\,v^3\,w^3\,x^4\\
&\quad+p\,q\,w\,x-2\,p\,q\,v\,w\,x-p^2\,v^3\,x\,q^2\,w^2+v\,\mathrm{vv0}(v\,w)\,p^2\,q\,v1\,x^2-\mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,w\,x^3\\
&\quad-p^2\,v^2\,\mathrm{vv0}(v\,w)\,q\,w\,x^3+\mathrm{vv0}(v\,w)\,p^2\,q^2\,v\,w\,x^2+p^2\,q^2\,v\,w\,x^3-p^2\,q\,v\,w\,x^3\\
&\quad+\mathrm{vv0}(v\,w)\,p^4\,q^2\,v\,v1\,w\,x^3-\mathrm{vv0}(v\,w)\,p^3\,q^2\,v^2\,v1\,w\,x^3-p^3\,q^3\,w^2\,v\,v1\,x^3-p^2\,q^4\,w^2\,v^2\,v1\,x^2\\
&\quad+\mathrm{vv0}(v\,w)\,p\,q^2\,v\,w\,x^2+2\,\mathrm{vv0}(v\,w)\,p\,q\,v\,w\,x-p^2\,q^2\,v\,x^3+p\,q^2\,v\,x^3-2\,p\,q^2\,v\,x^2-2\,p\,q\,v\,x^3\\
&\quad+p\,q^2\,v\,x+4\,p\,q\,v\,x^2+p\,q\,v^2\,x^3-q^2\,v^2\,v1\,w\,x\,p+p^3\,q^3\,v^3\,v1\,w^2\,x^2-2\,p^2\,q^3\,v1\,x^2\,v^2\,w\\
&\quad+4\,p^2\,q^3\,v^3\,v1\,w^2\,x^2+3\,p^3\,q^4\,v^2\,v1\,w\,x^3-2\,p^2\,q^2\,v^2\,v1\,w\,x^2-q^2\,v^2\,w\,x^2-v^2\,p^2\,\mathrm{vv0}(v\,w)\,q\,x^2\\
&\quad+\mathrm{vv0}(v\,w)\,p\,q\,v\,x-v\,p^2\,\mathrm{vv0}(v\,w)\,q\,x^3+\mathrm{vv0}(v\,w)\,p^2\,q^2\,v1\,x^3+2\,v\,p^2\,\mathrm{vv0}(v\,w)\,q\,x^2\\
&\quad-2\,p\,q\,v^2\,x^2-2\,q\,v^2\,w\,x-p^2\,q\,x^3\,v^2+p^2\,q\,v1\,x^2+q^2\,v\,v1\,x+2\,p^2\,v^3\,x^3\,q^5\,w^3-p\,q^5\,w^4\,v^4\,v1\,x^3\\
&\quad-p^4\,q^6\,w\,v\,v1\,x^4+p^4\,q^6\,w\,v^2\,x^5\,v1-2\,p^4\,q^4\,w\,v^3\,x^5\,v1-p\,q^3\,w^2\,v^2\,v1\,x+p^4\,q^5\,w\,v^3\,x^5\,v1\\
&\quad+p^2\,q^2\,v\,w\,x^2-q\,v\,x^2-p\,q\,x^2-2\,p\,q^2\,v\,w^2\,x^2-2\,p^3\,q^3\,v^2\,w\,x^3+p^3\,q^4\,v^2\,w\,x^3-3\,p^3\,q^2\,v^3\,w\,x^3\\
&\quad+2\,p^3\,q^3\,v^3\,w\,x^3+5\,p^3\,q^4\,v^3\,w^2\,x^3-6\,p^3\,q^3\,v^3\,w^2\,x^3-2\,p^2\,q^2\,v^3\,w\,x^2+p^3\,q^3\,v^4\,w^2\,x^3\\
&\quad-2\,p^3\,q^3\,v^2\,w\,x^2+3\,p^3\,q^2\,v^2\,w\,x^2+p\,q^2\,w+2\,p\,v\,\mathrm{vv0}(v\,w)\,x^2+p^2\,q^5\,v^3\,w^4\,x^4+p^3\,q^4\,w^3\,v^3\,x^2\\
&\quad+2\,p\,q^2\,w^2\,v\,x-p^3\,q^6\,v^6\,w^6\,x^5-p^2\,q^4\,v^3\,w^4\,x^4-q\,v+2\,p^2\,q^2\,w\,x-p^2\,q\,w\,x-p^3\,q\,v\,v1\,x^3\\
&\quad+4\,p^2\,q^4\,v^2\,v1\,w\,x^3+p\,q^2\,v^2\,w^2-v^3\,p^2\,q\,w\,x^2+2\,\mathrm{vv0}(v\,w)\,p^2\,q^3\,v^3\,w^3\,x^2\\
&\quad-p^2\,q^4\,w^3\,\mathrm{vv0}(v\,w)\,v^2\,x^3+2\,p^3\,q^2\,v^3\,w^2\,x^3+p^3\,q^2\,v^2\,w\,x^3+x^2\,p^3\,q\,v\,w-v^2\,x^2\,p^3\,q\,w\\
&\quad+5\,p^3\,q^3\,v^2\,w^2\,x^3-2\,p^3\,q^2\,v^2\,w^2\,x^3-3\,p^3\,q^2\,v\,w\,x^2+p^3\,q^3\,v^3\,w^3\,x^3-\mathrm{vv0}(v\,w)\,p^2\,q\,v\,w\,x\\
&\quad-\mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,w^2\,x^2-2\,p^2\,q^3\,w^3\,v^3\,x+2\,p^3\,q^5\,w^3\,v^3\,x^3+p^3\,q^4\,w^4\,v^4\,x^2+4\,p^2\,q^4\,w^4\,v^4\,x^2\\
&\quad-4\,p^2\,q^4\,w^4\,v^3\,x^2-2\,p^3\,q^5\,w^5\,v^5\,x^3+2\,p^3\,q^5\,w^5\,v^4\,x^3-2\,p^3\,q^5\,w^4\,v^4\,x^3+2\,p^2\,q^4\,w^3\,v^2\,x^2\\
&\quad-2\,p^2\,q^3\,w^3\,v^2\,x^2-p^2\,q^3\,w^2\,v\,x+2\,p^2\,q^3\,w^3\,v^2\,x+p^3\,q^3\,w^3\,v^2\,x^2-p^3\,q^4\,w^4\,v^3\,x^2-p^4\,q^2\,v\,v1\,w\,x^3\\
&\quad+p\,v\,x^3+p^3\,q^6\,v^4\,w^4\,x^5+4\,p^2\,q^4\,v^5\,w^4\,x^4-2\,p\,q^3\,v\,w^2\,x-2\,p^2\,q^4\,v^3\,w^2\,x^4-p^2\,q^3\,v^3\,w^3\,x^4\\
&\quad-\mathrm{vv0}(v\,w)\,p^2\,q\,v1\,x^2+\mathrm{vv0}(v\,w)\,p\,q^2\,v1\,x^2+2\,p\,q\,v^2\,w\,x-2\,q\,x+2\,q\,v\,x+2\,p^3\,q^5\,v^5\,w^5\,x^5\\
&\quad-p^2\,q^2\,v^2\,x^2+2\,p^2\,q^2\,v\,x^2-3\,p^2\,q\,v\,x^2+p\,v^2\,x\,q+p^2\,q^2\,x\,v1-p\,q\,v^2\,w\,x^2-2\,p^2\,q^2\,v^3\,w^2\,x^2\\
&\quad-2\,p^2\,q^3\,v^3\,w^2\,x^3+2\,p^2\,q^2\,v^3\,w^2\,x^3+3\,p^2\,q^2\,v^2\,w\,x^2+p^2\,q\,w\,\mathrm{vv0}(v\,w)\,x-p^2\,q^2\,w\,\mathrm{vv0}(v\,w)\,x
\end{aligned}
$$

