```
> restart;
> read "hsum19.mpl";
```

Package "Hypergeometric Summation", Maple V - Maple 2019

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```
> RecurrenceNormalForm2:=proc(P,k,pn)
  local p,n;
  p:=op(0,pn);
  n:=op(1,pn);
  [sumrecursion(P,k,p(n)),normal(subs[eval]({k=0,n=0},P)),normal
  (subs[eval]({k=0,n=1},P)+subs[eval]({k=1,n=1},P))]
  end proc:
```

Jacobi polynomials

```
> term1:=pochhammer(alpha+1,n)/n!*hyperterm([-n,n+alpha+beta+1],
  [alpha+1],(1-x)/2,k);
```

$$term1 := \frac{\mathrm{pochhammer}(\alpha+1,n)\,\mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}(n+\alpha+\beta+1,k)\left(\frac{1}{2}-\frac{x}{2}\right)^k}{n!\,\mathrm{pochhammer}(\alpha+1,k)\,k!} \quad \textbf{(2)}$$

```
> RE1:=RecurrenceNormalForm2(term1,k,p(n));
```

$$RE1 := \left[2\,(n+2)\,(2+2\,n+\alpha+\beta)\,(n+2+\alpha+\beta)\,p(n+2)-(2\,n+3+\alpha+\beta)\,(\alpha^2 x + 2\,\alpha\,\beta\,x+4\,\alpha\,n\,x+\beta^2 x+4\,\beta\,n\,x+4\,n^2 x+\alpha^2+6\,\alpha\,x-\beta^2+6\,\beta\,x+12\,n\,x+8\,x)\,p(n+1)+2\,(1+n+\beta)\,(\alpha+1+n)\,(\alpha+\beta+2\,n+4)\,p(n)=0,\,1,\,\frac{1}{2}\,\alpha+x+\frac{1}{2}\,\alpha\,x-\frac{1}{2}\,\beta+\frac{1}{2}\,\beta\,x\right] \quad \textbf{(3)}$$

```
> term2:=(-1)^n*binomial(n+beta,n)*hyperterm([-n,n+alpha+beta+1],
  [beta+1],(1+x)/2,k);
```

$$term2 := \frac{(-1)^n\binom{n+\beta}{n}\,\mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}(n+\alpha+\beta+1,k)\left(\frac{1}{2}+\frac{x}{2}\right)^k}{\mathrm{pochhammer}(\beta+1,k)\,k!} \quad \textbf{(4)}$$

```
> RE2:=RecurrenceNormalForm2(term2,k,p(n));
```

$$RE2 := \left[2\,(n+2)\,(2+2\,n+\alpha+\beta)\,(n+2+\alpha+\beta)\,p(n+2)-(2\,n+3+\alpha+\beta)\,(\alpha^2 x + 2\,\alpha\,\beta\,x+4\,\alpha\,n\,x+\beta^2 x+4\,\beta\,n\,x+4\,n^2 x+\alpha^2+6\,\alpha\,x-\beta^2+6\,\beta\,x+12\,n\,x+8\,x)\,p(n+1)+2\,(1+n+\beta)\,(\alpha+1+n)\,(\alpha+\beta+2\,n+4)\,p(n)=0,\,1,\,\frac{1}{2}\,\alpha+x+\frac{1}{2}\,\alpha\,x-\frac{1}{2}\,\beta+\frac{1}{2}\,\beta\,x\right] \quad \textbf{(5)}$$

```
> simplify(RE1-RE2);
```

$$[0,0,0] \quad \textbf{(6)}$$

```
> term3:=binomial(2*n+alpha+beta,n)*((x-1)/2)^n*hyperterm([-n,-n-alpha],[-2*n-alpha-beta],2/(1-x),k);
```

$$term3 := \frac{\binom{2n+\alpha+\beta}{n}\left(-\frac{1}{2}+\frac{x}{2}\right)^n \mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}(-n-\alpha,k)\left(\frac{2}{1-x}\right)^k}{\mathrm{pochhammer}(-2n-\alpha-\beta,k)\,k!} \tag{7}$$

```
> RE3:=RecurrenceNormalForm2(term3,k,p(n));
```

$$RE3 := \left[2(n+2)(2+2n+\alpha+\beta)(n+2+\alpha+\beta)\,p(n+2)-(2n+3+\alpha+\beta)\left(\alpha^2 x+2\alpha\beta x+4\alpha n x+\beta^2 x+4\beta n x+4n^2 x+\alpha^2+6\alpha x-\beta^2+6\beta x+12nx+8x\right)p(n+1)+2(1+n+\beta)(\alpha+1+n)(\alpha+\beta+2n+4)\,p(n)=0,\ 1,\ \frac{1}{2}\alpha+x+\frac{1}{2}\alpha x-\frac{1}{2}\beta+\frac{1}{2}\beta x\right] \tag{8}$$

```
> simplify(RE1-RE3);
```

$$[0,0,0] \tag{9}$$

```
> term4:=binomial(n+alpha,n)*((1+x)/2)^n*hyperterm([-n,-n-beta],[alpha+1],(x-1)/(x+1),k);
```

$$term4 := \frac{\binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^n \mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}(-n-\beta,k)\left(\frac{-1+x}{1+x}\right)^k}{\mathrm{pochhammer}(\alpha+1,k)\,k!} \tag{10}$$

```
> RE4:=RecurrenceNormalForm2(term4,k,p(n));
```

$$RE4 := \left[2(n+2)(2+2n+\alpha+\beta)(n+2+\alpha+\beta)\,p(n+2)-(2n+3+\alpha+\beta)\left(\alpha^2 x+2\alpha\beta x+4\alpha n x+\beta^2 x+4\beta n x+4n^2 x+\alpha^2+6\alpha x-\beta^2+6\beta x+12nx+8x\right)p(n+1)+2(1+n+\beta)(\alpha+1+n)(\alpha+\beta+2n+4)\,p(n)=0,\ 1,\ \frac{1}{2}\alpha+x+\frac{1}{2}\alpha x-\frac{1}{2}\beta+\frac{1}{2}\beta x\right] \tag{11}$$

```
> simplify(RE1-RE4);
```

$$[0,0,0] \tag{12}$$

```
> term5:=binomial(n+beta,n)*((x-1)/2)^n*hyperterm([-n,-n-alpha],[beta+1],(x+1)/(x-1),k);
```

$$term5 := \frac{\binom{n+\beta}{n}\left(-\frac{1}{2}+\frac{x}{2}\right)^n \mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}(-n-\alpha,k)\left(\frac{1+x}{-1+x}\right)^k}{\mathrm{pochhammer}(\beta+1,k)\,k!} \tag{13}$$

```
> RE5:=RecurrenceNormalForm2(term5,k,p(n));
```

$$RE5 := \left[2(n+2)(2+2n+\alpha+\beta)(n+2+\alpha+\beta)\,p(n+2)-(2n+3+\alpha+\beta)\left(\alpha^2 x\right.\right. \tag{14}$$

$$+ 2\,\alpha\,\beta\,x + 4\,\alpha\,n\,x + \beta^2\,x + 4\,\beta\,n\,x + 4\,n^2\,x + \alpha^2 + 6\,\alpha\,x - \beta^2 + 6\,\beta\,x + 12\,n\,x + 8\,x\Big)\,p(n$$

$$+ 1) + 2\,(1 + n + \beta)\,(\alpha + 1 + n)\,(\alpha + \beta + 2\,n + 4)\,p(n) = 0,\ 1,\ \frac{1}{2}\,\alpha + x + \frac{1}{2}\,\alpha\,x$$

$$- \frac{1}{2}\,\beta + \frac{1}{2}\,\beta\,x\Big]$$

```
> simplify(RE1-RE5);
```

$$[0, 0, 0] \tag{15}$$

Next, we reverse the order of summation of series 1.

```
> convert(Sumtohyper(subs(k=n-k,term1),k),binomial);
```

$$(-1)^n \left(\frac{1}{2} - \frac{x}{2}\right)^n \mathrm{Hypergeom}\left([-n-\alpha, -n], [-2\,n-\alpha-\beta], \frac{2}{1-x}\right) \binom{2\,n+\alpha+\beta}{n} \tag{16}$$

```
> term3a:=termtohyper(subs(k=n-k,term1),k);
```

$$term3a := \frac{1}{n!^2\,\mathrm{pochhammer}(-2\,n-\alpha-\beta, k)\,k!} \Big(\mathrm{pochhammer}(-n, n)\,\mathrm{pochhammer}(n + \alpha \tag{17}$$

$$+ \beta + 1, n)\left(\frac{1}{2} - \frac{x}{2}\right)^n \mathrm{pochhammer}(-n-\alpha, k)\,\mathrm{pochhammer}(-n, k)\left(\frac{2}{1-x}\right)^k\Big)$$

```
> simplify(term3/term3a) assuming n::integer;
```

$$1 \tag{18}$$

This shows that the reverse of series 1 is series 3.

Let's reverse series 2:

```
> convert(Sumtohyper(subs(k=n-k,term2),k),binomial);
```

$$\left((-1)^n\right)^2 \left(\frac{1}{2} + \frac{x}{2}\right)^n \mathrm{Hypergeom}\Big([-n-\beta, -n], [-2\,n-\alpha-\beta], \tag{19}$$

$$-\frac{2}{-x-1}\Big) \binom{2\,n+\alpha+\beta}{n}$$

This is a new identity, not yet in our list.

```
> term6:=binomial(2*n+alpha+beta,n)*((1+x)/2)^n*hyperterm([-n,-n-
  beta],[-2*n-alpha-beta],2/(1+x),k);
```

$$term6 := \tag{20}$$

$$\frac{\binom{2\,n+\alpha+\beta}{n}\left(\frac{1}{2} + \frac{x}{2}\right)^n \mathrm{pochhammer}(-n, k)\,\mathrm{pochhammer}(-n-\beta, k)\left(\frac{2}{1+x}\right)^k}{\mathrm{pochhammer}(-2\,n-\alpha-\beta, k)\,k!}$$

```
> RE6:=RecurrenceNormalForm2(term6,k,p(n));
```

$$RE6 := \Big[2\,(n+2)\,(2 + 2\,n + \alpha + \beta)\,(n + 2 + \alpha + \beta)\,p(n+2) - (2\,n + 3 + \alpha + \beta)\,(\alpha^2\,x \tag{21}$$

$$+ 2\,\alpha\,\beta\,x + 4\,\alpha\,n\,x + \beta^2\,x + 4\,\beta\,n\,x + 4\,n^2\,x + \alpha^2 + 6\,\alpha\,x - \beta^2 + 6\,\beta\,x + 12\,n\,x + 8\,x\Big)\,p(n$$

$$+ 1) + 2\,(1 + n + \beta)\,(\alpha + 1 + n)\,(\alpha + \beta + 2\,n + 4)\,p(n) = 0,\ 1,\ \frac{1}{2}\,\alpha + x + \frac{1}{2}\,\alpha\,x$$

$$-\frac{1}{2}\beta+\frac{1}{2}\beta x\Big]$$

```
> simplify(RE1-RE6);
```

$$[0, 0, 0] \tag{22}$$

Let's reverse series 4:

```
> convert(Sumtohyper(subs(k=n-k,term4),k),binomial);
```

$$\frac{\left(\frac{1}{2}+\frac{x}{2}\right)^{n}(-1)^{n}(-1+x)^{n}\,\mathrm{Hypergeom}\left([-n-\alpha,-n],[\beta+1],\frac{1+x}{-1+x}\right)\binom{-\beta-1}{n}}{(1+x)^{n}} \tag{23}$$

```
> term5a:=termtohyper(subs(k=n-k,term4),k);
```

$$term5a := \left(\binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^{n}\mathrm{pochhammer}(-n,n)\,\mathrm{pochhammer}(-n-\beta, n)\left(\frac{-1+x}{1+x}\right)^{n}\mathrm{pochhammer}(-n-\alpha,k)\,\mathrm{pochhammer}(-n,k)\left(\frac{1+x}{-1+x}\right)^{k}\right)\Big/\left(\mathrm{pochhammer}(\alpha+1,n)\,n!\,\mathrm{pochhammer}(\beta+1,k)\,k!\right) \tag{24}$$

```
> simplify(term5/term5a) assuming n::integer;
```

$$1 \tag{25}$$

This shows that the reverse of series 4 is series 5.

Relation (15.8.1) in Olver, Lozier, Boisvert and Clark, 2010

```
> TERM1:= (1-z)^(-a)*Hypergeom([a, c-b],[c],z/(z-1));
```

$$TERM1 := (1-z)^{-a}\,\mathrm{Hypergeom}\left([a,c-b],[c],\frac{z}{z-1}\right) \tag{26}$$

```
> TERM2:= (1-z)^(-b)*Hypergeom([c-a, b],[c],z/(z-1));
```

$$TERM2 := (1-z)^{-b}\,\mathrm{Hypergeom}\left([c-a,b],[c],\frac{z}{z-1}\right) \tag{27}$$

```
> TERM3:=(1-z)^(c-a-b)*Hypergeom([c-a, c-b],[c],z);
```

$$TERM3 := (1-z)^{c-a-b}\,\mathrm{Hypergeom}([c-a,c-b],[c],z) \tag{28}$$

Relation (15.8.6) in Olver, Lozier, Boisvert and Clark, 2010

```
> TERM4:=pochhammer(b,n)/pochhammer(c,n)*(-z)^n*Hypergeom([-n,1-c-
  n],[1-b-n],1/z);
```

$$TERM4 := \frac{\mathrm{pochhammer}(b,n)\,(-z)^{n}\,\mathrm{Hypergeom}\left([-n,1-c-n],[1-b-n],\frac{1}{z}\right)}{\mathrm{pochhammer}(c,n)} \tag{29}$$

```
> TERM5:=pochhammer(b,n)/pochhammer(c,n)*(1-z)^n*Hypergeom([-n,c-
  b],[1-b-n],1/(1-z));
```

$$TERM5 := \frac{\mathrm{pochhammer}(b,n)\,(1-z)^{n}\,\mathrm{Hypergeom}\left([-n,c-b],[1-b-n],\frac{1}{1-z}\right)}{\mathrm{pochhammer}(c,n)} \tag{30}$$

Relation (15.8.7) in Olver, Lozier, Boisvert and Clark, 2010

```
> TERM6:=pochhammer(c-b,n)/pochhammer(c,n)*Hypergeom([-n,b],[b-c-
  n+1],1-z);
```

(31)

$$TERM6 := \frac{\text{pochhammer}(c-b,n)\,\text{Hypergeom}([-n,b],[b-c-n+1],1-z)}{\text{pochhammer}(c,n)} \tag{31}$$

```
> TERM7:=pochhammer(c-b,n)/pochhammer(c,n)*(z)^n*Hypergeom([-n,1-c-
  n],[b-c-n+1],1-1/z);
```

$$TERM7 := \frac{\text{pochhammer}(c-b,n)\,z^n\,\text{Hypergeom}\left([-n,1-c-n],[b-c-n+1],1-\frac{1}{z}\right)}{\text{pochhammer}(c,n)} \tag{32}$$

Substitutions done in order to get series 1 and 2

```
> chang1:= {a=-n, b=n+alpha+beta+1,c=alpha+1, z=(1-x)/2};
```

$$chang1 := \left\{a=-n,\, b=n+\alpha+\beta+1,\, c=\alpha+1,\, z=\frac{1}{2}-\frac{x}{2}\right\} \tag{33}$$

```
> chang2:= {a=-n, b=n+alpha+beta+1,c=beta+1, z=(1+x)/2};
```

$$chang2 := \left\{a=-n,\, b=n+\alpha+\beta+1,\, c=\beta+1,\, z=\frac{1}{2}+\frac{x}{2}\right\} \tag{34}$$

We substitute chang1 in (15.8.6) and (15.8.7)

```
> ser31:=simplify(subs(chang1, binomial(n+alpha, n)*TERM4));
```

$$ser31 := \left(-\frac{1}{2}+\frac{x}{2}\right)^n \text{Hypergeom}\left([-n,-n-\alpha],[-2n-\alpha-\beta],-\frac{2}{-1+x}\right)\binom{2n+\alpha+\beta}{n} \tag{35}$$

```
> term31:=binomial(n+alpha, n)*pochhammer(n+alpha+beta+1, n)*(-1/2+
  (1/2)*x)^n*hyperterm([-n, -n-alpha], [-2*n-alpha-beta], -2/(-1+
  x),k)/pochhammer(alpha+1, n);
```

$$term31 := \left(\binom{n+\alpha}{n}\text{pochhammer}(n+\alpha+\beta+1,n)\left(-\frac{1}{2}+\frac{x}{2}\right)^n \text{pochhammer}(-n,k)\,\text{pochhammer}(-n-\alpha,k)\left(-\frac{2}{-1+x}\right)^k\right) \Big/ \left(\text{pochhammer}(-2n-\alpha-\beta,k)\,k!\,\text{pochhammer}(\alpha+1,n)\right) \tag{36}$$

```
> simplify(term3/term31);
```

$$1 \tag{37}$$

We recover here series 3

```
> ser61:=simplify(subs(chang1, binomial(n+alpha, n)*TERM5));
```

$$ser61 := \left(\frac{1}{2}+\frac{x}{2}\right)^n \text{Hypergeom}\left([-n,-n-\beta],[-2n-\alpha-\beta],\frac{2}{1+x}\right)\binom{2n+\alpha+\beta}{n} \tag{38}$$

```
> term61:=binomial(n+alpha, n)*pochhammer(n+alpha+beta+1, n)*(1/2+
  (1/2)*x)^n*hyperterm([-n, -n-beta], [-2*n-alpha-beta], 2/(1+x),k)
  /pochhammer(alpha+1, n);
```

$$term61 := \left(\binom{n+\alpha}{n}\text{pochhammer}(n+\alpha+\beta+1,n)\left(\frac{1}{2}+\frac{x}{2}\right)^n \text{pochhammer}(-n,k)\,\text{pochhammer}(-n-\beta,k)\left(\frac{2}{1+x}\right)^k\right) \Big/ \left(\text{pochhammer}(-2n-\alpha-\beta,k)\,k!\right. \tag{39}$$

$\text{pochhammer}(\alpha+1, n))$

```
> simplify(term6/term61);
```

$$1 \tag{40}$$

We recover here series 6

```
> ser21:=simplify(subs(chang1, binomial(n+alpha, n)*TERM6));
```

$$ser21 := \text{Hypergeom}\left([-n, n+\alpha+\beta+1], [\beta+1], \frac{1}{2}+\frac{x}{2}\right)\binom{-\beta-1}{n} \tag{41}$$

```
> term21:=GAMMA(-beta)*hyperterm([-n, n+alpha+beta+1], [1+beta],
  1/2+(1/2)*x,k)/(GAMMA(n+1)*GAMMA(-n-beta));
```

$$term21 := \frac{\Gamma(-\beta)\,\text{pochhammer}(-n,k)\,\text{pochhammer}(n+\alpha+\beta+1,k)\left(\frac{1}{2}+\frac{x}{2}\right)^k}{\text{pochhammer}(\beta+1,k)\,k!\,\Gamma(n+1)\,\Gamma(-n-\beta)} \tag{42}$$

```
> simplify(term2/term21) assuming n::integer;
```

$$1 \tag{43}$$

We recover here series 2

```
> ser51:=simplify(subs(chang1, binomial(n+alpha, n)*TERM7));
```

$$ser51 := \left(\frac{1}{2}-\frac{x}{2}\right)^n \text{Hypergeom}\left([-n, -n-\alpha], [\beta+1], \frac{1+x}{-1+x}\right)\binom{-\beta-1}{n} \tag{44}$$

```
> term51:=GAMMA(-beta)*(1/2-(1/2)*x)^n*hyperterm([-n, -n-alpha],
  [1+beta], (1+x)/(-1+x),k)/(GAMMA(n+1)*GAMMA(-n-beta));
```

$$term51 := \frac{\Gamma(-\beta)\left(\frac{1}{2}-\frac{x}{2}\right)^n \text{pochhammer}(-n,k)\,\text{pochhammer}(-n-\alpha,k)\left(\frac{1+x}{-1+x}\right)^k}{\text{pochhammer}(\beta+1,k)\,k!\,\Gamma(n+1)\,\Gamma(-n-\beta)} \tag{45}$$

```
> simplify(term5/term51) assuming n::integer;
```

$$1 \tag{46}$$

We recover here series 5

We now substitute chang2 in (15.8.6) and (15.8.7)

```
> simpcomb(subs(chang2, [(-1)^n*binomial(n+beta, n)*TERM4, (-1)^n*
  binomial(n+beta, n)*TERM5, (-1)^n*binomial(n+beta, n)*TERM6, (-1)
  ^n*binomial(n+beta, n)*TERM7]));
```

$$\left[\frac{1}{\Gamma(n+1)\,\Gamma(n+\alpha+\beta+1)}\left((-1)^n\,\Gamma(2n+\alpha+\beta+1)\left(-\frac{1}{2}-\frac{x}{2}\right)^n \text{Hypergeom}\left([-n, -n-\beta], [-2n-\alpha-\beta], \frac{2}{1+x}\right)\right), \frac{1}{\Gamma(n+1)\,\Gamma(n+\alpha+\beta+1)}\left((-1)^n\,\Gamma(2n+\alpha+\beta+1)\left(\frac{1}{2}-\frac{x}{2}\right)^n \text{Hypergeom}\left([\right.\right. \tag{47}$$

$$-n, -n-\alpha], [-2n-\alpha-\beta], -\frac{2}{-1+x}\Big)\Big),$$

$$\frac{(-1)^n \Gamma(-\alpha)\ \mathrm{Hypergeom}\left([-n, n+\alpha+\beta+1], [\alpha+1], \frac{1}{2}-\frac{x}{2}\right)}{\Gamma(n+1)\,\Gamma(-n-\alpha)},$$

$$\frac{(-1)^n \Gamma(-\alpha)\left(\frac{1}{2}+\frac{x}{2}\right)^n \mathrm{Hypergeom}\left([-n, -n-\beta], [\alpha+1], \frac{-1+x}{1+x}\right)}{\Gamma(n+1)\,\Gamma(-n-\alpha)}\Bigg]$$

and recover series 6, series 3, series 1, and series 4.

The substitution of chang1 in (15.8.1) yields

```
> sol1:=simplify(subs(chang1, [binomial(n+alpha, n)*TERM1, binomial
  (n+alpha, n)*TERM2, binomial(n+alpha, n)*TERM3]));
```

$$sol1 := \Bigg[\binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^n \mathrm{Hypergeom}\left([-n, -n-\beta], [\alpha+1], \frac{-1+x}{1+x}\right), \binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^{-n-\alpha-\beta-1} \mathrm{Hypergeom}\left([\alpha+1+n, n+\alpha+\beta+1], [\alpha+1], \frac{-1+x}{1+x}\right), \binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^{-\beta} \mathrm{Hypergeom}\left([\alpha+1+n, -n-\beta], [\alpha+1], \frac{1}{2}-\frac{x}{2}\right)\Bigg] \quad \textbf{(48)}$$

We recover here series 4 and two series representations of the Jacobi polynomials

```
> series1:=sol1[2];
```

$$series1 := \binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^{-n-\alpha-\beta-1} \mathrm{Hypergeom}\left([\alpha+1+n, n+\alpha+\beta+1], [\alpha+1], \frac{-1+x}{1+x}\right) \quad \textbf{(49)}$$

```
> series2:= sol1[3];
```

$$series2 := \binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^{-\beta} \mathrm{Hypergeom}\left([\alpha+1+n, -n-\beta], [\alpha+1], \frac{1}{2}-\frac{x}{2}\right) \quad \textbf{(50)}$$

```
> termseries1:=binomial(n+alpha, n)*(1/2+(1/2)*x)^(-n-alpha-beta-1)
  *hyperterm([alpha+1+n, n+alpha+beta+1], [alpha+1], (-1+x)/(1+x),
  k);
```

$$termseries1 := \frac{1}{\mathrm{pochhammer}(\alpha+1, k)\ k!}\left(\binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^{-n-\alpha-\beta-1} \mathrm{pochhammer}(\alpha+1+n, k)\ \mathrm{pochhammer}(n+\alpha+\beta+1, k)\left(\frac{-1+x}{1+x}\right)^k\right) \quad \textbf{(51)}$$

```
> termseries2:=binomial(n+alpha, n)*(1/2+(1/2)*x)^(-beta)*hyperterm
  ([alpha+1+n, -n-beta], [alpha+1], 1/2-(1/2)*x, k);
```

$$termseries2 := \quad \textbf{(52)}$$

$$\frac{1}{\text{pochhammer}(\alpha+1,k)\,k!}\left(\binom{n+\alpha}{n}\left(\frac{1}{2}+\frac{x}{2}\right)^{-\beta}\text{pochhammer}(\alpha+1+n,k)\,\text{pochhammer}(-n-\beta,k)\left(\frac{1}{2}-\frac{x}{2}\right)^{k}\right)$$

```
> op(1, sumrecursion(termseries1,k,p(n)))-op([1,1],RE1);
  op(1, sumrecursion(termseries2,k,p(n)))-op([1,1],RE1);
```

$$0$$

$$0 \tag{53}$$

This means the latter two series representations satisfy the same recurrence relation with the same initial conditions given below.

```
> initial1:=simplify([sum(subs(n=0,termseries1), k=0..infinity),
  sum(subs(n=1,termseries1), k=0..infinity)]) assuming(x>0,x<1);
```

$$initial1 := \left[1, \frac{(2+\alpha+\beta)\,x}{2} - \frac{\beta}{2} + \frac{\alpha}{2}\right] \tag{54}$$

```
> initial2:=simplify([sum(subs(n=0,termseries2), k=0..infinity),
  sum(subs(n=1,termseries2), k=0..infinity)]) assuming(x>0,x<1);
```

$$initial2 := \left[1, \frac{(2+\alpha+\beta)\,x}{2} - \frac{\beta}{2} + \frac{\alpha}{2}\right] \tag{55}$$

```
> [op(2, RE1),op(3, RE1)];
```

$$\left[1, \frac{1}{2}\alpha + x + \frac{1}{2}\alpha x - \frac{1}{2}\beta + \frac{1}{2}\beta x\right] \tag{56}$$

```
> simplify(initial2- [op(2, RE1),op(3, RE1)]);
```

$$[0, 0] \tag{57}$$

The substitution of chang2 in (15.8.1) yields

```
> sol2:=simplify(subs(chang2, [(-1)^n*binomial(n+beta, n)*TERM1,
  (-1)^n*binomial(n+beta, n)*TERM2, (-1)^n*binomial(n+beta, n)*
  TERM3]));
```

$$sol2 := \left[(-1)^n\binom{n+\beta}{n}\left(\frac{1}{2}-\frac{x}{2}\right)^{n}\text{Hypergeom}\left([-n,-n-\alpha],[\beta+1],\frac{1+x}{-1+x}\right), (-1)^n\binom{n+\beta}{n}\left(\frac{1}{2}-\frac{x}{2}\right)^{-n-\alpha-\beta-1}\text{Hypergeom}\left([1+n+\beta,n+\alpha+\beta+1],[\beta+1],\frac{1+x}{-1+x}\right), (-1)^n\binom{n+\beta}{n}\left(\frac{1}{2}-\frac{x}{2}\right)^{-\alpha}\text{Hypergeom}\left([1+n+\beta,-n-\alpha],[\beta+1],\frac{1}{2}+\frac{x}{2}\right)\right] \tag{58}$$

We recover here series 5 and two series representations of the Jacobi polynomials

```
> series3:=sol2[2];
```

$$series3 := (-1)^n\binom{n+\beta}{n}\left(\frac{1}{2}-\frac{x}{2}\right)^{-n-\alpha-\beta-1}\text{Hypergeom}\left([1+n+\beta,n+\alpha+\beta+1],[\beta+1],\frac{1+x}{-1+x}\right) \tag{59}$$

```
> series4:= sol2[3];
```

$$series4 := (-1)^n \binom{n+\beta}{n} \left(\frac{1}{2} - \frac{x}{2}\right)^{-\alpha} \text{Hypergeom}\left([1+n+\beta, -n-\alpha], [\beta+1], \frac{1}{2} + \frac{x}{2}\right) \tag{60}$$

```
> termseries3:=-(-1)^(n+1)*binomial(n+beta, n)*(1/2-(1/2)*x)^(-n-alpha-beta-1)*hyperterm([n+beta+1, n+alpha+beta+1], [1+beta], (1+x)/(-1+x), k);
```

$$termseries3 := -\frac{1}{\text{pochhammer}(\beta+1, k)\, k!} \left((-1)^{n+1} \binom{n+\beta}{n} \left(\frac{1}{2} - \frac{x}{2}\right)^{-n-\alpha-\beta}{}^{-1} \text{pochhammer}(1+n+\beta, k)\, \text{pochhammer}(n+\alpha+\beta+1, k) \left(\frac{1+x}{-1+x}\right)^k\right) \tag{61}$$

```
> termseries4:=(-1)^n*binomial(n+beta, n)*(1/2-(1/2)*x)^(-alpha)*hyperterm([n+beta+1, -n-alpha], [1+beta], 1/2+(1/2)*x, k);
```

$$termseries4 := \frac{1}{\text{pochhammer}(\beta+1, k)\, k!} \left((-1)^n \binom{n+\beta}{n} \left(\frac{1}{2} - \frac{x}{2}\right)^{-\alpha} \text{pochhammer}(1+n+\beta, k)\, \text{pochhammer}(-n-\alpha, k) \left(\frac{1}{2} + \frac{x}{2}\right)^k\right) \tag{62}$$

```
> op(1, sumrecursion(termseries3,k,p(n)))-op([1,1],RE1);
  op(1, sumrecursion(termseries4,k,p(n)))-op([1,1],RE1);
```

$$0$$

$$0 \tag{63}$$

This means the latter two series representations satisfy the same recurrence relation with the same initial conditions given below.