$$
\begin{aligned}
&- 3\, p^3\, q^4\, v^4\, v1\, w^3\, x^4 - 2\, p^4\, q^5\, w^2\, v\, v1\, x^4 + p^3\, q^6\, v^3\, w^4\, x^4 - x^2 - p\, x + p\, q^3\, v^2\, w^3\, x^3 + p^2\, q^2\, w^2\, v\, x^2 \\
&- p^2\, q^3\, w^2\, v\, x^2 - p^3\, q^2\, w^2\, v\, x^3 + 2\, p^3\, q^3\, w^2\, v\, x^3 - p^3\, q^4\, w^2\, v\, x^3 + 3\, p^3\, q^4\, w^3\, v^2\, x^3 - 2\, p^3\, q^3\, w^3\, v^2\, x^3 \\
&- 2\, p^3\, q^3\, w^2\, v\, x^2 + p^3\, q^2\, w^2\, v\, x^2 - p^3\, q^4\, w^2\, v^2\, x^2 - p^3\, v\, x^2\, q^4\, w - \mathrm{vv0}(v\, w)\, p^4\, q^3\, v^3\, v1\, w\, x^5 \\
&- \mathrm{vv0}(v\, w)\, p^4\, q^3\, v\, v1\, w\, x^4 + 2\, \mathrm{vv0}(v\, w)\, p^3\, q^2\, v^3\, w\, x^3 + \mathrm{vv0}(v\, w)\, p^4\, q^4\, v^3\, v1\, w\, x^5 + q\, v^2\, w \\
&+ p^3\, q^3\, v^2\, v1\, x^4 + 2\, p^3\, q^2\, v\, v1\, x^3 - p^3\, q^4\, v\, v1\, x^3 + p^2\, q^3\, v^2\, v1\, x^3 + p^2\, q^2\, v\, v1\, x^3 + 2\, p^2\, q^2\, v\, v1\, x^2 \\
&- 3\, p\, q^2\, v\, v1\, x^3 + q^2\, v^2\, w\, x - p^4\, q^4\, w^2\, \mathrm{vv0}(v\, w)\, v\, v1\, x^4 + p^4\, q^5\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^4 \\
&+ 2\, p^3\, q^5\, w^2\, \mathrm{vv0}(v\, w)\, v\, v1\, x^4 - \mathrm{vv0}(v\, w)\, p^2\, v\, x^2 + 4\, p^3\, q^4\, v^3\, v1\, w^2\, x^4 - 8\, p^2\, q^4\, v^4\, v1\, w^3\, x^3 \\
&+ 2\, p^2\, q\, v^2\, x^2 + p^3\, q^3\, v^2\, w^3\, x^4 + p^2\, q^3\, x^2\, w + v\, p^2\, x^2 - p^2\, q^2\, v1\, x^3 + x\, p^2\, q\, v\, w - 2\, p^2\, v^5\, x^3\, q^3\, w^3 \\
&- \mathrm{vv0}(v\, w)\, x - 3\, p^3\, q^5\, v^3\, w^3\, x^5 - 2\, p^3\, q^4\, v^4\, w^3\, x^5 + 3\, p^4\, q^5\, v\, v1\, w\, x^4 + p^4\, q^3\, v^3\, v1\, w^2\, x^3 \\
&+ 2\, p^4\, q^3\, v^2\, v1\, w^2\, x^4 - p^4\, q^3\, v^2\, v1\, w\, x^5 + p\, q^2\, v\, v1\, x^2 + p\, q^2\, v\, v1\, x + 2\, q^3\, v\, v1\, x^3\, p - 2\, p^2\, q^3\, v\, v1\, x^3 \\
&- p^2\, q^3\, v^2\, v1\, x^4 + p^2\, q^4\, v\, v1\, x^3 - 2\, p^3\, q^5\, v^2\, v1\, w\, x^4 - 3\, p^3\, q^4\, v^2\, v1\, w^2\, x^4 - 2\, p^3\, q^3\, v^4\, v1\, w^2\, x^3 \\
&+ 7\, p^2\, q^4\, v^3\, v1\, w^3\, x^3 + 3\, p^3\, q^4\, v^2\, v1\, w\, x^4 - 3\, p^2\, q^3\, v^4\, v1\, w^2\, x^3 + 2\, p^3\, q^3\, v^2\, w^2\, x^2 - p\, q^2\, v1\, x \\
&+ p^2\, q^3\, v1\, x^3 - p^2\, q^3\, v1\, x^2 - p\, q^3\, v1\, x^3 + p\, q^3\, v1\, x^2 - p^2\, q^2\, v1\, x^2 - q^2\, v1\, x + q^2\, v1\, x^2 \\
&+ 2\, p^3\, q^5\, v^4\, w^3\, x^5 + 2\, p^2\, q^3\, v^3\, x^3\, \mathrm{vv0}(v\, w)\, w^2 + p^3\, q^3\, v^2\, x^3\, \mathrm{vv0}(v\, w)\, w - 2\, p^3\, q^4\, v^4\, x^4\, \mathrm{vv0}(v\, w)\, w^3 \\
&+ p^2\, q^3\, v^2\, w^3\, x^3 - 3\, p\, q^2\, v^2\, w^2\, x^2 - p\, q^2\, v\, w\, x + p\, q^2\, v^2\, w^2\, x + p^3\, v^3\, x^4\, \mathrm{vv0}(v\, w)\, q\, w \\
&+ 2\, p^2\, v^2\, x\, q^2\, w - p^2\, q^5\, v^2\, v1\, w\, x^4 - 2\, p\, q^3\, v^3\, w^3\, x + p\, x^2 + q^2\, v\, v1\, w\, x + 9\, p^2\, q^3\, v^2\, w^2\, x^2 \\
&- p^2\, q^2\, v^2\, w^2\, x^2 - 4\, p^2\, q^2\, v\, w\, x + 2\, p^2\, q^2\, v^2\, w^2\, x - 5\, p^2\, q^4\, v^3\, w^3\, x^3 + 6\, p^2\, q^3\, v^3\, w^3\, x^3 \\
&- 3\, p^2\, q^3\, v^3\, w^3\, x^2 + 3\, p\, v^4\, x^2\, q^3\, w^3 + \mathrm{vv0}(v\, w)\, p\, x - q\, v\, w + q^2\, v^2\, w^2\, x - q^2\, v^3\, w^2\, x + p\, q^4\, v^3\, w^3\, x^3 \\
&- 2\, p^2\, q^3\, v\, w\, x^2 - 3\, p\, q^2\, v^3\, w^2\, x + p^3\, q^3\, v^4\, w^3\, x^2 - 5\, p^3\, q^4\, v^2\, w^2\, x^3 - 2\, p^3\, q^3\, v^3\, w^3\, x^2 \\
&+ p^3\, q^2\, v^4\, w^2\, x^3 + 5\, p^2\, q^3\, v^4\, w^3\, x^2 + p^3\, q^4\, v\, w\, x^3 - p^3\, q^2\, v^3\, w^2\, x^2 + 2\, p^2\, q^2\, v^4\, w^2\, x^2 + p^3\, q\, v^3\, w\, x^3 \\
&+ 3\, p^3\, q^3\, v\, w\, x^2 - 3\, p^3\, q^4\, v^5\, w^4\, x^3 + 3\, p^3\, q^4\, v^4\, w^4\, x^3 - p^3\, q^3\, v^5\, w^3\, x^3 - 5\, p^3\, q^4\, v^3\, w^3\, x^3 \\
&+ 2\, p^3\, q^3\, v^4\, w^3\, x^3 + q^2\, x^2\, v\, w - p\, q\, w\, x^2 + p^3\, q^5\, v^3\, w^2\, x^5 + p^3\, q^4\, v^4\, w^2\, x^5 + 2\, p^3\, q^4\, v^3\, w^3\, x^5 \\
&- 3\, p^2\, q^4\, v^4\, w^4\, x^4 - p\, v^2\, x^3 + \mathrm{vv0}(v\, w)\, p^3\, q^3\, v\, w\, x^3 + 5\, p^3\, q^3\, v1\, x^3\, v\, w - p^3\, q^3\, v^2\, v1\, w^2\, x^3 \\
&- p^3\, q^2\, v\, v1\, w\, x^2 - 2\, p\, q^2\, w\, x + 2\, p^2\, q^6\, w^3\, v^2\, v1\, x^4 + p^3\, q^5\, w^3\, v^2\, v1\, x^5 - 3\, p^2\, q^6\, w^3\, v^3\, v1\, x^4 \\
&+ p^2\, q^5\, w^3\, v^4\, v1\, x^4 - p^2\, q^5\, w^4\, v^3\, v1\, x^4 + p\, v^2\, x^2 + p^2\, x^3\, v^2 - 2\, p\, x^2\, v - p^2\, v\, x^3 + 2\, p^2\, q^3\, v^2\, w^2\, x^4 \\
&+ p^2\, q^2\, v^3\, w^2\, x^4 + 2\, p\, q^3\, v^3\, w^3\, x^3 - p\, v^2\, x^2\, q^3\, w - p\, v^3\, x^2\, q^2\, w + p^3\, q^3\, v\, v1\, w\, x^4 + 3\, p^4\, q^6\, w^3\, v^2\, v1\, x^5 \\
&+ 2\, p^4\, q^7\, w^5\, v^4\, v1\, x^5 - p\, q^2\, v\, w^2 - p\, q^2\, v\, w - p^2\, q^3\, w\, x - 4\, p^2\, q^3\, v^3\, w^2\, x^2 - p^3\, q^3\, v^3\, w^2\, x^2 \\
&+ p^3\, q^4\, v^4\, w^3\, x^3 + 2\, p\, q^2\, v^2\, w\, x - 2\, q^3\, v\, v1\, x^2\, p + p\, q^3\, v^3\, w^2\, x^3 + p^3\, v^6\, x^4\, q^4\, w^4 - p^3\, v^5\, x^4\, q^4\, w^3 \\
&- p^3\, v^3\, x^4\, q^5\, w^2 - v\, p^2\, q\, v1\, x^2 + 2\, p^2\, q\, v\, x^3 + 4\, p^3\, q^5\, v^4\, w^4\, x^4 - p\, q^3\, w^2\, v\, v1\, x^2 \\
&+ \mathrm{vv0}(v\, w)\, p^4\, q^2\, v^3\, v1\, w\, x^4 - \mathrm{vv0}(v\, w)\, p^4\, q^3\, v^3\, v1\, w^2\, x^3 - \mathrm{vv0}(v\, w)\, p^4\, q^3\, v^3\, v1\, w\, x^4 \\
&- 2\, \mathrm{vv0}(v\, w)\, p^4\, q^3\, v^2\, v1\, w^2\, x^4 + \mathrm{vv0}(v\, w)\, p^4\, q^3\, v^2\, v1\, w\, x^5 + q^2\, v\, v1\, w\, x\, p + 2\, p^3\, q^3\, v1\, x^2\, v\, w \\
&- 2\, p^3\, q^3\, v^2\, v1\, w^2\, x^2 - p^4\, q^4\, w^2\, v1\, x^3\, v^2 - p^4\, q^6\, w^3\, v^3\, v1\, x^4 + 4\, p^4\, q^6\, w^2\, v^3\, v1\, x^5 - p^4\, q^5\, w^4\, v^4\, v1\, x^3 \\
&+ p^4\, q^5\, w^4\, v^3\, v1\, x^4 - 3\, p^3\, q^6\, w^4\, v^3\, v1\, x^4 + 2\, p^4\, q^6\, w^3\, v^2\, v1\, x^4 + p^4\, q^5\, w^4\, v^3\, v1\, x^3 - 2\, p^3\, q^2\, v\, v1\, w\, x^3
\end{aligned}
$$

$$+ p^2 q^2 v^3 v1 w x^2 - p^2 q^2 v^2 v1 w x^3 + 4 p^2 q^3 v1 x^2 v w - 4 p^2 q^3 v^2 v1 w^2 x^2 - 3 p q^3 v^2 v1 w^2 x^2$$
$$+ 2 p q^3 v1 x^2 v w + p^2 q^3 v^3 w^2 x^4 + p^2 q^2 v^4 w^2 x^4 - 3 p q^3 v^4 w^3 x^3 - 2 p^3 q^5 v^2 w^2 x^4$$
$$+ 6 p^3 q^4 v^2 w^2 x^4 - p^3 q^5 v^4 w^4 x^5 + p^3 q^4 v^5 w^4 x^5 - p^3 q^5 v^5 w^4 x^5 - p^3 q^4 v^6 w^4 x^5 + p^2 q^3 w v v1 x$$
$$- 3 p^4 q^6 w^2 v^2 v1 x^4 - 2 p^4 q^5 w^3 v^2 v1 x^4 + 5 p^3 q^6 w^3 v^2 v1 x^4 + 5 p^3 q^5 w^4 v^3 v1 x^3$$
$$- 5 p^2 q^5 w^4 v^4 v1 x^3 + p^4 q^4 w^3 v^2 v1 x^4 - 3 p^3 q^5 w^3 v^2 v1 x^4 + 5 p^2 q^5 w^4 v^3 v1 x^3 - 2 p^3 q^4 v^3 w^2 x^5$$
$$- p^3 q^3 v^4 w^2 x^5 + 2 p^2 q^3 v^5 w^3 x^4 - p^2 v^2 x^2 + 2 p^2 q^4 w^2 \mathrm{vv0}(v w) v^2 v1 x^3$$
$$- 4 p^3 q^5 w^2 \mathrm{vv0}(v w) v^2 v1 x^4 + p^3 q^3 w^2 \mathrm{vv0}(v w) v v1 x^3 - 2 p^2 q^4 w^2 \mathrm{vv0}(v w) v v1 x^3$$
$$- p^2 q^3 w^2 \mathrm{vv0}(v w) v v1 x^2 - 5 p^2 q^3 v^4 w^3 x^3 - 3 p^2 q^2 v^4 w^2 x^3 + 2 p^2 q^2 v^3 w x^3 + 4 p q^2 v^3 w^2 x^2$$
$$+ 2 p q v^3 w x^2 + 2 p^3 q^4 v^5 w^4 x^4 - 4 p^3 q^4 v^4 w^4 x^4 + 4 p^3 q^4 v^4 w^3 x^4 + p^3 q^3 v^5 w^3 x^4$$
$$- 3 p^3 q^3 v^4 w^3 x^4 + p^3 q^3 v^4 w^2 x^4 - p^3 q^2 v^4 w^2 x^4 - p^3 q^4 x^4 v^3 w^2 + 3 p^3 q^3 x^4 v^3 w^2 - p^3 q^3 x^4 v^3 w$$
$$+ 2 p^3 q^2 x^4 v^3 w - 7 p^2 q^3 x^3 v^2 w^2 + 2 p^2 q^3 x^3 v^2 w - 3 p^2 q^2 x^3 v^2 w + 2 p q^2 x^2 v w$$
$$+ p^3 x^4 q^3 v^3 w^3 - p^3 x^4 q^2 v^3 w^2 - 2 p q^2 v w x^3 + 2 p q v w x^3 + 2 q v w x - p^4 q^5 w^3 v^2 v1 x^5$$
$$+ p q^4 v^2 w^3 x^2 + p^2 q^2 v v1 w x^3 - 2 p q^3 v^2 v1 w x^2 - \mathrm{vv0}(v w) p q x + \mathrm{vv0}(v w) v x$$
$$- \mathrm{vv0}(v w) p x^2 + p^4 q^6 w^2 v v1 x^4 - 4 p^3 q^3 v1 x^3 v^2 w + 4 p^3 q^3 v^3 v1 w^2 x^3$$
$$+ 3 \mathrm{vv0}(v w) p^4 q^4 v^4 v1 w^3 x^4 + \mathrm{vv0}(v w) p^4 q^4 v^4 v1 w^3 x^5 - \mathrm{vv0}(v w) p^4 q^4 v^5 v1 w^3 x^5$$
$$- 2 \mathrm{vv0}(v w) p^4 q^5 v^4 v1 w^3 x^5 - 2 \mathrm{vv0}(v w) p^4 q^5 v^5 v1 w^4 x^5 + 2 \mathrm{vv0}(v w) p^4 q^5 v^4 v1 w^4 x^5$$
$$+ p^2 q^2 v v1 w x^2 - p^3 q^4 w^3 v^2 v1 x^3 + p^2 q^5 w^3 \mathrm{vv0}(v w) v^2 v1 x^4 + p^2 q^4 w^3 \mathrm{vv0}(v w) v^2 v1 x^4$$
$$+ p^4 q^5 w^2 \mathrm{vv0}(v w) v x^4 v1 + 2 \mathrm{vv0}(v w) p^4 q^4 v v1 w x^4 - p^3 q^4 w^2 \mathrm{vv0}(v w) v^3 x^4$$
$$- 2 p^2 q^3 w^3 \mathrm{vv0}(v w) v^2 x^2 - p^3 q^2 w \mathrm{vv0}(v w) v^3 x^4 + 2 p q^3 v^2 w^3 x + p^3 q^4 v^3 w^4 x^4$$
$$+ 2 p^2 q^2 v^2 w x^4 + p^2 q v^3 w x^4 - p q^3 v^2 w^2 x^3 - p q^2 v^3 w^2 x^3 - p^2 q^2 v^3 w x^4 - 2 p^2 q^2 v^2 w^2 x^4$$
$$- p q^2 v^4 w^2 x^3 - 7 p^3 q^5 v^3 v1 w^2 x^4 - 6 p^3 q^4 v^4 v1 w^3 x^3 + 11 p^3 q^5 v^2 v1 w^2 x^4$$
$$+ 7 p^3 q^4 v^3 v1 w^3 x^3 - p q^4 v^2 w^3 x^3 + p^3 q^5 v^3 w^4 x^5 - 2 p^2 q^5 v^4 w^5 x^4 - p q v^3 w x^3 - p q v^2 w x^3$$
$$- p^3 q^6 v^3 w^4 x^5 + 2 p^2 q^5 v^5 w^5 x^4 - 2 p^2 q^4 v^2 w^3 x^3 - p^2 q^2 v w^2 x - 2 p^2 q^4 v w^2 x^3 - q x^2 v w$$
$$+ q^2 v^3 w^2 x^2 - q^2 v^2 w^2 x^2 - p^3 x^4 q v^3 w + p^2 x^3 q^2 v^2 w^2 + p^2 x^3 q v^2 w + p^4 q^5 v^3 v1 w^3 x^5$$
$$+ p^4 q^4 v^5 v1 w^3 x^4 - 6 p^3 q^6 v^2 w^2 x^4 v1 + 3 p^3 q^5 v w x^3 v1 - 6 p^4 q^6 v^2 v1 w^2 x^5 + 2 p q^4 w^2 v v1 x^2$$
$$- 2 p q^4 w^3 v^2 v1 x^2 - 2 p q^4 w^2 v^2 v1 x^2 - p q^5 w^3 v^2 v1 x^3 + 2 p q^4 w^3 v^3 v1 x^2 + p q^5 w^4 v^3 v1 x^3$$
$$+ p q^5 w^3 v^3 v1 x^3 - p^2 q v^2 w x^4 + p q^2 v^2 w^2 x^3 + 7 p^3 q^5 v^5 v1 w^4 x^4 - 7 p^3 q^5 v^4 v1 w^4 x^4$$
$$+ 4 p^3 q^5 v^4 v1 w^3 x^4 + 3 p^3 q^4 v^5 v1 w^3 x^4 - p^4 q^2 w v^2 \mathrm{vv0}(v w) v1 x^3 - p^3 q^3 v^2 v1 w x^4$$
$$- 8 p^2 q^4 v^2 v1 w^2 x^3 + 2 p^2 q^3 v^3 v1 w^2 x^3 - p^2 q^4 v^4 w^4 x^3 + p^2 q^5 w^2 v v1 x^4 - p^4 q^4 v^3 x^4 v1 w$$
$$+ p^3 q^4 v^4 x^4 v1 w^2 + p^4 q^5 v^4 x^5 v1 w^2 + 2 p^4 q^3 v^3 x^4 v1 w + q v^2 w x^2 + v x^2 - 4 p^4 q^5 v^4 v1 w^4 x^4$$
$$+ p^4 q^5 v^4 v1 w^3 x^5 + p^3 q^5 v^3 w^3 x^4 - p^2 q^3 v^2 w x^4 - p^2 q^3 v^2 w^3 x^4 + p^2 x^2 q w + 3 p q^3 v w^2 x^2$$
$$+ 2 p^3 q^5 v^2 w^3 x^4 + p q^3 v^2 w x^3 - p^3 q^4 v^2 w x^4 - 6 p^3 q^3 v^2 w^2 x^4 + 3 p^3 q^3 v^2 w x^4$$
$$+ 2 p^3 q^2 v^2 w^2 x^4 + 4 p^2 q^4 v^2 w^2 x^3 - 3 p^3 q^2 v^2 w x^4 + p^3 q v^2 w x^4 + p^3 q^5 w^3 \mathrm{vv0}(v w) v^2 v1 x^4$$

$$- 3\, p^3\, q^5\, w^4\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^4 + p^4\, q^5\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, v1\, x^4 - 4\, p^4\, q^5\, w^2\, \mathrm{vv0}(v\, w)\, v^2\, v1\, x^5$$
$$+ p^3\, q^5\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^4 - p\, q^4\, v^3\, w^3\, x^2 + p^4\, q^4\, v^2\, v1\, w\, x^3 - 3\, p^4\, q^4\, v\, v1\, w\, x^4 - p^4\, q^2\, v^3\, v1\, w\, x^4$$
$$+ 2\, p^2\, q^4\, v^3\, v1\, w^2\, x^3 + 3\, p^3\, v^3\, x^5\, q^6\, w^2\, v1 + p^3\, q^6\, v^3\, w^3\, x^5 - 2\, p^3\, q^5\, v^4\, w^5\, x^4 + p\, q^4\, v^3\, w^4\, x^3$$
$$- 2\, p^4\, q^6\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, v1\, x^5 - 3\, p^3\, q^4\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^3 + 3\, p^3\, q^4\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, v1\, x^3$$
$$- 2\, p^2\, q^4\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^3 - p^4\, q^4\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^3 - p^4\, q^4\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, v1\, x^4$$
$$+ 2\, p^4\, q^4\, w^2\, \mathrm{vv0}(v\, w)\, v^2\, v1\, x^5 + 2\, p^3\, v^2\, x^3\, q^5\, w^2 + 2\, p^2\, v^4\, x^3\, q^4\, w^3 + 2\, p^4\, q^4\, w^2\, v1\, x^3\, v$$
$$- p^4\, q^4\, w^3\, v^2\, v1\, x^3 + 3\, p^3\, q^4\, w^2\, v1\, x^3\, v + p^4\, q^4\, w^2\, v\, v1\, x^4 + p^2\, q^3\, w^2\, v\, v1\, x - p^4\, q^3\, w^2\, v\, v1\, x^3$$
$$+ p^3\, q^4\, w^2\, v1\, x^2\, v - 2\, p^3\, q^4\, w^3\, v^2\, v1\, x^2 - 4\, p^2\, q^4\, w^3\, v^2\, v1\, x^2 + 2\, p^2\, q^4\, w^2\, v1\, x^2\, v$$
$$+ 2\, p^2\, q^4\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, v1\, x^3 + p^4\, q^3\, w^2\, \mathrm{vv0}(v\, w)\, v\, v1\, x^3 - 2\, p^3\, q^4\, w^2\, \mathrm{vv0}(v\, w)\, v\, v1\, x^3$$
$$- \mathrm{vv0}(v\, w)\, p^2\, q^3\, v1\, x^2\, v\, w - 3\, p^3\, q^4\, v^2\, w^3\, x^4 + 5\, p^2\, q^4\, v^3\, w^4\, x^3 + 2\, p^2\, q^3\, v\, w^2\, x^3 - 3\, p\, q^3\, v^2\, w^3\, x^2$$
$$+ p^3\, q^6\, v^5\, w^6\, x^5 + 2\, p^2\, q^5\, v^4\, w^5\, x^3 - p^3\, q^5\, v^3\, w^4\, x^4 - 6\, p^4\, q^5\, v^3\, v1\, w^2\, x^5 - 3\, p^4\, q^4\, v^4\, v1\, w^3\, x^4$$
$$+ p^3\, q^3\, v^3\, w^2\, x^5 + 3\, p^2\, q^4\, v^3\, w^3\, x^4 + p^4\, q^2\, w\, v^2\, v1\, x^3 - 2\, p^3\, q^5\, v^2\, w^3\, x^3 + p^3\, q^3\, w^2\, v\, v1\, x^2$$
$$- 3\, p^2\, q^3\, v\, v1\, w\, x^3 - v\, p\, \mathrm{vv0}(v\, w)\, q\, x^2 + p^2\, v^3\, x^3\, q^3\, w + p\, v^4\, x^2\, q^2\, w^2 + p^3\, q^2\, v^2\, v1\, w\, x^3$$
$$+ p^2\, q^5\, v^2\, w^3\, x^4 - p\, q^4\, v^4\, w^4\, x^3 - p^3\, q^6\, v^5\, w^5\, x^5 - \mathrm{vv0}(v\, w)\, p^2\, q^2\, v\, v1\, w\, x^3$$
$$+ \mathrm{vv0}(v\, w)\, p\, q^2\, v^2\, v1\, w\, x^2 - 2\, \mathrm{vv0}(v\, w)\, p\, q^2\, v\, v1\, w\, x^2 - \mathrm{vv0}(v\, w)\, p^2\, q^2\, v^3\, v1\, w\, x^3$$
$$+ 2\, \mathrm{vv0}(v\, w)\, p^3\, q^2\, v\, v1\, w\, x^3 + \mathrm{vv0}(v\, w)\, p^2\, q^2\, v^2\, v1\, w\, x^2 - 3\, \mathrm{vv0}(v\, w)\, p^2\, q^3\, v^3\, v1\, w^2\, x^3$$
$$- \mathrm{vv0}(v\, w)\, p^3\, q^3\, v\, v1\, w\, x^4 - \mathrm{vv0}(v\, w)\, p^3\, q^2\, v^3\, v1\, w\, x^3 + 4\, \mathrm{vv0}(v\, w)\, p^2\, q^3\, v^2\, v1\, w^2\, x^3$$
$$- 3\, \mathrm{vv0}(v\, w)\, p^3\, q^3\, v^3\, v1\, w^2\, x^3 - \mathrm{vv0}(v\, w)\, p^3\, q^3\, v^3\, v1\, w\, x^4 + 2\, \mathrm{vv0}(v\, w)\, p^3\, q^3\, v^4\, v1\, w^2\, x^4$$
$$- p^2\, q^3\, v^2\, v1\, w\, x^3 + 4\, p\, q^3\, v^3\, v1\, w^2\, x^2 - p^3\, v^4\, x^4\, q^6\, w^4 - 2\, p^3\, v^4\, x^4\, q^4\, w^2 - p\, q^4\, v^3\, w^4\, x^2 - p\, v^3\, x\, q\, w$$
$$+ p\, q^4\, v^4\, w^4\, x^2 - p^4\, q^5\, w^2\, v\, v1\, x^3 - 3\, p^2\, v^2\, x^2\, q^3\, w - p^2\, q^5\, v^2\, w^3\, x^3 + 3\, p^2\, v^3\, x^3\, q^4\, w^2$$
$$- p^3\, v^3\, x^4\, q^6\, w^3 + 2\, \mathrm{vv0}(v\, w)\, p^2\, q^2\, v^3\, w^2\, x^2 - 2\, \mathrm{vv0}(v\, w)\, p^2\, q^2\, v^2\, w\, x^2 - \mathrm{vv0}(v\, w)\, p^2\, q^2\, v\, v1\, x^2$$
$$+ \mathrm{vv0}(v\, w)\, p^2\, q^2\, v\, w\, x - \mathrm{vv0}(v\, w)\, p^2\, q^2\, v^2\, w^2\, x + \mathrm{vv0}(v\, w)\, p^3\, q^3\, v^3\, w^3\, x^2$$
$$+ \mathrm{vv0}(v\, w)\, p^3\, q^2\, v^3\, w^2\, x^2 + 4\, \mathrm{vv0}(v\, w)\, p^3\, q^3\, v^3\, w^2\, x^3 - 2\, \mathrm{vv0}(v\, w)\, p^3\, q^2\, v^2\, w\, x^2$$
$$- 2\, \mathrm{vv0}(v\, w)\, p^3\, q^2\, v^3\, w^2\, x^3 + \mathrm{vv0}(v\, w)\, p^3\, q^3\, v^3\, w^3\, x^3 - \mathrm{vv0}(v\, w)\, p\, q\, v^2\, w\, x$$
$$- \mathrm{vv0}(v\, w)\, p^3\, q^2\, v\, v1\, x^3 - 3\, p^4\, q^5\, v^3\, v1\, w^2\, x^4 + 6\, p^4\, q^5\, v^2\, v1\, w^2\, x^5 - p^4\, q^4\, v^4\, v1\, w^3\, x^3$$
$$- 2\, p^4\, q^4\, v^2\, x^5\, \mathrm{vv0}(v\, w)\, v1\, w + 3\, p^4\, q^5\, v^3\, x^5\, \mathrm{vv0}(v\, w)\, v1\, w^2 + p^4\, q^5\, v^2\, x^5\, \mathrm{vv0}(v\, w)\, v1\, w$$
$$+ p^3\, q^3\, v^2\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w - 3\, p^3\, q^4\, v^3\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w^2 + 2\, p^3\, q^3\, v^2\, x^3\, \mathrm{vv0}(v\, w)\, v1\, w$$
$$+ 3\, \mathrm{vv0}(v\, w)\, p^3\, q^4\, v^2\, v1\, w^2\, x^4 - 2\, \mathrm{vv0}(v\, w)\, p^3\, q^3\, v^3\, v1\, w^2\, x^4 - 5\, \mathrm{vv0}(v\, w)\, p^3\, q^4\, v^3\, v1\, w^3\, x^4$$
$$+ 5\, \mathrm{vv0}(v\, w)\, p^3\, q^4\, v^4\, v1\, w^3\, x^4 - 2\, p^4\, q^4\, v^3\, x^5\, \mathrm{vv0}(v\, w)\, v1\, w^2 + 3\, p^4\, q^3\, v^2\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w$$
$$+ 2\, p^2\, q^3\, v^2\, x^3\, \mathrm{vv0}(v\, w)\, v1\, w - 2\, p^4\, q^4\, v^2\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w - p^4\, q^4\, v^3\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w^2$$
$$+ p^4\, q^3\, v^2\, x^3\, \mathrm{vv0}(v\, w)\, v1\, w - p^3\, q^4\, v^2\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w + p^2\, q^4\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, x^3$$
$$+ p^3\, q^3\, w^2\, \mathrm{vv0}(v\, w)\, v\, x^2 + 2\, p^3\, q^3\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, x^3 + 2\, p^2\, q^3\, w^2\, \mathrm{vv0}(v\, w)\, v\, x^2$$
$$- p^3\, q^3\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, x^2 + 2\, p^3\, q^4\, w^2\, v^2\, x^3\, \mathrm{vv0}(v\, w) + \mathrm{vv0}(v\, w)\, p^3\, q^2\, v^4\, w^2\, x^4$$