```
> initial3:=simplify([sum(subs(n=0,termseries3), k=0..infinity), sum(subs(n=1,termseries3), k=0..infinity)]) assuming(x>0,x<1);
```

$$initial3 := \left[-2\left(\sum_{k=0}^{\infty} \frac{(-1+x)^{-1-k} (1+x)^k \left(\frac{1}{2} - \frac{x}{2}\right)^{-\alpha-\beta} \text{pochhammer}(1+\alpha+\beta, k)}{k!}\right), -4\left(\sum_{k=0}^{\infty} \frac{(-1+x)^{-2-k} (1+x)^k (k+\beta+1) \left(\frac{1}{2} - \frac{x}{2}\right)^{-\alpha-\beta} (k+1+\alpha+\beta)!}{k!\,(1+\alpha+\beta)!}\right)\right] \tag{64}$$

```
> initial4:=simplify([sum(subs(n=0,termseries4), k=0..infinity), sum(subs(n=1,termseries4), k=0..infinity)]) assuming(x>0,x<1);
```

$$initial4 := \left[1, \frac{(2+\alpha+\beta)\, x}{2} - \frac{\beta}{2} + \frac{\alpha}{2}\right] \tag{65}$$

```
> [op(2, RE1),op(3, RE1)];
```

$$\left[1, \frac{1}{2}\alpha + x + \frac{1}{2}\alpha x - \frac{1}{2}\beta + \frac{1}{2}\beta x\right] \tag{66}$$

```
> simplify(initial4- [op(2, RE1),op(3, RE1)]);
```

$$[0, 0] \tag{67}$$

Gegenbauer polynomials

```
> convert(Sumtohyper(pochhammer(2*lambda,n)/pochhammer(lambda+1/2,
  n)*subs({alpha=lambda-1/2,beta=lambda-1/2},term1),k),binomial);
```

$$\mathrm{Hypergeom}\left([-n, n+2\lambda], \left[\lambda+\frac{1}{2}\right], \frac{1}{2}-\frac{x}{2}\right)\binom{n+2\lambda-1}{n} \tag{68}$$

```
> convert(Sumtohyper(pochhammer(2*lambda,n)/pochhammer(lambda+1/2,
  n)*subs({alpha=lambda-1/2,beta=lambda-1/2},term2),k),binomial);
```

$$(-1)^n\,\mathrm{Hypergeom}\left([-n, n+2\lambda], \left[\lambda+\frac{1}{2}\right], \frac{1}{2}+\frac{x}{2}\right)\binom{n+2\lambda-1}{n} \tag{69}$$

```
> convert(simplify(Sumtohyper(pochhammer(2*lambda,n)/pochhammer
  (lambda+1/2,n)*subs({alpha=lambda-1/2,beta=lambda-1/2},term3),k)
  ),binomial);
```

$$\mathrm{Hypergeom}\left(\left[-n, -n-\lambda+\frac{1}{2}\right], [-2n-2\lambda+1], -\frac{2}{-1+x}\right)(-2+2x)^n\binom{n+\lambda-1}{n} \tag{70}$$

```
> convert(Sumtohyper(pochhammer(2*lambda,n)/pochhammer(lambda+1/2,
  n)*subs({alpha=lambda-1/2,beta=lambda-1/2},term4),k),binomial);
```

$$\left(\frac{1}{2}+\frac{x}{2}\right)^n\mathrm{Hypergeom}\left(\left[-n, -n-\lambda+\frac{1}{2}\right], \left[\lambda+\frac{1}{2}\right], \frac{-2+2x}{2+2x}\right)\binom{n+2\lambda-1}{n} \tag{71}$$

```
> convert(Sumtohyper(pochhammer(2*lambda,n)/pochhammer(lambda+1/2,
  n)*subs({alpha=lambda-1/2,beta=lambda-1/2},term5),k),binomial);
```

$$\left(-\frac{1}{2}+\frac{x}{2}\right)^n\mathrm{Hypergeom}\left(\left[-n, -n-\lambda+\frac{1}{2}\right], \left[\lambda+\frac{1}{2}\right], \frac{2+2x}{-2+2x}\right)\binom{n+2\lambda-1}{n} \tag{72}$$

```
> convert(simplify(Sumtohyper(pochhammer(2*lambda,n)/pochhammer
  (lambda+1/2,n)*subs({alpha=lambda-1/2,beta=lambda-1/2},term6),k)
  ),binomial);
```

$$\mathrm{Hypergeom}\left(\left[-n, -n-\lambda+\frac{1}{2}\right], [-2n-2\lambda+1], \frac{2}{1+x}\right)(2+2x)^n\binom{n+\lambda-1}{n} \tag{73}$$

```
> RE1:=RecurrenceNormalForm2(pochhammer(2*lambda,n)/pochhammer
  (lambda+1/2,n)*subs({alpha=lambda-1/2,beta=lambda-1/2},term1),k,p
  (n));
```

$$RE1 := [(n+2)\,p(n+2) - 2x\,(n+\lambda+1)\,p(n+1) + (n+2\lambda)\,p(n) = 0, 1, 2\lambda x] \tag{74}$$

```
> term7:=(2*x)^n*pochhammer(lambda,n)/n!*hyperterm([-n/2,-(n-1)/2],
  [1-lambda-n],1/x^2,k);
```

$$term7 := \tag{75}$$

$$\frac{(2x)^n\,\mathrm{pochhammer}(\lambda, n)\,\mathrm{pochhammer}\left(-\frac{n}{2}, k\right)\mathrm{pochhammer}\left(-\frac{n}{2}+\frac{1}{2}, k\right)\left(\frac{1}{x^2}\right)^k}{n!\,\mathrm{pochhammer}(-n-\lambda+1, k)\,k!}$$

```
> RE7:=RecurrenceNormalForm2(term7,k,p(n));
```

$$RE7 := [(n+2)\,p(n+2) - 2x\,(n+\lambda+1)\,p(n+1) + (n+2\lambda)\,p(n) = 0, 1, 2\lambda x] \tag{76}$$

Reversion yields

```
> res1:=convert(Sumtohyper(subs(k=n-k,subs(n=2*n,term7)),k),
  binomial);
```

$$res1 := \tag{77}$$

$$\frac{\sqrt{\pi}\,\Gamma(-2n-\lambda+1)\,(2^n)^2\,(-1)^n\,\mathrm{Hypergeom}\left([n+\lambda,-n],\left[\frac{1}{2}\right],x^2\right)\binom{2n+\lambda-1}{2n}}{\Gamma\left(-n+\frac{1}{2}\right)\Gamma(-n-\lambda+1)}$$

```
> convert(termtohyper(eval(subs(Hypergeom=1,res1)),n),binomial);
```

$$\binom{n+\lambda-1}{\lambda-1}(-1)^n \tag{78}$$

Reversion yields

```
> res2:=convert(Sumtohyper(subs(k=n-k,subs(n=2*n+1,term7)),k),
  binomial);
```

$$res2 := -\frac{1}{\Gamma\left(-n-\frac{1}{2}\right)\Gamma(-n-\lambda)}\left(4\sqrt{\pi}\,\Gamma(-\lambda-2n)\,(2^n)^2\,x\,(-1)^n\,\mathrm{Hypergeom}\left([n+\lambda+1,-n],\left[\frac{3}{2}\right],x^2\right)\binom{2n+\lambda}{\lambda-1}\right) \tag{79}$$

```
> convert(termtohyper(eval(subs(Hypergeom=1,res2)),n),binomial);
```

$$2\lambda x\binom{n+\lambda}{\lambda}(-1)^n \tag{80}$$

Check (19)=(21)

```
> term8:=subs(n=2*n,term7);
```

$$term8 := \frac{(2x)^{2n}\,\mathrm{pochhammer}(\lambda,2n)\,\mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}\left(-n+\frac{1}{2},k\right)\left(\frac{1}{x^2}\right)^k}{(2n)!\,\mathrm{pochhammer}(-2n-\lambda+1,k)\,k!} \tag{81}$$

```
> RE8:=RecurrenceNormalForm2(term8,k,p(n));
```

$$RE8 := \Big[(n+2)(2n+3)(2n+1+\lambda)\,p(n+2)-(2n+2+\lambda)\left(2\lambda^2x^2+8\lambda n x^2+8n^2x^2+8\lambda x^2+16nx^2-4n\lambda-4n^2+6x^2-5\lambda-8n-3\right)p(n+1)+(n+\lambda)(2n+2\lambda+1)(2n+3+\lambda)\,p(n)=0,\ 1,\ \frac{\mathrm{pochhammer}(\lambda,2)\,(2\lambda x^2+2x^2-1)}{\lambda+1}\Big] \tag{82}$$

```
> term9:=(-1)^n*binomial(n+lambda-1,n)*hyperterm([-n,n+lambda],
  [1/2],x^2,k);
```

$$term9 := \frac{(-1)^n\binom{n+\lambda-1}{n}\,\mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}(n+\lambda,k)\,4^k\,(x^2)^k}{(2k)!} \tag{83}$$

```
> RE9:=RecurrenceNormalForm2(term9,k,p(n));
```

$$RE9 := \left[(n+2)(2n+3)(2n+1+\lambda)\,p(n+2) - (2n+2+\lambda)\left(2\lambda^2 x^2 + 8\lambda n x^2 + 8 n^2 x^2 + 8\lambda x^2 + 16 n x^2 - 4 n\lambda - 4 n^2 + 6 x^2 - 5\lambda - 8 n - 3\right) p(n+1) + (n+\lambda)(2n+2\lambda+1)(2n+3+\lambda)\,p(n) = 0,\ 1,\ 2\lambda^2 x^2 + 2\lambda x^2 - \lambda\right] \tag{84}$$

```
> normal(expand(RE8-RE9));
```

$$[0, 0, 0] \tag{85}$$

Check (20)=(22)

```
> term10:=subs(n=2*n+1,term7);
```

$$term10 := \frac{1}{(2n+1)!\,\mathrm{pochhammer}(-\lambda-2n,k)\,k!}\left((2x)^{2n+1}\,\mathrm{pochhammer}(\lambda,2n+1)\,\mathrm{pochhammer}\left(-n-\frac{1}{2},k\right)\mathrm{pochhammer}(-n,k)\left(\frac{1}{x^2}\right)^k\right) \tag{86}$$

```
> RE10:=RecurrenceNormalForm2(term10,k,p(n));
```

$$RE10 := \left[(5+2n)(n+2)(2n+2+\lambda)\,p(n+2) - (2n+3+\lambda)\left(2\lambda^2 x^2 + 8\lambda n x^2 + 8 n^2 x^2 + 12\lambda x^2 + 24 n x^2 - 4 n\lambda - 4 n^2 + 16 x^2 - 7\lambda - 12 n - 8\right) p(n+1) + (n+\lambda+1)(2n+4+\lambda)(2n+2\lambda+1)\,p(n) = 0,\ 2\lambda x,\ \frac{2x\,\mathrm{pochhammer}(\lambda,3)\left(2\lambda x^2 + 4x^2 - 3\right)}{3(2+\lambda)}\right] \tag{87}$$

```
> term11:=2*lambda*x*(-1)^n*binomial(n+lambda,n)*hyperterm([-n,n+
  lambda+1],[3/2],x^2,k);
```

$$term11 := \frac{2\lambda x(-1)^n\binom{n+\lambda}{n}\,\mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}(n+\lambda+1,k)\left(x^2\right)^k}{\mathrm{pochhammer}\left(\frac{3}{2},k\right)k!} \tag{88}$$

```
> RE11:=RecurrenceNormalForm2(term11,k,p(n));
```

$$RE11 := \left[(5+2n)(n+2)(2n+2+\lambda)\,p(n+2) - (2n+3+\lambda)\left(2\lambda^2 x^2 + 8\lambda n x^2 + 8 n^2 x^2 + 12\lambda x^2 + 24 n x^2 - 4 n\lambda - 4 n^2 + 16 x^2 - 7\lambda - 12 n - 8\right) p(n+1) + (n+\lambda+1)(2n+4+\lambda)(2n+2\lambda+1)\,p(n) = 0,\ 2\lambda x,\ -2\lambda^2 x - 2\lambda x + \frac{4}{3}\lambda^3 x^3 + 4\lambda^2 x^3 + \frac{8}{3}\lambda x^3\right] \tag{89}$$

```
> normal(expand(RE10-RE11));
```

$$[0, 0, 0] \tag{90}$$

Legendre polynomials

```
> convert(Sumtohyper(subs({alpha=0,beta=0},term1),k),binomial);
```

$$\mathrm{Hypergeom}\left([n+1, -n], [1], \frac{1}{2} - \frac{x}{2}\right) \tag{91}$$

```
> convert(Sumtohyper(subs({alpha=0,beta=0},term2),k),binomial);
```

$$(-1)^n \,\mathrm{Hypergeom}\left([n+1, -n], [1], \frac{1}{2} + \frac{x}{2}\right) \tag{92}$$

```
> convert(Sumtohyper(subs({alpha=0,beta=0},term3),k),binomial);
```

$$\left(-\frac{1}{2} + \frac{x}{2}\right)^n \mathrm{Hypergeom}\left([-n, -n], [-2\,n], -\frac{2}{-1+x}\right) \binom{2\,n}{n} \tag{93}$$

```
> convert(Sumtohyper(subs({alpha=0,beta=0},term4),k),binomial);
```

$$\left(\frac{1}{2} + \frac{x}{2}\right)^n \mathrm{Hypergeom}\left([-n, -n], [1], \frac{-1+x}{1+x}\right) \tag{94}$$

```
> convert(Sumtohyper(subs({alpha=0,beta=0},term5),k),binomial);
```

$$\left(-\frac{1}{2} + \frac{x}{2}\right)^n \mathrm{Hypergeom}\left([-n, -n], [1], \frac{1+x}{-1+x}\right) \tag{95}$$

```
> convert(Sumtohyper(subs({alpha=0,beta=0},term6),k),binomial);
```

$$\left(\frac{1}{2} + \frac{x}{2}\right)^n \mathrm{Hypergeom}\left([-n, -n], [-2\,n], \frac{2}{1+x}\right) \binom{2\,n}{n} \tag{96}$$

```
> convert(Sumtohyper(subs({lambda=1/2},term7),k),binomial);
```

$$\frac{2^n\, x^n\, \mathrm{Hypergeom}\left(\left[-\frac{n}{2}, -\frac{n}{2} + \frac{1}{2}\right], \left[-n + \frac{1}{2}\right], \frac{1}{x^2}\right) \binom{2\,n}{n}}{4^n} \tag{97}$$

```
> simplify(convert(Sumtohyper(subs({lambda=1/2},term8),k),
  binomial),power);
```

$$4^{-n}\, x^{2\,n}\, \mathrm{Hypergeom}\left(\left[-n, -n + \frac{1}{2}\right], \left[-2\,n + \frac{1}{2}\right], \frac{1}{x^2}\right) \binom{4\,n}{2\,n} \tag{98}$$

```
> convert(Sumtohyper(subs({lambda=1/2},term9),k),binomial);
```

$$(-1)^n \,\mathrm{Hypergeom}\left(\left[\frac{1}{2} + n, -n\right], \left[\frac{1}{2}\right], x^2\right) \binom{n - \frac{1}{2}}{-\frac{1}{2}} \tag{99}$$

```
> convert(termtohyper((-1)^n*binomial(-1/2 + n, -1/2),n),binomial);
```

$$\frac{(-1)^n \binom{2\,n}{n}}{4^n} \tag{100}$$

```
> simplify(convert(Sumtohyper(subs({lambda=1/2},term10),k),
  binomial),power);
```

$$\frac{x^{2\,n+1}\, 4^{-n} \binom{4\,n+2}{2\,n+1} \mathrm{Hypergeom}\left(\left[-n - \frac{1}{2}, -n\right], \left[-2\,n - \frac{1}{2}\right], \frac{1}{x^2}\right)}{2} \tag{101}$$

```
> convert(Sumtohyper(subs({lambda=1/2},term11),k),binomial);
```

$$2\,x\,(-1)^n\,\mathrm{Hypergeom}\left(\left[-n,\frac{3}{2}+n\right],\left[\frac{3}{2}\right],x^2\right)(n+1)\binom{\frac{1}{2}+n}{-\frac{1}{2}} \tag{102}$$

```
> termtohyper(2*x*(-1)^n*(n + 1)*binomial(n + 1/2, -1/2),n);
```

$$\frac{x\,\mathrm{pochhammer}\left(\frac{3}{2},n\right)(-1)^n}{n!} \tag{103}$$

```
> term12:=x^n*hyperterm([-n/2,-(n-1)/2],[1],1-1/x^2,k);
```

$$term12 := \frac{x^n\,\mathrm{pochhammer}\left(-\frac{n}{2},k\right)\mathrm{pochhammer}\left(-\frac{n}{2}+\frac{1}{2},k\right)\left(1-\frac{1}{x^2}\right)^k}{k!^2} \tag{104}$$

```
> RE1:=RecurrenceNormalForm2(subs({alpha=0,beta=0},term1),k,p(n));
```

$$RE1 := [(n+2)\,p(n+2)-x\,(2\,n+3)\,p(n+1)+(n+1)\,p(n)=0,1,x] \tag{105}$$

```
> RE12:=RecurrenceNormalForm2(term12,k,p(n));
```

$$RE12 := [(n+2)\,p(n+2)-x\,(2\,n+3)\,p(n+1)+(n+1)\,p(n)=0,1,x] \tag{106}$$

```
> term13:=subs(n=2*n,term12);
```

$$term13 := \frac{x^{2\,n}\,\mathrm{pochhammer}(-n,k)\,\mathrm{pochhammer}\left(-n+\frac{1}{2},k\right)\left(1-\frac{1}{x^2}\right)^k}{k!^2} \tag{107}$$

```
> RE13:=RecurrenceNormalForm2(term13,k,p(n));
```

$$RE13 := \Big[2\,(4\,n+3)\,(2\,n+3)\,(n+2)\,p(n+2)-(4\,n+5)\,(16\,n^2\,x^2+40\,n\,x^2-8\,n^2+21\,x^2-20\,n-11)\,p(n+1)+2\,(n+1)\,(2\,n+1)\,(4\,n+7)\,p(n)=0,1,\frac{3\,x^2}{2}-\frac{1}{2}\Big] \tag{108}$$

Reversion yields

```
> simplify(convert(Sumtohyper(subs(k=n-k,subs(n=2*n,term12)),k),
  binomial),power) assuming n::integer;
```

$$(-1)^n\,(x^2-1)^n\binom{-\frac{1}{2}}{n}\mathrm{Hypergeom}\left([-n,-n],\left[\frac{1}{2}\right],\frac{x^2}{(-1+x)\,(1+x)}\right) \tag{109}$$

```
> term14:=binomial(-1/2,n)*(-1)^n*(x^2-1)^n*hyperterm([-n, -n],
  [1/2], x^2/((-1 + x)*(1 + x)),k);
```

$$term14 := \frac{\binom{-\frac{1}{2}}{n}(-1)^n\,(x^2-1)^n\,\mathrm{pochhammer}(-n,k)^2\,4^k\left(\frac{x^2}{(-1+x)\,(1+x)}\right)^k}{(2\,k)!} \tag{110}$$

```
> RE14:=RecurrenceNormalForm2(term14,k,p(n));
```

(111)

$$RE14 := \left[2\,(4\,n+3)\,(2\,n+3)\,(n+2)\,p(n+2) - (4\,n+5)\,\left(16\,n^2\,x^2 + 40\,n\,x^2 - 8\,n^2 + 21\,x^2 - 20\,n - 11\right)\,p(n+1) + 2\,(n+1)\,(2\,n+1)\,(4\,n+7)\,p(n) = 0,\ 1,\ \frac{3\,x^2}{2} - \frac{1}{2}\right] \tag{111}$$

```
> RE13-RE14;
```

$$[0, 0, 0] \tag{112}$$

```
> term15:=subs(n=2*n+1,term12);
```

$$term15 := \frac{x^{2\,n+1}\,\mathrm{pochhammer}\left(-n-\frac{1}{2}, k\right)\,\mathrm{pochhammer}(-n, k)\,\left(1-\frac{1}{x^2}\right)^k}{k!^2} \tag{113}$$

```
> RE15:=RecurrenceNormalForm2(term15,k,p(n));
```

$$RE15 := \left[2\,(5+2\,n)\,(4\,n+5)\,(n+2)\,p(n+2) - (4\,n+7)\,\left(16\,n^2\,x^2 + 56\,n\,x^2 - 8\,n^2 + 45\,x^2 - 28\,n - 23\right)\,p(n+1) + 2\,(2\,n+3)\,(n+1)\,(4\,n+9)\,p(n) = 0,\ x,\ \frac{x\,(5\,x^2-3)}{2}\right] \tag{114}$$

Reversion yields

```
> simplify(convert(Sumtohyper(subs(k=n-k,subs(n=2*n+1,term12)),k),
  binomial),power) assuming n::integer;
```

$$(-1)^n\,x\,(2\,n+1)\,\left(x^2-1\right)^n \binom{-\frac{1}{2}}{n}\,\mathrm{Hypergeom}\left([-n, -n], \left[\frac{3}{2}\right], \frac{x^2}{(-1+x)\,(1+x)}\right) \tag{115}$$

```
> term16:=binomial(-1/2,n)*(2*n+1)*(-1)^n*x*(x^2 - 1)^n*hyperterm(
  [-n, -n], [3/2], x^2/((-1 + x)*(1 + x)),k);
```

$$term16 := \frac{\binom{-\frac{1}{2}}{n}\,(2\,n+1)\,(-1)^n\,x\,\left(x^2-1\right)^n\,\mathrm{pochhammer}(-n, k)^2\,\left(\frac{x^2}{(-1+x)\,(1+x)}\right)^k}{\mathrm{pochhammer}\left(\frac{3}{2}, k\right)\,k!} \tag{116}$$

```
> RE16:=RecurrenceNormalForm2(term16,k,p(n));
```

$$RE16 := \left[2\,(5+2\,n)\,(4\,n+5)\,(n+2)\,p(n+2) - (4\,n+7)\,\left(16\,n^2\,x^2 + 56\,n\,x^2 - 8\,n^2 + 45\,x^2 - 28\,n - 23\right)\,p(n+1) + 2\,(2\,n+3)\,(n+1)\,(4\,n+9)\,p(n) = 0,\ x,\ \frac{x\,(5\,x^2-3)}{2}\right] \tag{117}$$

```
> RE15-RE16;
```

$$[0, 0, 0] \tag{118}$$

Chebyshev polynomials T_n

```
> convert(Sumtohyper(subs({alpha=-1/2,beta=-1/2},term1)/binomial(2*
  n,n)*4^n,k),binomial);
```

$$\mathrm{Hypergeom}\left([n, -n], \left[\frac{1}{2}\right], \frac{1}{2} - \frac{x}{2}\right) \tag{119}$$

```
> simplify(Sumtohyper(subs({alpha=-1/2,beta=-1/2},term2)/binomial
  (2*n,n)*4^n,k));
```

$$(-1)^n \,\mathrm{Hypergeom}\left([n, -n], \left[\frac{1}{2}\right], \frac{1}{2} + \frac{x}{2}\right) \tag{120}$$

```
> simplify(Sumtohyper(subs({alpha=-1/2,beta=-1/2},term3)/binomial
  (2*n,n)*4^n,k));
```

$$\frac{\mathrm{Hypergeom}\left(\left[-n, -n + \frac{1}{2}\right], [-2\,n + 1], -\frac{2}{-1 + x}\right) (-2 + 2\,x)^n}{2} \tag{121}$$

```
> simplify(Sumtohyper(subs({alpha=-1/2,beta=-1/2},term4)/binomial
  (2*n,n)*4^n,k));
```

$$\left(\frac{1}{2} + \frac{x}{2}\right)^n \mathrm{Hypergeom}\left(\left[-n, -n + \frac{1}{2}\right], \left[\frac{1}{2}\right], \frac{-1 + x}{1 + x}\right) \tag{122}$$

```
> simplify(Sumtohyper(subs({alpha=-1/2,beta=-1/2},term5)/binomial
  (2*n,n)*4^n,k));
```

$$\left(-\frac{1}{2} + \frac{x}{2}\right)^n \mathrm{Hypergeom}\left(\left[-n, -n + \frac{1}{2}\right], \left[\frac{1}{2}\right], \frac{1 + x}{-1 + x}\right) \tag{123}$$

```
> simplify(Sumtohyper(subs({alpha=-1/2,beta=-1/2},term6)/binomial
  (2*n,n)*4^n,k));
```

$$\frac{\mathrm{Hypergeom}\left(\left[-n, -n + \frac{1}{2}\right], [-2\,n + 1], \frac{2}{1 + x}\right) (2 + 2\,x)^n}{2} \tag{124}$$

Chebyshev polynomials U_n

```
> Sumtohyper(subs({alpha=1/2,beta=1/2},term1)*(n+1)/binomial(n+1/2,
  n),k);
```

$$(n + 1)\,\mathrm{Hypergeom}\left([n + 2, -n], \left[\frac{3}{2}\right], \frac{1}{2} - \frac{x}{2}\right) \tag{125}$$

```
> Sumtohyper(subs({alpha=1/2,beta=1/2},term2)*(n+1)/binomial(n+1/2,
  n),k);
```

$$(-1)^n\,(n + 1)\,\mathrm{Hypergeom}\left([n + 2, -n], \left[\frac{3}{2}\right], \frac{1}{2} + \frac{x}{2}\right) \tag{126}$$

```
> simplify(Sumtohyper(subs({alpha=1/2,beta=1/2},term3)*(n+1)
  /binomial(n+1/2,n),k));
```

$$\mathrm{Hypergeom}\left(\left[-n - \frac{1}{2}, -n\right], [-2\,n - 1], -\frac{2}{-1 + x}\right) (-2 + 2\,x)^n \tag{127}$$

```
> Sumtohyper(subs({alpha=1/2,beta=1/2},term4)*(n+1)/binomial(n+1/2,
  n),k);
```

(128)

$$\left(\frac{1}{2}+\frac{x}{2}\right)^{n}(n+1)\,\mathrm{Hypergeom}\left(\left[-n-\frac{1}{2},-n\right],\left[\frac{3}{2}\right],\frac{-2+2x}{2+2x}\right) \tag{128}$$

```
> Sumtohyper(subs({alpha=1/2,beta=1/2},term5)*(n+1)/binomial(n+1/2,
  n),k);
```

$$\left(-\frac{1}{2}+\frac{x}{2}\right)^{n}(n+1)\,\mathrm{Hypergeom}\left(\left[-n-\frac{1}{2},-n\right],\left[\frac{3}{2}\right],\frac{2+2x}{-2+2x}\right) \tag{129}$$

```
> simplify(Sumtohyper(subs({alpha=1/2,beta=1/2},term6)*(n+1)
  /binomial(n+1/2,n),k));
```

$$\mathrm{Hypergeom}\left(\left[-n-\frac{1}{2},-n\right],[-2n-1],\frac{2}{1+x}\right)(2+2x)^{n} \tag{130}$$

```
> simplify(pochhammer(3/2,n)/binomial(n+1/2,n)/n!);
```

$$1 \tag{131}$$

```
> convert(Sumtohyper(subs({lambda=1},term7),k),binomial);
```

$$2^{n}x^{n}\,\mathrm{Hypergeom}\left(\left[-\frac{n}{2},-\frac{n}{2}+\frac{1}{2}\right],[-n],\frac{1}{x^{2}}\right) \tag{132}$$

```
> simplify(convert(Sumtohyper(subs({lambda=1},term8),k),binomial),
  power);
```

$$4^{n}x^{2n}\,\mathrm{Hypergeom}\left(\left[-n,-n+\frac{1}{2}\right],[-2n],\frac{1}{x^{2}}\right) \tag{133}$$

```
> convert(Sumtohyper(subs({lambda=1},term9),k),binomial);
```

$$(-1)^{n}\,\mathrm{Hypergeom}\left([n+1,-n],\left[\frac{1}{2}\right],x^{2}\right) \tag{134}$$

```
> simplify(convert(Sumtohyper(subs({lambda=1},term10),k),binomial),
  power);
```

$$2x^{2n+1}4^{n}\,\mathrm{Hypergeom}\left(\left[-n-\frac{1}{2},-n\right],[-2n-1],\frac{1}{x^{2}}\right) \tag{135}$$

```
> convert(Sumtohyper(subs({lambda=1},term11),k),binomial);
```

$$2x(-1)^{n}(n+1)\,\mathrm{Hypergeom}\left([n+2,-n],\left[\frac{3}{2}\right],x^{2}\right) \tag{136}$$

Laguerre polynomials

```
> term17:=pochhammer(alpha+1,n)/n!*hyperterm([-n],[alpha+1],x,k);
```

$$term17 := \frac{\mathrm{pochhammer}(\alpha+1,n)\,\mathrm{pochhammer}(-n,k)\,x^{k}}{n!\,\mathrm{pochhammer}(\alpha+1,k)\,k!} \tag{137}$$

```
> RE17:=RecurrenceNormalForm2(term17,k,p(n));
```

$$RE17 := [(n+2)\,p(n+2)-(\alpha+2n-x+3)\,p(n+1)+(\alpha+1+n)\,p(n)=0,1,\alpha+1-x] \tag{138}$$

```
> convert(Sumtohyper(term17,k),binomial);
```

$$\mathrm{Hypergeom}([-n],[\alpha+1],x)\binom{n+\alpha}{\alpha} \tag{139}$$

Let's reverse this series:

```
> convert(Sumtohyper(subs(k=n-k,term17),k),factorial);
```

$$\frac{(-1)^n x^n \,\mathrm{Hypergeom}\left([-n-\alpha, -n], [\ ], -\frac{1}{x}\right)}{n!} \tag{140}$$

This is a new identity.

```
> term18:=(-1)^n*x^n*hyperterm([-n,-n-alpha],[],-1/x,k)/n!;
```

$$term18 := \frac{(-1)^n x^n \,\mathrm{pochhammer}(-n, k)\,\mathrm{pochhammer}(-n-\alpha, k)\left(-\frac{1}{x}\right)^k}{k!\,n!} \tag{141}$$

```
> RE18:=RecurrenceNormalForm2(term18,k,p(n));
```

$$RE18 := [(n+2)\,p(n+2) - (\alpha + 2\,n - x + 3)\,p(n+1) + (\alpha + 1 + n)\,p(n) = 0, 1, \alpha + 1 - x] \tag{142}$$

```
> RE17-RE18;
```

$$[0, 0, 0] \tag{143}$$

Bessel polynomials

```
> term19:=hyperterm([-n,n+alpha+1],[],-x/2,k);
```

$$term19 := \frac{\mathrm{pochhammer}(-n, k)\,\mathrm{pochhammer}(\alpha + 1 + n, k)\left(-\frac{x}{2}\right)^k}{k!} \tag{144}$$

```
> RE19:=RecurrenceNormalForm2(term19,k,p(n));
```

$$RE19 := \Big[-2\,(\alpha + 2 + 2\,n)\,(\alpha + 2 + n)\,p(n+2) + (\alpha + 2\,n + 3)\,(\alpha^2 x + 4\,\alpha\,n\,x + 4\,n^2 x + 6\,\alpha\,x + 12\,n\,x + 2\,\alpha + 8\,x)\,p(n+1) + 2\,(\alpha + 4 + 2\,n)\,(n+1)\,p(n) = 0, 1, 1 + \frac{1}{2}\,\alpha\,x + x\Big] \tag{145}$$

Let's reverse this series:

```
> convert(Sumtohyper(subs(k=n-k,term19),k),binomial);
```

$$\frac{(-1)^n\,\Gamma(\alpha + 1 + 2\,n)\left(-\frac{1}{2}\right)^n x^n \,\mathrm{Hypergeom}\left([-n], [-\alpha - 2\,n], \frac{2}{x}\right)}{\Gamma(\alpha + 1 + n)} \tag{146}$$

This is the second hypergeometric representation.

```
> term20:=pochhammer(n+alpha+1,n)*(x/2)^n*hyperterm([-n],[-2*n-
  alpha],2/x,k);
```

$$term20 := \frac{\mathrm{pochhammer}(\alpha + 1 + n, n)\left(\frac{x}{2}\right)^n \mathrm{pochhammer}(-n, k)\left(\frac{2}{x}\right)^k}{\mathrm{pochhammer}(-\alpha - 2\,n, k)\,k!} \tag{147}$$

```
> RE20:=RecurrenceNormalForm2(term20,k,p(n));
```

$$RE20 := \Big[-2\,(\alpha + 2 + 2\,n)\,(\alpha + 2 + n)\,p(n+2) + (\alpha + 2\,n + 3)\,(\alpha^2 x + 4\,\alpha\,n\,x + 4\,n^2 x + 6\,\alpha\,x + 12\,n\,x + 2\,\alpha + 8\,x)\,p(n+1) + 2\,(\alpha + 4 + 2\,n)\,(n+1)\,p(n) = 0, 1, \tag{148}$$

$$1 + \frac{1}{2}\,\alpha\,x + x\Big]$$

```
> RE19-RE20;
```

$$[0, 0, 0] \tag{149}$$

Hermite polynomials

```
> term21:=(2*x)^n*hyperterm([-n/2,-(n-1)/2],[],-1/x^2,k);
```

$$term21 := \frac{(2\,x)^n\,\mathrm{pochhammer}\left(-\frac{n}{2}, k\right)\,\mathrm{pochhammer}\left(-\frac{n}{2}+\frac{1}{2}, k\right)\left(-\frac{1}{x^2}\right)^k}{k!} \tag{150}$$

```
> RE21:=RecurrenceNormalForm2(term21,k,p(n));
```

$$RE21 := [p(n+2) - 2\,x\,p(n+1) + 2\,(n+1)\,p(n) = 0, 1, 2\,x] \tag{151}$$

Even and odd indices:

```
> term22:=subs(n=2*n,term21);
```

$$term22 := \frac{(2\,x)^{2\,n}\,\mathrm{pochhammer}(-n, k)\,\mathrm{pochhammer}\left(-n+\frac{1}{2}, k\right)\left(-\frac{1}{x^2}\right)^k}{k!} \tag{152}$$

```
> RE22:=RecurrenceNormalForm2(term22,k,p(n));
```

$$RE22 := [p(n+2) + 2\,(-2\,x^2 + 4\,n + 5)\,p(n+1) + 8\,(2\,n+1)\,(n+1)\,p(n) = 0, 1, 4\,x^2 - 2] \tag{153}$$

```
> term24:=subs(n=2*n+1,term21);
```

$$term24 := \frac{(2\,x)^{2\,n+1}\,\mathrm{pochhammer}\left(-n-\frac{1}{2}, k\right)\,\mathrm{pochhammer}(-n, k)\left(-\frac{1}{x^2}\right)^k}{k!} \tag{154}$$

```
> RE24:=RecurrenceNormalForm2(term24,k,p(n));
```

$$RE24 := [p(n+2) + 2\,(-2\,x^2 + 4\,n + 7)\,p(n+1) + 8\,(n+1)\,(2\,n+3)\,p(n) = 0, 2\,x, 8\,x^3 - 12\,x] \tag{155}$$

Let's reverse the series for even n:

```
> res23:=simplify(convert(Sumtohyper(subs(k=n-k,term22),k),
  binomial));
```

$$res23 := \frac{4^n\,(-1)^{2\,n}\,\sqrt{\pi}\,\mathrm{Hypergeom}\left([-n], \left[\frac{1}{2}\right], x^2\right)}{\Gamma\left(-n+\frac{1}{2}\right)} \tag{156}$$

```
> simplify(convert(termtohyper(eval(subs(Hypergeom=1,res23)),n),
  binomial)) assuming n::integer;;
```

$$n!\,(-1)^n\,\binom{2\,n}{n} \tag{157}$$

This is a second hypergeometric representation for even n:

```
> term23:=n!*(-1)^n*binomial(2*n, n)*hyperterm([-n],[1/2],x^2,k);
```

$$term23 := \frac{n!\,(-1)^n\,\binom{2\,n}{n}\,\mathrm{pochhammer}(-n, k)\,4^k\,(x^2)^k}{(2\,k)!} \tag{158}$$

```
> RE23:=RecurrenceNormalForm2(term23,k,p(n));
```

$$RE23 := [p(n+2) + 2\,(-2\,x^2 + 4\,n + 5)\,p(n+1) + 8\,(2\,n+1)\,(n+1)\,p(n) = 0, 1, 4\,x^2 - 2] \quad (159)$$

```
> RE22-RE23;
```

$$[0, 0, 0] \quad (160)$$

Let's reverse the series for odd n:

```
> res25:=simplify(convert(Sumtohyper(subs(k=n-k,term24),k),
  binomial));
```

$$res25 := -\frac{(-1)^{2\,n}\,2^{2\,n+2}\,x\,\sqrt{\pi}\,\mathrm{Hypergeom}\left([-n], \left[\frac{3}{2}\right], x^2\right)}{\Gamma\left(-n - \frac{1}{2}\right)} \quad (161)$$

```
> termtohyper(eval(subs(Hypergeom=1,res25)),n);
```

$$2\,x\,\mathrm{pochhammer}\left(\frac{3}{2}, n\right)\,(-4)^n \quad (162)$$

This is a second hypergeometric representation for odd n:

```
> term25:=2*x*pochhammer(3/2, n)*(-4)^n*hyperterm([-n],[3/2],x^2,k)
  ;
```

$$term25 := \frac{2\,x\,\mathrm{pochhammer}\left(\frac{3}{2}, n\right)\,(-4)^n\,\mathrm{pochhammer}(-n, k)\,\left(x^2\right)^k}{\mathrm{pochhammer}\left(\frac{3}{2}, k\right)\,k!} \quad (163)$$

```
> RE25:=RecurrenceNormalForm2(term25,k,p(n));
```

$$RE25 := [p(n+2) + 2\,(-2\,x^2 + 4\,n + 7)\,p(n+1) + 8\,(n+1)\,(2\,n+3)\,p(n) = 0, 2\,x, 8\,x^3 - 12\,x] \quad (164)$$

```
> RE24-RE25;
```

$$[0, 0, 0] \quad (165)$$

Masjed-Jamei families

```
> chang:={alpha=-p+I*q/2, beta=-p-I*q/2, x=I*((a^2+c^2)*x+a*b+c*d)/
  (a*d-b*c)};
```

$$chang := \left\{\alpha = -p + \frac{\mathrm{I}\,q}{2}, \beta = -p - \frac{\mathrm{I}\,q}{2}, x = \frac{\mathrm{I}\,\left(\left(a^2 + c^2\right)\,x + a\,b + c\,d\right)}{a\,d - b\,c}\right\} \quad (166)$$

```
> an:=2^n*(a*d-b*c)^n*n!/(-I)^n;
```

$$an := \frac{2^n\,(a\,d - b\,c)^n\,n!}{(-\mathrm{I})^n} \quad (167)$$

```
> convert(Sumtohyper(an*subs(chang, term1),k),binomial);
```

$$\frac{1}{(-1)^n\,\mathrm{I}^n\,\Gamma\left(-p + \frac{\mathrm{I}\,q}{2} + 1\right)}\left(2^n\,(a\,d - b\,c)^n\,\Gamma\left(n - p + \frac{\mathrm{I}\,q}{2} + 1\right)\,\mathrm{Hypergeom}\left([-n, n - 2\,p + 1], \left[-p + \frac{\mathrm{I}\,q}{2} + 1\right], \frac{-\mathrm{I}\,a^2\,x - \mathrm{I}\,c^2\,x - \mathrm{I}\,a\,b - \mathrm{I}\,c\,d + a\,d - b\,c}{2\,a\,d - 2\,b\,c}\right)\right) \quad (168)$$

```
> convert(Sumtohyper(an*subs(chang, term2),k),binomial);
```

$$\frac{1}{\mathrm{I}^n\,\Gamma\left(-p-\frac{\mathrm{I}\,q}{2}+1\right)}\left(2^n\,(a\,d-b\,c)^n\,\Gamma\left(n-p-\frac{\mathrm{I}\,q}{2}+1\right)\mathrm{Hypergeom}\left([-n,n-2\,p+1],\left[-p-\frac{\mathrm{I}\,q}{2}+1\right],\frac{-\mathrm{I}\,a^2\,x-\mathrm{I}\,c^2\,x-\mathrm{I}\,a\,b-\mathrm{I}\,c\,d-a\,d+b\,c}{-2\,a\,d+2\,b\,c}\right)\right) \tag{169}$$

```
> convert(Sumtohyper(an*subs(chang, term3),k),binomial);
```

$$\frac{1}{(-1)^n\,\mathrm{I}^n\,\Gamma(n-2\,p+1)}\left(2^n\,(a\,d-b\,c)^n\,\Gamma(2\,n-2\,p+1)\left(\frac{\mathrm{I}\,a^2\,x+\mathrm{I}\,c^2\,x+\mathrm{I}\,a\,b+\mathrm{I}\,c\,d-a\,d+b\,c}{2\,(a\,d-b\,c)}\right)^n\mathrm{Hypergeom}\left(\left[-n+p-\frac{\mathrm{I}\,q}{2},-n\right],[-2\,n+2\,p],\frac{-2\,a\,d+2\,b\,c}{\mathrm{I}\,a^2\,x+\mathrm{I}\,c^2\,x+\mathrm{I}\,a\,b+\mathrm{I}\,c\,d-a\,d+b\,c}\right)\right) \tag{170}$$

```
> convert(Sumtohyper(an*subs(chang, term4),k),binomial);
```

$$\frac{1}{(-1)^n\,\mathrm{I}^n\,\Gamma\left(-p+\frac{\mathrm{I}\,q}{2}+1\right)}\left(2^n\,(a\,d-b\,c)^n\,\Gamma\left(n-p+\frac{\mathrm{I}\,q}{2}+1\right)\left(\frac{\mathrm{I}\,a^2\,x+\mathrm{I}\,c^2\,x+\mathrm{I}\,a\,b+\mathrm{I}\,c\,d+a\,d-b\,c}{2\,(a\,d-b\,c)}\right)^n\mathrm{Hypergeom}\left(\left[-n,-n+p+\frac{\mathrm{I}\,q}{2}\right],\left[-p+\frac{\mathrm{I}\,q}{2}+1\right],\frac{2\,\mathrm{I}\,a^2\,x+2\,\mathrm{I}\,c^2\,x+2\,\mathrm{I}\,a\,b+2\,\mathrm{I}\,c\,d-2\,a\,d+2\,b\,c}{2\,\mathrm{I}\,a^2\,x+2\,\mathrm{I}\,c^2\,x+2\,\mathrm{I}\,a\,b+2\,\mathrm{I}\,c\,d+2\,a\,d-2\,b\,c}\right)\right) \tag{171}$$

```
> convert(Sumtohyper(an*subs(chang, term5),k),binomial);
```

$$\frac{1}{(-1)^n\,\mathrm{I}^n\,\Gamma\left(-p-\frac{\mathrm{I}\,q}{2}+1\right)}\left(2^n\,(a\,d-b\,c)^n\,\Gamma\left(n-p-\frac{\mathrm{I}\,q}{2}+1\right)\left(\frac{\mathrm{I}\,a^2\,x+\mathrm{I}\,c^2\,x+\mathrm{I}\,a\,b+\mathrm{I}\,c\,d-a\,d+b\,c}{2\,(a\,d-b\,c)}\right)^n\mathrm{Hypergeom}\left(\left[-n+p-\frac{\mathrm{I}\,q}{2},-n\right],\left[-p-\frac{\mathrm{I}\,q}{2}+1\right],\frac{-2\,\mathrm{I}\,a^2\,x-2\,\mathrm{I}\,c^2\,x-2\,\mathrm{I}\,a\,b-2\,\mathrm{I}\,c\,d-2\,a\,d+2\,b\,c}{-2\,\mathrm{I}\,a^2\,x-2\,\mathrm{I}\,c^2\,x-2\,\mathrm{I}\,a\,b-2\,\mathrm{I}\,c\,d+2\,a\,d-2\,b\,c}\right)\right) \tag{172}$$

```
> convert(Sumtohyper(an*subs(chang, term6),k),binomial);
```

$$\frac{1}{(-1)^n\,\mathrm{I}^n\,\Gamma(n-2\,p+1)}\left(2^n\,(a\,d-b\,c)^n\,\Gamma(2\,n-2\,p+1)\left(\frac{\mathrm{I}\,a^2\,x+\mathrm{I}\,c^2\,x+\mathrm{I}\,a\,b+\mathrm{I}\,c\,d+a\,d-b\,c}{2\,(a\,d-b\,c)}\right)^n\mathrm{Hypergeom}\left(\left[-n,-n+p+\frac{\mathrm{I}\,q}{2}\right],[-2\,n+2\,p],\frac{2\,a\,d-2\,b\,c}{\mathrm{I}\,a^2\,x+\mathrm{I}\,c^2\,x+\mathrm{I}\,a\,b+\mathrm{I}\,c\,d+a\,d-b\,c}\right)\right) \tag{173}$$

```
> TermMJ1:=2^n*(a*d-b*c)^n*GAMMA(-p+(1/2*I)*q+1+n)*hyperterm([n-2*
  p+1, -n], [-p+(1/2*I)*q+1], (-I*a^2*x-I*c^2*x-I*a*b-I*c*d+a*d-b*
```

```
c)/(2*a*d-2*b*c), k)/((-1)^n*I^n*GAMMA(-p+(1/2*I)*q+1));
```

$$TermMJ1 := \left(2^n\,(a\,d-b\,c)^n\,\Gamma\left(n-p+\frac{\mathrm{I}\,q}{2}+1\right)\,\mathrm{pochhammer}(n-2\,p+1,\,k)\,\mathrm{pochhammer}(-n,k)\left(\frac{-\mathrm{I}\,a^2\,x-\mathrm{I}\,c^2\,x-\mathrm{I}\,a\,b-\mathrm{I}\,c\,d+a\,d-b\,c}{2\,a\,d-2\,b\,c}\right)^k\right)\Big/\left(\mathrm{pochhammer}\left(-p+\frac{\mathrm{I}\,q}{2}+1,k\right)k!\,(-1)^n\,\mathrm{I}^n\,\Gamma\left(-p+\frac{\mathrm{I}\,q}{2}+1\right)\right) \tag{174}$$

```
> REMJ1:=simplify(RecurrenceNormalForm2(TermMJ1,k,S(n)));
```

$$REMJ1 := \Big[4\left(\frac{3}{2}+n-p\right)\Big(\left(a^2\,x+a\,b+c\,(c\,x+d)\right)n^2-2\left(-\frac{3}{2}+p\right)\left(a^2\,x+a\,b+c\,(c\,x+d)\right)n+x\,(-1+p)\,(p-2)\,a^2+\left(b\,p^2+\left(-\frac{d\,q}{2}-3\,b\right)p+2\,b\right)a+\frac{\left(2\,x\,(-1+p)\,(p-2)\,c+2\,d\,p^2+(b\,q-6\,d)\,p+4\,d\right)c}{2}\Big)S(n+1)+(1+n-p)\,(n-2\,p+2)\,S(n+2)-4\,S(n)\,(n+1)\left(n^2+(-2\,p+2)\,n+p^2+\frac{q^2}{4}-2\,p+1\right)(-p+2+n)\,(a\,d-b\,c)^2=0,\,1,\,2\,x\,(-1+p)\,a^2+(2\,b\,p-d\,q-2\,b)\,a+(2\,x\,(-1+p)\,c+b\,q+2\,d\,p-2\,d)\,c\Big] \tag{175}$$

```
> TermMJ2:=2^n*(a*d-b*c)^n*GAMMA(n-p-(1/2*I)*q+1)*hyperterm([n-2*
  p+1, -n], [-p-(1/2*I)*q+1], (-I*a^2*x-I*c^2*x-I*a*b-I*c*d-a*d+b*
  c)/(-2*a*d+2*b*c), k)/(I^n*GAMMA(-p-(1/2*I)*q+1));
```

$$TermMJ2 := \left(2^n\,(a\,d-b\,c)^n\,\Gamma\left(n-p-\frac{\mathrm{I}\,q}{2}+1\right)\,\mathrm{pochhammer}(n-2\,p+1,\,k)\,\mathrm{pochhammer}(-n,k)\left(\frac{-\mathrm{I}\,a^2\,x-\mathrm{I}\,c^2\,x-\mathrm{I}\,a\,b-\mathrm{I}\,c\,d-a\,d+b\,c}{-2\,a\,d+2\,b\,c}\right)^k\right)\Big/\left(\mathrm{pochhammer}\left(-p-\frac{\mathrm{I}\,q}{2}+1,k\right)k!\,\mathrm{I}^n\,\Gamma\left(-p-\frac{\mathrm{I}\,q}{2}+1\right)\right) \tag{176}$$

```
> REMJ2:=simplify(RecurrenceNormalForm2(TermMJ2,k,S(n)));
```

$$REMJ2 := \Big[4\left(\frac{3}{2}+n-p\right)\Big(\left(a^2\,x+a\,b+c\,(c\,x+d)\right)n^2-2\left(-\frac{3}{2}+p\right)\left(a^2\,x+a\,b+c\,(c\,x+d)\right)n+x\,(-1+p)\,(p-2)\,a^2+\left(b\,p^2+\left(-\frac{d\,q}{2}-3\,b\right)p+2\,b\right)a+\frac{\left(2\,x\,(-1+p)\,(p-2)\,c+2\,d\,p^2+(b\,q-6\,d)\,p+4\,d\right)c}{2}\Big)S(n+1)+(1+n-p)\,(n-2\,p+2)\,S(n+2)-4\,S(n)\,(n+1)\left(n^2+(-2\,p+2)\,n+p^2+\frac{q^2}{4}-2\,p \tag{177}$$

$$+1\Big)\,(-p+2+n)\,(a\,d-b\,c)^2=0,\,1,\,2\,x\,(-1+p)\,a^2+(2\,b\,p-d\,q-2\,b)\,a$$

$$+(2\,x\,(-1+p)\,c+b\,q+2\,d\,p-2\,d)\,c\Big]$$

```
> REMJ1-REMJ2;
```

$$[0,\,0,\,0] \tag{178}$$

```
> TermMJ3:=2^n*(a*d-b*c)^n*GAMMA(2*n-2*p+1)*((1/2)*(I*a^2*x+I*c^2*
  x+I*a*b+I*c*d-a*d+b*c)/(a*d-b*c))^n*hyperterm([-n+p-(1/2*I)*q, -
  n], [-2*n+2*p], (-2*a*d+2*b*c)/(I*a^2*x+I*c^2*x+I*a*b+I*c*d-a*d+
  b*c), k)/((-1)^n*I^n*GAMMA(n-2*p+1));
```

$$TermMJ3 := \Bigg(2^n\,(a\,d-b\,c)^n\,\Gamma(2\,n-2\,p+1)\left(\frac{\mathrm{I}\,a^2\,x+\mathrm{I}\,c^2\,x+\mathrm{I}\,a\,b+\mathrm{I}\,c\,d-a\,d+b\,c}{2\,(a\,d-b\,c)}\right)^n \mathrm{pochhammer}\Big(-n+p-\frac{\mathrm{I}\,q}{2},\,k\Big)\,\mathrm{pochhammer}(-n,k)\left(\frac{-2\,a\,d+2\,b\,c}{\mathrm{I}\,a^2\,x+\mathrm{I}\,c^2\,x+\mathrm{I}\,a\,b+\mathrm{I}\,c\,d-a\,d+b\,c}\right)^k\Bigg)\Big/\Big(\mathrm{pochhammer}(-2\,n+2\,p,k)\,k!\,(-1)^n\,\mathrm{I}^n\,\Gamma(n-2\,p+1)\Big) \tag{179}$$