$$- 3\,\mathrm{vv0}(v\,w)\,p^3\,q^3\,v^4\,w^3\,x^3 - 2\,\mathrm{vv0}(v\,w)\,p^3\,q^3\,v^4\,w^2\,x^4 - 2\,\mathrm{vv0}(v\,w)\,p^3\,q^3\,v^3\,w^3\,x^4$$
$$+ 3\,\mathrm{vv0}(v\,w)\,p^3\,q^4\,v^3\,w^3\,x^4 + 2\,\mathrm{vv0}(v\,w)\,p^3\,q^3\,v^4\,w^3\,x^4 + p^4\,q^4\,w\,\mathrm{vv0}(v\,w)\,v\,v1\,x^3$$
$$- 2\,p^4\,q^7\,w^3\,v^2\,v1\,x^5 - p^4\,q^6\,w^4\,v^3\,v1\,x^4 + \mathrm{vv0}(v\,w)\,p^2\,q^3\,v^2\,v1\,w^2\,x^2 + \mathrm{vv0}(v\,w)\,p^3\,q^4\,v^2\,v1\,w^2\,x^3$$
$$+ 2\,\mathrm{vv0}(v\,w)\,p^3\,q^4\,v\,v1\,w\,x^3 - \mathrm{vv0}(v\,w)\,p^2\,q^2\,v\,v1\,w\,x^2 - 3\,\mathrm{vv0}(v\,w)\,p^3\,q^3\,v1\,x^3\,v\,w$$
$$+ 2\,\mathrm{vv0}(v\,w)\,p^3\,q^3\,v^2\,v1\,w^2\,x^3 + \mathrm{vv0}(v\,w)\,p^3\,q^2\,v\,v1\,w\,x^2 - \mathrm{vv0}(v\,w)\,p^3\,q^3\,v1\,x^2\,v\,w$$
$$+ \mathrm{vv0}(v\,w)\,p^3\,q^3\,v^2\,v1\,w^2\,x^2 - 2\,p^2\,x^2\,q^2\,w - 2\,p^3\,q^4\,w\,v\,v1\,x^2 - 4\,p^3\,q^6\,w^3\,v^3\,v1\,x^4$$
$$- 5\,p^3\,q^5\,w^4\,v^4\,v1\,x^3 - 4\,p^3\,q^6\,w^5\,v^4\,v1\,x^4 + p^4\,q^5\,w\,v\,v1\,x^3 + p^2\,v^2\,x^4\,q^5\,w^2\,v1 - p^4\,q^5\,v^6\,v1\,w^4\,x^5$$
$$+ 3\,p^4\,q^6\,v^4\,v1\,w^4\,x^5 + p^4\,q^6\,v^4\,v1\,w^3\,x^5 + 3\,p^4\,q^5\,v^5\,v1\,w^4\,x^4 - p^4\,q^5\,v^5\,v1\,w^3\,x^5$$
$$- 2\,p^4\,q^6\,v^6\,v1\,w^5\,x^5 + 2\,p^4\,q^6\,v^5\,v1\,w^5\,x^5 + p^3\,q^5\,w^4\,\mathrm{vv0}(v\,w)\,v^3\,x^4 + p^2\,q^3\,w^3\,\mathrm{vv0}(v\,w)\,v^2\,x^3$$
$$- 3\,p^3\,v^4\,x^4\,q^5\,w^3 - 2\,\mathrm{vv0}(v\,w)\,p^4\,q^3\,v\,v1\,w\,x^3 - \mathrm{vv0}(v\,w)\,p^4\,q^2\,v^2\,v1\,w\,x^4 + p^2\,q^2\,w\,\mathrm{vv0}(v\,w)\,x^2$$
$$- p^3\,q^6\,v^5\,w^6\,x^4 - p^3\,q^3\,w^2\,\mathrm{vv0}(v\,w)\,v\,v1\,x^2 - p^4\,q^4\,w^2\,\mathrm{vv0}(v\,w)\,v1\,x^3\,v$$
$$+ p^4\,q^4\,w^3\,\mathrm{vv0}(v\,w)\,v^2\,v1\,x^3 - 4\,p^2\,v^2\,x^2\,q^4\,w^2 + 3\,p^4\,q^3\,v\,v1\,w\,x^3 - \mathrm{vv0}(v\,w)\,p^3\,q^3\,v\,v1\,x^3$$
$$- 3\,p^4\,q^4\,v\,v1\,w\,x^3 - 2\,p^4\,q^3\,v^2\,v1\,w\,x^3 + p^4\,q^3\,v\,v1\,w\,x^4 - p^3\,q^4\,v\,v1\,w\,x^4 + 2\,p^2\,q^4\,v\,w^2\,x^2$$
$$+ p^3\,v^6\,x^4\,q^6\,w^6 - 2\,p^2\,v^5\,x^3\,q^5\,w^5 - p^2\,q^5\,w^3\,v^3\,v1\,x^3 - p^4\,q^7\,w^4\,v^4\,v1\,x^5 + 2\,p^4\,q^6\,w^5\,v^5\,v1\,x^4$$
$$- 4\,p^4\,q^6\,w^4\,v^5\,v1\,x^5 - p^4\,q^7\,w^4\,v^3\,v1\,x^5 - 2\,p^4\,q^6\,w^5\,v^4\,v1\,x^4 + 4\,p^3\,q^6\,w^5\,v^5\,v1\,x^4$$
$$+ 3\,p^4\,q^7\,w^3\,v^3\,v1\,x^5 + 3\,p^4\,q^6\,w^4\,v^4\,v1\,x^4 - 4\,p^2\,v^5\,x^3\,q^4\,w^4 - p^4\,q^7\,w^6\,v^6\,v1\,x^5 + p^4\,q^7\,w^6\,v^5\,v1\,x^5$$
$$- 3\,p^4\,q^7\,w^5\,v^5\,v1\,x^5 - p^2\,q^3\,w^2\,v^2\,v1\,x + 2\,p^3\,q^4\,w^3\,v^3\,v1\,x^2 - p^4\,q^5\,w^3\,v^3\,v1\,x^3 + p^4\,q^5\,w^2\,v^2\,v1\,x^3$$
$$+ 5\,p^3\,q^5\,w^2\,v^2\,v1\,x^3 - p^2\,q^5\,w^3\,v^2\,v1\,x^3 - 6\,p^4\,q^4\,v^2\,v1\,w^2\,x^4 + 3\,p^4\,q^4\,v^2\,v1\,w\,x^5$$
$$- p^4\,q^3\,v^3\,v1\,w^2\,x^4 + p^4\,q^3\,v^3\,v1\,w\,x^5 - 3\,p^3\,v^5\,x^5\,q^7\,w^5\,v1 + 7\,p^4\,q^5\,v^2\,v1\,w^2\,x^4$$
$$+ 2\,p^4\,q^4\,v^3\,v1\,w^3\,x^3 + 3\,p^4\,q^4\,v^3\,v1\,w^2\,x^4 + 3\,p^3\,q^7\,v^3\,w^3\,x^5\,v1 - 2\,p^4\,q^4\,v^2\,v1\,w^2\,x^5$$
$$- p^4\,q^3\,v^4\,v1\,w^2\,x^4 + p^4\,q^4\,v^3\,v1\,w^3\,x^4 + 2\,p^4\,q^4\,v^3\,v1\,w^2\,x^5 + 2\,p^3\,q^5\,v^3\,v1\,w^3\,x^4 + 2\,p^2\,q^3\,v\,w\,x$$
$$+ 2\,p\,q^3\,v^2\,w^2\,x + 2\,p^3\,v^6\,x^4\,q^5\,w^5 + 4\,\mathrm{vv0}(v\,w)\,p^4\,q^4\,v^2\,v1\,w^2\,x^4 - 2\,p\,v^3\,x^2\,q^3\,w^2$$
$$+ \mathrm{vv0}(v\,w)\,p^2\,q^2\,v^3\,w\,x^3 + \mathrm{vv0}(v\,w)\,p\,q^2\,v^3\,w^2\,x^2 - 2\,\mathrm{vv0}(v\,w)\,p\,q^2\,v^2\,w^2\,x^2$$
$$- 2\,\mathrm{vv0}(v\,w)\,p^2\,q^3\,v^4\,w^3\,x^3 + \mathrm{vv0}(v\,w)\,p^2\,q^3\,v^3\,w^3\,x^3 - \mathrm{vv0}(v\,w)\,p^2\,q^2\,v^4\,w^2\,x^3$$
$$- p^3\,q^2\,v\,x^4\,\mathrm{vv0}(v\,w)\,v1 + p^3\,q^3\,v\,x^4\,\mathrm{vv0}(v\,w)\,v1 - p\,q^2\,v^2\,x^2\,\mathrm{vv0}(v\,w)\,w$$
$$+ 2\,p^3\,q^4\,w^3\,\mathrm{vv0}(v\,w)\,v^2\,x^4 + p^2\,q^4\,w^4\,\mathrm{vv0}(v\,w)\,v^3\,x^3 - 2\,p^3\,q^4\,w^2\,\mathrm{vv0}(v\,w)\,v^2\,x^4$$
$$- 2\,p^2\,q^3\,w^2\,v^2\,x^2\,\mathrm{vv0}(v\,w) + p^3\,q^5\,w^5\,\mathrm{vv0}(v\,w)\,v^5\,x^4 - p^3\,q^5\,w^5\,\mathrm{vv0}(v\,w)\,v^4\,x^4$$
$$- p^3\,q^5\,w^3\,\mathrm{vv0}(v\,w)\,v^3\,x^4 - 2\,p^3\,q^4\,w^4\,\mathrm{vv0}(v\,w)\,v^4\,x^3 + 2\,p^3\,q^4\,w^4\,\mathrm{vv0}(v\,w)\,v^3\,x^3$$
$$- p^2\,q^4\,w^4\,\mathrm{vv0}(v\,w)\,v^4\,x^3 - p^3\,q^2\,w\,\mathrm{vv0}(v\,w)\,v1\,x^2 + p^3\,q^3\,w\,\mathrm{vv0}(v\,w)\,v1\,x^2$$
$$+ p^2\,q^3\,w\,\mathrm{vv0}(v\,w)\,v1\,x^2 + \mathrm{vv0}(v\,w)\,p^3\,q^3\,v^5\,w^3\,x^4 - p^3\,q^2\,w^2\,\mathrm{vv0}(v\,w)\,v\,x^2$$
$$- 2\,p^3\,q^4\,w^3\,\mathrm{vv0}(v\,w)\,v^2\,x^3 - p^2\,q^2\,w^2\,\mathrm{vv0}(v\,w)\,v\,x^2 + p^2\,q^2\,w^2\,\mathrm{vv0}(v\,w)\,v\,x$$
$$- \mathrm{vv0}(v\,w)\,p\,q^2\,v\,v1\,x^2 - p^3\,q^3\,v^2\,x^4\,\mathrm{vv0}(v\,w)\,w - \mathrm{vv0}(v\,w)\,p^3\,q^2\,v^4\,w^2\,x^3$$
$$+ \mathrm{vv0}(v\,w)\,p^3\,q^2\,v^3\,w^2\,x^4 + \mathrm{vv0}(v\,w)\,p^3\,q^2\,v\,v1\,x^2 + \mathrm{vv0}(v\,w)\,p^2\,q\,v^3\,w\,x^2$$