```
> REMJ3:=RecurrenceNormalForm2(TermMJ3,k,S(n));
```

$$REMJ3 := \Big[(-32\,a\,b\,c\,d\,n^3+144\,a\,b\,c\,d\,p^3-48\,a\,b\,c\,d\,n^2-16\,a\,b\,c\,d\,p^2-80\,a\,b\,c\,d\,n \tag{180}$$

$$+32\,a^2\,d^2+32\,b^2\,c^2-32\,a^4\,x^2-32\,c^4\,x^2-32\,a^2\,b^2-32\,c^2\,d^2-104\,a^2\,c^2\,n^2\,x^2$$

$$-128\,a^2\,c^2\,p^2\,x^2+116\,c^4\,n\,p\,x^2-24\,c^3\,d\,n^3\,x+32\,c^3\,d\,p^3\,x-104\,a^3\,b\,n^2\,x$$

$$-128\,a^3\,b\,p^2\,x+40\,a^2\,b^2\,n^2\,p-44\,a^2\,b^2\,n\,p^2-144\,a^2\,c^2\,n\,x^2+160\,a^2\,c^2\,p\,x^2$$

$$-104\,c^3\,d\,n^2\,x-128\,c^3\,d\,p^2\,x+40\,c^2\,d^2\,n^2\,p-44\,c^2\,d^2\,n\,p^2-144\,a^3\,b\,n\,x+160\,a^3\,b\,p\,x$$

$$+16\,a^3\,d\,q\,x+116\,a^2\,b^2\,n\,p-16\,b\,c^3\,q\,x-144\,c^3\,d\,n\,x+160\,c^3\,d\,p\,x+116\,c^2\,d^2\,n\,p$$

$$+16\,a^2\,b\,d\,q-64\,a^2\,c\,d\,x-16\,a\,b^2\,c\,q-64\,a\,b\,c^2\,x+16\,a\,c\,d^2\,q-16\,b\,c^2\,d\,q$$

$$-104\,\mathrm{I}\,a\,b^2\,c\,n\,p^2+2\,\mathrm{I}\,a\,b^2\,c\,n\,q^2+24\,\mathrm{I}\,a\,c^2\,d\,n^2\,x+40\,a^4\,n^2\,p\,x^2-44\,a^4\,n\,p^2\,x^2$$

$$-24\,a^2\,c^2\,n^3\,x^2+32\,a^2\,c^2\,p^3\,x^2+40\,c^4\,n^2\,p\,x^2-44\,c^4\,n\,p^2\,x^2+116\,a^4\,n\,p\,x^2-24\,a^3\,b\,n^3\,x$$

$$+32\,a^3\,b\,p^3\,x-32\,a^2\,b\,c\,n\,q\,x+44\,a^2\,b\,c\,p\,q\,x-24\,a^2\,b\,d\,n\,p\,q+232\,a^2\,c\,d\,n\,p\,x$$

$$+ 24\, a\, b^2\, c\, n\, p\, q + 232\, a\, b\, c^2\, n\, p\, x + 32\, a\, c^2\, d\, n\, q\, x - 44\, a\, c^2\, d\, p\, q\, x - 24\, a\, c\, d^2\, n\, p\, q$$

$$+ 24\, b\, c^2\, d\, n\, p\, q + 4\, a^2\, d^2\, n^3 - 56\, a^2\, d^2\, p^3 + 4\, b^2\, c^2\, n^3 - 56\, b^2\, c^2\, p^3 - 28\, a^2\, d^2\, n^2$$

$$- 56\, a^2\, d^2\, p^2 - 28\, b^2\, c^2\, n^2 - 56\, b^2\, c^2\, p^2 - 16\, \mathrm{I}\, b^2\, c^2\, p\, q - 24\, \mathrm{I}\, b\, c^3\, p\, x - 104\, \mathrm{I}\, b\, c^2\, d\, p^2$$

$$+ 4\, \mathrm{I}\, b\, c^2\, d\, q^2 + 8\, \mathrm{I}\, c^3\, d\, q\, x - 4\, \mathrm{I}\, c^2\, d^2\, p\, q + 80\, \mathrm{I}\, a^2\, b\, c\, x + 24\, \mathrm{I}\, p\, d\, b\, a^2 - 24\, \mathrm{I}\, a\, b^2\, c\, p$$

$$- 80\, \mathrm{I}\, a\, c^2\, d\, x + 24\, \mathrm{I}\, a\, c\, d^2\, p - 24\, \mathrm{I}\, b\, c^2\, d\, p - 4\, \mathrm{I}\, a^4\, p\, q\, x^2 - 48\, \mathrm{I}\, a^3\, d\, p^3\, x + 48\, \mathrm{I}\, b\, c^3\, p^3\, x$$

$$- 4\, \mathrm{I}\, c^4\, p\, q\, x^2 + 104\, \mathrm{I}\, a^3\, d\, p^2\, x - 4\, \mathrm{I}\, a^3\, d\, q^2\, x - 48\, \mathrm{I}\, p^3\, d\, b\, a^2 + 8\, \mathrm{I}\, a^2\, c^2\, q\, x^2$$

$$- 36\, \mathrm{I}\, a^2\, d^2\, p^2\, q + 48\, \mathrm{I}\, a\, b^2\, c\, p^3 - 48\, \mathrm{I}\, a\, c\, d^2\, p^3 - 24\, a^3\, d\, n\, p\, q\, x - 12\, a^2\, b\, c\, n^2\, q\, x$$

$$- 8\, a^2\, b\, c\, p^2\, q\, x + 80\, a^2\, c\, d\, n^2\, p\, x - 88\, a^2\, c\, d\, n\, p^2\, x + 80\, a\, b\, c^2\, n^2\, p\, x - 88\, a\, b\, c^2\, n\, p^2\, x$$

$$+ 12\, a\, c^2\, d\, n^2\, q\, x + 8\, a\, c^2\, d\, p^2\, q\, x + 24\, b\, c^3\, n\, p\, q\, x - 72\, \mathrm{I}\, a\, c\, d^2\, n^2\, p + 104\, \mathrm{I}\, a\, c\, d^2\, n\, p^2$$

$$- 2\, \mathrm{I}\, a\, c\, d^2\, n\, q^2 + 38\, \mathrm{I}\, b^2\, c^2\, n\, p\, q + 112\, \mathrm{I}\, b\, c^3\, n\, p\, x + 72\, \mathrm{I}\, b\, c^2\, d\, n^2\, p - 104\, \mathrm{I}\, b\, c^2\, d\, n\, p^2$$

$$+ 2\, \mathrm{I}\, b\, c^2\, d\, n\, q^2 + 12\, \mathrm{I}\, c^3\, d\, n\, q\, x - 2\, \mathrm{I}\, c^2\, d^2\, n\, p\, q + 56\, \mathrm{I}\, a^2\, b\, c\, n\, x - 112\, \mathrm{I}\, a^2\, b\, d\, n\, p$$

$$+ 112\, \mathrm{I}\, a\, b^2\, c\, n\, p - 56\, \mathrm{I}\, a\, c^2\, d\, n\, x - 112\, \mathrm{I}\, a\, c\, d^2\, n\, p + 112\, \mathrm{I}\, b\, c^2\, d\, n\, p - 2\, \mathrm{I}\, a^4\, n\, p\, q\, x^2$$

$$+ 4\, \mathrm{I}\, a^2\, c^2\, n^2\, q\, x^2 - 2\, \mathrm{I}\, c^4\, n\, p\, q\, x^2 + 4\, \mathrm{I}\, a^3\, b\, n^2\, q\, x - 72\, \mathrm{I}\, a^3\, d\, n^2\, p\, x + 104\, \mathrm{I}\, a^3\, d\, n\, p^2\, x$$

$$- 2\, \mathrm{I}\, a^3\, d\, n\, q^2\, x - 16\, \mathrm{I}\, a^2\, b\, c\, n^3\, x + 12\, \mathrm{I}\, a^2\, c^2\, n\, q\, x^2 + 16\, \mathrm{I}\, a\, c^2\, d\, n^3\, x + 72\, \mathrm{I}\, b\, c^3\, n^2\, p\, x$$

$$- 104\, \mathrm{I}\, b\, c^3\, n\, p^2\, x + 2\, \mathrm{I}\, b\, c^3\, n\, q^2\, x + 4\, \mathrm{I}\, c^3\, d\, n^2\, q\, x + 12\, \mathrm{I}\, a^3\, b\, n\, q\, x - 112\, \mathrm{I}\, a^3\, d\, n\, p\, x$$

$$- 2\, \mathrm{I}\, a^2\, b^2\, n\, p\, q - 24\, \mathrm{I}\, a^2\, b\, c\, n^2\, x - 72\, \mathrm{I}\, a^2\, b\, d\, n^2\, p + 104\, \mathrm{I}\, a^2\, b\, d\, n\, p^2 - 2\, \mathrm{I}\, a^2\, b\, d\, n\, q^2$$

$$+ 38\, \mathrm{I}\, a^2\, d^2\, n\, p\, q + 72\, \mathrm{I}\, a\, b^2\, c\, n^2\, p - 32\, a^2\, d^2\, n + 80\, a^2\, d^2\, p - 32\, b^2\, c^2\, n + 80\, b^2\, c^2\, p$$

$$+ 80\, a^3\, b\, n^2\, p\, x - 88\, a^3\, b\, n\, p^2\, x + 12\, a^3\, d\, n^2\, q\, x + 8\, a^3\, d\, p^2\, q\, x + 232\, a^2\, c^2\, n\, p\, x^2$$

$$- 24\, a^2\, c\, d\, n^3\, x + 32\, a^2\, c\, d\, p^3\, x + 144\, a\, b\, c\, d\, n^2\, p - 240\, a\, b\, c\, d\, n\, p^2 + 12\, a\, b\, c\, d\, n\, q^2$$

$$- 20\, a\, b\, c\, d\, p\, q^2 + 64\, a\, b\, c\, d\, n\, p - 36\, \mathrm{I}\, b^2\, c^2\, p^2\, q - 104\, \mathrm{I}\, b\, c^3\, p^2\, x + 4\, \mathrm{I}\, b\, c^3\, q^2\, x$$

$$+ 48\, \mathrm{I}\, b\, c^2\, d\, p^3 + 8\, \mathrm{I}\, a^3\, b\, q\, x + 24\, \mathrm{I}\, a^3\, d\, p\, x - 4\, \mathrm{I}\, q\, p\, b^2\, a^2 + 104\, \mathrm{I}\, p^2\, d\, b\, a^2 - 4\, \mathrm{I}\, a^2\, b\, d\, q^2$$

$$- 16\, \mathrm{I}\, q\, p\, d^2\, a^2 - 104\, \mathrm{I}\, a\, b^2\, c\, p^2 + 4\, \mathrm{I}\, a\, b^2\, c\, q^2 + 104\, \mathrm{I}\, a\, c\, d^2\, p^2 - 4\, \mathrm{I}\, a\, c\, d^2\, q^2$$

$$+ 6\, \mathrm{I}\, c^2\, d^2\, n\, q - 56\, \mathrm{I}\, a^2\, b\, d\, n + 56\, \mathrm{I}\, a\, b^2\, c\, n - 56\, \mathrm{I}\, a\, c\, d^2\, n + 56\, \mathrm{I}\, b\, c^2\, d\, n + 6\, \mathrm{I}\, c^4\, n\, q\, x^2$$

$$+ 24\, \mathrm{I}\, a^3\, d\, n^2\, x + 2\, \mathrm{I}\, a^2\, b^2\, n^2\, q + 16\, \mathrm{I}\, a^2\, b\, d\, n^3 - 10\, \mathrm{I}\, a^2\, d^2\, n^2\, q - 16\, \mathrm{I}\, a\, b^2\, c\, n^3$$

$$+ 16\, \mathrm{I}\, a\, c\, d^2\, n^3 - 10\, \mathrm{I}\, b^2\, c^2\, n^2\, q - 24\, \mathrm{I}\, b\, c^3\, n^2\, x - 16\, \mathrm{I}\, b\, c^2\, d\, n^3 + 2\, \mathrm{I}\, c^2\, d^2\, n^2\, q$$

$$- 56\, \mathrm{I}\, a^3\, d\, n\, x + 6\, \mathrm{I}\, a^2\, b^2\, n\, q + 24\, \mathrm{I}\, a^2\, b\, d\, n^2 + 14\, \mathrm{I}\, a^2\, d^2\, n\, q - 24\, \mathrm{I}\, a\, b^2\, c\, n^2$$

$$+ 24\, \mathrm{I}\, a\, c\, d^2\, n^2 + 14\, \mathrm{I}\, b^2\, c^2\, n\, q + 56\, \mathrm{I}\, b\, c^3\, n\, x - 24\, \mathrm{I}\, b\, c^2\, d\, n^2 + 2\, \mathrm{I}\, a^4\, n^2\, q\, x^2 + 2\, \mathrm{I}\, c^4\, n^2\, q\, x^2$$

$$+ 6\, \mathrm{I}\, a^4\, n\, q\, x^2 + 16\, \mathrm{I}\, a^3\, d\, n^3\, x - 16\, \mathrm{I}\, b\, c^3\, n^3\, x - 32\, a^2\, d^2\, n^2\, p + 76\, a^2\, d^2\, n\, p^2 - 6\, a^2\, d^2\, n\, q^2$$

$$+ 10\, a^2\, d^2\, p\, q^2 - 32\, b^2\, c^2\, n^2\, p + 76\, b^2\, c^2\, n\, p^2 - 6\, b^2\, c^2\, n\, q^2 + 10\, b^2\, c^2\, p\, q^2 + 84\, a^2\, d^2\, n\, p$$

$$+ 84\, b^2\, c^2\, n\, p - 128\, a\, b\, c\, d + 24\, a^2\, b\, c\, n\, p\, q\, x - 24\, a\, c^2\, d\, n\, p\, q\, x + 80\, a^2\, c^2\, n^2\, p\, x^2$$

$$- 88\, a^2\, c^2\, n\, p^2\, x^2 - 104\, a^2\, c\, d\, n^2\, x - 128\, a^2\, c\, d\, p^2\, x - 12\, a\, b^2\, c\, n^2\, q - 8\, a\, b^2\, c\, p^2\, q$$

$$- 104\, a\, b\, c^2\, n^2\, x - 128\, a\, b\, c^2\, p^2\, x + 12\, a\, c\, d^2\, n^2\, q + 8\, a\, c\, d^2\, p^2\, q - 32\, b\, c^3\, n\, q\, x$$

$$+ 44\, b\, c^3\, p\, q\, x - 12\, b\, c^2\, d\, n^2\, q - 8\, b\, c^2\, d\, p^2\, q + 232\, c^3\, d\, n\, p\, x - 16\, a^2\, b\, c\, q\, x$$

$$+ 32\, a^2\, b\, d\, n\, q - 44\, a^2\, b\, d\, p\, q - 144\, a^2\, c\, d\, n\, x + 160\, a^2\, c\, d\, p\, x - 32\, a\, b^2\, c\, n\, q$$

$$+ 44\, a\, b^2\, c\, p\, q - 144\, a\, b\, c^2\, n\, x + 160\, a\, b\, c^2\, p\, x + 16\, a\, c^2\, d\, q\, x + 32\, a\, c\, d^2\, n\, q$$

$$- 44\, a\, c\, d^2\, p\, q - 32\, b\, c^2\, d\, n\, q + 44\, b\, c^2\, d\, p\, q - 24\, a\, b\, c^2\, n^3\, x + 32\, a\, b\, c^2\, p^3\, x$$

$$- 12\, b\, c^3\, n^2\, q\, x - 8\, b\, c^3\, p^2\, q\, x + 80\, c^3\, d\, n^2\, p\, x - 88\, c^3\, d\, n\, p^2\, x + 232\, a^3\, b\, n\, p\, x$$

$$+ 32\, a^3\, d\, n\, q\, x - 44\, a^3\, d\, p\, q\, x + 12\, a^2\, b\, d\, n^2\, q + 8\, a^2\, b\, d\, p^2\, q - 12\, a^4\, n^3\, x^2 + 16\, a^4\, p^3\, x^2$$

$$- 12\, c^4\, n^3\, x^2 + 16\, c^4\, p^3\, x^2 - 52\, a^4\, n^2\, x^2 - 64\, a^4\, p^2\, x^2 - 52\, c^4\, n^2\, x^2 - 64\, c^4\, p^2\, x^2$$

$$- 72\, a^4\, n\, x^2 + 80\, a^4\, p\, x^2 - 12\, a^2\, b^2\, n^3 + 16\, a^2\, b^2\, p^3 - 72\, c^4\, n\, x^2 + 80\, c^4\, p\, x^2 - 12\, c^2\, d^2\, n^3$$

$$+ 16\, c^2\, d^2\, p^3 - 52\, a^2\, b^2\, n^2 - 64\, a^2\, b^2\, p^2 - 64\, a^2\, c^2\, x^2 - 52\, c^2\, d^2\, n^2 - 64\, c^2\, d^2\, p^2$$

$$- 64\, a^3\, b\, x - 72\, a^2\, b^2\, n + 80\, a^2\, b^2\, p - 64\, c^3\, d\, x - 72\, c^2\, d^2\, n + 80\, c^2\, d^2\, p + 24\, \mathrm{I}\, a\, b\, c\, d\, p\, q$$

$$+ 12\, \mathrm{I}\, a^2\, c\, d\, n\, q\, x + 12\, \mathrm{I}\, a\, b\, c^2\, n\, q\, x + 24\, \mathrm{I}\, a\, b\, c\, d\, n^2\, q - 112\, \mathrm{I}\, a\, c^2\, d\, n\, p\, x$$

$$- 16\, \mathrm{I}\, a\, b\, c\, d\, n\, q - 4\, \mathrm{I}\, a^2\, c^2\, n\, p\, q\, x^2 - 4\, \mathrm{I}\, a^3\, b\, n\, p\, q\, x + 72\, \mathrm{I}\, a^2\, b\, c\, n^2\, p\, x$$

$$- 104\, \mathrm{I}\, a^2\, b\, c\, n\, p^2\, x + 2\, \mathrm{I}\, a^2\, b\, c\, n\, q^2\, x + 4\, \mathrm{I}\, a^2\, c\, d\, n^2\, q\, x + 4\, \mathrm{I}\, a\, b\, c^2\, n^2\, q\, x$$

$$- 72\, \mathrm{I}\, a\, c^2\, d\, n^2\, p\, x + 104\, \mathrm{I}\, a\, c^2\, d\, n\, p^2\, x - 2\, \mathrm{I}\, a\, c^2\, d\, n\, q^2\, x - 4\, \mathrm{I}\, c^3\, d\, n\, p\, q\, x$$

$$+ 112\, \mathrm{I}\, a^2\, b\, c\, n\, p\, x - 8\, \mathrm{I}\, a^2\, c\, d\, p\, q\, x - 8\, \mathrm{I}\, a\, b\, c^2\, p\, q\, x + 72\, \mathrm{I}\, a\, b\, c\, d\, p^2\, q - 4\, \mathrm{I}\, a^2\, c\, d\, n\, p\, q\, x$$

$$- 4\, \mathrm{I}\, a\, b\, c^2\, n\, p\, q\, x - 80\, \mathrm{I}\, a\, b\, c\, d\, n\, p\, q + 48\, \mathrm{I}\, a^2\, b\, c\, p^3\, x - 8\, \mathrm{I}\, a^2\, c^2\, p\, q\, x^2 - 48\, \mathrm{I}\, a\, c^2\, d\, p^3\, x$$

$$- 8\, \mathrm{I}\, a^3\, b\, p\, q\, x - 104\, \mathrm{I}\, a^2\, b\, c\, p^2\, x + 4\, \mathrm{I}\, a^2\, b\, c\, q^2\, x - 2\, \mathrm{I}\, a\, b\, c\, d\, q^3 + 104\, \mathrm{I}\, a\, c^2\, d\, p^2\, x$$

$$- 4\, \mathrm{I}\, a\, c^2\, d\, q^2\, x - 8\, \mathrm{I}\, c^3\, d\, p\, q\, x - 24\, \mathrm{I}\, a^2\, b\, c\, p\, x + 8\, \mathrm{I}\, a^2\, c\, d\, q\, x + 8\, \mathrm{I}\, a\, b\, c^2\, q\, x$$

$$+ 24\, \mathrm{I}\, a\, c^2\, d\, p\, x - 40\, \mathrm{I}\, a\, b\, c\, d\, q + \mathrm{I}\, a^2\, d^2\, q^3 + \mathrm{I}\, b^2\, c^2\, q^3 + 4\, \mathrm{I}\, a^4\, q\, x^2 + 4\, \mathrm{I}\, c^4\, q\, x^2$$

$$- 80\, \mathrm{I}\, a^3\, d\, x + 4\, \mathrm{I}\, q\, b^2\, a^2 + 24\, \mathrm{I}\, q\, d^2\, a^2 + 24\, \mathrm{I}\, b^2\, c^2\, q + 80\, \mathrm{I}\, b\, c^3\, x + 4\, \mathrm{I}\, c^2\, d^2\, q$$

$$- 80\, \mathrm{I}\, d\, b\, a^2 + 80\, \mathrm{I}\, a\, b^2\, c - 80\, \mathrm{I}\, a\, c\, d^2 + 80\, \mathrm{I}\, b\, c^2\, d\Big)\, (\mathrm{I}\, q + 2\, n + 4 - 2\, p)\, (\mathrm{I}\, q - 2\, n$$

$$+ 2\, p + 2)\, (\mathrm{I}\, q - 2\, n + 2\, p)\, (n - 2\, p + 2)\, (1 + n - p)\, (a\, x + b + \mathrm{I}\, c\, x + \mathrm{I}\, d)^2\, (\mathrm{I}\, c$$

$$- a)^2 \, (\mathrm{I}\, q - 4\, n + 6\, p - 6)^5 \, S(n+2) + \big(-32\, a\, b\, c\, d\, n^3 + 144\, a\, b\, c\, d\, p^3 - 48\, a\, b\, c\, d\, n^2$$

$$- 16\, a\, b\, c\, d\, p^2 - 80\, a\, b\, c\, d\, n + 32\, a^2\, d^2 + 32\, b^2\, c^2 - 32\, a^4\, x^2 - 32\, c^4\, x^2 - 32\, a^2\, b^2$$

$$- 32\, c^2\, d^2 - 104\, a^2\, c^2\, n^2\, x^2 - 128\, a^2\, c^2\, p^2\, x^2 + 116\, c^4\, n\, p\, x^2 - 24\, c^3\, d\, n^3\, x + 32\, c^3\, d\, p^3\, x$$

$$- 104\, a^3\, b\, n^2\, x - 128\, a^3\, b\, p^2\, x + 40\, a^2\, b^2\, n^2\, p - 44\, a^2\, b^2\, n\, p^2 - 144\, a^2\, c^2\, n\, x^2$$

$$+ 160\, a^2\, c^2\, p\, x^2 - 104\, c^3\, d\, n^2\, x - 128\, c^3\, d\, p^2\, x + 40\, c^2\, d^2\, n^2\, p - 44\, c^2\, d^2\, n\, p^2$$

$$- 144\, a^3\, b\, n\, x + 160\, a^3\, b\, p\, x + 16\, a^3\, d\, q\, x + 116\, a^2\, b^2\, n\, p - 16\, b\, c^3\, q\, x - 144\, c^3\, d\, n\, x$$

$$+ 160\, c^3\, d\, p\, x + 116\, c^2\, d^2\, n\, p + 16\, a^2\, b\, d\, q - 64\, a^2\, c\, d\, x - 16\, a\, b^2\, c\, q - 64\, a\, b\, c^2\, x$$

$$+ 16\, a\, c\, d^2\, q - 16\, b\, c^2\, d\, q - 104\, \mathrm{I}\, a\, b^2\, c\, n\, p^2 + 2\, \mathrm{I}\, a\, b^2\, c\, n\, q^2 + 24\, \mathrm{I}\, a\, c^2\, d\, n^2\, x$$

$$+ 40\, a^4\, n^2\, p\, x^2 - 44\, a^4\, n\, p^2\, x^2 - 24\, a^2\, c^2\, n^3\, x^2 + 32\, a^2\, c^2\, p^3\, x^2 + 40\, c^4\, n^2\, p\, x^2$$

$$- 44\, c^4\, n\, p^2\, x^2 + 116\, a^4\, n\, p\, x^2 - 24\, a^3\, b\, n^3\, x + 32\, a^3\, b\, p^3\, x - 32\, a^2\, b\, c\, n\, q\, x$$

$$+ 44\, a^2\, b\, c\, p\, q\, x - 24\, a^2\, b\, d\, n\, p\, q + 232\, a^2\, c\, d\, n\, p\, x + 24\, a\, b^2\, c\, n\, p\, q + 232\, a\, b\, c^2\, n\, p\, x$$

$$+ 32\, a\, c^2\, d\, n\, q\, x - 44\, a\, c^2\, d\, p\, q\, x - 24\, a\, c\, d^2\, n\, p\, q + 24\, b\, c^2\, d\, n\, p\, q + 4\, a^2\, d^2\, n^3$$

$$- 56\, a^2\, d^2\, p^3 + 4\, b^2\, c^2\, n^3 - 56\, b^2\, c^2\, p^3 - 28\, a^2\, d^2\, n^2 - 56\, a^2\, d^2\, p^2 - 28\, b^2\, c^2\, n^2$$

$$- 56\, b^2\, c^2\, p^2 - 16\, \mathrm{I}\, b^2\, c^2\, p\, q - 24\, \mathrm{I}\, b\, c^3\, p\, x - 104\, \mathrm{I}\, b\, c^2\, d\, p^2 + 4\, \mathrm{I}\, b\, c^2\, d\, q^2 + 8\, \mathrm{I}\, c^3\, d\, q\, x$$

$$- 4\, \mathrm{I}\, c^2\, d^2\, p\, q + 80\, \mathrm{I}\, a^2\, b\, c\, x + 24\, \mathrm{I}\, p\, d\, b\, a^2 - 24\, \mathrm{I}\, a\, b^2\, c\, p - 80\, \mathrm{I}\, a\, c^2\, d\, x + 24\, \mathrm{I}\, a\, c\, d^2\, p$$

$$- 24\, \mathrm{I}\, b\, c^2\, d\, p - 4\, \mathrm{I}\, a^4\, p\, q\, x^2 - 48\, \mathrm{I}\, a^3\, d\, p^3\, x + 48\, \mathrm{I}\, b\, c^3\, p^3\, x - 4\, \mathrm{I}\, c^4\, p\, q\, x^2 + 104\, \mathrm{I}\, a^3\, d\, p^2\, x$$

$$- 4\, \mathrm{I}\, a^3\, d\, q^2\, x - 48\, \mathrm{I}\, p^3\, d\, b\, a^2 + 8\, \mathrm{I}\, a^2\, c^2\, q\, x^2 - 36\, \mathrm{I}\, a^2\, d^2\, p^2\, q + 48\, \mathrm{I}\, a\, b^2\, c\, p^3$$

$$- 48\, \mathrm{I}\, a\, c\, d^2\, p^3 - 24\, a^3\, d\, n\, p\, q\, x - 12\, a^2\, b\, c\, n^2\, q\, x - 8\, a^2\, b\, c\, p^2\, q\, x + 80\, a^2\, c\, d\, n^2\, p\, x$$

$$- 88\, a^2\, c\, d\, n\, p^2\, x + 80\, a\, b\, c^2\, n^2\, p\, x - 88\, a\, b\, c^2\, n\, p^2\, x + 12\, a\, c^2\, d\, n^2\, q\, x + 8\, a\, c^2\, d\, p^2\, q\, x$$

$$+ 24\, b\, c^3\, n\, p\, q\, x - 72\, \mathrm{I}\, a\, c\, d^2\, n^2\, p + 104\, \mathrm{I}\, a\, c\, d^2\, n\, p^2 - 2\, \mathrm{I}\, a\, c\, d^2\, n\, q^2 + 38\, \mathrm{I}\, b^2\, c^2\, n\, p\, q$$

$$+ 112\, \mathrm{I}\, b\, c^3\, n\, p\, x + 72\, \mathrm{I}\, b\, c^2\, d\, n^2\, p - 104\, \mathrm{I}\, b\, c^2\, d\, n\, p^2 + 2\, \mathrm{I}\, b\, c^2\, d\, n\, q^2 + 12\, \mathrm{I}\, c^3\, d\, n\, q\, x$$

$$- 2\, \mathrm{I}\, c^2\, d^2\, n\, p\, q + 56\, \mathrm{I}\, a^2\, b\, c\, n\, x - 112\, \mathrm{I}\, a^2\, b\, d\, n\, p + 112\, \mathrm{I}\, a\, b^2\, c\, n\, p - 56\, \mathrm{I}\, a\, c^2\, d\, n\, x$$

$$- 112\, \mathrm{I}\, a\, c\, d^2\, n\, p + 112\, \mathrm{I}\, b\, c^2\, d\, n\, p - 2\, \mathrm{I}\, a^4\, n\, p\, q\, x^2 + 4\, \mathrm{I}\, a^2\, c^2\, n^2\, q\, x^2 - 2\, \mathrm{I}\, c^4\, n\, p\, q\, x^2$$

$$+ 4\, \mathrm{I}\, a^3\, b\, n^2\, q\, x - 72\, \mathrm{I}\, a^3\, d\, n^2\, p\, x + 104\, \mathrm{I}\, a^3\, d\, n\, p^2\, x - 2\, \mathrm{I}\, a^3\, d\, n\, q^2\, x - 16\, \mathrm{I}\, a^2\, b\, c\, n^3\, x$$

$$+ 12\, \mathrm{I}\, a^2\, c^2\, n\, q\, x^2 + 16\, \mathrm{I}\, a\, c^2\, d\, n^3\, x + 72\, \mathrm{I}\, b\, c^3\, n^2\, p\, x - 104\, \mathrm{I}\, b\, c^3\, n\, p^2\, x + 2\, \mathrm{I}\, b\, c^3\, n\, q^2\, x$$

$$+ 4\, \mathrm{I}\, c^3\, d\, n^2\, q\, x + 12\, \mathrm{I}\, a^3\, b\, n\, q\, x - 112\, \mathrm{I}\, a^3\, d\, n\, p\, x - 2\, \mathrm{I}\, a^2\, b^2\, n\, p\, q - 24\, \mathrm{I}\, a^2\, b\, c\, n^2\, x$$

$$- 72\, \mathrm{I}\, a^2\, b\, d\, n^2\, p + 104\, \mathrm{I}\, a^2\, b\, d\, n\, p^2 - 2\, \mathrm{I}\, a^2\, b\, d\, n\, q^2 + 38\, \mathrm{I}\, a^2\, d^2\, n\, p\, q + 72\, \mathrm{I}\, a\, b^2\, c\, n^2\, p$$

$$- 32\, a^2\, d^2\, n + 80\, a^2\, d^2\, p - 32\, b^2\, c^2\, n + 80\, b^2\, c^2\, p + 80\, a^3\, b\, n^2\, p\, x - 88\, a^3\, b\, n\, p^2\, x$$

$$+ 12\, a^3\, d\, n^2\, q\, x + 8\, a^3\, d\, p^2\, q\, x + 232\, a^2\, c^2\, n\, p\, x^2 - 24\, a^2\, c\, d\, n^3\, x + 32\, a^2\, c\, d\, p^3\, x$$

$$+ 144\, a\, b\, c\, d\, n^2\, p - 240\, a\, b\, c\, d\, n\, p^2 + 12\, a\, b\, c\, d\, n\, q^2 - 20\, a\, b\, c\, d\, p\, q^2 + 64\, a\, b\, c\, d\, n\, p$$

$$- 36\, \mathrm{I}\, b^2\, c^2\, p^2\, q - 104\, \mathrm{I}\, b\, c^3\, p^2\, x + 4\, \mathrm{I}\, b\, c^3\, q^2\, x + 48\, \mathrm{I}\, b\, c^2\, d\, p^3 + 8\, \mathrm{I}\, a^3\, b\, q\, x + 24\, \mathrm{I}\, a^3\, d\, p\, x$$

$$- 4\, \mathrm{I}\, q\, p\, b^2\, a^2 + 104\, \mathrm{I}\, p^2\, d\, b\, a^2 - 4\, \mathrm{I}\, a^2\, b\, d\, q^2 - 16\, \mathrm{I}\, q\, p\, d^2\, a^2 - 104\, \mathrm{I}\, a\, b^2\, c\, p^2$$

$$+ 4\, \mathrm{I}\, a\, b^2\, c\, q^2 + 104\, \mathrm{I}\, a\, c\, d^2\, p^2 - 4\, \mathrm{I}\, a\, c\, d^2\, q^2 + 6\, \mathrm{I}\, c^2\, d^2\, n\, q - 56\, \mathrm{I}\, a^2\, b\, d\, n + 56\, \mathrm{I}\, a\, b^2\, c\, n$$

$$- 56\, \mathrm{I}\, a\, c\, d^2\, n + 56\, \mathrm{I}\, b\, c^2\, d\, n + 6\, \mathrm{I}\, c^4\, n\, q\, x^2 + 24\, \mathrm{I}\, a^3\, d\, n^2\, x + 2\, \mathrm{I}\, a^2\, b^2\, n^2\, q + 16\, \mathrm{I}\, a^2\, b\, d\, n^3$$

$$- 10\, \mathrm{I}\, a^2\, d^2\, n^2\, q - 16\, \mathrm{I}\, a\, b^2\, c\, n^3 + 16\, \mathrm{I}\, a\, c\, d^2\, n^3 - 10\, \mathrm{I}\, b^2\, c^2\, n^2\, q - 24\, \mathrm{I}\, b\, c^3\, n^2\, x$$

$$- 16\, \mathrm{I}\, b\, c^2\, d\, n^3 + 2\, \mathrm{I}\, c^2\, d^2\, n^2\, q - 56\, \mathrm{I}\, a^3\, d\, n\, x + 6\, \mathrm{I}\, a^2\, b^2\, n\, q + 24\, \mathrm{I}\, a^2\, b\, d\, n^2$$

$$+ 14\,\mathrm{I}\,a^2\,d^2\,n\,q - 24\,\mathrm{I}\,a\,b^2\,c\,n^2 + 24\,\mathrm{I}\,a\,c\,d^2\,n^2 + 14\,\mathrm{I}\,b^2\,c^2\,n\,q + 56\,\mathrm{I}\,b\,c^3\,n\,x$$

$$- 24\,\mathrm{I}\,b\,c^2\,d\,n^2 + 2\,\mathrm{I}\,a^4\,n^2\,q\,x^2 + 2\,\mathrm{I}\,c^4\,n^2\,q\,x^2 + 6\,\mathrm{I}\,a^4\,n\,q\,x^2 + 16\,\mathrm{I}\,a^3\,d\,n^3\,x - 16\,\mathrm{I}\,b\,c^3\,n^3\,x$$

$$- 32\,a^2\,d^2\,n^2\,p + 76\,a^2\,d^2\,n\,p^2 - 6\,a^2\,d^2\,n\,q^2 + 10\,a^2\,d^2\,p\,q^2 - 32\,b^2\,c^2\,n^2\,p + 76\,b^2\,c^2\,n\,p^2$$

$$- 6\,b^2\,c^2\,n\,q^2 + 10\,b^2\,c^2\,p\,q^2 + 84\,a^2\,d^2\,n\,p + 84\,b^2\,c^2\,n\,p - 128\,a\,b\,c\,d + 24\,a^2\,b\,c\,n\,p\,q\,x$$

$$- 24\,a\,c^2\,d\,n\,p\,q\,x + 80\,a^2\,c^2\,n^2\,p\,x^2 - 88\,a^2\,c^2\,n\,p^2\,x^2 - 104\,a^2\,c\,d\,n^2\,x - 128\,a^2\,c\,d\,p^2\,x$$

$$- 12\,a\,b^2\,c\,n^2\,q - 8\,a\,b^2\,c\,p^2\,q - 104\,a\,b\,c^2\,n^2\,x - 128\,a\,b\,c^2\,p^2\,x + 12\,a\,c\,d^2\,n^2\,q$$

$$+ 8\,a\,c\,d^2\,p^2\,q - 32\,b\,c^3\,n\,q\,x + 44\,b\,c^3\,p\,q\,x - 12\,b\,c^2\,d\,n^2\,q - 8\,b\,c^2\,d\,p^2\,q$$

$$+ 232\,c^3\,d\,n\,p\,x - 16\,a^2\,b\,c\,q\,x + 32\,a^2\,b\,d\,n\,q - 44\,a^2\,b\,d\,p\,q - 144\,a^2\,c\,d\,n\,x$$

$$+ 160\,a^2\,c\,d\,p\,x - 32\,a\,b^2\,c\,n\,q + 44\,a\,b^2\,c\,p\,q - 144\,a\,b\,c^2\,n\,x + 160\,a\,b\,c^2\,p\,x$$

$$+ 16\,a\,c^2\,d\,q\,x + 32\,a\,c\,d^2\,n\,q - 44\,a\,c\,d^2\,p\,q - 32\,b\,c^2\,d\,n\,q + 44\,b\,c^2\,d\,p\,q$$

$$- 24\,a\,b\,c^2\,n^3\,x + 32\,a\,b\,c^2\,p^3\,x - 12\,b\,c^3\,n^2\,q\,x - 8\,b\,c^3\,p^2\,q\,x + 80\,c^3\,d\,n^2\,p\,x$$

$$- 88\,c^3\,d\,n\,p^2\,x + 232\,a^3\,b\,n\,p\,x + 32\,a^3\,d\,n\,q\,x - 44\,a^3\,d\,p\,q\,x + 12\,a^2\,b\,d\,n^2\,q$$

$$+ 8\,a^2\,b\,d\,p^2\,q - 12\,a^4\,n^3\,x^2 + 16\,a^4\,p^3\,x^2 - 12\,c^4\,n^3\,x^2 + 16\,c^4\,p^3\,x^2 - 52\,a^4\,n^2\,x^2$$

$$- 64\,a^4\,p^2\,x^2 - 52\,c^4\,n^2\,x^2 - 64\,c^4\,p^2\,x^2 - 72\,a^4\,n\,x^2 + 80\,a^4\,p\,x^2 - 12\,a^2\,b^2\,n^3$$

$$+ 16\,a^2\,b^2\,p^3 - 72\,c^4\,n\,x^2 + 80\,c^4\,p\,x^2 - 12\,c^2\,d^2\,n^3 + 16\,c^2\,d^2\,p^3 - 52\,a^2\,b^2\,n^2$$

$$- 64\,a^2\,b^2\,p^2 - 64\,a^2\,c^2\,x^2 - 52\,c^2\,d^2\,n^2 - 64\,c^2\,d^2\,p^2 - 64\,a^3\,b\,x - 72\,a^2\,b^2\,n + 80\,a^2\,b^2\,p$$

$$- 64\,c^3\,d\,x - 72\,c^2\,d^2\,n + 80\,c^2\,d^2\,p + 24\,\mathrm{I}\,a\,b\,c\,d\,p\,q + 12\,\mathrm{I}\,a^2\,c\,d\,n\,q\,x + 12\,\mathrm{I}\,a\,b\,c^2\,n\,q\,x$$

$$+ 24\,\mathrm{I}\,a\,b\,c\,d\,n^2\,q - 112\,\mathrm{I}\,a\,c^2\,d\,n\,p\,x - 16\,\mathrm{I}\,a\,b\,c\,d\,n\,q - 4\,\mathrm{I}\,a^2\,c^2\,n\,p\,q\,x^2 - 4\,\mathrm{I}\,a^3\,b\,n\,p\,q\,x$$

$$+ 72\,\mathrm{I}\,a^2\,b\,c\,n^2\,p\,x - 104\,\mathrm{I}\,a^2\,b\,c\,n\,p^2\,x + 2\,\mathrm{I}\,a^2\,b\,c\,n\,q^2\,x + 4\,\mathrm{I}\,a^2\,c\,d\,n^2\,q\,x$$

$$+ 4\,\mathrm{I}\,a\,b\,c^2\,n^2\,q\,x - 72\,\mathrm{I}\,a\,c^2\,d\,n^2\,p\,x + 104\,\mathrm{I}\,a\,c^2\,d\,n\,p^2\,x - 2\,\mathrm{I}\,a\,c^2\,d\,n\,q^2\,x$$

$$- 4\,\mathrm{I}\,c^3\,d\,n\,p\,q\,x + 112\,\mathrm{I}\,a^2\,b\,c\,n\,p\,x - 8\,\mathrm{I}\,a^2\,c\,d\,p\,q\,x - 8\,\mathrm{I}\,a\,b\,c^2\,p\,q\,x + 72\,\mathrm{I}\,a\,b\,c\,d\,p^2\,q$$

$$- 4\,\mathrm{I}\,a^2\,c\,d\,n\,p\,q\,x - 4\,\mathrm{I}\,a\,b\,c^2\,n\,p\,q\,x - 80\,\mathrm{I}\,a\,b\,c\,d\,n\,p\,q + 48\,\mathrm{I}\,a^2\,b\,c\,p^3\,x - 8\,\mathrm{I}\,a^2\,c^2\,p\,q\,x^2$$

$$- 48\,\mathrm{I}\,a\,c^2\,d\,p^3\,x - 8\,\mathrm{I}\,a^3\,b\,p\,q\,x - 104\,\mathrm{I}\,a^2\,b\,c\,p^2\,x + 4\,\mathrm{I}\,a^2\,b\,c\,q^2\,x - 2\,\mathrm{I}\,a\,b\,c\,d\,q^3$$

$$+ 104\,\mathrm{I}\,a\,c^2\,d\,p^2\,x - 4\,\mathrm{I}\,a\,c^2\,d\,q^2\,x - 8\,\mathrm{I}\,c^3\,d\,p\,q\,x - 24\,\mathrm{I}\,a^2\,b\,c\,p\,x + 8\,\mathrm{I}\,a^2\,c\,d\,q\,x$$

$$+ 8\,\mathrm{I}\,a\,b\,c^2\,q\,x + 24\,\mathrm{I}\,a\,c^2\,d\,p\,x - 40\,\mathrm{I}\,a\,b\,c\,d\,q + \mathrm{I}\,a^2\,d^2\,q^3 + \mathrm{I}\,b^2\,c^2\,q^3 + 4\,\mathrm{I}\,a^4\,q\,x^2$$

$$+ 4\,\mathrm{I}\,c^4\,q\,x^2 - 80\,\mathrm{I}\,a^3\,d\,x + 4\,\mathrm{I}\,q\,b^2\,a^2 + 24\,\mathrm{I}\,q\,d^2\,a^2 + 24\,\mathrm{I}\,b^2\,c^2\,q + 80\,\mathrm{I}\,b\,c^3\,x + 4\,\mathrm{I}\,c^2\,d^2\,q$$

$$- 80\,\mathrm{I}\,d\,b\,a^2 + 80\,\mathrm{I}\,a\,b^2\,c - 80\,\mathrm{I}\,a\,c\,d^2 + 80\,\mathrm{I}\,b\,c^2\,d\big)\,\big(2\,a^2\,x\,n^2 - 4\,a^2\,x\,p\,n + 2\,a^2\,p^2\,x$$

$$+ 2\,c^2\,x\,n^2 - 4\,c^2\,x\,p\,n + 2\,c^2\,p^2\,x + 6\,a^2\,x\,n - 6\,a^2\,x\,p + 2\,a\,b\,n^2 - 4\,a\,b\,p\,n + 2\,a\,b\,p^2$$

$$- a\,d\,p\,q + b\,c\,p\,q + 6\,c^2\,x\,n - 6\,c^2\,x\,p + 2\,c\,d\,n^2 - 4\,c\,d\,p\,n + 2\,c\,d\,p^2 + 4\,a^2\,x + 6\,a\,b\,n$$

$$- 6\,a\,b\,p + 4\,c^2\,x + 6\,c\,d\,n - 6\,c\,d\,p + 4\,a\,b + 4\,c\,d\big)\,(\mathrm{I}\,q - 2\,n + 2\,p)\,(\mathrm{I}\,q + 2\,n + 4$$

$$- 2\,p)\,(\mathrm{I}\,q - 2\,n + 2\,p + 2)\,(3 + 2\,n - 2\,p)\,(a\,x + b + \mathrm{I}\,c\,x + \mathrm{I}\,d)^2\,(\mathrm{I}\,c - a)^2\,(\mathrm{I}\,q$$

$$- 4\,n + 6\,p - 6)^5\,S(n+1) + \big(-32\,a\,b\,c\,d\,n^3 + 144\,a\,b\,c\,d\,p^3 - 48\,a\,b\,c\,d\,n^2$$

$$- 16\,a\,b\,c\,d\,p^2 - 80\,a\,b\,c\,d\,n + 32\,a^2\,d^2 + 32\,b^2\,c^2 - 32\,a^4\,x^2 - 32\,c^4\,x^2 - 32\,a^2\,b^2$$

$$- 32\,c^2\,d^2 - 104\,a^2\,c^2\,n^2\,x^2 - 128\,a^2\,c^2\,p^2\,x^2 + 116\,c^4\,n\,p\,x^2 - 24\,c^3\,d\,n^3\,x + 32\,c^3\,d\,p^3\,x$$

$$- 104\,a^3\,b\,n^2\,x - 128\,a^3\,b\,p^2\,x + 40\,a^2\,b^2\,n^2\,p - 44\,a^2\,b^2\,n\,p^2 - 144\,a^2\,c^2\,n\,x^2$$

$$+ 160\,a^2\,c^2\,p\,x^2 - 104\,c^3\,d\,n^2\,x - 128\,c^3\,d\,p^2\,x + 40\,c^2\,d^2\,n^2\,p - 44\,c^2\,d^2\,n\,p^2$$

$$- 144\, a^3\, b\, n\, x + 160\, a^3\, b\, p\, x + 16\, a^3\, d\, q\, x + 116\, a^2\, b^2\, n\, p - 16\, b\, c^3\, q\, x - 144\, c^3\, d\, n\, x$$

$$+ 160\, c^3\, d\, p\, x + 116\, c^2\, d^2\, n\, p + 16\, a^2\, b\, d\, q - 64\, a^2\, c\, d\, x - 16\, a\, b^2\, c\, q - 64\, a\, b\, c^2\, x$$

$$+ 16\, a\, c\, d^2\, q - 16\, b\, c^2\, d\, q - 104\, \mathrm{I}\, a\, b^2\, c\, n\, p^2 + 2\, \mathrm{I}\, a\, b^2\, c\, n\, q^2 + 24\, \mathrm{I}\, a\, c^2\, d\, n^2\, x$$

$$+ 40\, a^4\, n^2\, p\, x^2 - 44\, a^4\, n\, p^2\, x^2 - 24\, a^2\, c^2\, n^3\, x^2 + 32\, a^2\, c^2\, p^3\, x^2 + 40\, c^4\, n^2\, p\, x^2$$

$$- 44\, c^4\, n\, p^2\, x^2 + 116\, a^4\, n\, p\, x^2 - 24\, a^3\, b\, n^3\, x + 32\, a^3\, b\, p^3\, x - 32\, a^2\, b\, c\, n\, q\, x$$

$$+ 44\, a^2\, b\, c\, p\, q\, x - 24\, a^2\, b\, d\, n\, p\, q + 232\, a^2\, c\, d\, n\, p\, x + 24\, a\, b^2\, c\, n\, p\, q + 232\, a\, b\, c^2\, n\, p\, x$$

$$+ 32\, a\, c^2\, d\, n\, q\, x - 44\, a\, c^2\, d\, p\, q\, x - 24\, a\, c\, d^2\, n\, p\, q + 24\, b\, c^2\, d\, n\, p\, q + 4\, a^2\, d^2\, n^3$$

$$- 56\, a^2\, d^2\, p^3 + 4\, b^2\, c^2\, n^3 - 56\, b^2\, c^2\, p^3 - 28\, a^2\, d^2\, n^2 - 56\, a^2\, d^2\, p^2 - 28\, b^2\, c^2\, n^2$$

$$- 56\, b^2\, c^2\, p^2 - 16\, \mathrm{I}\, b^2\, c^2\, p\, q - 24\, \mathrm{I}\, b\, c^3\, p\, x - 104\, \mathrm{I}\, b\, c^2\, d\, p^2 + 4\, \mathrm{I}\, b\, c^2\, d\, q^2 + 8\, \mathrm{I}\, c^3\, d\, q\, x$$

$$- 4\, \mathrm{I}\, c^2\, d^2\, p\, q + 80\, \mathrm{I}\, a^2\, b\, c\, x + 24\, \mathrm{I}\, p\, d\, b\, a^2 - 24\, \mathrm{I}\, a\, b^2\, c\, p - 80\, \mathrm{I}\, a\, c^2\, d\, x + 24\, \mathrm{I}\, a\, c\, d^2\, p$$

$$- 24\, \mathrm{I}\, b\, c^2\, d\, p - 4\, \mathrm{I}\, a^4\, p\, q\, x^2 - 48\, \mathrm{I}\, a^3\, d\, p^3\, x + 48\, \mathrm{I}\, b\, c^3\, p^3\, x - 4\, \mathrm{I}\, c^4\, p\, q\, x^2 + 104\, \mathrm{I}\, a^3\, d\, p^2\, x$$

$$- 4\, \mathrm{I}\, a^3\, d\, q^2\, x - 48\, \mathrm{I}\, p^3\, d\, b\, a^2 + 8\, \mathrm{I}\, a^2\, c^2\, q\, x^2 - 36\, \mathrm{I}\, a^2\, d^2\, p^2\, q + 48\, \mathrm{I}\, a\, b^2\, c\, p^3$$

$$- 48\, \mathrm{I}\, a\, c\, d^2\, p^3 - 24\, a^3\, d\, n\, p\, q\, x - 12\, a^2\, b\, c\, n^2\, q\, x - 8\, a^2\, b\, c\, p^2\, q\, x + 80\, a^2\, c\, d\, n^2\, p\, x$$

$$- 88\, a^2\, c\, d\, n\, p^2\, x + 80\, a\, b\, c^2\, n^2\, p\, x - 88\, a\, b\, c^2\, n\, p^2\, x + 12\, a\, c^2\, d\, n^2\, q\, x + 8\, a\, c^2\, d\, p^2\, q\, x$$

$$+ 24\, b\, c^3\, n\, p\, q\, x - 72\, \mathrm{I}\, a\, c\, d^2\, n^2\, p + 104\, \mathrm{I}\, a\, c\, d^2\, n\, p^2 - 2\, \mathrm{I}\, a\, c\, d^2\, n\, q^2 + 38\, \mathrm{I}\, b^2\, c^2\, n\, p\, q$$

$$+ 112\, \mathrm{I}\, b\, c^3\, n\, p\, x + 72\, \mathrm{I}\, b\, c^2\, d\, n^2\, p - 104\, \mathrm{I}\, b\, c^2\, d\, n\, p^2 + 2\, \mathrm{I}\, b\, c^2\, d\, n\, q^2 + 12\, \mathrm{I}\, c^3\, d\, n\, q\, x$$

$$- 2\, \mathrm{I}\, c^2\, d^2\, n\, p\, q + 56\, \mathrm{I}\, a^2\, b\, c\, n\, x - 112\, \mathrm{I}\, a^2\, b\, d\, n\, p + 112\, \mathrm{I}\, a\, b^2\, c\, n\, p - 56\, \mathrm{I}\, a\, c^2\, d\, n\, x$$

$$- 112\, \mathrm{I}\, a\, c\, d^2\, n\, p + 112\, \mathrm{I}\, b\, c^2\, d\, n\, p - 2\, \mathrm{I}\, a^4\, n\, p\, q\, x^2 + 4\, \mathrm{I}\, a^2\, c^2\, n^2\, q\, x^2 - 2\, \mathrm{I}\, c^4\, n\, p\, q\, x^2$$

$$+ 4\,\mathrm{I}\,a^3\,b\,n^2\,q\,x - 72\,\mathrm{I}\,a^3\,d\,n^2\,p\,x + 104\,\mathrm{I}\,a^3\,d\,n\,p^2\,x - 2\,\mathrm{I}\,a^3\,d\,n\,q^2\,x - 16\,\mathrm{I}\,a^2\,b\,c\,n^3\,x$$

$$+ 12\,\mathrm{I}\,a^2\,c^2\,n\,q\,x^2 + 16\,\mathrm{I}\,a\,c^2\,d\,n^3\,x + 72\,\mathrm{I}\,b\,c^3\,n^2\,p\,x - 104\,\mathrm{I}\,b\,c^3\,n\,p^2\,x + 2\,\mathrm{I}\,b\,c^3\,n\,q^2\,x$$

$$+ 4\,\mathrm{I}\,c^3\,d\,n^2\,q\,x + 12\,\mathrm{I}\,a^3\,b\,n\,q\,x - 112\,\mathrm{I}\,a^3\,d\,n\,p\,x - 2\,\mathrm{I}\,a^2\,b^2\,n\,p\,q - 24\,\mathrm{I}\,a^2\,b\,c\,n^2\,x$$

$$- 72\,\mathrm{I}\,a^2\,b\,d\,n^2\,p + 104\,\mathrm{I}\,a^2\,b\,d\,n\,p^2 - 2\,\mathrm{I}\,a^2\,b\,d\,n\,q^2 + 38\,\mathrm{I}\,a^2\,d^2\,n\,p\,q + 72\,\mathrm{I}\,a\,b^2\,c\,n^2\,p$$

$$- 32\,a^2\,d^2\,n + 80\,a^2\,d^2\,p - 32\,b^2\,c^2\,n + 80\,b^2\,c^2\,p + 80\,a^3\,b\,n^2\,p\,x - 88\,a^3\,b\,n\,p^2\,x$$

$$+ 12\,a^3\,d\,n^2\,q\,x + 8\,a^3\,d\,p^2\,q\,x + 232\,a^2\,c^2\,n\,p\,x^2 - 24\,a^2\,c\,d\,n^3\,x + 32\,a^2\,c\,d\,p^3\,x$$

$$+ 144\,a\,b\,c\,d\,n^2\,p - 240\,a\,b\,c\,d\,n\,p^2 + 12\,a\,b\,c\,d\,n\,q^2 - 20\,a\,b\,c\,d\,p\,q^2 + 64\,a\,b\,c\,d\,n\,p$$

$$- 36\,\mathrm{I}\,b^2\,c^2\,p^2\,q - 104\,\mathrm{I}\,b\,c^3\,p^2\,x + 4\,\mathrm{I}\,b\,c^3\,q^2\,x + 48\,\mathrm{I}\,b\,c^2\,d\,p^3 + 8\,\mathrm{I}\,a^3\,b\,q\,x + 24\,\mathrm{I}\,a^3\,d\,p\,x$$

$$- 4\,\mathrm{I}\,q\,p\,b^2\,a^2 + 104\,\mathrm{I}\,p^2\,d\,b\,a^2 - 4\,\mathrm{I}\,a^2\,b\,d\,q^2 - 16\,\mathrm{I}\,q\,p\,d^2\,a^2 - 104\,\mathrm{I}\,a\,b^2\,c\,p^2$$

$$+ 4\,\mathrm{I}\,a\,b^2\,c\,q^2 + 104\,\mathrm{I}\,a\,c\,d^2\,p^2 - 4\,\mathrm{I}\,a\,c\,d^2\,q^2 + 6\,\mathrm{I}\,c^2\,d^2\,n\,q - 56\,\mathrm{I}\,a^2\,b\,d\,n + 56\,\mathrm{I}\,a\,b^2\,c\,n$$

$$- 56\,\mathrm{I}\,a\,c\,d^2\,n + 56\,\mathrm{I}\,b\,c^2\,d\,n + 6\,\mathrm{I}\,c^4\,n\,q\,x^2 + 24\,\mathrm{I}\,a^3\,d\,n^2\,x + 2\,\mathrm{I}\,a^2\,b^2\,n^2\,q + 16\,\mathrm{I}\,a^2\,b\,d\,n^3$$

$$- 10\,\mathrm{I}\,a^2\,d^2\,n^2\,q - 16\,\mathrm{I}\,a\,b^2\,c\,n^3 + 16\,\mathrm{I}\,a\,c\,d^2\,n^3 - 10\,\mathrm{I}\,b^2\,c^2\,n^2\,q - 24\,\mathrm{I}\,b\,c^3\,n^2\,x$$

$$- 16\,\mathrm{I}\,b\,c^2\,d\,n^3 + 2\,\mathrm{I}\,c^2\,d^2\,n^2\,q - 56\,\mathrm{I}\,a^3\,d\,n\,x + 6\,\mathrm{I}\,a^2\,b^2\,n\,q + 24\,\mathrm{I}\,a^2\,b\,d\,n^2$$

$$+ 14\,\mathrm{I}\,a^2\,d^2\,n\,q - 24\,\mathrm{I}\,a\,b^2\,c\,n^2 + 24\,\mathrm{I}\,a\,c\,d^2\,n^2 + 14\,\mathrm{I}\,b^2\,c^2\,n\,q + 56\,\mathrm{I}\,b\,c^3\,n\,x$$

$$- 24\,\mathrm{I}\,b\,c^2\,d\,n^2 + 2\,\mathrm{I}\,a^4\,n^2\,q\,x^2 + 2\,\mathrm{I}\,c^4\,n^2\,q\,x^2 + 6\,\mathrm{I}\,a^4\,n\,q\,x^2 + 16\,\mathrm{I}\,a^3\,d\,n^3\,x - 16\,\mathrm{I}\,b\,c^3\,n^3\,x$$

$$- 32\,a^2\,d^2\,n^2\,p + 76\,a^2\,d^2\,n\,p^2 - 6\,a^2\,d^2\,n\,q^2 + 10\,a^2\,d^2\,p\,q^2 - 32\,b^2\,c^2\,n^2\,p + 76\,b^2\,c^2\,n\,p^2$$

$$- 6\,b^2\,c^2\,n\,q^2 + 10\,b^2\,c^2\,p\,q^2 + 84\,a^2\,d^2\,n\,p + 84\,b^2\,c^2\,n\,p - 128\,a\,b\,c\,d + 24\,a^2\,b\,c\,n\,p\,q\,x$$

$$- 24\,a\,c^2\,d\,n\,p\,q\,x + 80\,a^2\,c^2\,n^2\,p\,x^2 - 88\,a^2\,c^2\,n\,p^2\,x^2 - 104\,a^2\,c\,d\,n^2\,x - 128\,a^2\,c\,d\,p^2\,x$$

$$- 12\, a\, b^2\, c\, n^2\, q - 8\, a\, b^2\, c\, p^2\, q - 104\, a\, b\, c^2\, n^2\, x - 128\, a\, b\, c^2\, p^2\, x + 12\, a\, c\, d^2\, n^2\, q$$

$$+ 8\, a\, c\, d^2\, p^2\, q - 32\, b\, c^3\, n\, q\, x + 44\, b\, c^3\, p\, q\, x - 12\, b\, c^2\, d\, n^2\, q - 8\, b\, c^2\, d\, p^2\, q$$

$$+ 232\, c^3\, d\, n\, p\, x - 16\, a^2\, b\, c\, q\, x + 32\, a^2\, b\, d\, n\, q - 44\, a^2\, b\, d\, p\, q - 144\, a^2\, c\, d\, n\, x$$

$$+ 160\, a^2\, c\, d\, p\, x - 32\, a\, b^2\, c\, n\, q + 44\, a\, b^2\, c\, p\, q - 144\, a\, b\, c^2\, n\, x + 160\, a\, b\, c^2\, p\, x$$

$$+ 16\, a\, c^2\, d\, q\, x + 32\, a\, c\, d^2\, n\, q - 44\, a\, c\, d^2\, p\, q - 32\, b\, c^2\, d\, n\, q + 44\, b\, c^2\, d\, p\, q$$

$$- 24\, a\, b\, c^2\, n^3\, x + 32\, a\, b\, c^2\, p^3\, x - 12\, b\, c^3\, n^2\, q\, x - 8\, b\, c^3\, p^2\, q\, x + 80\, c^3\, d\, n^2\, p\, x$$

$$- 88\, c^3\, d\, n\, p^2\, x + 232\, a^3\, b\, n\, p\, x + 32\, a^3\, d\, n\, q\, x - 44\, a^3\, d\, p\, q\, x + 12\, a^2\, b\, d\, n^2\, q$$

$$+ 8\, a^2\, b\, d\, p^2\, q - 12\, a^4\, n^3\, x^2 + 16\, a^4\, p^3\, x^2 - 12\, c^4\, n^3\, x^2 + 16\, c^4\, p^3\, x^2 - 52\, a^4\, n^2\, x^2$$

$$- 64\, a^4\, p^2\, x^2 - 52\, c^4\, n^2\, x^2 - 64\, c^4\, p^2\, x^2 - 72\, a^4\, n\, x^2 + 80\, a^4\, p\, x^2 - 12\, a^2\, b^2\, n^3$$

$$+ 16\, a^2\, b^2\, p^3 - 72\, c^4\, n\, x^2 + 80\, c^4\, p\, x^2 - 12\, c^2\, d^2\, n^3 + 16\, c^2\, d^2\, p^3 - 52\, a^2\, b^2\, n^2$$

$$- 64\, a^2\, b^2\, p^2 - 64\, a^2\, c^2\, x^2 - 52\, c^2\, d^2\, n^2 - 64\, c^2\, d^2\, p^2 - 64\, a^3\, b\, x - 72\, a^2\, b^2\, n + 80\, a^2\, b^2\, p$$

$$- 64\, c^3\, d\, x - 72\, c^2\, d^2\, n + 80\, c^2\, d^2\, p + 24\, \mathrm{I}\, a\, b\, c\, d\, p\, q + 12\, \mathrm{I}\, a^2\, c\, d\, n\, q\, x + 12\, \mathrm{I}\, a\, b\, c^2\, n\, q\, x$$

$$+ 24\, \mathrm{I}\, a\, b\, c\, d\, n^2\, q - 112\, \mathrm{I}\, a\, c^2\, d\, n\, p\, x - 16\, \mathrm{I}\, a\, b\, c\, d\, n\, q - 4\, \mathrm{I}\, a^2\, c^2\, n\, p\, q\, x^2 - 4\, \mathrm{I}\, a^3\, b\, n\, p\, q\, x$$

$$+ 72\, \mathrm{I}\, a^2\, b\, c\, n^2\, p\, x - 104\, \mathrm{I}\, a^2\, b\, c\, n\, p^2\, x + 2\, \mathrm{I}\, a^2\, b\, c\, n\, q^2\, x + 4\, \mathrm{I}\, a^2\, c\, d\, n^2\, q\, x$$

$$+ 4\, \mathrm{I}\, a\, b\, c^2\, n^2\, q\, x - 72\, \mathrm{I}\, a\, c^2\, d\, n^2\, p\, x + 104\, \mathrm{I}\, a\, c^2\, d\, n\, p^2\, x - 2\, \mathrm{I}\, a\, c^2\, d\, n\, q^2\, x$$

$$- 4\, \mathrm{I}\, c^3\, d\, n\, p\, q\, x + 112\, \mathrm{I}\, a^2\, b\, c\, n\, p\, x - 8\, \mathrm{I}\, a^2\, c\, d\, p\, q\, x - 8\, \mathrm{I}\, a\, b\, c^2\, p\, q\, x + 72\, \mathrm{I}\, a\, b\, c\, d\, p^2\, q$$

$$- 4\, \mathrm{I}\, a^2\, c\, d\, n\, p\, q\, x - 4\, \mathrm{I}\, a\, b\, c^2\, n\, p\, q\, x - 80\, \mathrm{I}\, a\, b\, c\, d\, n\, p\, q + 48\, \mathrm{I}\, a^2\, b\, c\, p^3\, x - 8\, \mathrm{I}\, a^2\, c^2\, p\, q\, x^2$$

$$- 48\, \mathrm{I}\, a\, c^2\, d\, p^3\, x - 8\, \mathrm{I}\, a^3\, b\, p\, q\, x - 104\, \mathrm{I}\, a^2\, b\, c\, p^2\, x + 4\, \mathrm{I}\, a^2\, b\, c\, q^2\, x - 2\, \mathrm{I}\, a\, b\, c\, d\, q^3$$

$$+ 104\,\mathrm{I}\,a\,c^2\,d\,p^2\,x - 4\,\mathrm{I}\,a\,c^2\,d\,q^2\,x - 8\,\mathrm{I}\,c^3\,d\,p\,q\,x - 24\,\mathrm{I}\,a^2\,b\,c\,p\,x + 8\,\mathrm{I}\,a^2\,c\,d\,q\,x$$

$$+ 8\,\mathrm{I}\,a\,b\,c^2\,q\,x + 24\,\mathrm{I}\,a\,c^2\,d\,p\,x - 40\,\mathrm{I}\,a\,b\,c\,d\,q + \mathrm{I}\,a^2\,d^2\,q^3 + \mathrm{I}\,b^2\,c^2\,q^3 + 4\,\mathrm{I}\,a^4\,q\,x^2$$

$$+ 4\,\mathrm{I}\,c^4\,q\,x^2 - 80\,\mathrm{I}\,a^3\,d\,x + 4\,\mathrm{I}\,q\,b^2\,a^2 + 24\,\mathrm{I}\,q\,d^2\,a^2 + 24\,\mathrm{I}\,b^2\,c^2\,q + 80\,\mathrm{I}\,b\,c^3\,x + 4\,\mathrm{I}\,c^2\,d^2\,q$$

$$- 80\,\mathrm{I}\,d\,b\,a^2 + 80\,\mathrm{I}\,a\,b^2\,c - 80\,\mathrm{I}\,a\,c\,d^2 + 80\,\mathrm{I}\,b\,c^2\,d\big)\,(\mathrm{I}\,q - 2\,n + 2\,p - 2)\,(\mathrm{I}\,q + 2\,n$$

$$- 2\,p + 2)\,(\mathrm{I}\,q - 2\,n + 2\,p + 2)\,(\mathrm{I}\,q + 2\,n + 4 - 2\,p)\,(\mathrm{I}\,q - 2\,n + 2\,p)\,(-p + 2$$

$$+ n)\,(n + 1)\,(a\,x + b + \mathrm{I}\,c\,x + \mathrm{I}\,d)^2\,(a\,d - b\,c)^2\,(\mathrm{I}\,c - a)^2\,(\mathrm{I}\,q - 4\,n + 6\,p - 6)^5\,S(n)$$

$$= 0,\ 1,\ -\frac{1}{2\,(-1 + p)\,\Gamma(-2\,p + 2)}\big(\Gamma(3 - 2\,p)\,\big(2\,a^2\,x\,p + 2\,c^2\,x\,p - 2\,a^2\,x$$

$$+ 2\,a\,b\,p - q\,a\,d + q\,b\,c - 2\,c^2\,x + 2\,c\,d\,p - 2\,a\,b - 2\,c\,d\big)\big)\Big]$$

We simplify the TTRR by the common factor appearing in each term