$$
\begin{aligned}
&- \mathrm{vv0}(v\,w)\,p^3\,q\,v^3\,w\,x^3 - v^2\,\mathrm{vv0}(v\,w)\,p^3\,q\,v1\,x^3 + 2\,p^2\,v^4\,x^3\,q^3\,w^2 - 2\,p^4\,q^5\,w^2\,v^2\,x^4\,\mathrm{vv0}(v\,w)\,v1 \\
&- p^4\,q^6\,w^5\,\mathrm{vv0}(v\,w)\,v^5\,v1\,x^5 - 2\,p^4\,q^5\,w^4\,\mathrm{vv0}(v\,w)\,v^3\,v1\,x^4 + 3\,p^3\,q^5\,w^4\,\mathrm{vv0}(v\,w)\,v^4\,v1\,x^4 \\
&+ 2\,p^4\,q^6\,w^2\,\mathrm{vv0}(v\,w)\,v^2\,v1\,x^5 + p^4\,q^6\,w^3\,\mathrm{vv0}(v\,w)\,v^3\,v1\,x^5 + 2\,p^4\,q^5\,w^4\,\mathrm{vv0}(v\,w)\,v^4\,v1\,x^4 \\
&+ p^4\,q^6\,w^5\,\mathrm{vv0}(v\,w)\,v^4\,v1\,x^5 - 2\,p^4\,q^6\,w^4\,\mathrm{vv0}(v\,w)\,v^4\,v1\,x^5 + p^4\,q^6\,w^4\,\mathrm{vv0}(v\,w)\,v^3\,v1\,x^5 \\
&- \mathrm{vv0}(v\,w)\,p^2\,q^2\,v\,v1\,x^3 - \mathrm{vv0}(v\,w)\,p^3\,q^2\,v^2\,w\,x^3 - 5\,\mathrm{vv0}(v\,w)\,p^3\,q^3\,v^2\,w^2\,x^3 \\
&+ 2\,\mathrm{vv0}(v\,w)\,p^3\,q^4\,v^5\,w^4\,x^4 - p^3\,q^3\,w\,\mathrm{vv0}(v\,w)\,v\,x^2 - 2\,p^3\,q^4\,w^4\,\mathrm{vv0}(v\,w)\,v^3\,x^4 \\
&- p^3\,v^2\,\mathrm{vv0}(v\,w)\,q\,w\,x^4 - 2\,\mathrm{vv0}(v\,w)\,p^3\,q^2\,v^2\,w^2\,x^4 + 2\,\mathrm{vv0}(v\,w)\,p^3\,q^2\,v^2\,w^2\,x^3 \\
&+ v\,\mathrm{vv0}(v\,w)\,p^3\,q\,v1\,x^3 + 2\,\mathrm{vv0}(v\,w)\,p^3\,q^2\,v^2\,w\,x^4 + 4\,\mathrm{vv0}(v\,w)\,p^3\,q^3\,v^2\,w^2\,x^4 \\
&+ \mathrm{vv0}(v\,w)\,p^2\,q\,v\,w\,x^3 - \mathrm{vv0}(v\,w)\,p^3\,q\,v\,w\,x^2 + \mathrm{vv0}(v\,w)\,p^3\,q\,v^2\,w\,x^2 + 2\,\mathrm{vv0}(v\,w)\,p^3\,q^2\,v\,w\,x^2 \\
&+ p^3\,q^4\,v\,w^2\,x^2 + p^3\,v^5\,x^4\,q^6\,w^5 - 5\,p^3\,q^4\,v^2\,v1\,w^2\,x^3 - 5\,p^3\,q^4\,v\,v1\,w\,x^3 \\
&+ \mathrm{vv0}(v\,w)\,p^4\,q^3\,v^4\,v1\,w^2\,x^4 - 2\,\mathrm{vv0}(v\,w)\,p^4\,q^4\,v^3\,v1\,w^3\,x^4 - 4\,p^3\,q^5\,w^2\,v\,v1\,x^3 \\
&+ 4\,p^2\,q^4\,w^3\,v^3\,v1\,x^2 + p^2\,q^3\,v\,x^3\,\mathrm{vv0}(v\,w)\,v1 - 2\,\mathrm{vv0}(v\,w)\,p^3\,q^2\,v\,w\,x^3 + \mathrm{vv0}(v\,w)\,p^3\,q^2\,v^2\,v1\,x^4 \\
&- p^3\,q^4\,w\,\mathrm{vv0}(v\,w)\,v1\,x^3 + p^3\,q^3\,w\,\mathrm{vv0}(v\,w)\,v1\,x^3 - p^3\,q^3\,w^2\,\mathrm{vv0}(v\,w)\,v\,x^3 + 6\,p^3\,q^6\,w^4\,v^4\,v1\,x^4 \\
&+ p^4\,q^2\,v^2\,v1\,w\,x^4 + 2\,p^4\,q^5\,v^4\,v1\,w^3\,x^4 - 4\,p^4\,q^3\,v^2\,v1\,w\,x^4 + p^4\,q^5\,v^5\,v1\,w^4\,x^5 - 3\,p^3\,q^5\,w^3\,v^3\,v1\,x^3 \\
&- 5\,p^4\,q^6\,v^3\,v1\,w^3\,x^5 - 2\,p^4\,q^5\,v1\,x^4\,v^2\,w + 5\,p^4\,q^4\,v^2\,v1\,w\,x^4 + 2\,\mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,v1\,w\,x^3 \\
&+ p^4\,q^3\,w^2\,\mathrm{vv0}(v\,w)\,v^3\,v1\,x^4 + p^4\,q^5\,w^3\,\mathrm{vv0}(v\,w)\,v^2\,v1\,x^5 - p^2\,q^4\,w^2\,v\,v1\,x^4 + p\,q^4\,w^3\,v^2\,v1\,x^3 \\
&- p\,q^4\,w^2\,v\,v1\,x^3 + 2\,p^3\,q^4\,v^2\,v1\,w^2\,x^5 - 2\,p^3\,q^5\,v^2\,v1\,w^2\,x^5 + p^3\,q^6\,v^4\,v1\,w^4\,x^5 - p^2\,q^2\,v^2\,v1\,w\,x^4 \\
&- p\,q^3\,v^2\,v1\,w\,x^3 + 2\,p^2\,q^4\,w^2\,v\,v1\,x^3 + p^2\,q^3\,w^2\,v\,v1\,x^3 + 6\,p^2\,q^5\,w^2\,v^2\,v1\,x^3 + p^2\,q^4\,w^3\,v^2\,v1\,x^3 \\
&- 2\,p^3\,q^5\,w^2\,v\,v1\,x^4 - p^2\,q^4\,w^3\,v^2\,v1\,x^4 + 2\,p^3\,q^6\,w^2\,v\,v1\,x^4 - p^2\,q^5\,w^3\,v^2\,v1\,x^4 - 4\,p^2\,q^5\,w^2\,v\,v1\,x^3 \\
&+ \mathrm{vv0}(v\,w)\,p^2\,q^2\,v^3\,w^2\,x^3 + p^3\,q^4\,w^2\,\mathrm{vv0}(v\,w)\,v^3\,x^5 + p^3\,q^3\,w^2\,\mathrm{vv0}(v\,w)\,v^4\,x^5 \\
&- p^2\,q^4\,w^4\,\mathrm{vv0}(v\,w)\,v^3\,x^4 - 2\,p^3\,q^4\,w^3\,\mathrm{vv0}(v\,w)\,v^3\,x^5 + p^3\,q^3\,w^3\,\mathrm{vv0}(v\,w)\,v^4\,x^5 + p^3\,q^5\,v^2\,v1\,w\,x^5 \\
&+ \mathrm{vv0}(v\,w)\,p^2\,q^2\,v^4\,w^2\,x^4 - 3\,\mathrm{vv0}(v\,w)\,p^2\,q^2\,v^3\,w^2\,x^4 + 2\,\mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,w^2\,x^4 \\
&- \mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,w\,x^4 - \mathrm{vv0}(v\,w)\,p\,q^2\,v^3\,w^2\,x^3 + p\,q^2\,v^2\,x^3\,\mathrm{vv0}(v\,w)\,w \\
&- p^2\,q^3\,v\,x^4\,\mathrm{vv0}(v\,w)\,v1 - p^2\,q^3\,v^3\,x^4\,\mathrm{vv0}(v\,w)\,w^2 + p^2\,q^2\,v\,x^4\,\mathrm{vv0}(v\,w)\,v1 \\
&+ \mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,v1\,x^3 - \mathrm{vv0}(v\,w)\,p\,q\,v\,v1\,x^3 + 2\,\mathrm{vv0}(v\,w)\,p\,q^2\,v^2\,w^2\,x^3 \\
&- 3\,\mathrm{vv0}(v\,w)\,p^2\,q^3\,v^3\,w^3\,x^4 + p^2\,q^4\,w^3\,\mathrm{vv0}(v\,w)\,v^2\,x^4 - p^3\,q^3\,w^2\,\mathrm{vv0}(v\,w)\,v^3\,x^5 \\
&- 2\,p^3\,q^4\,w^4\,\mathrm{vv0}(v\,w)\,v^5\,x^5 - p^2\,q^3\,w\,\mathrm{vv0}(v\,w)\,v1\,x^3 - p^3\,q^5\,w^4\,\mathrm{vv0}(v\,w)\,v^3\,x^5 \\
&+ 2\,p^3\,q^4\,w^4\,\mathrm{vv0}(v\,w)\,v^4\,x^5 - p^3\,q^5\,w^5\,\mathrm{vv0}(v\,w)\,v^5\,x^5 + p^3\,q^5\,w^5\,\mathrm{vv0}(v\,w)\,v^4\,x^5 \\
&+ p^3\,q^5\,w^3\,\mathrm{vv0}(v\,w)\,v^3\,x^5 + p^3\,q^4\,w^3\,\mathrm{vv0}(v\,w)\,v^4\,x^5 - p^3\,q^3\,w^3\,\mathrm{vv0}(v\,w)\,v^5\,x^5 \\
&- \mathrm{vv0}(v\,w)\,p^2\,q^2\,v^2\,v1\,x^4 + \mathrm{vv0}(v\,w)\,p^2\,q\,v^2\,w\,x^4 + 2\,\mathrm{vv0}(v\,w)\,p\,q\,v^2\,w\,x^3 \\
&+ \mathrm{vv0}(v\,w)\,p^2\,q^4\,v^4\,w^4\,x^4 - \mathrm{vv0}(v\,w)\,p^2\,q^4\,v^3\,w^3\,x^4 + 2\,\mathrm{vv0}(v\,w)\,p^2\,q^3\,v^4\,w^3\,x^4 \\
&- \mathrm{vv0}(v\,w)\,p\,q^2\,v\,w^2\,x^3 + p^2\,q^3\,w^3\,\mathrm{vv0}(v\,w)\,v^2\,x^4 + p\,q\,v^2\,x^3\,\mathrm{vv0}(v\,w)\,v1 + p\,q^2\,w\,x^2\,\mathrm{vv0}(v\,w)\,v1 \\
&- p^3\,q^3\,w\,\mathrm{vv0}(v\,w)\,v^2\,x^5\,v1 + p^3\,q^4\,v^2\,x^5\,\mathrm{vv0}(v\,w)\,w\,v1 - p^4\,q^5\,w\,v\,x^4\,\mathrm{vv0}(v\,w)\,v1
\end{aligned}
$$

$$+ p\, q^2\, v\, v1\, w\, x^2 - 2\, p^2\, q^3\, w^2\, \mathrm{vv0}(v\, w)\, v\, x^3 - \mathrm{vv0}(v\, w)\, q\, v\, v1\, x^2 + \mathrm{vv0}(v\, w)\, p\, q\, w\, x^2$$
$$+ p^3\, q^4\, v^3\, x^5\, v1\, w + \mathrm{vv0}(v\, w)\, p\, q^2\, v\, v1\, x^3 + p\, q^2\, w^2\, \mathrm{vv0}(v\, w)\, v\, x^2 + \mathrm{vv0}(v\, w)\, p\, v^2\, x^3$$
$$+ \mathrm{vv0}(v\, w)\, q\, v1\, x^2 + \mathrm{vv0}(v\, w)\, p\, q\, v\, x^3 - \mathrm{vv0}(v\, w)\, p\, q^2\, v1\, x^3 - p\, q^3\, w\, v1\, x - p^3\, q^3\, w\, v1\, x^3$$
$$- p^3\, q^5\, w\, v1\, x^3 + 2\, p^3\, q^4\, w\, v1\, x^3 + 2\, p^2\, q^4\, w\, v1\, x^2 - p^2\, q^3\, w\, v1\, x^2 + q^3\, v\, v1\, w\, x^2 - p^2\, q^2\, v\, v1\, x^4$$
$$- q^3\, v^2\, v1\, w^2\, x^2 + 2\, p\, q^2\, v^2\, v1\, x^3 - q^3\, v^2\, v1\, w\, x^2 + 2\, p^2\, q^3\, v\, v1\, x^4 + q^3\, v^3\, v1\, w^2\, x^2 - p^2\, q^4\, v\, v1\, x^4$$
$$- p\, q^2\, v^2\, v1\, x^2 - q^2\, v^2\, v1\, w\, x + p^2\, q^2\, v^2\, x^4\, v1 + 2\, p^2\, q^6\, w^5\, v^5\, v1\, x^4 + p^4\, q^8\, w^6\, v^6\, v1\, x^6$$
$$- p^4\, q^8\, w^6\, v^5\, v1\, x^6 + p^4\, q^8\, w^5\, v^5\, v1\, x^6 + 2\, p^4\, q^7\, w^5\, v^6\, v1\, x^6 - 2\, p^4\, q^7\, w^5\, v^5\, v1\, x^6 - p^3\, q^7\, w^6\, v^6\, v1\, x^5$$
$$- p^4\, q^8\, w^4\, v^4\, v1\, x^6 + p^4\, q^7\, w^4\, v^5\, v1\, x^6 + p^4\, q^6\, w^4\, v^6\, v1\, x^6 + p^3\, q^7\, w^6\, v^5\, v1\, x^5 + p^4\, q^8\, w^4\, v^3\, v1\, x^6$$
$$+ p^4\, q^7\, w^4\, v^4\, v1\, x^6 - p^4\, q^6\, w^4\, v^5\, v1\, x^6 - p^4\, q^8\, w^3\, v^3\, v1\, x^6 - 2\, p^4\, q^7\, w^3\, v^4\, v1\, x^6 - p^4\, q^7\, w^4\, v^3\, v1\, x^6$$
$$+ 2\, p^3\, q^7\, w^5\, v^4\, v1\, x^5 + 2\, p^3\, q^6\, w^4\, v^3\, v1\, x^5 - 2\, p^2\, q^6\, w^5\, v^4\, v1\, x^4 + 2\, p^4\, q^7\, w^2\, v^2\, v1\, x^5$$
$$- p^4\, q^5\, w^2\, v^3\, v1\, x^6 - p^3\, q^7\, w^3\, v^2\, v1\, x^5 + 3\, p^4\, q^7\, w^3\, v^3\, v1\, x^6 + 2\, p^4\, q^6\, w^3\, v^4\, v1\, x^6 + p^3\, q^7\, w^4\, v^4\, v1\, x^5$$
$$- p^4\, q^7\, w^2\, v^3\, v1\, x^6 - p^4\, q^6\, w^2\, v^4\, v1\, x^6 - 2\, p^4\, q^6\, w^3\, v^3\, v1\, x^6 - 2\, p^3\, q^7\, w^4\, v^3\, v1\, x^5 + p^2\, q^6\, w^4\, v^4\, v1\, x^4$$
$$+ 2\, p^4\, q^6\, w^2\, v^3\, v1\, x^6 + p^4\, q^5\, w^2\, v^4\, v1\, x^6 - p^2\, q^3\, w\, v1\, x + p^3\, q^4\, w\, v1\, x^2 - 2\, p^3\, q^3\, w\, v1\, x^2$$
$$- p^2\, q^5\, w^4\, v^3\, x^3 + p^3\, q^2\, w\, v1\, x^2 + p^3\, q^2\, v\, v1\, x^4 + p^3\, q^4\, v\, v1\, x^4 - 2\, p^3\, q^3\, v\, v1\, x^4 - p^2\, q^2\, v^2\, v1\, x^3$$
$$+ v^2\, p^3\, q\, v1\, x^3 + v\, p^3\, q^3\, v1\, x^2 - p^3\, q^2\, v^2\, x^4\, v1 - v\, p^2\, q^2\, x\, v1 - p^3\, q^2\, v^2\, v1\, x^3 - p^3\, q^2\, v\, v1\, x^2$$
$$- p^2\, q^4\, v^2\, v1\, w\, x^4 - 2\, p^2\, q^3\, v^2\, v1\, w^2\, x^4 + p\, q^4\, v^3\, v1\, w^2\, x^3 - p\, q^3\, v^4\, v1\, w^2\, x^3 + 3\, p^2\, q^3\, v^2\, v1\, w\, x^4$$
$$+ p^2\, q^2\, v^3\, v1\, w\, x^4 - p\, q^4\, v^2\, v1\, w^2\, x^3 - p\, q^3\, v^3\, v1\, w^2\, x^3 - 4\, p^2\, q^5\, v^3\, v1\, w^2\, x^4 - p^2\, q^4\, v^3\, v1\, w^3\, x^4$$
$$- 2\, p^3\, q^4\, v^3\, v1\, w\, x^4 - p^3\, q^3\, v^3\, v1\, w\, x^5 + 3\, p^2\, q^4\, v^3\, v1\, w^2\, x^4 + p^2\, q^3\, v^4\, v1\, w^2\, x^4 - 3\, p\, q^4\, v^4\, v1\, w^3\, x^3$$
$$+ p^2\, q^4\, v^2\, v1\, w^2\, x^4 + 2\, p\, q^4\, v^3\, v1\, w^3\, x^3 - 2\, p^3\, q^6\, v^6\, v1\, w^5\, x^5 + 2\, p^3\, q^6\, v^5\, v1\, w^5\, x^5$$
$$- 4\, p^3\, q^6\, v^5\, v1\, w^4\, x^5 - p^3\, q^5\, v^6\, v1\, w^4\, x^5 + p^3\, q^5\, v^5\, v1\, w^4\, x^5 + 3\, p^3\, q^6\, v^4\, v1\, w^3\, x^5$$
$$- 6\, p^3\, q^6\, v^3\, v1\, w^3\, x^5 - 3\, p^3\, q^5\, v^4\, v1\, w^3\, x^5 + 4\, p^2\, q^5\, v^5\, v1\, w^4\, x^4 + 3\, p^3\, q^5\, v^3\, v1\, w^3\, x^5$$
$$- 3\, p^2\, q^5\, v^4\, v1\, w^4\, x^4 - 3\, p^3\, q^5\, v^3\, v1\, w^2\, x^5 + 2\, p^2\, q^4\, v^5\, v1\, w^3\, x^4 + 3\, p^2\, q^5\, v^3\, v1\, w^3\, x^4$$
$$+ p\, q^2\, v^3\, v1\, w\, x^2 + p^2\, q^3\, v^3\, x^3\, v1\, w + p^3\, q^3\, v^3\, x^4\, v1\, w - p^3\, q^5\, v^5\, x^5\, v1\, w^3 - p^2\, q^4\, v^3\, x^4\, v1\, w$$
$$- 2\, p^3\, q^4\, v^4\, x^5\, v1\, w^2 + 2\, p^3\, q^5\, v^4\, x^5\, v1\, w^2 - p^2\, q^4\, v^4\, x^4\, v1\, w^2 + p\, q^3\, v^3\, x^3\, v1\, w - p^2\, q^3\, v^3\, x^4\, v1\, w$$
$$- p\, q^2\, v^2\, v1\, w\, x^2 + 2\, p^4\, q^6\, w^4\, \mathrm{vv0}(v\, w)\, v^5\, v1\, x^6 + p^4\, q^7\, w^4\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^6$$
$$- 2\, p^4\, q^6\, w^4\, \mathrm{vv0}(v\, w)\, v^4\, v1\, x^6 - p^3\, q^6\, w^5\, \mathrm{vv0}(v\, w)\, v^5\, v1\, x^5 - p^4\, q^7\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^6$$
$$+ p^2\, q^5\, w^4\, \mathrm{vv0}(v\, w)\, v^4\, v1\, x^4 - p^3\, q^5\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, v1\, x^5 - p^2\, q^5\, w^4\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^4$$
$$- p^2\, q^5\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^4 + p^4\, q^5\, w^2\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^6 - p^3\, q^6\, w^3\, \mathrm{vv0}(v\, w)\, v^2\, x^5\, v1$$
$$+ 2\, p^3\, q^6\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^5 - p^4\, q^6\, w^2\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^6 - p^4\, q^5\, w^2\, \mathrm{vv0}(v\, w)\, v^4\, v1\, x^6$$
$$+ p^2\, q^4\, w^2\, \mathrm{vv0}(v\, w)\, v\, v1\, x^4 - p^2\, q^3\, w^2\, \mathrm{vv0}(v\, w)\, v\, v1\, x^3 + p^4\, q^5\, w^3\, \mathrm{vv0}(v\, w)\, v^5\, v1\, x^6$$
$$+ p^3\, q^6\, w^5\, \mathrm{vv0}(v\, w)\, v^4\, v1\, x^5 + p^4\, q^7\, w^5\, \mathrm{vv0}(v\, w)\, v^5\, v1\, x^6 - p^4\, q^7\, w^5\, \mathrm{vv0}(v\, w)\, v^4\, v1\, x^6$$
$$+ 2\, \mathrm{vv0}(v\, w)\, p^2\, q^3\, v\, v1\, w\, x^4 + 2\, p^3\, q^5\, v^3\, x^5\, w^2\, \mathrm{vv0}(v\, w)\, v1 + p^3\, q^4\, v^3\, x^5\, \mathrm{vv0}(v\, w)\, v1\, w^2$$
$$- p^2\, q^3\, v^2\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w - p^2\, q^4\, v^3\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w^2 - p^2\, q^4\, v^2\, x^4\, \mathrm{vv0}(v\, w)\, v1\, w$$