```
> REMJ3f:=collect(REMJ3[1]/((160*a^2*c^2*p*x^2-(56*I)*a^3*d*n*x+80*
  a^2*c^2*n^2*p*x^2+(48*I)*b*c^2*d*p^3+16*c^4*p^3*x^2+40*c^4*n^2*p*
  x^2+32*a^2*c^2*p^3*x^2-(16*I)*b*c^3*n^3*x-(80*I)*a*c^2*d*x-144*
  c^3*d*n*x+(24*I)*a^2*b*d*n^2+I*b^2*c^2*q^3-(10*I)*b^2*c^2*n^2*q-
  (4*I)*a^2*c*d*n*p*q*x-(4*I)*a*b*c^2*n*p*q*x+(16*I)*a^3*d*n^3*x+
  (2*I)*a^4*n^2*q*x^2+(4*I)*a^4*q*x^2+(4*I)*c^4*q*x^2-(80*I)*a^3*d*
  x+(4*I)*q*b^2*a^2+(24*I)*q*d^2*a^2+(24*I)*b^2*c^2*q+(80*I)*b*c^3*
  x+(4*I)*c^2*d^2*q-(80*I)*d*b*a^2+(80*I)*a*b^2*c-(80*I)*a*c*d^2+
  (80*I)*b*c^2*d-(104*I)*b*c^3*p^2*x+(56*I)*a*b^2*c*n-28*a^2*d^2*
  n^2-56*a^2*d^2*p^2+(6*I)*a^4*n*q*x^2+160*c^3*d*p*x-(48*I)*p^3*d*
  b*a^2+(2*I)*c^4*n^2*q*x^2+(24*I)*a*c*d^2*n^2-64*c^3*d*x-24*a^2*
  c^2*n^3*x^2-44*c^4*n*p^2*x^2+116*a^4*n*p*x^2-24*a^3*b*n^3*x+32*
  a^3*b*p^3*x-104*a^2*c^2*n^2*x^2+116*a^2*b^2*n*p-144*a^2*c^2*n*x^2
  -(24*I)*a*b^2*c*p-(16*I)*a*b^2*c*n^3+(24*I)*p*d*b*a^2+4*a^2*d^2*
  n^3+4*b^2*c^2*n^3-32*a^2*d^2*n^2*p+76*a^2*d^2*n*p^2-32*b^2*c^2*
  n^2*p+76*b^2*c^2*n*p^2+84*a^2*d^2*n*p+84*b^2*c^2*n*p+116*c^2*d^2*
  n*p-12*a^4*n^3*x^2+16*a^4*p^3*x^2+80*c^2*d^2*p-72*c^2*d^2*n-(4*I)
  *c^4*p*q*x^2+(56*I)*b*c^2*d*n-12*c^4*n^3*x^2+I*a^2*d^2*q^3-(36*I)
  *a^2*d^2*p^2*q-6*a^2*d^2*n*q^2+10*a^2*d^2*p*q^2+(6*I)*c^4*n*q*
  x^2+16*a^3*d*q*x+(24*I)*a^3*d*n^2*x+(48*I)*b*c^3*p^3*x-44*a^4*n*
  p^2*x^2+(8*I)*a^3*b*q*x-(56*I)*a^2*b*d*n+80*b^2*c^2*p+80*a^2*d^2*
  p-32*b^2*c^2*n+(56*I)*b*c^3*n*x+(24*I)*a*c*d^2*p-(2*I)*a*c^2*d*n*
  q^2*x+(112*I)*a^2*b*c*n*p*x+(12*I)*a^2*c*d*n*q*x+(12*I)*a*b*c^2*
  n*q*x+(24*I)*a*b*c*d*n^2*q+(2*I)*a^2*b^2*n^2*q-(48*I)*a^3*d*p^3*
  x-32*a^2*b*c*n*q*x+44*a^2*b*c*p*q*x-24*a^2*b*d*n*p*q+232*a^2*c*d*
  n*p*x+24*a*b^2*c*n*p*q+232*a*b*c^2*n*p*x+144*a*b*c*d*n^2*p-240*a*
  b*c*d*n*p^2+12*a*b*c*d*n*q^2-20*a*b*c*d*p*q^2+32*a*c^2*d*n*q*
  x-44*a*c^2*d*p*q*x-24*a*c*d^2*n*p*q+24*b*c^2*d*n*p*q+64*a*b*c*d*
  n*p-24*a^3*d*n*p*q*x-12*a^2*b*c*n^2*q*x-8*a^2*b*c*p^2*q*x+80*a^2*
  c*d*n^2*p*x-88*a^2*c*d*n*p^2*x+80*a*b*c^2*n^2*p*x-88*a*b*c^2*n*
```

```
p^2*x+12*a*c^2*d*n^2*q*x+8*a*c^2*d*p^2*q*x+24*b*c^3*n*p*q*x+(16*
I)*a^2*b*d*n^3-104*c^3*d*n^2*x+(104*I)*a^3*d*p^2*x-144*a^3*b*n*x-
(36*I)*b^2*c^2*p^2*q+116*c^4*n*p*x^2-(4*I)*a^4*p*q*x^2-56*b^2*
c^2*p^3-28*b^2*c^2*n^2-56*b^2*c^2*p^2-32*a^2*d^2*n-56*a^2*d^2*
p^3+32*c^3*d*p^3*x-24*c^3*d*n^3*x-(24*I)*b*c^2*d*n^2-(112*I)*a*
c^2*d*n*p*x+(14*I)*a^2*d^2*n*q-44*a^2*b^2*n*p^2+16*a^2*b*d*q-64*
a^2*c*d*x+(14*I)*b^2*c^2*n*q-128*c^3*d*p^2*x+40*c^2*d^2*n^2*p-44*
c^2*d^2*n*p^2+40*a^4*n^2*p*x^2-16*a*b^2*c*q-64*a*b*c^2*x+(8*I)*
c^3*d*q*x+160*a^3*b*p*x+(6*I)*c^2*d^2*n*q+40*a^2*b^2*n^2*p+24*
a^2*b*c*n*p*q*x-24*a*c^2*d*n*p*q*x-(16*I)*b*c^2*d*n^3-88*a^2*c^2*
n*p^2*x^2+80*a^3*b*n^2*p*x+32*a^2*d^2+32*b^2*c^2-32*a^4*x^2-32*
c^4*x^2-32*a^2*b^2-32*c^2*d^2-128*a^2*c^2*p^2*x^2-128*a^3*b*p^2*
x-104*a^3*b*n^2*x+(8*I)*a^2*c^2*q*x^2-128*a*b*c*d-16*b*c^2*d*q-
(10*I)*a^2*d^2*n^2*q-(56*I)*a*c*d^2*n+(16*I)*a*c*d^2*n^3-52*a^4*
n^2*x^2-(24*I)*a*b^2*c*n^2+(48*I)*a*b^2*c*p^3-(4*I)*a^3*b*n*p*q*
x+(24*I)*a^3*d*p*x+10*b^2*c^2*p*q^2-6*b^2*c^2*n*q^2-(4*I)*c^3*d*
n*p*q*x-(4*I)*a^3*d*q^2*x+16*a*c*d^2*q-(4*I)*c^2*d^2*p*q-16*b*
c^3*q*x-(80*I)*a*b*c*d*n*p*q-(24*I)*b*c^2*d*p-(24*I)*b*c^3*n^2*
x-64*a^4*p^2*x^2-(8*I)*a^2*c*d*p*q*x-(8*I)*a*b*c^2*p*q*x+(72*I)*
a*b*c*d*p^2*q+(24*I)*a*b*c*d*p*q-(16*I)*a*b*c*d*n*q-(4*I)*a^2*
c^2*n*p*q*x^2+(72*I)*a^2*b*c*n^2*p*x-(104*I)*a^2*b*c*n*p^2*x+(2*
I)*a^2*b*c*n*q^2*x+(4*I)*a^2*c*d*n^2*q*x+(4*I)*a*b*c^2*n^2*q*x-
(72*I)*a*c^2*d*n^2*p*x+(104*I)*a*c^2*d*n*p^2*x-52*c^4*n^2*x^2-64*
c^4*p^2*x^2-72*a^4*n*x^2+80*a^4*p*x^2-12*a^2*b^2*n^3-16*a^2*b*c*
q*x+32*a^2*b*d*n*q-44*a^2*b*d*p*q-144*a^2*c*d*n*x+160*a^2*c*d*p*
x-32*a*b^2*c*n*q+44*a*b^2*c*p*q-144*a*b*c^2*n*x+160*a*b*c^2*p*
x-48*a*b*c*d*n^2-16*a*b*c*d*p^2+16*a*c^2*d*q*x+32*a*c*d^2*n*q-44*
a*c*d^2*p*q-32*b*c^2*d*n*q+44*b*c^2*d*p*q-80*a*b*c*d*n+232*a^3*b*
n*p*x+32*a^3*d*n*q*x-44*a^3*d*p*q*x+12*a^2*b*d*n^2*q+8*a^2*b*d*
p^2*q-104*a^2*c*d*n^2*x-128*a^2*c*d*p^2*x-12*a*b^2*c*n^2*q-8*a*
b^2*c*p^2*q-104*a*b*c^2*n^2*x-128*a*b*c^2*p^2*x-32*a*b*c*d*
n^3+144*a*b*c*d*p^3+12*a*c*d^2*n^2*q+8*a*c*d^2*p^2*q-32*b*c^3*n*
q*x+44*b*c^3*p*q*x-12*b*c^2*d*n^2*q-8*b*c^2*d*p^2*q+232*c^3*d*n*
p*x-88*a^3*b*n*p^2*x+12*a^3*d*n^2*q*x+8*a^3*d*p^2*q*x+232*a^2*
c^2*n*p*x^2-24*a^2*c*d*n^3*x+32*a^2*c*d*p^3*x-24*a*b*c^2*n^3*
x+32*a*b*c^2*p^3*x-12*b*c^3*n^2*q*x-8*b*c^3*p^2*q*x+80*c^3*d*n^2*
p*x-88*c^3*d*n*p^2*x+(80*I)*a^2*b*c*x+16*a^2*b^2*p^3-72*c^4*n*
x^2+80*c^4*p*x^2-12*c^2*d^2*n^3+16*c^2*d^2*p^3-52*a^2*b^2*n^2-64*
a^2*b^2*p^2-64*a^2*c^2*x^2+(104*I)*a*c*d^2*n*p^2-(2*I)*a*c*d^2*n*
q^2+(38*I)*b^2*c^2*n*p*q+(112*I)*b*c^3*n*p*x-(2*I)*a^4*n*p*q*x^2+
(48*I)*a^2*b*c*p^3*x-(8*I)*a^2*c^2*p*q*x^2-(48*I)*a*c^2*d*p^3*x-
(8*I)*a^3*b*p*q*x-(104*I)*a^2*b*c*p^2*x+(4*I)*a^2*b*c*q^2*x-(2*I)
*a*b*c*d*q^3+(104*I)*a*c^2*d*p^2*x-(4*I)*a*c^2*d*q^2*x-(8*I)*c^3*
d*p*q*x-(24*I)*a^2*b*c*p*x+(8*I)*a^2*c*d*q*x+(8*I)*a*b*c^2*q*x+
(24*I)*a*c^2*d*p*x-(40*I)*a*b*c*d*q+(72*I)*b*c^2*d*n^2*p-(104*I)*
b*c^2*d*n*p^2+(2*I)*b*c^2*d*n*q^2+(12*I)*c^3*d*n*q*x-(2*I)*c^2*
d^2*n*p*q+(56*I)*a^2*b*c*n*x-(112*I)*a^2*b*d*n*p+(112*I)*a*b^2*c*
n*p-(56*I)*a*c^2*d*n*x-(112*I)*a*c*d^2*n*p+(112*I)*b*c^2*d*n*p-
(24*I)*a^2*b*c*n^2*x-(72*I)*a^2*b*d*n^2*p+(104*I)*a^2*b*d*n*p^2-
(2*I)*a^2*b*d*n*q^2+(38*I)*a^2*d^2*n*p*q+(72*I)*a*b^2*c*n^2*p-
(104*I)*a*b^2*c*n*p^2+(2*I)*a*b^2*c*n*q^2+(24*I)*a*c^2*d*n^2*x-
(72*I)*a*c*d^2*n^2*p+(4*I)*a^2*c^2*n^2*q*x^2-(2*I)*c^4*n*p*q*x^2+
(4*I)*a^3*b*n^2*q*x-(72*I)*a^3*d*n^2*p*x+(104*I)*a^3*d*n*p^2*x-
(2*I)*a^3*d*n*q^2*x-(16*I)*a^2*b*c*n^3*x+(12*I)*a^2*c^2*n*q*x^2+
(16*I)*a*c^2*d*n^3*x+(72*I)*b*c^3*n^2*p*x-(104*I)*b*c^3*n*p^2*x+
(2*I)*b*c^3*n*q^2*x+(4*I)*c^3*d*n^2*q*x+(12*I)*a^3*b*n*q*x-(112*
I)*a^3*d*n*p*x-(2*I)*a^2*b^2*n*p*q+(4*I)*b*c^2*d*q^2+(4*I)*b*c^3*
```

```
q^2*x+(6*I)*a^2*b^2*n*q-(4*I)*q*p*b^2*a^2+(104*I)*p^2*d*b*a^2-(4*
I)*a^2*b*d*q^2-(16*I)*q*p*d^2*a^2-(104*I)*a*b^2*c*p^2+(4*I)*a*
b^2*c*q^2+(104*I)*a*c*d^2*p^2-(4*I)*a*c*d^2*q^2-(16*I)*b^2*c^2*p*
q-(24*I)*b*c^3*p*x-(104*I)*b*c^2*d*p^2+(2*I)*c^2*d^2*n^2*q-52*
c^2*d^2*n^2-64*c^2*d^2*p^2-64*a^3*b*x-72*a^2*b^2*n+80*a^2*b^2*p-
(48*I)*a*c*d^2*p^3)*(I*q+2*n+4-2*p)*(I*q-2*n+2*p+2)*(I*q-2*n+2*p)
*(a*x+b+I*c*x+I*d)^2*(I*c-a)^2*(I*q-4*n+6*p-6)^5), S, factor);
```

$$REMJ3f := (\mathrm{I}\,q - 2\,n + 2\,p - 2)\,(\mathrm{I}\,q + 2\,n - 2\,p + 2)\,(-p + 2 + n)\,(n + 1)\,(a\,d - b\,c)^2\,S(n) + (3 + 2\,n - 2\,p)\,\big(2\,a^2\,x\,n^2 - 4\,a^2\,x\,p\,n + 2\,a^2\,p^2\,x + 2\,c^2\,x\,n^2 - 4\,c^2\,x\,p\,n + 2\,c^2\,p^2\,x + 6\,a^2\,x\,n - 6\,a^2\,x\,p + 2\,a\,b\,n^2 - 4\,a\,b\,p\,n + 2\,a\,b\,p^2 - a\,d\,p\,q + b\,c\,p\,q + 6\,c^2\,x\,n - 6\,c^2\,x\,p + 2\,c\,d\,n^2 - 4\,c\,d\,p\,n + 2\,c\,d\,p^2 + 4\,a^2\,x + 6\,a\,b\,n - 6\,a\,b\,p + 4\,c^2\,x + 6\,c\,d\,n - 6\,c\,d\,p + 4\,a\,b + 4\,c\,d\big)\,S(n+1) + (1 + n - p)\,(n - 2\,p + 2)\,S(n+2) = 0 \tag{181}$$