$$+ p\, q^3\, v^2\, x^3\, \mathrm{vv0}(v\, w)\, v1\, w - 2\, \mathrm{vv0}(v\, w)\, p^3\, q^5\, v^5\, v1\, w^4\, x^5 + 2\, \mathrm{vv0}(v\, w)\, p^3\, q^5\, v^4\, v1\, w^4\, x^5$$
$$- \mathrm{vv0}(v\, w)\, p^3\, q^4\, v^5\, v1\, w^3\, x^5 + \mathrm{vv0}(v\, w)\, p^3\, q^4\, v^4\, v1\, w^3\, x^5 + 2\, \mathrm{vv0}(v\, w)\, p^2\, q^4\, v^4\, v1\, w^3\, x^4$$
$$- 2\, \mathrm{vv0}(v\, w)\, p\, q^2\, v\, v1\, w\, x^3 + 2\, p^4\, q^6\, w^3\, \mathrm{vv0}(v\, w)\, v^3\, v1\, x^6 - p^4\, q^5\, w^3\, \mathrm{vv0}(v\, w)\, v^4\, v1\, x^6$$
$$- p^3\, q^6\, w^4\, \mathrm{vv0}(v\, w)\, v^4\, v1\, x^5 + \mathrm{vv0}(v\, w)\, p^2\, q^2\, v^2\, v1\, w\, x^4 + 2\, \mathrm{vv0}(v\, w)\, p\, q^3\, v^2\, v1\, w^2\, x^3$$
$$- \mathrm{vv0}(v\, w)\, p\, q^3\, v\, v1\, w\, x^3 + 2\, \mathrm{vv0}(v\, w)\, p\, q^2\, v^2\, v1\, w\, x^3 - 2\, \mathrm{vv0}(v\, w)\, p^3\, q^4\, v^2\, v1\, w^2\, x^5$$
$$- 3\, \mathrm{vv0}(v\, w)\, p^2\, q^4\, v^3\, v1\, w^3\, x^4 + \mathrm{vv0}(v\, w)\, p^3\, q^3\, v^3\, v1\, w\, x^5 + \mathrm{vv0}(v\, w)\, p^2\, q^3\, v^4\, v1\, w^2\, x^4$$
$$- 3\, \mathrm{vv0}(v\, w)\, p^2\, q^3\, v^3\, v1\, w^2\, x^4 - \mathrm{vv0}(v\, w)\, p^2\, q^3\, v^3\, v1\, w\, x^4 - \mathrm{vv0}(v\, w)\, p^2\, q^2\, v^3\, v1\, w\, x^4$$
$$- \mathrm{vv0}(v\, w)\, p\, q^3\, v^3\, v1\, w^2\, x^3 - p\, q^2\, w\, v1\, x^2 - \mathrm{vv0}(v\, w)\, v\, x^2 + p\, q^2\, v1\, x^3 + p\, q^2\, w\, x^2 - q^2\, v\, v1\, x^2$$
$$+ q\, v\, v1\, x^2 - p\, q\, v^2\, x^3\, v1 - p^2\, q^4\, w\, x^3\, v1 + p^2\, q^3\, w\, x^3\, v1 + p\, q^3\, w\, x^2\, v1 + p\, q\, v\, x^3\, v1$$
$$+ \mathrm{vv0}(v\, w)\, p^3\, q^4\, v^4\, v1\, w^2\, x^5 + 2\, \mathrm{vv0}(v\, w)\, p^2\, q^3\, v^2\, v1\, w^2\, x^4 + p\, q^2\, w^2\, v\, x^3 - \mathrm{vv0}(v\, w)\, p^2\, q\, v^3\, w\, x^4$$
$$+ p^3\, q^2\, w^2\, \mathrm{vv0}(v\, w)\, v\, x^3 - 2\, \mathrm{vv0}(v\, w)\, q\, v\, w\, x^3\, p - p\, q^2\, v^3\, w\, x^3\, v1 - p\, q\, w\, \mathrm{vv0}(v\, w)\, v^2\, x^2$$
$$+ \mathrm{vv0}(v\, w)\, p^3\, q\, v\, w\, x^3 + p\, q^3\, w^2\, v\, x^3\, v1 + q^2\, v^2\, v1\, w\, x^2 - q^2\, v\, v1\, w\, x^2 - p\, q^3\, w^2\, v\, x^3$$
$$- \mathrm{vv0}(v\, w)\, p\, v\, x^3 - 3\, p^4\, q^5\, w\, v^2\, v1\, x^5 + p\, q^3\, w^2\, v\, v1\, x - 3\, p^2\, q^4\, w\, v\, v1\, x^2 + p\, q^3\, w\, v\, v1\, x$$
$$- p\, q^4\, v\, v1\, w\, x^3 - p\, q^3\, v\, v1\, w\, x^3 - p\, q^2\, v^2\, v1\, w\, x^3 + 2\, p\, q^2\, v\, v1\, w\, x^3 - 2\, p^2\, q^3\, v\, v1\, w\, x^4$$
$$+ 2\, p\, q^4\, v^2\, v1\, w\, x^3 + p\, q^3\, v^2\, v1\, w^2\, x^3 + 2\, p^2\, q^4\, v\, v1\, w\, x^4 + p^3\, q^3\, v^2\, v1\, w\, x^5 + p^2\, q^3\, v^3\, v1\, w^2\, x^4$$
$$- 2\, p^3\, q^4\, v^2\, v1\, w\, x^5 - \mathrm{vv0}(v\, w)\, p\, v\, x + p^2\, v^2\, \mathrm{vv0}(v\, w)\, x^2 + \mathrm{vv0}(v\, w)\, x^2 - p^2\, q\, w\, x^2\, \mathrm{vv0}(v\, w)$$
$$- p\, q\, w\, x\, \mathrm{vv0}(v\, w) - q\, v1\, x^2 - p\, q^3\, w^2\, v\, x^3\, \mathrm{vv0}(v\, w)\, v1 - p^4\, q^6\, v^4\, w^3\, x^6\, \mathrm{vv0}(v\, w)\, v1$$
$$+ \mathrm{vv0}(v\, w)\, p^2\, v\, x^3 - p^2\, v^2\, x^3\, \mathrm{vv0}(v\, w) - p\, v^2\, x^2\, \mathrm{vv0}(v\, w)) \Big/ ($$
$$(p\, q\, v^2\, w\, x - p\, q\, v\, w\, x + p\, q\, v\, x + p\, v^2\, x - p\, v\, x - v + 1)\, (q\, v\, w\, x + v\, x - 1)\, (p\, q\, v\, w\, x - 1)$$
$$(q\, v\, w\, x + \mathrm{vv0}(v\, w)\, x - 1)\, (p\, q^2\, v^2\, w^2\, x + \mathrm{vv0}(v\, w)\, p\, q\, v\, w\, x - p\, q^2\, x - p\, q\, v\, w\, x$$
$$- \mathrm{vv0}(v\, w)\, p\, q\, x + 2\, p\, q\, x + \mathrm{vv0}(v\, w)\, p\, x - p\, x - q\, v\, w + q)\, (p\, q\, v1\, x - 1)$$
$$(2\, q\, v1\, x - q\, x + x - 1))$$

```
>
>
>
>
> #expension of R(x,1,1;v,q)
> simplify(taylor(v*x+subs(p=v,subs(v=1,w=1,subs(FDD(x,1)=DD(x,1),vv
  0(1)=subs(w=1,VV0),vv0(v1)=subs(w=vv1,VV0),v1=vv1,vv0(v*w)=subs(w=
  v*w,VV0),FFRR2))),x,10));
```