```
> simplify(REMJ1-[REMJ3f, REMJ3[2], REMJ3[3]]);
```

$$[0 = 0, 0, 0] \tag{182}$$

```
> TermMJ4:=2^n*(a*d-b*c)^n*GAMMA(-p+(1/2*I)*q+1+n)*((1/2)*(I*a^2*x+
I*c^2*x+I*a*b+I*c*d+a*d-b*c)/(a*d-b*c))^n*hyperterm([-n+p+(1/2*I)
*q, -n], [-p+(1/2*I)*q+1], ((2*I)*a^2*x+(2*I)*c^2*x+(2*I)*a*b+(2*
I)*c*d-2*a*d+2*b*c)/((2*I)*a^2*x+(2*I)*c^2*x+(2*I)*a*b+(2*I)*c*
d+2*a*d-2*b*c), k)/((-1)^n*I^n*GAMMA(-p+(1/2*I)*q+1));
```

$$TermMJ4 := \left(2^n\,(a\,d - b\,c)^n\,\Gamma\left(n - p + \frac{\mathrm{I}\,q}{2} + 1\right)\left(\frac{\mathrm{I}\,a^2\,x + \mathrm{I}\,c^2\,x + \mathrm{I}\,a\,b + \mathrm{I}\,c\,d + a\,d - b\,c}{2\,(a\,d - b\,c)}\right)^n \mathrm{pochhammer}\left(-n + p + \frac{\mathrm{I}\,q}{2}, k\right)\mathrm{pochhammer}(-n, k)\left(\frac{2\,\mathrm{I}\,a^2\,x + 2\,\mathrm{I}\,c^2\,x + 2\,\mathrm{I}\,a\,b + 2\,\mathrm{I}\,c\,d - 2\,a\,d + 2\,b\,c}{2\,\mathrm{I}\,a^2\,x + 2\,\mathrm{I}\,c^2\,x + 2\,\mathrm{I}\,a\,b + 2\,\mathrm{I}\,c\,d + 2\,a\,d - 2\,b\,c}\right)^k\right) \Big/ \left(\mathrm{pochhammer}\left(-p + \frac{\mathrm{I}\,q}{2} + 1, k\right) k!\,(-1)^n\,\mathrm{I}^n\,\Gamma\left(-p + \frac{\mathrm{I}\,q}{2} + 1\right)\right) \tag{183}$$

```
> REMJ4:=RecurrenceNormalForm2(TermMJ4,k,S(n));
```

$$REMJ4 := \Big[(2\,\mathrm{I}\,n - 2\,\mathrm{I}\,p + 4\,\mathrm{I} - q)\,(2\,\mathrm{I}\,n - 2\,\mathrm{I}\,p + q + 4\,\mathrm{I})\,(1 + n - p)\,(n - 2\,p + 2)\,(\mathrm{I}\,c\,x + \mathrm{I}\,d - a\,x - b)^3\,(a + \mathrm{I}\,c)^3\,S(n+2) + \big(2\,a^2\,x\,n^2 - 4\,a^2\,x\,p\,n + 2\,a^2\,p^2\,x + 2\,c^2\,x\,n^2 - 4\,c^2\,x\,p\,n + 2\,c^2\,p^2\,x + 6\,a^2\,x\,n - 6\,a^2\,x\,p + 2\,a\,b\,n^2 - 4\,a\,b\,p\,n + 2\,a\,b\,p^2 \tag{184}$$

$$- a\,d\,p\,q + b\,c\,p\,q + 6\,c^2\,x\,n - 6\,c^2\,x\,p + 2\,c\,d\,n^2 - 4\,c\,d\,p\,n + 2\,c\,d\,p^2 + 4\,a^2\,x + 6\,a\,b\,n$$

$$- 6\,a\,b\,p + 4\,c^2\,x + 6\,c\,d\,n - 6\,c\,d\,p + 4\,a\,b + 4\,c\,d\big)\,(2\,\mathrm{I}\,n - 2\,\mathrm{I}\,p + 4\,\mathrm{I} - q)\,(2\,\mathrm{I}\,n$$

$$- 2\,\mathrm{I}\,p + q + 4\,\mathrm{I})\,(3 + 2\,n - 2\,p)\,(\mathrm{I}\,c\,x + \mathrm{I}\,d - a\,x - b)^3\,(a + \mathrm{I}\,c)^3\,S(n+1) + (\mathrm{I}\,q$$

$$+ 2\,n - 2\,p + 2)\,(\mathrm{I}\,q - 2\,n - 4 + 2\,p)\,(\mathrm{I}\,q - 2\,n + 2\,p - 2)\,(\mathrm{I}\,q + 2\,n + 4 - 2\,p)\,(-p$$

$$+ 2 + n)\,(n+1)\,(a\,d - b\,c)^2\,(\mathrm{I}\,c\,x + \mathrm{I}\,d - a\,x - b)^3\,(a + \mathrm{I}\,c)^3\,S(n) = 0,\ 1,$$

$$\frac{1}{\Gamma\left(-p + \frac{\mathrm{I}\,q}{2} + 1\right)(\mathrm{I}\,q - 2\,p + 2)}\Big(2\,\big(2\,a^2\,x\,p + 2\,c^2\,x\,p - 2\,a^2\,x + 2\,a\,b\,p - q\,a\,d$$

$$+ q\,b\,c - 2\,c^2\,x + 2\,c\,d\,p - 2\,a\,b - 2\,c\,d\big)\,\Gamma\left(2 - p + \frac{\mathrm{I}\,q}{2}\right)\Big)\Big]$$

```
> factor(REMJ4[1]);
```

$$- \big(8\,S(n)\,a^2\,d^2 + 8\,S(n)\,b^2\,c^2 - 12\,S(n+1)\,a^2\,x - 12\,S(n+1)\,c^2\,x - 12\,S(n+1)\,a\,b \tag{185}$$

$$- 12\,S(n+1)\,c\,d + 3\,S(n+2)\,n\,p - 4\,S(n+1)\,c\,d\,n^3 + 4\,S(n+1)\,c\,d\,p^3 - 26\,S(n$$

$$+ 1)\,a^2\,n\,x + 26\,S(n+1)\,a^2\,p\,x - 18\,S(n+1)\,a\,b\,n^2 - 18\,S(n+1)\,a\,b\,p^2 - 26\,S(n$$

$$+ 1)\,c^2\,n\,x + 26\,S(n+1)\,c^2\,p\,x - 18\,S(n+1)\,c\,d\,n^2 - 18\,S(n+1)\,c\,d\,p^2 - 26\,S(n$$

$$+ 1)\,a\,b\,n + 26\,S(n+1)\,a\,b\,p - 26\,S(n+1)\,c\,d\,n + 26\,S(n+1)\,c\,d\,p$$

$$+ 4\,S(n)\,a^2\,d^2\,n^4 + 4\,S(n)\,b^2\,c^2\,n^4 + 20\,S(n)\,a^2\,d^2\,n^3 - 4\,S(n)\,a^2\,d^2\,p^3 + 20\,S(n)\,b^2\,c^2\,n^3$$

$$- 4\,S(n)\,b^2\,c^2\,p^3 + 36\,S(n)\,a^2\,d^2\,n^2 + 16\,S(n)\,a^2\,d^2\,p^2 + 2\,S(n)\,a^2\,d^2\,q^2$$

$$+ 36\,S(n)\,b^2\,c^2\,n^2 + 16\,S(n)\,b^2\,c^2\,p^2 + 2\,S(n)\,b^2\,c^2\,q^2 - 4\,S(n+1)\,a^2\,n^3\,x + 4\,S(n$$

$$+ 1)\,a^2\,p^3\,x - 4\,S(n+1)\,c^2\,n^3\,x + 4\,S(n+1)\,c^2\,p^3\,x + 28\,S(n)\,a^2\,d^2\,n - 20\,S(n)\,a^2\,d^2\,p$$

$$+ 28\,S(n)\,b^2\,c^2\,n - 20\,S(n)\,b^2\,c^2\,p - 18\,S(n+1)\,a^2\,n^2\,x - 18\,S(n+1)\,a^2\,p^2\,x - 4\,S(n$$

$$+ 1)\,a\,b\,n^3 + 4\,S(n+1)\,a\,b\,p^3 - 18\,S(n+1)\,c^2\,n^2\,x - 18\,S(n+1)\,c^2\,p^2\,x - S(n$$

$$+ 2)\,n^2 - 2\,S(n+2)\,p^2 - 3\,S(n+2)\,n + 4\,S(n+2)\,p - S(n)\,b^2\,c^2\,n\,p\,q^2$$

$$- 12\,S(n)\,a^2\,d^2\,n^3\,p + 12\,S(n)\,a^2\,d^2\,n^2\,p^2 + S(n)\,a^2\,d^2\,n^2\,q^2 - 4\,S(n)\,a^2\,d^2\,n\,p^3$$

$$- 12\, S(n)\, b^2 c^2 n^3 p + 12\, S(n)\, b^2 c^2 n^2 p^2 + S(n)\, b^2 c^2 n^2 q^2 - 4\, S(n)\, b^2 c^2 n p^3$$
$$- 44\, S(n)\, a^2 d^2 n^2 p + 28\, S(n)\, a^2 d^2 n p^2 + 3\, S(n)\, a^2 d^2 n q^2 - S(n)\, a^2 d^2 p q^2$$
$$- 44\, S(n)\, b^2 c^2 n^2 p + 28\, S(n)\, b^2 c^2 n p^2 + 3\, S(n)\, b^2 c^2 n q^2 - S(n)\, b^2 c^2 p q^2$$
$$- 52\, S(n)\, a^2 d^2 n p - 52\, S(n)\, b^2 c^2 n p + 12\, S(n+1)\, a^2 n^2 p x - 12\, S(n+1)\, a^2 n p^2 x$$
$$+ 12\, S(n+1)\, c^2 n^2 p x - 12\, S(n+1)\, c^2 n p^2 x + 36\, S(n+1)\, a^2 n p x + 12\, S(n$$
$$+ 1)\, a b n^2 p - 12\, S(n+1)\, a b n p^2 - 2\, S(n+1)\, a d p^2 q + 2\, S(n+1)\, b c p^2 q$$
$$+ 36\, S(n+1)\, c^2 n p x + 12\, S(n+1)\, c d n^2 p - 12\, S(n+1)\, c d n p^2 - 16\, S(n)\, a b c d$$
$$+ 36\, S(n+1)\, a b n p + 3\, S(n+1)\, a d p q - 3\, S(n+1)\, b c p q + 36\, S(n+1)\, c d n p$$
$$- 40\, S(n)\, a b c d n^3 + 8\, S(n)\, a b c d p^3 - 72\, S(n)\, a b c d n^2 + 2\, S(n)\, a b c d n p q^2$$
$$- 2\, S(n+2) + 24\, S(n)\, a b c d n^3 p - 24\, S(n)\, a b c d n^2 p^2 - 2\, S(n)\, a b c d n^2 q^2$$
$$+ 8\, S(n)\, a b c d n p^3 + 88\, S(n)\, a b c d n^2 p - 56\, S(n)\, a b c d n p^2 - 6\, S(n)\, a b c d n q^2$$
$$+ 2\, S(n)\, a b c d p q^2 + 104\, S(n)\, a b c d n p - 32\, S(n)\, a b c d p^2 - 4\, S(n)\, a b c d q^2$$
$$- 56\, S(n)\, a b c d n + 40\, S(n)\, a b c d p + 2\, S(n+1)\, a d n p q - 2\, S(n+1)\, b c n p q$$
$$- S(n)\, a^2 d^2 n p q^2 - 8\, S(n)\, a b c d n^4 \big)\, (2\, \mathrm{I} n - 2\, \mathrm{I} p + q + 4\, \mathrm{I})\, (2\, \mathrm{I} n - 2\, \mathrm{I} p + 4\, \mathrm{I}$$
$$- q)\, (\mathrm{I} c x + \mathrm{I} d - a x - b)^3\, (a + \mathrm{I} c)^3 = 0$$

We remark that the tree-term recurrence relation is multiplied by the following factor

```
> (-2*p+I*q+4+2*n)*(I*q-2*n-4+2*p)*(I*c*x+I*d-a*x-b)^3*(a+I*c)^3;
```

$$(\mathrm{I} q + 2\, n + 4 - 2\, p)\, (\mathrm{I} q - 2\, n - 4 + 2\, p)\, (\mathrm{I} c x + \mathrm{I} d - a x - b)^3\, (a + \mathrm{I} c)^3 \tag{186}$$

We first simplify the TTRR by the latter common factor

```
> REMJ4f:=collect(REMJ4[1]/((-2*p+I*q+4+2*n)*(I*q-2*n-4+2*p)*(I*c*
  x+I*d-a*x-b)^3*(a+I*c)^3), S, factor);
```

$$REMJ4f := (\mathrm{I} q - 2\, n + 2\, p - 2)\, (\mathrm{I} q + 2\, n - 2\, p + 2)\, (-p + 2 + n)\, (n + 1)\, (a\, d \tag{187}$$
$$- b\, c)^2\, S(n) + (3 + 2\, n - 2\, p)\, \big(2\, a^2 x n^2 - 4\, a^2 x p n + 2\, a^2 p^2 x + 2\, c^2 x n^2 - 4\, c^2 x p n$$
$$+ 2\, c^2 p^2 x + 6\, a^2 x n - 6\, a^2 x p + 2\, a b n^2 - 4\, a b p n + 2\, a b p^2 - a d p q + b c p q$$
$$+ 6\, c^2 x n - 6\, c^2 x p + 2\, c d n^2 - 4\, c d p n + 2\, c d p^2 + 4\, a^2 x + 6\, a b n - 6\, a b p + 4\, c^2 x$$
$$+ 6\, c d n - 6\, c d p + 4\, a b + 4\, c d\big)\, S(n+1) + (1 + n - p)\, (n - 2\, p + 2)\, S(n+2) = 0$$

```
> simplify(REMJ1-[REMJ4f, REMJ4[2], REMJ4[3]]);
```

$$[0 = 0, 0, 0] \tag{188}$$

```
> TermMJ5:=2^n*(a*d-b*c)^n*GAMMA(n-p-(1/2*I)*q+1)*((1/2)*(I*a^2*x+
  I*c^2*x+I*a*b+I*c*d-a*d+b*c)/(a*d-b*c))^n*hyperterm([-n+p-(1/2*I)
  *q, -n], [-p-(1/2*I)*q+1], (-(2*I)*a^2*x-(2*I)*c^2*x-(2*I)*a*b-
  (2*I)*c*d-2*a*d+2*b*c)/(-(2*I)*a^2*x-(2*I)*c^2*x-(2*I)*a*b-(2*I)*
  c*d+2*a*d-2*b*c), k)/((-1)^n*I^n*GAMMA(-p-(1/2*I)*q+1));
```

$$TermMJ5 := \Bigg(2^n\, (a\, d - b\, c)^n\, \Gamma\Bigg(n - p - \frac{\mathrm{I} q}{2} \tag{189}$$
$$+ 1\Bigg)\, \left(\frac{\mathrm{I} a^2 x + \mathrm{I} c^2 x + \mathrm{I} a\, b + \mathrm{I} c\, d - a\, d + b\, c}{2\, (a\, d - b\, c)}\right)^n \mathrm{pochhammer}\Bigg(-n + p - \frac{\mathrm{I} q}{2},$$

$$k\Big)\,\mathrm{pochhammer}(-n,k)\left(\frac{-2\,\mathrm{I}\,a^2x-2\,\mathrm{I}\,c^2x-2\,\mathrm{I}\,a\,b-2\,\mathrm{I}\,c\,d-2\,a\,d+2\,b\,c}{-2\,\mathrm{I}\,a^2x-2\,\mathrm{I}\,c^2x-2\,\mathrm{I}\,a\,b-2\,\mathrm{I}\,c\,d+2\,a\,d-2\,b\,c}\right)^k\Bigg)\Bigg/$$

$$\left(\mathrm{pochhammer}\left(-p-\frac{\mathrm{I}\,q}{2}+1,k\right)k!\,(-1)^n\,\mathrm{I}^n\,\Gamma\left(-p-\frac{\mathrm{I}\,q}{2}+1\right)\right)$$

```
> REMJ5:=RecurrenceNormalForm2(TermMJ5,k,S(n));
```

$$REMJ5 := \Big[-(2\,\mathrm{I}\,n-2\,\mathrm{I}\,p+q+4\,\mathrm{I})\,(2\,\mathrm{I}\,n-2\,\mathrm{I}\,p+4\,\mathrm{I}-q)\,(n-2\,p+2)\,(1+n \tag{190}$$

$$-p)\,(a\,x+b+\mathrm{I}\,c\,x+\mathrm{I}\,d)^3\,(\mathrm{I}\,c-a)^3\,S(n+2)-\big(2\,a^2\,x\,n^2-4\,a^2\,x\,p\,n+2\,a^2\,p^2\,x$$

$$+2\,c^2\,x\,n^2-4\,c^2\,x\,p\,n+2\,c^2\,p^2\,x+6\,a^2\,x\,n-6\,a^2\,x\,p+2\,a\,b\,n^2-4\,a\,b\,p\,n+2\,a\,b\,p^2$$

$$-a\,d\,p\,q+b\,c\,p\,q+6\,c^2\,x\,n-6\,c^2\,x\,p+2\,c\,d\,n^2-4\,c\,d\,p\,n+2\,c\,d\,p^2+4\,a^2\,x+6\,a\,b\,n$$

$$-6\,a\,b\,p+4\,c^2\,x+6\,c\,d\,n-6\,c\,d\,p+4\,a\,b+4\,c\,d\big)\,(2\,\mathrm{I}\,n-2\,\mathrm{I}\,p+q+4\,\mathrm{I})\,(2\,\mathrm{I}\,n$$

$$-2\,\mathrm{I}\,p+4\,\mathrm{I}-q)\,(3+2\,n-2\,p)\,(a\,x+b+\mathrm{I}\,c\,x+\mathrm{I}\,d)^3\,(\mathrm{I}\,c-a)^3\,S(n+1)-(\mathrm{I}\,q$$

$$-2\,n+2\,p-2)\,(\mathrm{I}\,q-2\,n-4+2\,p)\,(\mathrm{I}\,q+2\,n-2\,p+2)\,(\mathrm{I}\,q+2\,n+4-2\,p)\,(-p$$

$$+2+n)\,(n+1)\,(a\,d-b\,c)^2\,(a\,x+b+\mathrm{I}\,c\,x+\mathrm{I}\,d)^3\,(\mathrm{I}\,c-a)^3\,S(n)=0,\,1,$$

$$-\frac{1}{\Gamma\left(-p-\frac{\mathrm{I}\,q}{2}+1\right)(\mathrm{I}\,q+2\,p-2)}\Big(2\,\big(2\,a^2\,x\,p+2\,c^2\,x\,p-2\,a^2\,x+2\,a\,b\,p-q\,a\,d$$

$$+ q\,b\,c - 2\,c^2\,x + 2\,c\,d\,p - 2\,a\,b - 2\,c\,d)\,\Gamma\left(2 - p - \frac{\mathrm{I}\,q}{2}\right)\Big)\Big]$$

```
> factor(REMJ5[1]);
```

$$\begin{aligned}
&(8\,S(n)\,a^2\,d^2 + 8\,S(n)\,b^2\,c^2 - 12\,S(n+1)\,a^2\,x - 12\,S(n+1)\,c^2\,x - 12\,S(n+1)\,a\,b \\
&- 12\,S(n+1)\,c\,d + 3\,S(n+2)\,n\,p + 88\,S(n)\,a\,b\,c\,d\,n^2\,p - 56\,S(n)\,a\,b\,c\,d\,n\,p^2 \\
&- 6\,S(n)\,a\,b\,c\,d\,n\,q^2 + 2\,S(n)\,a\,b\,c\,d\,p\,q^2 + 104\,S(n)\,a\,b\,c\,d\,n\,p - 2\,S(n+2)\,p^2 \\
&- 3\,S(n+2)\,n + 4\,S(n+2)\,p - 40\,S(n)\,a\,b\,c\,d\,n^3 + 8\,S(n)\,a\,b\,c\,d\,p^3 \\
&- 72\,S(n)\,a\,b\,c\,d\,n^2 - 32\,S(n)\,a\,b\,c\,d\,p^2 - 4\,S(n)\,a\,b\,c\,d\,q^2 - 56\,S(n)\,a\,b\,c\,d\,n \\
&+ 40\,S(n)\,a\,b\,c\,d\,p + 2\,S(n+1)\,a\,d\,n\,p\,q - 2\,S(n+1)\,b\,c\,n\,p\,q - S(n+2)\,n^2 - 2\,S(n \\
&+ 2) - S(n)\,a^2\,d^2\,n\,p\,q^2 - 8\,S(n)\,a\,b\,c\,d\,n^4 - 12\,S(n)\,a^2\,d^2\,n^3\,p + 12\,S(n)\,a^2\,d^2\,n^2\,p^2 \\
&+ S(n)\,a^2\,d^2\,n^2\,q^2 - 4\,S(n)\,a^2\,d^2\,n\,p^3 - 12\,S(n)\,b^2\,c^2\,n^3\,p + 12\,S(n)\,b^2\,c^2\,n^2\,p^2 \\
&+ S(n)\,b^2\,c^2\,n^2\,q^2 - 4\,S(n)\,b^2\,c^2\,n\,p^3 - 44\,S(n)\,a^2\,d^2\,n^2\,p + 28\,S(n)\,a^2\,d^2\,n\,p^2 \\
&+ 3\,S(n)\,a^2\,d^2\,n\,q^2 - S(n)\,a^2\,d^2\,p\,q^2 - 44\,S(n)\,b^2\,c^2\,n^2\,p + 28\,S(n)\,b^2\,c^2\,n\,p^2 \\
&+ 3\,S(n)\,b^2\,c^2\,n\,q^2 - S(n)\,b^2\,c^2\,p\,q^2 - 52\,S(n)\,a^2\,d^2\,n\,p - 52\,S(n)\,b^2\,c^2\,n\,p + 12\,S(n \\
&+ 1)\,a^2\,n^2\,p\,x - 12\,S(n+1)\,a^2\,n\,p^2\,x + 12\,S(n+1)\,c^2\,n^2\,p\,x - 12\,S(n+1)\,c^2\,n\,p^2\,x \\
&+ 36\,S(n+1)\,a^2\,n\,p\,x + 12\,S(n+1)\,a\,b\,n^2\,p - 12\,S(n+1)\,a\,b\,n\,p^2 - 2\,S(n \\
&+ 1)\,a\,d\,p^2\,q + 2\,S(n+1)\,b\,c\,p^2\,q + 36\,S(n+1)\,c^2\,n\,p\,x + 12\,S(n+1)\,c\,d\,n^2\,p \\
&- 12\,S(n+1)\,c\,d\,n\,p^2 - 16\,S(n)\,a\,b\,c\,d + 36\,S(n+1)\,a\,b\,n\,p + 3\,S(n+1)\,a\,d\,p\,q \\
&- 3\,S(n+1)\,b\,c\,p\,q + 36\,S(n+1)\,c\,d\,n\,p - 26\,S(n+1)\,a\,b\,n + 26\,S(n+1)\,a\,b\,p \\
&- 26\,S(n+1)\,c\,d\,n + 26\,S(n+1)\,c\,d\,p - 18\,S(n+1)\,c\,d\,p^2 + 4\,S(n+1)\,c\,d\,p^3 \\
&- 26\,S(n+1)\,a^2\,n\,x + 26\,S(n+1)\,a^2\,p\,x - 18\,S(n+1)\,a\,b\,n^2 - 18\,S(n+1)\,a\,b\,p^2 \\
&- 26\,S(n+1)\,c^2\,n\,x + 26\,S(n+1)\,c^2\,p\,x - 18\,S(n+1)\,c\,d\,n^2 - 4\,S(n+1)\,a\,b\,n^3 \\
&+ 4\,S(n+1)\,a\,b\,p^3 - 18\,S(n+1)\,c^2\,n^2\,x - 18\,S(n+1)\,c^2\,p^2\,x - 4\,S(n+1)\,c\,d\,n^3 \\
&- 20\,S(n)\,a^2\,d^2\,p + 28\,S(n)\,b^2\,c^2\,n - 20\,S(n)\,b^2\,c^2\,p - 18\,S(n+1)\,a^2\,n^2\,x - 18\,S(n \\
&+ 1)\,a^2\,p^2\,x + 2\,S(n)\,b^2\,c^2\,q^2 - 4\,S(n+1)\,a^2\,n^3\,x + 4\,S(n+1)\,a^2\,p^3\,x - 4\,S(n \\
&+ 1)\,c^2\,n^3\,x + 4\,S(n+1)\,c^2\,p^3\,x + 28\,S(n)\,a^2\,d^2\,n + 4\,S(n)\,a^2\,d^2\,n^4 + 4\,S(n)\,b^2\,c^2\,n^4 \\
&+ 20\,S(n)\,a^2\,d^2\,n^3 - 4\,S(n)\,a^2\,d^2\,p^3 + 20\,S(n)\,b^2\,c^2\,n^3 - 4\,S(n)\,b^2\,c^2\,p^3 \\
&+ 36\,S(n)\,a^2\,d^2\,n^2 + 16\,S(n)\,a^2\,d^2\,p^2 + 2\,S(n)\,a^2\,d^2\,q^2 + 36\,S(n)\,b^2\,c^2\,n^2 \\
&+ 16\,S(n)\,b^2\,c^2\,p^2 - S(n)\,b^2\,c^2\,n\,p\,q^2 + 2\,S(n)\,a\,b\,c\,d\,n\,p\,q^2 + 24\,S(n)\,a\,b\,c\,d\,n^3\,p \\
&- 24\,S(n)\,a\,b\,c\,d\,n^2\,p^2 - 2\,S(n)\,a\,b\,c\,d\,n^2\,q^2 + 8\,S(n)\,a\,b\,c\,d\,n\,p^3)\,(2\,\mathrm{I}\,n - 2\,\mathrm{I}\,p + q \\
&+ 4\,\mathrm{I})\,(2\,\mathrm{I}\,n - 2\,\mathrm{I}\,p + 4\,\mathrm{I} - q)\,(a\,x + b + \mathrm{I}\,c\,x + \mathrm{I}\,d)^3\,(\mathrm{I}\,c - a)^3 = 0
\end{aligned} \tag{191}$$

```
> REMJ5f:=collect(-REMJ5[1]/((-2*p+I*q+4+2*n)*(I*q-2*n-4+2*p)*(a*x+
  b+I*c*x+I*d)^3*(I*c-a)^3), S, factor);
```

$$\begin{aligned}
&REMJ5f := (\mathrm{I}\,q - 2\,n + 2\,p - 2)\,(\mathrm{I}\,q + 2\,n - 2\,p + 2)\,(-p + 2 + n)\,(n+1)\,(a\,d \\
&- b\,c)^2\,S(n) + (3 + 2\,n - 2\,p)\,(2\,a^2\,x\,n^2 - 4\,a^2\,x\,p\,n + 2\,a^2\,p^2\,x + 2\,c^2\,x\,n^2 - 4\,c^2\,x\,p\,n
\end{aligned} \tag{192}$$

$$+ 2 c^2 p^2 x + 6 a^2 x n - 6 a^2 x p + 2 a b n^2 - 4 a b p n + 2 a b p^2 - a d p q + b c p q$$
$$+ 6 c^2 x n - 6 c^2 x p + 2 c d n^2 - 4 c d p n + 2 c d p^2 + 4 a^2 x + 6 a b n - 6 a b p + 4 c^2 x$$
$$+ 6 c d n - 6 c d p + 4 a b + 4 c d) S(n+1) + (1+n-p)(n-2p+2) S(n+2) = 0$$

```
> simplify(REMJ1-[REMJ5f, REMJ5[2], REMJ5[3]]);
```

$$[0 = 0, 0, 0] \tag{193}$$

```
> TermMJ6:=2^n*(a*d-b*c)^n*GAMMA(2*n-2*p+1)*((1/2)*(I*a^2*x+I*c^2*
  x+I*a*b+I*c*d+a*d-b*c)/(a*d-b*c))^n*hyperterm([-n+p+(1/2*I)*q, -
  n], [-2*n+2*p], (2*a*d-2*b*c)/(I*a^2*x+I*c^2*x+I*a*b+I*c*d+a*d-b*
  c), k)/((-1)^n*I^n*GAMMA(n-2*p+1));
```

$$TermMJ6 := \Bigg(2^n (a d - b c)^n \Gamma(2 n - 2 p + 1) \left(\frac{\mathrm{I} a^2 x + \mathrm{I} c^2 x + \mathrm{I} a b + \mathrm{I} c d + a d - b c}{2 (a d - b c)}\right)^n \mathrm{pochhammer}\left(-n + p + \frac{\mathrm{I} q}{2}, k\right) \mathrm{pochhammer}(-n, k) \left(\frac{2 a d - 2 b c}{\mathrm{I} a^2 x + \mathrm{I} c^2 x + \mathrm{I} a b + \mathrm{I} c d + a d - b c}\right)^k\Bigg) \Big/ \big(\mathrm{pochhammer}(-2 n + 2 p, k)\, k!\, (-1)^n \mathrm{I}^n \Gamma(n - 2 p + 1)\big) \tag{194}$$

```
> REMJ6:=RecurrenceNormalForm2(TermMJ6,k,S(n));
```

$$REMJ6 := \Big[(32 a b c d n^3 - 144 a b c d p^3 + 48 a b c d n^2 + 16 a b c d p^2 + 80 a b c d n \tag{195}$$
$$- 32 a^2 d^2 - 32 b^2 c^2 + 32 a^4 x^2 + 32 c^4 x^2 + 32 a^2 b^2 + 32 c^2 d^2 + 104 a^2 c^2 n^2 x^2$$
$$+ 128 a^2 c^2 p^2 x^2 - 116 c^4 n p x^2 + 24 c^3 d n^3 x - 32 c^3 d p^3 x + 104 a^3 b n^2 x$$
$$+ 128 a^3 b p^2 x - 40 a^2 b^2 n^2 p + 44 a^2 b^2 n p^2 + 144 a^2 c^2 n x^2 - 160 a^2 c^2 p x^2$$
$$+ 104 c^3 d n^2 x + 128 c^3 d p^2 x - 40 c^2 d^2 n^2 p + 44 c^2 d^2 n p^2 + 144 a^3 b n x - 160 a^3 b p x$$
$$- 16 a^3 d q x - 116 a^2 b^2 n p + 16 b c^3 q x + 144 c^3 d n x - 160 c^3 d p x - 116 c^2 d^2 n p$$
$$- 16 a^2 b d q + 64 a^2 c d x + 16 a b^2 c q + 64 a b c^2 x - 16 a c d^2 q + 16 b c^2 d q$$
$$- 104 \mathrm{I} a b^2 c n p^2 + 2 \mathrm{I} a b^2 c n q^2 + 24 \mathrm{I} a c^2 d n^2 x - 40 a^4 n^2 p x^2 + 44 a^4 n p^2 x^2$$
$$+ 24 a^2 c^2 n^3 x^2 - 32 a^2 c^2 p^3 x^2 - 40 c^4 n^2 p x^2 + 44 c^4 n p^2 x^2 - 116 a^4 n p x^2 + 24 a^3 b n^3 x$$
$$- 32 a^3 b p^3 x + 32 a^2 b c n q x - 44 a^2 b c p q x + 24 a^2 b d n p q - 232 a^2 c d n p x$$

$$- 24\, a\, b^2\, c\, n\, p\, q - 232\, a\, b\, c^2\, n\, p\, x - 32\, a\, c^2\, d\, n\, q\, x + 44\, a\, c^2\, d\, p\, q\, x + 24\, a\, c\, d^2\, n\, p\, q$$

$$- 24\, b\, c^2\, d\, n\, p\, q - 4\, a^2\, d^2\, n^3 + 56\, a^2\, d^2\, p^3 - 4\, b^2\, c^2\, n^3 + 56\, b^2\, c^2\, p^3 + 28\, a^2\, d^2\, n^2$$

$$+ 56\, a^2\, d^2\, p^2 + 28\, b^2\, c^2\, n^2 + 56\, b^2\, c^2\, p^2 - 16\, \mathrm{I}\, b^2\, c^2\, p\, q - 24\, \mathrm{I}\, b\, c^3\, p\, x - 104\, \mathrm{I}\, b\, c^2\, d\, p^2$$

$$+ 4\, \mathrm{I}\, b\, c^2\, d\, q^2 + 8\, \mathrm{I}\, c^3\, d\, q\, x - 4\, \mathrm{I}\, c^2\, d^2\, p\, q + 80\, \mathrm{I}\, a^2\, b\, c\, x + 24\, \mathrm{I}\, p\, d\, b\, a^2 - 24\, \mathrm{I}\, a\, b^2\, c\, p$$

$$- 80\, \mathrm{I}\, a\, c^2\, d\, x + 24\, \mathrm{I}\, a\, c\, d^2\, p - 24\, \mathrm{I}\, b\, c^2\, d\, p - 4\, \mathrm{I}\, a^4\, p\, q\, x^2 - 48\, \mathrm{I}\, a^3\, d\, p^3\, x + 48\, \mathrm{I}\, b\, c^3\, p^3\, x$$

$$- 4\, \mathrm{I}\, c^4\, p\, q\, x^2 + 104\, \mathrm{I}\, a^3\, d\, p^2\, x - 4\, \mathrm{I}\, a^3\, d\, q^2\, x - 48\, \mathrm{I}\, p^3\, d\, b\, a^2 + 8\, \mathrm{I}\, a^2\, c^2\, q\, x^2$$

$$- 36\, \mathrm{I}\, a^2\, d^2\, p^2\, q + 48\, \mathrm{I}\, a\, b^2\, c\, p^3 - 48\, \mathrm{I}\, a\, c\, d^2\, p^3 + 24\, a^3\, d\, n\, p\, q\, x + 12\, a^2\, b\, c\, n^2\, q\, x$$

$$+ 8\, a^2\, b\, c\, p^2\, q\, x - 80\, a^2\, c\, d\, n^2\, p\, x + 88\, a^2\, c\, d\, n\, p^2\, x - 80\, a\, b\, c^2\, n^2\, p\, x + 88\, a\, b\, c^2\, n\, p^2\, x$$

$$- 12\, a\, c^2\, d\, n^2\, q\, x - 8\, a\, c^2\, d\, p^2\, q\, x - 24\, b\, c^3\, n\, p\, q\, x - 72\, \mathrm{I}\, a\, c\, d^2\, n^2\, p + 104\, \mathrm{I}\, a\, c\, d^2\, n\, p^2$$

$$- 2\, \mathrm{I}\, a\, c\, d^2\, n\, q^2 + 38\, \mathrm{I}\, b^2\, c^2\, n\, p\, q + 112\, \mathrm{I}\, b\, c^3\, n\, p\, x + 72\, \mathrm{I}\, b\, c^2\, d\, n^2\, p - 104\, \mathrm{I}\, b\, c^2\, d\, n\, p^2$$

$$+ 2\, \mathrm{I}\, b\, c^2\, d\, n\, q^2 + 12\, \mathrm{I}\, c^3\, d\, n\, q\, x - 2\, \mathrm{I}\, c^2\, d^2\, n\, p\, q + 56\, \mathrm{I}\, a^2\, b\, c\, n\, x - 112\, \mathrm{I}\, a^2\, b\, d\, n\, p$$

$$+ 112\, \mathrm{I}\, a\, b^2\, c\, n\, p - 56\, \mathrm{I}\, a\, c^2\, d\, n\, x - 112\, \mathrm{I}\, a\, c\, d^2\, n\, p + 112\, \mathrm{I}\, b\, c^2\, d\, n\, p - 2\, \mathrm{I}\, a^4\, n\, p\, q\, x^2$$

$$+ 4\, \mathrm{I}\, a^2\, c^2\, n^2\, q\, x^2 - 2\, \mathrm{I}\, c^4\, n\, p\, q\, x^2 + 4\, \mathrm{I}\, a^3\, b\, n^2\, q\, x - 72\, \mathrm{I}\, a^3\, d\, n^2\, p\, x + 104\, \mathrm{I}\, a^3\, d\, n\, p^2\, x$$

$$- 2\, \mathrm{I}\, a^3\, d\, n\, q^2\, x - 16\, \mathrm{I}\, a^2\, b\, c\, n^3\, x + 12\, \mathrm{I}\, a^2\, c^2\, n\, q\, x^2 + 16\, \mathrm{I}\, a\, c^2\, d\, n^3\, x + 72\, \mathrm{I}\, b\, c^3\, n^2\, p\, x$$

$$- 104\, \mathrm{I}\, b\, c^3\, n\, p^2\, x + 2\, \mathrm{I}\, b\, c^3\, n\, q^2\, x + 4\, \mathrm{I}\, c^3\, d\, n^2\, q\, x + 12\, \mathrm{I}\, a^3\, b\, n\, q\, x - 112\, \mathrm{I}\, a^3\, d\, n\, p\, x$$

$$- 2\, \mathrm{I}\, a^2\, b^2\, n\, p\, q - 24\, \mathrm{I}\, a^2\, b\, c\, n^2\, x - 72\, \mathrm{I}\, a^2\, b\, d\, n^2\, p + 104\, \mathrm{I}\, a^2\, b\, d\, n\, p^2 - 2\, \mathrm{I}\, a^2\, b\, d\, n\, q^2$$

$$+ 38\, \mathrm{I}\, a^2\, d^2\, n\, p\, q + 72\, \mathrm{I}\, a\, b^2\, c\, n^2\, p + 32\, a^2\, d^2\, n - 80\, a^2\, d^2\, p + 32\, b^2\, c^2\, n - 80\, b^2\, c^2\, p$$

$$- 80\, a^3\, b\, n^2\, p\, x + 88\, a^3\, b\, n\, p^2\, x - 12\, a^3\, d\, n^2\, q\, x - 8\, a^3\, d\, p^2\, q\, x - 232\, a^2\, c^2\, n\, p\, x^2$$

$$+ 24\, a^2\, c\, d\, n^3\, x - 32\, a^2\, c\, d\, p^3\, x - 144\, a\, b\, c\, d\, n^2\, p + 240\, a\, b\, c\, d\, n\, p^2 - 12\, a\, b\, c\, d\, n\, q^2$$

$$+ 20\, a\, b\, c\, d\, p\, q^2 - 64\, a\, b\, c\, d\, n\, p - 36\, \mathrm{I}\, b^2\, c^2\, p^2\, q - 104\, \mathrm{I}\, b\, c^3\, p^2\, x + 4\, \mathrm{I}\, b\, c^3\, q^2\, x$$

$$+ 48\, \mathrm{I}\, b\, c^2\, d\, p^3 + 8\, \mathrm{I}\, a^3\, b\, q\, x + 24\, \mathrm{I}\, a^3\, d\, p\, x - 4\, \mathrm{I}\, q\, p\, b^2\, a^2 + 104\, \mathrm{I}\, p^2\, d\, b\, a^2 - 4\, \mathrm{I}\, a^2\, b\, d\, q^2$$

$$- 16\, \mathrm{I}\, q\, p\, d^2\, a^2 - 104\, \mathrm{I}\, a\, b^2\, c\, p^2 + 4\, \mathrm{I}\, a\, b^2\, c\, q^2 + 104\, \mathrm{I}\, a\, c\, d^2\, p^2 - 4\, \mathrm{I}\, a\, c\, d^2\, q^2$$

$$+ 6\, \mathrm{I}\, c^2\, d^2\, n\, q - 56\, \mathrm{I}\, a^2\, b\, d\, n + 56\, \mathrm{I}\, a\, b^2\, c\, n - 56\, \mathrm{I}\, a\, c\, d^2\, n + 56\, \mathrm{I}\, b\, c^2\, d\, n + 6\, \mathrm{I}\, c^4\, n\, q\, x^2$$

$$+ 24\, \mathrm{I}\, a^3\, d\, n^2\, x + 2\, \mathrm{I}\, a^2\, b^2\, n^2\, q + 16\, \mathrm{I}\, a^2\, b\, d\, n^3 - 10\, \mathrm{I}\, a^2\, d^2\, n^2\, q - 16\, \mathrm{I}\, a\, b^2\, c\, n^3$$

$$+ 16\, \mathrm{I}\, a\, c\, d^2\, n^3 - 10\, \mathrm{I}\, b^2\, c^2\, n^2\, q - 24\, \mathrm{I}\, b\, c^3\, n^2\, x - 16\, \mathrm{I}\, b\, c^2\, d\, n^3 + 2\, \mathrm{I}\, c^2\, d^2\, n^2\, q$$

$$- 56\, \mathrm{I}\, a^3\, d\, n\, x + 6\, \mathrm{I}\, a^2\, b^2\, n\, q + 24\, \mathrm{I}\, a^2\, b\, d\, n^2 + 14\, \mathrm{I}\, a^2\, d^2\, n\, q - 24\, \mathrm{I}\, a\, b^2\, c\, n^2$$

$$+ 24\, \mathrm{I}\, a\, c\, d^2\, n^2 + 14\, \mathrm{I}\, b^2\, c^2\, n\, q + 56\, \mathrm{I}\, b\, c^3\, n\, x - 24\, \mathrm{I}\, b\, c^2\, d\, n^2 + 2\, \mathrm{I}\, a^4\, n^2\, q\, x^2 + 2\, \mathrm{I}\, c^4\, n^2\, q\, x^2$$

$$+ 6\, \mathrm{I}\, a^4\, n\, q\, x^2 + 16\, \mathrm{I}\, a^3\, d\, n^3\, x - 16\, \mathrm{I}\, b\, c^3\, n^3\, x + 32\, a^2\, d^2\, n^2\, p - 76\, a^2\, d^2\, n\, p^2 + 6\, a^2\, d^2\, n\, q^2$$

$$- 10\, a^2\, d^2\, p\, q^2 + 32\, b^2\, c^2\, n^2\, p - 76\, b^2\, c^2\, n\, p^2 + 6\, b^2\, c^2\, n\, q^2 - 10\, b^2\, c^2\, p\, q^2 - 84\, a^2\, d^2\, n\, p$$

$$- 84\, b^2\, c^2\, n\, p + 128\, a\, b\, c\, d - 24\, a^2\, b\, c\, n\, p\, q\, x + 24\, a\, c^2\, d\, n\, p\, q\, x - 80\, a^2\, c^2\, n^2\, p\, x^2$$

$$+ 88\, a^2\, c^2\, n\, p^2\, x^2 + 104\, a^2\, c\, d\, n^2\, x + 128\, a^2\, c\, d\, p^2\, x + 12\, a\, b^2\, c\, n^2\, q + 8\, a\, b^2\, c\, p^2\, q$$

$$+ 104\, a\, b\, c^2\, n^2\, x + 128\, a\, b\, c^2\, p^2\, x - 12\, a\, c\, d^2\, n^2\, q - 8\, a\, c\, d^2\, p^2\, q + 32\, b\, c^3\, n\, q\, x$$

$$- 44\, b\, c^3\, p\, q\, x + 12\, b\, c^2\, d\, n^2\, q + 8\, b\, c^2\, d\, p^2\, q - 232\, c^3\, d\, n\, p\, x + 16\, a^2\, b\, c\, q\, x$$

$$- 32\, a^2\, b\, d\, n\, q + 44\, a^2\, b\, d\, p\, q + 144\, a^2\, c\, d\, n\, x - 160\, a^2\, c\, d\, p\, x + 32\, a\, b^2\, c\, n\, q$$

$$- 44\, a\, b^2\, c\, p\, q + 144\, a\, b\, c^2\, n\, x - 160\, a\, b\, c^2\, p\, x - 16\, a\, c^2\, d\, q\, x - 32\, a\, c\, d^2\, n\, q$$

$$+ 44\, a\, c\, d^2\, p\, q + 32\, b\, c^2\, d\, n\, q - 44\, b\, c^2\, d\, p\, q + 24\, a\, b\, c^2\, n^3\, x - 32\, a\, b\, c^2\, p^3\, x$$

$$+ 12\, b\, c^3\, n^2\, q\, x + 8\, b\, c^3\, p^2\, q\, x - 80\, c^3\, d\, n^2\, p\, x + 88\, c^3\, d\, n\, p^2\, x - 232\, a^3\, b\, n\, p\, x$$

$$- 32\, a^3\, d\, n\, q\, x + 44\, a^3\, d\, p\, q\, x - 12\, a^2\, b\, d\, n^2\, q - 8\, a^2\, b\, d\, p^2\, q + 12\, a^4\, n^3\, x^2 - 16\, a^4\, p^3\, x^2$$

$$+ 12\, c^4\, n^3\, x^2 - 16\, c^4\, p^3\, x^2 + 52\, a^4\, n^2\, x^2 + 64\, a^4\, p^2\, x^2 + 52\, c^4\, n^2\, x^2 + 64\, c^4\, p^2\, x^2$$

$$+ 72\, a^4\, n\, x^2 - 80\, a^4\, p\, x^2 + 12\, a^2\, b^2\, n^3 - 16\, a^2\, b^2\, p^3 + 72\, c^4\, n\, x^2 - 80\, c^4\, p\, x^2 + 12\, c^2\, d^2\, n^3$$

$$- 16\, c^2\, d^2\, p^3 + 52\, a^2\, b^2\, n^2 + 64\, a^2\, b^2\, p^2 + 64\, a^2\, c^2\, x^2 + 52\, c^2\, d^2\, n^2 + 64\, c^2\, d^2\, p^2$$

$$+ 64\, a^3\, b\, x + 72\, a^2\, b^2\, n - 80\, a^2\, b^2\, p + 64\, c^3\, d\, x + 72\, c^2\, d^2\, n - 80\, c^2\, d^2\, p + 24\, \mathrm{I}\, a\, b\, c\, d\, p\, q$$

$$+ 12\, \mathrm{I}\, a^2\, c\, d\, n\, q\, x + 12\, \mathrm{I}\, a\, b\, c^2\, n\, q\, x + 24\, \mathrm{I}\, a\, b\, c\, d\, n^2\, q - 112\, \mathrm{I}\, a\, c^2\, d\, n\, p\, x$$

$$- 16\, \mathrm{I}\, a\, b\, c\, d\, n\, q - 4\, \mathrm{I}\, a^2\, c^2\, n\, p\, q\, x^2 - 4\, \mathrm{I}\, a^3\, b\, n\, p\, q\, x + 72\, \mathrm{I}\, a^2\, b\, c\, n^2\, p\, x$$

$$- 104\, \mathrm{I}\, a^2\, b\, c\, n\, p^2\, x + 2\, \mathrm{I}\, a^2\, b\, c\, n\, q^2\, x + 4\, \mathrm{I}\, a^2\, c\, d\, n^2\, q\, x + 4\, \mathrm{I}\, a\, b\, c^2\, n^2\, q\, x$$

$$- 72\, \mathrm{I}\, a\, c^2\, d\, n^2\, p\, x + 104\, \mathrm{I}\, a\, c^2\, d\, n\, p^2\, x - 2\, \mathrm{I}\, a\, c^2\, d\, n\, q^2\, x - 4\, \mathrm{I}\, c^3\, d\, n\, p\, q\, x$$

$$+ 112\, \mathrm{I}\, a^2\, b\, c\, n\, p\, x - 8\, \mathrm{I}\, a^2\, c\, d\, p\, q\, x - 8\, \mathrm{I}\, a\, b\, c^2\, p\, q\, x + 72\, \mathrm{I}\, a\, b\, c\, d\, p^2\, q - 4\, \mathrm{I}\, a^2\, c\, d\, n\, p\, q\, x$$

$$- 4\, \mathrm{I}\, a\, b\, c^2\, n\, p\, q\, x - 80\, \mathrm{I}\, a\, b\, c\, d\, n\, p\, q + 48\, \mathrm{I}\, a^2\, b\, c\, p^3\, x - 8\, \mathrm{I}\, a^2\, c^2\, p\, q\, x^2 - 48\, \mathrm{I}\, a\, c^2\, d\, p^3\, x$$

$$- 8\, \mathrm{I}\, a^3\, b\, p\, q\, x - 104\, \mathrm{I}\, a^2\, b\, c\, p^2\, x + 4\, \mathrm{I}\, a^2\, b\, c\, q^2\, x - 2\, \mathrm{I}\, a\, b\, c\, d\, q^3 + 104\, \mathrm{I}\, a\, c^2\, d\, p^2\, x$$

$$- 4\, \mathrm{I}\, a\, c^2\, d\, q^2\, x - 8\, \mathrm{I}\, c^3\, d\, p\, q\, x - 24\, \mathrm{I}\, a^2\, b\, c\, p\, x + 8\, \mathrm{I}\, a^2\, c\, d\, q\, x + 8\, \mathrm{I}\, a\, b\, c^2\, q\, x$$

$$+ 24\, \mathrm{I}\, a\, c^2\, d\, p\, x - 40\, \mathrm{I}\, a\, b\, c\, d\, q + \mathrm{I}\, a^2\, d^2\, q^3 + \mathrm{I}\, b^2\, c^2\, q^3 + 4\, \mathrm{I}\, a^4\, q\, x^2 + 4\, \mathrm{I}\, c^4\, q\, x^2$$

$$- 80\, \mathrm{I}\, a^3\, d\, x + 4\, \mathrm{I}\, q\, b^2\, a^2 + 24\, \mathrm{I}\, q\, d^2\, a^2 + 24\, \mathrm{I}\, b^2\, c^2\, q + 80\, \mathrm{I}\, b\, c^3\, x + 4\, \mathrm{I}\, c^2\, d^2\, q$$

$$- 80\, \mathrm{I}\, d\, b\, a^2 + 80\, \mathrm{I}\, a\, b^2\, c - 80\, \mathrm{I}\, a\, c\, d^2 + 80\, \mathrm{I}\, b\, c^2\, d\Big)\, (\mathrm{I}\, q + 2\, n - 2\, p - 2)\, (\mathrm{I}\, q - 2\, n - 4$$

$$+ 2\, p)\, (\mathrm{I}\, q + 2\, n - 2\, p)\, (1 + n - p)\, (n - 2\, p + 2)\, (\mathrm{I}\, c\, x + \mathrm{I}\, d - a\, x - b)^2\, (a$$

$$+ \mathrm{I}\,c)^2\,(\mathrm{I}\,q + 4\,n - 6\,p + 6)^5\,S(n+2) + \big(32\,a\,b\,c\,d\,n^3 - 144\,a\,b\,c\,d\,p^3 + 48\,a\,b\,c\,d\,n^2$$

$$+ 16\,a\,b\,c\,d\,p^2 + 80\,a\,b\,c\,d\,n - 32\,a^2\,d^2 - 32\,b^2\,c^2 + 32\,a^4\,x^2 + 32\,c^4\,x^2 + 32\,a^2\,b^2$$

$$+ 32\,c^2\,d^2 + 104\,a^2\,c^2\,n^2\,x^2 + 128\,a^2\,c^2\,p^2\,x^2 - 116\,c^4\,n\,p\,x^2 + 24\,c^3\,d\,n^3\,x - 32\,c^3\,d\,p^3\,x$$

$$+ 104\,a^3\,b\,n^2\,x + 128\,a^3\,b\,p^2\,x - 40\,a^2\,b^2\,n^2\,p + 44\,a^2\,b^2\,n\,p^2 + 144\,a^2\,c^2\,n\,x^2$$

$$- 160\,a^2\,c^2\,p\,x^2 + 104\,c^3\,d\,n^2\,x + 128\,c^3\,d\,p^2\,x - 40\,c^2\,d^2\,n^2\,p + 44\,c^2\,d^2\,n\,p^2$$

$$+ 144\,a^3\,b\,n\,x - 160\,a^3\,b\,p\,x - 16\,a^3\,d\,q\,x - 116\,a^2\,b^2\,n\,p + 16\,b\,c^3\,q\,x + 144\,c^3\,d\,n\,x$$

$$- 160\,c^3\,d\,p\,x - 116\,c^2\,d^2\,n\,p - 16\,a^2\,b\,d\,q + 64\,a^2\,c\,d\,x + 16\,a\,b^2\,c\,q + 64\,a\,b\,c^2\,x$$

$$- 16\,a\,c\,d^2\,q + 16\,b\,c^2\,d\,q - 104\,\mathrm{I}\,a\,b^2\,c\,n\,p^2 + 2\,\mathrm{I}\,a\,b^2\,c\,n\,q^2 + 24\,\mathrm{I}\,a\,c^2\,d\,n^2\,x$$

$$- 40\,a^4\,n^2\,p\,x^2 + 44\,a^4\,n\,p^2\,x^2 + 24\,a^2\,c^2\,n^3\,x^2 - 32\,a^2\,c^2\,p^3\,x^2 - 40\,c^4\,n^2\,p\,x^2$$

$$+ 44\,c^4\,n\,p^2\,x^2 - 116\,a^4\,n\,p\,x^2 + 24\,a^3\,b\,n^3\,x - 32\,a^3\,b\,p^3\,x + 32\,a^2\,b\,c\,n\,q\,x$$

$$- 44\,a^2\,b\,c\,p\,q\,x + 24\,a^2\,b\,d\,n\,p\,q - 232\,a^2\,c\,d\,n\,p\,x - 24\,a\,b^2\,c\,n\,p\,q - 232\,a\,b\,c^2\,n\,p\,x$$

$$- 32\,a\,c^2\,d\,n\,q\,x + 44\,a\,c^2\,d\,p\,q\,x + 24\,a\,c\,d^2\,n\,p\,q - 24\,b\,c^2\,d\,n\,p\,q - 4\,a^2\,d^2\,n^3$$

$$+ 56\,a^2\,d^2\,p^3 - 4\,b^2\,c^2\,n^3 + 56\,b^2\,c^2\,p^3 + 28\,a^2\,d^2\,n^2 + 56\,a^2\,d^2\,p^2 + 28\,b^2\,c^2\,n^2$$

$$+ 56\,b^2\,c^2\,p^2 - 16\,\mathrm{I}\,b^2\,c^2\,p\,q - 24\,\mathrm{I}\,b\,c^3\,p\,x - 104\,\mathrm{I}\,b\,c^2\,d\,p^2 + 4\,\mathrm{I}\,b\,c^2\,d\,q^2 + 8\,\mathrm{I}\,c^3\,d\,q\,x$$

$$- 4\,\mathrm{I}\,c^2\,d^2\,p\,q + 80\,\mathrm{I}\,a^2\,b\,c\,x + 24\,\mathrm{I}\,p\,d\,b\,a^2 - 24\,\mathrm{I}\,a\,b^2\,c\,p - 80\,\mathrm{I}\,a\,c^2\,d\,x + 24\,\mathrm{I}\,a\,c\,d^2\,p$$

$$- 24\,\mathrm{I}\,b\,c^2\,d\,p - 4\,\mathrm{I}\,a^4\,p\,q\,x^2 - 48\,\mathrm{I}\,a^3\,d\,p^3\,x + 48\,\mathrm{I}\,b\,c^3\,p^3\,x - 4\,\mathrm{I}\,c^4\,p\,q\,x^2 + 104\,\mathrm{I}\,a^3\,d\,p^2\,x$$

$$- 4\,\mathrm{I}\,a^3\,d\,q^2\,x - 48\,\mathrm{I}\,p^3\,d\,b\,a^2 + 8\,\mathrm{I}\,a^2\,c^2\,q\,x^2 - 36\,\mathrm{I}\,a^2\,d^2\,p^2\,q + 48\,\mathrm{I}\,a\,b^2\,c\,p^3$$

$$- 48\,\mathrm{I}\,a\,c\,d^2\,p^3 + 24\,a^3\,d\,n\,p\,q\,x + 12\,a^2\,b\,c\,n^2\,q\,x + 8\,a^2\,b\,c\,p^2\,q\,x - 80\,a^2\,c\,d\,n^2\,p\,x$$

$$+ 88\, a^2\, c\, d\, n\, p^2\, x - 80\, a\, b\, c^2\, n^2\, p\, x + 88\, a\, b\, c^2\, n\, p^2\, x - 12\, a\, c^2\, d\, n^2\, q\, x - 8\, a\, c^2\, d\, p^2\, q\, x$$

$$- 24\, b\, c^3\, n\, p\, q\, x - 72\, \mathrm{I}\, a\, c\, d^2\, n^2\, p + 104\, \mathrm{I}\, a\, c\, d^2\, n\, p^2 - 2\, \mathrm{I}\, a\, c\, d^2\, n\, q^2 + 38\, \mathrm{I}\, b^2\, c^2\, n\, p\, q$$

$$+ 112\, \mathrm{I}\, b\, c^3\, n\, p\, x + 72\, \mathrm{I}\, b\, c^2\, d\, n^2\, p - 104\, \mathrm{I}\, b\, c^2\, d\, n\, p^2 + 2\, \mathrm{I}\, b\, c^2\, d\, n\, q^2 + 12\, \mathrm{I}\, c^3\, d\, n\, q\, x$$

$$- 2\, \mathrm{I}\, c^2\, d^2\, n\, p\, q + 56\, \mathrm{I}\, a^2\, b\, c\, n\, x - 112\, \mathrm{I}\, a^2\, b\, d\, n\, p + 112\, \mathrm{I}\, a\, b^2\, c\, n\, p - 56\, \mathrm{I}\, a\, c^2\, d\, n\, x$$

$$- 112\, \mathrm{I}\, a\, c\, d^2\, n\, p + 112\, \mathrm{I}\, b\, c^2\, d\, n\, p - 2\, \mathrm{I}\, a^4\, n\, p\, q\, x^2 + 4\, \mathrm{I}\, a^2\, c^2\, n^2\, q\, x^2 - 2\, \mathrm{I}\, c^4\, n\, p\, q\, x^2$$

$$+ 4\, \mathrm{I}\, a^3\, b\, n^2\, q\, x - 72\, \mathrm{I}\, a^3\, d\, n^2\, p\, x + 104\, \mathrm{I}\, a^3\, d\, n\, p^2\, x - 2\, \mathrm{I}\, a^3\, d\, n\, q^2\, x - 16\, \mathrm{I}\, a^2\, b\, c\, n^3\, x$$

$$+ 12\, \mathrm{I}\, a^2\, c^2\, n\, q\, x^2 + 16\, \mathrm{I}\, a\, c^2\, d\, n^3\, x + 72\, \mathrm{I}\, b\, c^3\, n^2\, p\, x - 104\, \mathrm{I}\, b\, c^3\, n\, p^2\, x + 2\, \mathrm{I}\, b\, c^3\, n\, q^2\, x$$

$$+ 4\, \mathrm{I}\, c^3\, d\, n^2\, q\, x + 12\, \mathrm{I}\, a^3\, b\, n\, q\, x - 112\, \mathrm{I}\, a^3\, d\, n\, p\, x - 2\, \mathrm{I}\, a^2\, b^2\, n\, p\, q - 24\, \mathrm{I}\, a^2\, b\, c\, n^2\, x$$

$$- 72\, \mathrm{I}\, a^2\, b\, d\, n^2\, p + 104\, \mathrm{I}\, a^2\, b\, d\, n\, p^2 - 2\, \mathrm{I}\, a^2\, b\, d\, n\, q^2 + 38\, \mathrm{I}\, a^2\, d^2\, n\, p\, q + 72\, \mathrm{I}\, a\, b^2\, c\, n^2\, p$$

$$+ 32\, a^2\, d^2\, n - 80\, a^2\, d^2\, p + 32\, b^2\, c^2\, n - 80\, b^2\, c^2\, p - 80\, a^3\, b\, n^2\, p\, x + 88\, a^3\, b\, n\, p^2\, x$$

$$- 12\, a^3\, d\, n^2\, q\, x - 8\, a^3\, d\, p^2\, q\, x - 232\, a^2\, c^2\, n\, p\, x^2 + 24\, a^2\, c\, d\, n^3\, x - 32\, a^2\, c\, d\, p^3\, x$$

$$- 144\, a\, b\, c\, d\, n^2\, p + 240\, a\, b\, c\, d\, n\, p^2 - 12\, a\, b\, c\, d\, n\, q^2 + 20\, a\, b\, c\, d\, p\, q^2 - 64\, a\, b\, c\, d\, n\, p$$

$$- 36\, \mathrm{I}\, b^2\, c^2\, p^2\, q - 104\, \mathrm{I}\, b\, c^3\, p^2\, x + 4\, \mathrm{I}\, b\, c^3\, q^2\, x + 48\, \mathrm{I}\, b\, c^2\, d\, p^3 + 8\, \mathrm{I}\, a^3\, b\, q\, x + 24\, \mathrm{I}\, a^3\, d\, p\, x$$

$$- 4\, \mathrm{I}\, q\, p\, b^2\, a^2 + 104\, \mathrm{I}\, p^2\, d\, b\, a^2 - 4\, \mathrm{I}\, a^2\, b\, d\, q^2 - 16\, \mathrm{I}\, q\, p\, d^2\, a^2 - 104\, \mathrm{I}\, a\, b^2\, c\, p^2$$

$$+ 4\, \mathrm{I}\, a\, b^2\, c\, q^2 + 104\, \mathrm{I}\, a\, c\, d^2\, p^2 - 4\, \mathrm{I}\, a\, c\, d^2\, q^2 + 6\, \mathrm{I}\, c^2\, d^2\, n\, q - 56\, \mathrm{I}\, a^2\, b\, d\, n + 56\, \mathrm{I}\, a\, b^2\, c\, n$$

$$- 56\, \mathrm{I}\, a\, c\, d^2\, n + 56\, \mathrm{I}\, b\, c^2\, d\, n + 6\, \mathrm{I}\, c^4\, n\, q\, x^2 + 24\, \mathrm{I}\, a^3\, d\, n^2\, x + 2\, \mathrm{I}\, a^2\, b^2\, n^2\, q + 16\, \mathrm{I}\, a^2\, b\, d\, n^3$$