$$v\, x + v\, (q\, v + 1)\, x^2 + v\, (q^2\, v^2 + q\, v^2 + 2\, q\, v + q + 1)\, x^3 +$$
$$v\, (q^3\, v^3 + 4\, q^2\, v^3 + 4\, q^2\, v^2 + q\, v^3 + 2\, q^2\, v + 2\, q\, v^2 + q^2 + 4\, q\, v + 2\, q + 1)\, x^4 + v\, (q^4\, v^4 + 11\, q^3\, v^4$$
$$+ 8\, q^3\, v^3 + 9\, q^2\, v^4 + 4\, q^3\, v^2 + 12\, q^2\, v^3 + q\, v^4 + 2\, q^3\, v + 14\, q^2\, v^2 + 2\, q\, v^3 + q^3 + 8\, q^2\, v + 4\, q\, v^2$$
$$+ 3\, q^2 + 6\, q\, v + 3\, q + 1)\, x^5 + v\, (q^5\, v^5 + 26\, q^4\, v^5 + 16\, q^4\, v^4 + 46\, q^3\, v^5 + 8\, q^4\, v^3 + 48\, q^3\, v^4$$
$$+ 16\, q^2\, v^5 + 4\, q^4\, v^2 + 44\, q^3\, v^3 + 24\, q^2\, v^4 + q\, v^5 + 2\, q^4\, v + 26\, q^3\, v^2 + 34\, q^2\, v^3 + 2\, q\, v^4 + q^4$$

$$+ 12 q^3 v + 32 q^2 v^2 + 4 q v^3 + 4 q^3 + 18 q^2 v + 6 q v^2 + 6 q^2 + 8 q v + 4 q + 1) x^6 + v (q^6 v^6$$
$$+ 57 q^5 v^6 + 32 q^5 v^5 + 180 q^4 v^6 + 16 q^5 v^4 + 160 q^4 v^5 + 130 q^3 v^6 + 8 q^5 v^3 + 128 q^4 v^4$$
$$+ 160 q^3 v^5 + 25 q^2 v^6 + 4 q^5 v^2 + 76 q^4 v^3 + 184 q^3 v^4 + 40 q^2 v^5 + q v^6 + 2 q^5 v + 38 q^4 v^2$$
$$+ 146 q^3 v^3 + 62 q^2 v^4 + 2 q v^5 + q^5 + 16 q^4 v + 84 q^3 v^2 + 68 q^2 v^3 + 4 q v^4 + 5 q^4 + 36 q^3 v$$
$$+ 58 q^2 v^2 + 6 q v^3 + 10 q^3 + 32 q^2 v + 8 q v^2 + 10 q^2 + 10 q v + 5 q + 1) x^7 + v (q^7 v^7 + 120 q^6 v^7$$
$$+ 64 q^6 v^6 + 603 q^5 v^7 + 32 q^6 v^5 + 480 q^5 v^6 + 750 q^4 v^7 + 16 q^6 v^4 + 352 q^5 v^5 + 800 q^4 v^6$$
$$+ 295 q^3 v^7 + 8 q^6 v^3 + 208 q^5 v^4 + 800 q^4 v^5 + 400 q^3 v^6 + 36 q^2 v^7 + 4 q^6 v^2 + 108 q^5 v^3$$
$$+ 584 q^4 v^4 + 520 q^3 v^5 + 60 q^2 v^6 + q v^7 + 2 q^6 v + 50 q^5 v^2 + 338 q^4 v^3 + 482 q^3 v^4 + 98 q^2 v^5$$
$$+ 2 q v^6 + q^6 + 20 q^5 v + 160 q^4 v^2 + 352 q^3 v^3 + 116 q^2 v^4 + 4 q v^5 + 6 q^5 + 60 q^4 v + 196 q^3 v^2$$
$$+ 114 q^2 v^3 + 6 q v^4 + 15 q^4 + 80 q^3 v + 92 q^2 v^2 + 8 q v^3 + 20 q^3 + 50 q^2 v + 10 q v^2 + 15 q^2$$
$$+ 12 q v + 6 q + 1) x^8 + \mathrm{O}(x^9)$$

```
>
> #formula for R(x,1,1;v,q)
> Rx11vq:=simplify(factor(simplify(rationalize(subs(p=v,subs(v=1,w=1
,subs(FDD(x,1)=DD(x,1),vv0(1)=subs(w=1,VV0),vv0(v1)=subs(w=vv1,VV0
),v1=vv1,vv0(v*w)=subs(w=v*w,VV0),FFRR2))))+1)-1)):
simplify(taylor(-Rx11vq+subs(p=v,subs(v=1,w=1,AAP(x,v,w)+v^2*CC(x,
v*w)+v^3*DD(x,v*w)+v*EE(v*x,w))),x,14));
```

$$\mathrm{O}(x^{14})$$

```
> #formulas of U0,UP,UN, U=FU from Section2
> U0:=(x,v)->1/2*(v*x^2*(2*(v-1)*v*q*x-(v-3)*v*x-3*v+1)+v*(v+1)*x^2*
((1-2*q)^2*v^2*x^2-2*v*x*(1+2*q)+1)^(1/2))/(2*q*v*x-v*x+v+x-1)/(q*
v*x-v*x-1):
UP:=(x,v,w)->-1/2*x^2*w^2*v*q*(q*v*w*x-v+x)/(2*q*v*w*x-v*w*x+v*w+x
-1)/(q^2*v*w^2*x^2-q*v*w^2*x^2-q*w*x+v*w*x-w*x-v+1)*((1-2*q)^2*v^2
*w^2*x^2-2*v*w*x*(1+2*q)+1)^(1/2)-1/2*x^2*w^2*v*q*(v+(-2*q*v^2*w-q
*v*w+v^2*w-2*v*w-2*v+1)*x+v*w*(2*q^2*v*w-q*v*w+1)*x^2)/(q^2*v*w^2*
x^2-q*v*w^2*x^2-q*w*x+v*w*x-w*x-v+1)/(2*q*v*w*x-v*w*x+v*w+x-1):
UN:=(x,v,w)->1/2*x^2*w*v^2*q*(q*v*w*x-v*w*x+v*w+w-1)/(2*q*v*w*x-v*
w*x+v*w+x-1)/(q^2*v^2*w*x^2-q*v^2*w*x^2-q*v*x+v*w*x-v*x-w+1)*((1-2
*q)^2*v^2*w^2*x^2-2*v*w*x*(1+2*q)+1)^(1/2)+1/2*(-2*q*v*x^2+q*v*x-2
*v*x^2+2*v*x+2*x-1+(2*q^2*v^2*x^3-3*q^2*v^2*x^2-2*q*v^2*x^3-q*v^2*
x+2*v^2*x^2+2*q*v*x-2*v^2*x+2*v*x^2-4*v*x+v-2*x+1)*w+v*x*(2*q-1)*(
q*v*x-1)*(q*v*x-v*x+v+1)*w^2)*q*v^2*w*x^2/(q^2*v^2*w*x^2-q*v^2*w*x
^2-q*v*x+v*w*x-v*x-w+1)/(q*v*x-1)/(2*q*v*w*x-v*w*x+v*w+x-1):
FU:=(x,v,w)->U0(x,v*w)+UP(x,v,w)+UN(x,v,w);
```

$$FU := (x, v, w) \to \mathrm{U0}(x, v\,w) + \mathrm{UP}(x, v, w) + \mathrm{UN}(x, v, w)$$

```
> simplify(taylor(v*x+Rx11vq-( FU(x,v,1)+v*x/(1-v*q*x)   ),x,17));
```

$$\mathrm{O}(x^{16})$$

```
> simplify(v*x+Rx11vq-( FU(x,v,1)+v*x/(1-v*q*x))  );
```

$$0$$

```
>
>
>
>
>
>
> tt:=40*p^2*q^2*x^2-32*p^2*q*x^2-12*(4*p^2*q^2*x^2-4*p^2*q*x^2+p^2*
  x^2-4*p*q*x-2*p*x+1)^(1/2)*p*q*x+10*p^2*x^2-6*(4*p^2*q^2*x^2-4*p^2
  *q*x^2+p^2*x^2-4*p*q*x-2*p*x+1)^(1/2)*p*x-40*p*q*x-20*p*x+10+6*(4*
  p^2*q^2*x^2-4*p^2*q*x^2+p^2*x^2-4*p*q*x-2*p*x+1)^(1/2);
```

$$tt := 40\,p^2\,q^2\,x^2 - 32\,p^2\,q\,x^2 - 12\sqrt{4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1}\;p\,q\,x + 10\,p^2\,x^2 - 6\sqrt{4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1}\;p\,x - 40\,p\,q\,x - 20\,p\,x + 10 + 6\sqrt{4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1}$$

```
> coeff(tt,(4*p^2*q^2*x^2-4*p^2*q*x^2+p^2*x^2-4*p*q*x-2*p*x+1)^(1/2)
  ,1)*(4*p^2*q^2*x^2-4*p^2*q*x^2+p^2*x^2-4*p*q*x-2*p*x+1)^(1/2)+fact
  or(coeff(tt,(4*p^2*q^2*x^2-4*p^2*q*x^2+p^2*x^2-4*p*q*x-2*p*x+1)^(1
  /2),0));
```

$$(-12\,p\,q\,x - 6\,p\,x + 6)\sqrt{4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1} + 40\,p^2\,q^2\,x^2 - 32\,p^2\,q\,x^2 + 10\,p^2\,x^2 - 40\,p\,q\,x - 20\,p\,x + 10$$

```
> A^2+B^2*(4*p^2*q^2*x^2-4*p^2*q*x^2+p^2*x^2-4*p*q*x-2*p*x+1)+2*A*B*
  (4*p^2*q^2*x^2-4*p^2*q*x^2+p^2*x^2-4*p*q*x-2*p*x+1)^(1/2);
```

$$A^2 + B^2\,(4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1) + 2\,A\,B\sqrt{4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1}$$

```
> solve({2*A*B=-12*p*q*x-6*p*x+6,
  A^2+B^2*(4*p^2*q^2*x^2-4*p^2*q*x^2+p^2*x^2-4*p*q*x-2*p*x+1)=+40*p^
  2*q^2*x^2-32*p^2*q*x^2+10*p^2*x^2-40*p*q*x-20*p*x+10},{A,B});
```

$$\{A = -2\,p\,q\,x - p\,x + 1,\ B = 3\},\ \{A = 2\,p\,q\,x + p\,x - 1,\ B = -3\},\ \{A = -\frac{3}{\mathrm{RootOf}((4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1)\,\_Z^2 - 1)},\ B = \mathrm{RootOf}((4\,p^2\,q^2\,x^2 - 4\,p^2\,q\,x^2 + p^2\,x^2 - 4\,p\,q\,x - 2\,p\,x + 1)\,\_Z^2 - 1)\,(2\,p\,q\,x + p\,x - 1)\}$$

```
> simplify(taylor(sqrt(tt)-(1-p*x-2*p*q*x+3*(4*p^2*q^2*x^2-4*p^2*q*x
  ^2+p^2*x^2-4*p*q*x-2*p*x+1)^(1/2)),x,14));
```

$$\mathrm{O}(x^{14})$$

```
>
```