$$- 10\, \mathrm{I}\, a^2\, d^2\, n^2\, q - 16\, \mathrm{I}\, a\, b^2\, c\, n^3 + 16\, \mathrm{I}\, a\, c\, d^2\, n^3 - 10\, \mathrm{I}\, b^2\, c^2\, n^2\, q - 24\, \mathrm{I}\, b\, c^3\, n^2\, x$$

$$- 16\, \mathrm{I}\, b\, c^2\, d\, n^3 + 2\, \mathrm{I}\, c^2\, d^2\, n^2\, q - 56\, \mathrm{I}\, a^3\, d\, n\, x + 6\, \mathrm{I}\, a^2\, b^2\, n\, q + 24\, \mathrm{I}\, a^2\, b\, d\, n^2$$

$$+ 14\,\mathrm{I}\,a^2\,d^2\,n\,q - 24\,\mathrm{I}\,a\,b^2\,c\,n^2 + 24\,\mathrm{I}\,a\,c\,d^2\,n^2 + 14\,\mathrm{I}\,b^2\,c^2\,n\,q + 56\,\mathrm{I}\,b\,c^3\,n\,x$$

$$- 24\,\mathrm{I}\,b\,c^2\,d\,n^2 + 2\,\mathrm{I}\,a^4\,n^2\,q\,x^2 + 2\,\mathrm{I}\,c^4\,n^2\,q\,x^2 + 6\,\mathrm{I}\,a^4\,n\,q\,x^2 + 16\,\mathrm{I}\,a^3\,d\,n^3\,x - 16\,\mathrm{I}\,b\,c^3\,n^3\,x$$

$$+ 32\,a^2\,d^2\,n^2\,p - 76\,a^2\,d^2\,n\,p^2 + 6\,a^2\,d^2\,n\,q^2 - 10\,a^2\,d^2\,p\,q^2 + 32\,b^2\,c^2\,n^2\,p - 76\,b^2\,c^2\,n\,p^2$$

$$+ 6\,b^2\,c^2\,n\,q^2 - 10\,b^2\,c^2\,p\,q^2 - 84\,a^2\,d^2\,n\,p - 84\,b^2\,c^2\,n\,p + 128\,a\,b\,c\,d - 24\,a^2\,b\,c\,n\,p\,q\,x$$

$$+ 24\,a\,c^2\,d\,n\,p\,q\,x - 80\,a^2\,c^2\,n^2\,p\,x^2 + 88\,a^2\,c^2\,n\,p^2\,x^2 + 104\,a^2\,c\,d\,n^2\,x + 128\,a^2\,c\,d\,p^2\,x$$

$$+ 12\,a\,b^2\,c\,n^2\,q + 8\,a\,b^2\,c\,p^2\,q + 104\,a\,b\,c^2\,n^2\,x + 128\,a\,b\,c^2\,p^2\,x - 12\,a\,c\,d^2\,n^2\,q$$

$$- 8\,a\,c\,d^2\,p^2\,q + 32\,b\,c^3\,n\,q\,x - 44\,b\,c^3\,p\,q\,x + 12\,b\,c^2\,d\,n^2\,q + 8\,b\,c^2\,d\,p^2\,q$$

$$- 232\,c^3\,d\,n\,p\,x + 16\,a^2\,b\,c\,q\,x - 32\,a^2\,b\,d\,n\,q + 44\,a^2\,b\,d\,p\,q + 144\,a^2\,c\,d\,n\,x$$

$$- 160\,a^2\,c\,d\,p\,x + 32\,a\,b^2\,c\,n\,q - 44\,a\,b^2\,c\,p\,q + 144\,a\,b\,c^2\,n\,x - 160\,a\,b\,c^2\,p\,x$$

$$- 16\,a\,c^2\,d\,q\,x - 32\,a\,c\,d^2\,n\,q + 44\,a\,c\,d^2\,p\,q + 32\,b\,c^2\,d\,n\,q - 44\,b\,c^2\,d\,p\,q$$

$$+ 24\,a\,b\,c^2\,n^3\,x - 32\,a\,b\,c^2\,p^3\,x + 12\,b\,c^3\,n^2\,q\,x + 8\,b\,c^3\,p^2\,q\,x - 80\,c^3\,d\,n^2\,p\,x$$

$$+ 88\,c^3\,d\,n\,p^2\,x - 232\,a^3\,b\,n\,p\,x - 32\,a^3\,d\,n\,q\,x + 44\,a^3\,d\,p\,q\,x - 12\,a^2\,b\,d\,n^2\,q$$

$$- 8\,a^2\,b\,d\,p^2\,q + 12\,a^4\,n^3\,x^2 - 16\,a^4\,p^3\,x^2 + 12\,c^4\,n^3\,x^2 - 16\,c^4\,p^3\,x^2 + 52\,a^4\,n^2\,x^2$$

$$+ 64\,a^4\,p^2\,x^2 + 52\,c^4\,n^2\,x^2 + 64\,c^4\,p^2\,x^2 + 72\,a^4\,n\,x^2 - 80\,a^4\,p\,x^2 + 12\,a^2\,b^2\,n^3$$

$$- 16\,a^2\,b^2\,p^3 + 72\,c^4\,n\,x^2 - 80\,c^4\,p\,x^2 + 12\,c^2\,d^2\,n^3 - 16\,c^2\,d^2\,p^3 + 52\,a^2\,b^2\,n^2$$

$$+ 64\,a^2\,b^2\,p^2 + 64\,a^2\,c^2\,x^2 + 52\,c^2\,d^2\,n^2 + 64\,c^2\,d^2\,p^2 + 64\,a^3\,b\,x + 72\,a^2\,b^2\,n - 80\,a^2\,b^2\,p$$

$$+ 64\,c^3\,d\,x + 72\,c^2\,d^2\,n - 80\,c^2\,d^2\,p + 24\,\mathrm{I}\,a\,b\,c\,d\,p\,q + 12\,\mathrm{I}\,a^2\,c\,d\,n\,q\,x + 12\,\mathrm{I}\,a\,b\,c^2\,n\,q\,x$$

$$+ 24\,\mathrm{I}\,a\,b\,c\,d\,n^2\,q - 112\,\mathrm{I}\,a\,c^2\,d\,n\,p\,x - 16\,\mathrm{I}\,a\,b\,c\,d\,n\,q - 4\,\mathrm{I}\,a^2\,c^2\,n\,p\,q\,x^2 - 4\,\mathrm{I}\,a^3\,b\,n\,p\,q\,x$$

$$+ 72\,\mathrm{I}\,a^2\,b\,c\,n^2\,p\,x - 104\,\mathrm{I}\,a^2\,b\,c\,n\,p^2\,x + 2\,\mathrm{I}\,a^2\,b\,c\,n\,q^2\,x + 4\,\mathrm{I}\,a^2\,c\,d\,n^2\,q\,x$$

$$+ 4\,\mathrm{I}\,a\,b\,c^2\,n^2\,q\,x - 72\,\mathrm{I}\,a\,c^2\,d\,n^2\,p\,x + 104\,\mathrm{I}\,a\,c^2\,d\,n\,p^2\,x - 2\,\mathrm{I}\,a\,c^2\,d\,n\,q^2\,x$$

$$- 4\,\mathrm{I}\,c^3\,d\,n\,p\,q\,x + 112\,\mathrm{I}\,a^2\,b\,c\,n\,p\,x - 8\,\mathrm{I}\,a^2\,c\,d\,p\,q\,x - 8\,\mathrm{I}\,a\,b\,c^2\,p\,q\,x + 72\,\mathrm{I}\,a\,b\,c\,d\,p^2\,q$$

$$- 4\,\mathrm{I}\,a^2\,c\,d\,n\,p\,q\,x - 4\,\mathrm{I}\,a\,b\,c^2\,n\,p\,q\,x - 80\,\mathrm{I}\,a\,b\,c\,d\,n\,p\,q + 48\,\mathrm{I}\,a^2\,b\,c\,p^3\,x - 8\,\mathrm{I}\,a^2\,c^2\,p\,q\,x^2$$

$$- 48\,\mathrm{I}\,a\,c^2\,d\,p^3\,x - 8\,\mathrm{I}\,a^3\,b\,p\,q\,x - 104\,\mathrm{I}\,a^2\,b\,c\,p^2\,x + 4\,\mathrm{I}\,a^2\,b\,c\,q^2\,x - 2\,\mathrm{I}\,a\,b\,c\,d\,q^3$$

$$+ 104\,\mathrm{I}\,a\,c^2\,d\,p^2\,x - 4\,\mathrm{I}\,a\,c^2\,d\,q^2\,x - 8\,\mathrm{I}\,c^3\,d\,p\,q\,x - 24\,\mathrm{I}\,a^2\,b\,c\,p\,x + 8\,\mathrm{I}\,a^2\,c\,d\,q\,x$$

$$+ 8\,\mathrm{I}\,a\,b\,c^2\,q\,x + 24\,\mathrm{I}\,a\,c^2\,d\,p\,x - 40\,\mathrm{I}\,a\,b\,c\,d\,q + \mathrm{I}\,a^2\,d^2\,q^3 + \mathrm{I}\,b^2\,c^2\,q^3 + 4\,\mathrm{I}\,a^4\,q\,x^2$$

$$+ 4\,\mathrm{I}\,c^4\,q\,x^2 - 80\,\mathrm{I}\,a^3\,d\,x + 4\,\mathrm{I}\,q\,b^2\,a^2 + 24\,\mathrm{I}\,q\,d^2\,a^2 + 24\,\mathrm{I}\,b^2\,c^2\,q + 80\,\mathrm{I}\,b\,c^3\,x + 4\,\mathrm{I}\,c^2\,d^2\,q$$

$$- 80\,\mathrm{I}\,d\,b\,a^2 + 80\,\mathrm{I}\,a\,b^2\,c - 80\,\mathrm{I}\,a\,c\,d^2 + 80\,\mathrm{I}\,b\,c^2\,d\big)\,\big(2\,a^2\,x\,n^2 - 4\,a^2\,x\,p\,n + 2\,a^2\,p^2\,x$$

$$+ 2\,c^2\,x\,n^2 - 4\,c^2\,x\,p\,n + 2\,c^2\,p^2\,x + 6\,a^2\,x\,n - 6\,a^2\,x\,p + 2\,a\,b\,n^2 - 4\,a\,b\,p\,n + 2\,a\,b\,p^2$$

$$- a\,d\,p\,q + b\,c\,p\,q + 6\,c^2\,x\,n - 6\,c^2\,x\,p + 2\,c\,d\,n^2 - 4\,c\,d\,p\,n + 2\,c\,d\,p^2 + 4\,a^2\,x + 6\,a\,b\,n$$

$$- 6\,a\,b\,p + 4\,c^2\,x + 6\,c\,d\,n - 6\,c\,d\,p + 4\,a\,b + 4\,c\,d\big)\,(\mathrm{I}\,q + 2\,n - 2\,p)\,(\mathrm{I}\,q - 2\,n - 4$$

$$+ 2\,p)\,(\mathrm{I}\,q + 2\,n - 2\,p - 2)\,(3 + 2\,n - 2\,p)\,(\mathrm{I}\,c\,x + \mathrm{I}\,d - a\,x - b)^2\,(a + \mathrm{I}\,c)^2\,(\mathrm{I}\,q$$

$$+ 4\,n - 6\,p + 6)^5\,S(n+1) + \big(32\,a\,b\,c\,d\,n^3 - 144\,a\,b\,c\,d\,p^3 + 48\,a\,b\,c\,d\,n^2$$

$$+ 16\,a\,b\,c\,d\,p^2 + 80\,a\,b\,c\,d\,n - 32\,a^2\,d^2 - 32\,b^2\,c^2 + 32\,a^4\,x^2 + 32\,c^4\,x^2 + 32\,a^2\,b^2$$

$$+ 32\,c^2\,d^2 + 104\,a^2\,c^2\,n^2\,x^2 + 128\,a^2\,c^2\,p^2\,x^2 - 116\,c^4\,n\,p\,x^2 + 24\,c^3\,d\,n^3\,x - 32\,c^3\,d\,p^3\,x$$

$$+ 104\,a^3\,b\,n^2\,x + 128\,a^3\,b\,p^2\,x - 40\,a^2\,b^2\,n^2\,p + 44\,a^2\,b^2\,n\,p^2 + 144\,a^2\,c^2\,n\,x^2$$

$$- 160\,a^2\,c^2\,p\,x^2 + 104\,c^3\,d\,n^2\,x + 128\,c^3\,d\,p^2\,x - 40\,c^2\,d^2\,n^2\,p + 44\,c^2\,d^2\,n\,p^2$$

$$+ 144\, a^3\, b\, n\, x - 160\, a^3\, b\, p\, x - 16\, a^3\, d\, q\, x - 116\, a^2\, b^2\, n\, p + 16\, b\, c^3\, q\, x + 144\, c^3\, d\, n\, x$$

$$- 160\, c^3\, d\, p\, x - 116\, c^2\, d^2\, n\, p - 16\, a^2\, b\, d\, q + 64\, a^2\, c\, d\, x + 16\, a\, b^2\, c\, q + 64\, a\, b\, c^2\, x$$

$$- 16\, a\, c\, d^2\, q + 16\, b\, c^2\, d\, q - 104\, \mathrm{I}\, a\, b^2\, c\, n\, p^2 + 2\, \mathrm{I}\, a\, b^2\, c\, n\, q^2 + 24\, \mathrm{I}\, a\, c^2\, d\, n^2\, x$$

$$- 40\, a^4\, n^2\, p\, x^2 + 44\, a^4\, n\, p^2\, x^2 + 24\, a^2\, c^2\, n^3\, x^2 - 32\, a^2\, c^2\, p^3\, x^2 - 40\, c^4\, n^2\, p\, x^2$$

$$+ 44\, c^4\, n\, p^2\, x^2 - 116\, a^4\, n\, p\, x^2 + 24\, a^3\, b\, n^3\, x - 32\, a^3\, b\, p^3\, x + 32\, a^2\, b\, c\, n\, q\, x$$

$$- 44\, a^2\, b\, c\, p\, q\, x + 24\, a^2\, b\, d\, n\, p\, q - 232\, a^2\, c\, d\, n\, p\, x - 24\, a\, b^2\, c\, n\, p\, q - 232\, a\, b\, c^2\, n\, p\, x$$

$$- 32\, a\, c^2\, d\, n\, q\, x + 44\, a\, c^2\, d\, p\, q\, x + 24\, a\, c\, d^2\, n\, p\, q - 24\, b\, c^2\, d\, n\, p\, q - 4\, a^2\, d^2\, n^3$$

$$+ 56\, a^2\, d^2\, p^3 - 4\, b^2\, c^2\, n^3 + 56\, b^2\, c^2\, p^3 + 28\, a^2\, d^2\, n^2 + 56\, a^2\, d^2\, p^2 + 28\, b^2\, c^2\, n^2$$

$$+ 56\, b^2\, c^2\, p^2 - 16\, \mathrm{I}\, b^2\, c^2\, p\, q - 24\, \mathrm{I}\, b\, c^3\, p\, x - 104\, \mathrm{I}\, b\, c^2\, d\, p^2 + 4\, \mathrm{I}\, b\, c^2\, d\, q^2 + 8\, \mathrm{I}\, c^3\, d\, q\, x$$

$$- 4\, \mathrm{I}\, c^2\, d^2\, p\, q + 80\, \mathrm{I}\, a^2\, b\, c\, x + 24\, \mathrm{I}\, p\, d\, b\, a^2 - 24\, \mathrm{I}\, a\, b^2\, c\, p - 80\, \mathrm{I}\, a\, c^2\, d\, x + 24\, \mathrm{I}\, a\, c\, d^2\, p$$

$$- 24\, \mathrm{I}\, b\, c^2\, d\, p - 4\, \mathrm{I}\, a^4\, p\, q\, x^2 - 48\, \mathrm{I}\, a^3\, d\, p^3\, x + 48\, \mathrm{I}\, b\, c^3\, p^3\, x - 4\, \mathrm{I}\, c^4\, p\, q\, x^2 + 104\, \mathrm{I}\, a^3\, d\, p^2\, x$$

$$- 4\, \mathrm{I}\, a^3\, d\, q^2\, x - 48\, \mathrm{I}\, p^3\, d\, b\, a^2 + 8\, \mathrm{I}\, a^2\, c^2\, q\, x^2 - 36\, \mathrm{I}\, a^2\, d^2\, p^2\, q + 48\, \mathrm{I}\, a\, b^2\, c\, p^3$$

$$- 48\, \mathrm{I}\, a\, c\, d^2\, p^3 + 24\, a^3\, d\, n\, p\, q\, x + 12\, a^2\, b\, c\, n^2\, q\, x + 8\, a^2\, b\, c\, p^2\, q\, x - 80\, a^2\, c\, d\, n^2\, p\, x$$

$$+ 88\, a^2\, c\, d\, n\, p^2\, x - 80\, a\, b\, c^2\, n^2\, p\, x + 88\, a\, b\, c^2\, n\, p^2\, x - 12\, a\, c^2\, d\, n^2\, q\, x - 8\, a\, c^2\, d\, p^2\, q\, x$$

$$- 24\, b\, c^3\, n\, p\, q\, x - 72\, \mathrm{I}\, a\, c\, d^2\, n^2\, p + 104\, \mathrm{I}\, a\, c\, d^2\, n\, p^2 - 2\, \mathrm{I}\, a\, c\, d^2\, n\, q^2 + 38\, \mathrm{I}\, b^2\, c^2\, n\, p\, q$$

$$+ 112\, \mathrm{I}\, b\, c^3\, n\, p\, x + 72\, \mathrm{I}\, b\, c^2\, d\, n^2\, p - 104\, \mathrm{I}\, b\, c^2\, d\, n\, p^2 + 2\, \mathrm{I}\, b\, c^2\, d\, n\, q^2 + 12\, \mathrm{I}\, c^3\, d\, n\, q\, x$$

$$- 2\, \mathrm{I}\, c^2\, d^2\, n\, p\, q + 56\, \mathrm{I}\, a^2\, b\, c\, n\, x - 112\, \mathrm{I}\, a^2\, b\, d\, n\, p + 112\, \mathrm{I}\, a\, b^2\, c\, n\, p - 56\, \mathrm{I}\, a\, c^2\, d\, n\, x$$

$$- 112\, \mathrm{I}\, a\, c\, d^2\, n\, p + 112\, \mathrm{I}\, b\, c^2\, d\, n\, p - 2\, \mathrm{I}\, a^4\, n\, p\, q\, x^2 + 4\, \mathrm{I}\, a^2\, c^2\, n^2\, q\, x^2 - 2\, \mathrm{I}\, c^4\, n\, p\, q\, x^2$$

$$+ 4\,\mathrm{I}\,a^3\,b\,n^2\,q\,x - 72\,\mathrm{I}\,a^3\,d\,n^2\,p\,x + 104\,\mathrm{I}\,a^3\,d\,n\,p^2\,x - 2\,\mathrm{I}\,a^3\,d\,n\,q^2\,x - 16\,\mathrm{I}\,a^2\,b\,c\,n^3\,x$$

$$+ 12\,\mathrm{I}\,a^2\,c^2\,n\,q\,x^2 + 16\,\mathrm{I}\,a\,c^2\,d\,n^3\,x + 72\,\mathrm{I}\,b\,c^3\,n^2\,p\,x - 104\,\mathrm{I}\,b\,c^3\,n\,p^2\,x + 2\,\mathrm{I}\,b\,c^3\,n\,q^2\,x$$

$$+ 4\,\mathrm{I}\,c^3\,d\,n^2\,q\,x + 12\,\mathrm{I}\,a^3\,b\,n\,q\,x - 112\,\mathrm{I}\,a^3\,d\,n\,p\,x - 2\,\mathrm{I}\,a^2\,b^2\,n\,p\,q - 24\,\mathrm{I}\,a^2\,b\,c\,n^2\,x$$

$$- 72\,\mathrm{I}\,a^2\,b\,d\,n^2\,p + 104\,\mathrm{I}\,a^2\,b\,d\,n\,p^2 - 2\,\mathrm{I}\,a^2\,b\,d\,n\,q^2 + 38\,\mathrm{I}\,a^2\,d^2\,n\,p\,q + 72\,\mathrm{I}\,a\,b^2\,c\,n^2\,p$$

$$+ 32\,a^2\,d^2\,n - 80\,a^2\,d^2\,p + 32\,b^2\,c^2\,n - 80\,b^2\,c^2\,p - 80\,a^3\,b\,n^2\,p\,x + 88\,a^3\,b\,n\,p^2\,x$$

$$- 12\,a^3\,d\,n^2\,q\,x - 8\,a^3\,d\,p^2\,q\,x - 232\,a^2\,c^2\,n\,p\,x^2 + 24\,a^2\,c\,d\,n^3\,x - 32\,a^2\,c\,d\,p^3\,x$$

$$- 144\,a\,b\,c\,d\,n^2\,p + 240\,a\,b\,c\,d\,n\,p^2 - 12\,a\,b\,c\,d\,n\,q^2 + 20\,a\,b\,c\,d\,p\,q^2 - 64\,a\,b\,c\,d\,n\,p$$

$$- 36\,\mathrm{I}\,b^2\,c^2\,p^2\,q - 104\,\mathrm{I}\,b\,c^3\,p^2\,x + 4\,\mathrm{I}\,b\,c^3\,q^2\,x + 48\,\mathrm{I}\,b\,c^2\,d\,p^3 + 8\,\mathrm{I}\,a^3\,b\,q\,x + 24\,\mathrm{I}\,a^3\,d\,p\,x$$

$$- 4\,\mathrm{I}\,q\,p\,b^2\,a^2 + 104\,\mathrm{I}\,p^2\,d\,b\,a^2 - 4\,\mathrm{I}\,a^2\,b\,d\,q^2 - 16\,\mathrm{I}\,q\,p\,d^2\,a^2 - 104\,\mathrm{I}\,a\,b^2\,c\,p^2$$

$$+ 4\,\mathrm{I}\,a\,b^2\,c\,q^2 + 104\,\mathrm{I}\,a\,c\,d^2\,p^2 - 4\,\mathrm{I}\,a\,c\,d^2\,q^2 + 6\,\mathrm{I}\,c^2\,d^2\,n\,q - 56\,\mathrm{I}\,a^2\,b\,d\,n + 56\,\mathrm{I}\,a\,b^2\,c\,n$$

$$- 56\,\mathrm{I}\,a\,c\,d^2\,n + 56\,\mathrm{I}\,b\,c^2\,d\,n + 6\,\mathrm{I}\,c^4\,n\,q\,x^2 + 24\,\mathrm{I}\,a^3\,d\,n^2\,x + 2\,\mathrm{I}\,a^2\,b^2\,n^2\,q + 16\,\mathrm{I}\,a^2\,b\,d\,n^3$$

$$- 10\,\mathrm{I}\,a^2\,d^2\,n^2\,q - 16\,\mathrm{I}\,a\,b^2\,c\,n^3 + 16\,\mathrm{I}\,a\,c\,d^2\,n^3 - 10\,\mathrm{I}\,b^2\,c^2\,n^2\,q - 24\,\mathrm{I}\,b\,c^3\,n^2\,x$$

$$- 16\,\mathrm{I}\,b\,c^2\,d\,n^3 + 2\,\mathrm{I}\,c^2\,d^2\,n^2\,q - 56\,\mathrm{I}\,a^3\,d\,n\,x + 6\,\mathrm{I}\,a^2\,b^2\,n\,q + 24\,\mathrm{I}\,a^2\,b\,d\,n^2$$

$$+ 14\,\mathrm{I}\,a^2\,d^2\,n\,q - 24\,\mathrm{I}\,a\,b^2\,c\,n^2 + 24\,\mathrm{I}\,a\,c\,d^2\,n^2 + 14\,\mathrm{I}\,b^2\,c^2\,n\,q + 56\,\mathrm{I}\,b\,c^3\,n\,x$$

$$- 24\,\mathrm{I}\,b\,c^2\,d\,n^2 + 2\,\mathrm{I}\,a^4\,n^2\,q\,x^2 + 2\,\mathrm{I}\,c^4\,n^2\,q\,x^2 + 6\,\mathrm{I}\,a^4\,n\,q\,x^2 + 16\,\mathrm{I}\,a^3\,d\,n^3\,x - 16\,\mathrm{I}\,b\,c^3\,n^3\,x$$

$$+ 32\,a^2\,d^2\,n^2\,p - 76\,a^2\,d^2\,n\,p^2 + 6\,a^2\,d^2\,n\,q^2 - 10\,a^2\,d^2\,p\,q^2 + 32\,b^2\,c^2\,n^2\,p - 76\,b^2\,c^2\,n\,p^2$$

$$+ 6\,b^2\,c^2\,n\,q^2 - 10\,b^2\,c^2\,p\,q^2 - 84\,a^2\,d^2\,n\,p - 84\,b^2\,c^2\,n\,p + 128\,a\,b\,c\,d - 24\,a^2\,b\,c\,n\,p\,q\,x$$

$$+ 24\,a\,c^2\,d\,n\,p\,q\,x - 80\,a^2\,c^2\,n^2\,p\,x^2 + 88\,a^2\,c^2\,n\,p^2\,x^2 + 104\,a^2\,c\,d\,n^2\,x + 128\,a^2\,c\,d\,p^2\,x$$

$$+ 12\, a\, b^2\, c\, n^2\, q + 8\, a\, b^2\, c\, p^2\, q + 104\, a\, b\, c^2\, n^2\, x + 128\, a\, b\, c^2\, p^2\, x - 12\, a\, c\, d^2\, n^2\, q$$

$$- 8\, a\, c\, d^2\, p^2\, q + 32\, b\, c^3\, n\, q\, x - 44\, b\, c^3\, p\, q\, x + 12\, b\, c^2\, d\, n^2\, q + 8\, b\, c^2\, d\, p^2\, q$$

$$- 232\, c^3\, d\, n\, p\, x + 16\, a^2\, b\, c\, q\, x - 32\, a^2\, b\, d\, n\, q + 44\, a^2\, b\, d\, p\, q + 144\, a^2\, c\, d\, n\, x$$

$$- 160\, a^2\, c\, d\, p\, x + 32\, a\, b^2\, c\, n\, q - 44\, a\, b^2\, c\, p\, q + 144\, a\, b\, c^2\, n\, x - 160\, a\, b\, c^2\, p\, x$$

$$- 16\, a\, c^2\, d\, q\, x - 32\, a\, c\, d^2\, n\, q + 44\, a\, c\, d^2\, p\, q + 32\, b\, c^2\, d\, n\, q - 44\, b\, c^2\, d\, p\, q$$

$$+ 24\, a\, b\, c^2\, n^3\, x - 32\, a\, b\, c^2\, p^3\, x + 12\, b\, c^3\, n^2\, q\, x + 8\, b\, c^3\, p^2\, q\, x - 80\, c^3\, d\, n^2\, p\, x$$

$$+ 88\, c^3\, d\, n\, p^2\, x - 232\, a^3\, b\, n\, p\, x - 32\, a^3\, d\, n\, q\, x + 44\, a^3\, d\, p\, q\, x - 12\, a^2\, b\, d\, n^2\, q$$

$$- 8\, a^2\, b\, d\, p^2\, q + 12\, a^4\, n^3\, x^2 - 16\, a^4\, p^3\, x^2 + 12\, c^4\, n^3\, x^2 - 16\, c^4\, p^3\, x^2 + 52\, a^4\, n^2\, x^2$$

$$+ 64\, a^4\, p^2\, x^2 + 52\, c^4\, n^2\, x^2 + 64\, c^4\, p^2\, x^2 + 72\, a^4\, n\, x^2 - 80\, a^4\, p\, x^2 + 12\, a^2\, b^2\, n^3$$

$$- 16\, a^2\, b^2\, p^3 + 72\, c^4\, n\, x^2 - 80\, c^4\, p\, x^2 + 12\, c^2\, d^2\, n^3 - 16\, c^2\, d^2\, p^3 + 52\, a^2\, b^2\, n^2$$

$$+ 64\, a^2\, b^2\, p^2 + 64\, a^2\, c^2\, x^2 + 52\, c^2\, d^2\, n^2 + 64\, c^2\, d^2\, p^2 + 64\, a^3\, b\, x + 72\, a^2\, b^2\, n - 80\, a^2\, b^2\, p$$

$$+ 64\, c^3\, d\, x + 72\, c^2\, d^2\, n - 80\, c^2\, d^2\, p + 24\, \mathrm{I}\, a\, b\, c\, d\, p\, q + 12\, \mathrm{I}\, a^2\, c\, d\, n\, q\, x + 12\, \mathrm{I}\, a\, b\, c^2\, n\, q\, x$$

$$+ 24\, \mathrm{I}\, a\, b\, c\, d\, n^2\, q - 112\, \mathrm{I}\, a\, c^2\, d\, n\, p\, x - 16\, \mathrm{I}\, a\, b\, c\, d\, n\, q - 4\, \mathrm{I}\, a^2\, c^2\, n\, p\, q\, x^2 - 4\, \mathrm{I}\, a^3\, b\, n\, p\, q\, x$$

$$+ 72\, \mathrm{I}\, a^2\, b\, c\, n^2\, p\, x - 104\, \mathrm{I}\, a^2\, b\, c\, n\, p^2\, x + 2\, \mathrm{I}\, a^2\, b\, c\, n\, q^2\, x + 4\, \mathrm{I}\, a^2\, c\, d\, n^2\, q\, x$$

$$+ 4\, \mathrm{I}\, a\, b\, c^2\, n^2\, q\, x - 72\, \mathrm{I}\, a\, c^2\, d\, n^2\, p\, x + 104\, \mathrm{I}\, a\, c^2\, d\, n\, p^2\, x - 2\, \mathrm{I}\, a\, c^2\, d\, n\, q^2\, x$$

$$- 4\, \mathrm{I}\, c^3\, d\, n\, p\, q\, x + 112\, \mathrm{I}\, a^2\, b\, c\, n\, p\, x - 8\, \mathrm{I}\, a^2\, c\, d\, p\, q\, x - 8\, \mathrm{I}\, a\, b\, c^2\, p\, q\, x + 72\, \mathrm{I}\, a\, b\, c\, d\, p^2\, q$$

$$- 4\, \mathrm{I}\, a^2\, c\, d\, n\, p\, q\, x - 4\, \mathrm{I}\, a\, b\, c^2\, n\, p\, q\, x - 80\, \mathrm{I}\, a\, b\, c\, d\, n\, p\, q + 48\, \mathrm{I}\, a^2\, b\, c\, p^3\, x - 8\, \mathrm{I}\, a^2\, c^2\, p\, q\, x^2$$

$$- 48\, \mathrm{I}\, a\, c^2\, d\, p^3\, x - 8\, \mathrm{I}\, a^3\, b\, p\, q\, x - 104\, \mathrm{I}\, a^2\, b\, c\, p^2\, x + 4\, \mathrm{I}\, a^2\, b\, c\, q^2\, x - 2\, \mathrm{I}\, a\, b\, c\, d\, q^3$$

$$+ 104\,\mathrm{I}\,a\,c^2\,d\,p^2\,x - 4\,\mathrm{I}\,a\,c^2\,d\,q^2\,x - 8\,\mathrm{I}\,c^3\,d\,p\,q\,x - 24\,\mathrm{I}\,a^2\,b\,c\,p\,x + 8\,\mathrm{I}\,a^2\,c\,d\,q\,x$$

$$+ 8\,\mathrm{I}\,a\,b\,c^2\,q\,x + 24\,\mathrm{I}\,a\,c^2\,d\,p\,x - 40\,\mathrm{I}\,a\,b\,c\,d\,q + \mathrm{I}\,a^2\,d^2\,q^3 + \mathrm{I}\,b^2\,c^2\,q^3 + 4\,\mathrm{I}\,a^4\,q\,x^2$$

$$+ 4\,\mathrm{I}\,c^4\,q\,x^2 - 80\,\mathrm{I}\,a^3\,d\,x + 4\,\mathrm{I}\,q\,b^2\,a^2 + 24\,\mathrm{I}\,q\,d^2\,a^2 + 24\,\mathrm{I}\,b^2\,c^2\,q + 80\,\mathrm{I}\,b\,c^3\,x + 4\,\mathrm{I}\,c^2\,d^2\,q$$

$$- 80\,\mathrm{I}\,d\,b\,a^2 + 80\,\mathrm{I}\,a\,b^2\,c - 80\,\mathrm{I}\,a\,c\,d^2 + 80\,\mathrm{I}\,b\,c^2\,d\big)\,(\mathrm{I}\,q - 2\,n - 4 + 2\,p)\,(\mathrm{I}\,q + 2\,n$$

$$- 2\,p)\,(\mathrm{I}\,q + 2\,n - 2\,p - 2)\,(\mathrm{I}\,q + 2\,n - 2\,p + 2)\,(\mathrm{I}\,q - 2\,n + 2\,p - 2)\,(-p + 2$$

$$+ n)\,(n + 1)\,(\mathrm{I}\,c\,x + \mathrm{I}\,d - a\,x - b)^2\,(a\,d - b\,c)^2\,(a + \mathrm{I}\,c)^2\,(\mathrm{I}\,q + 4\,n - 6\,p + 6)^5\,S(n)$$

$$= 0,\ 1,\ -\frac{1}{2\,(-1 + p)\,\Gamma(-2\,p + 2)}\big(\Gamma(3 - 2\,p)\,\big(2\,a^2\,x\,p + 2\,c^2\,x\,p - 2\,a^2\,x$$

$$+ 2\,a\,b\,p - q\,a\,d + q\,b\,c - 2\,c^2\,x + 2\,c\,d\,p - 2\,a\,b - 2\,c\,d\big)\big)\Big]$$

We simplify the TTRR by the common factor appearing in each term

```
> REMJ6f:=collect(REMJ6[1]/((-(16*I)*b*c^3*n^3*x-160*a^2*c^2*p*x^2+
(12*I)*a^2*c*d*n*q*x+(12*I)*a*b*c^2*n*q*x+(24*I)*a*b*c*d*n^2*q+
(24*I)*q*d^2*a^2+(104*I)*a^2*b*d*n*p^2+(4*I)*q*b^2*a^2+(4*I)*c^2*
d^2*q+(8*I)*c^3*d*q*x+(4*I)*a*b*c^2*n^2*q*x+(24*I)*p*d*b*a^2-
(112*I)*a*c^2*d*n*p*x+(38*I)*a^2*d^2*n*p*q-80*a^2*c^2*n^2*p*x^2+
(4*I)*a^2*c*d*n^2*q*x+(24*I)*a*c^2*d*n^2*x+I*a^2*d^2*q^3-(72*I)*
a*c*d^2*n^2*p+(112*I)*b*c^3*n*p*x-(4*I)*a^3*d*q^2*x-16*c^4*p^3*
x^2-40*c^4*n^2*p*x^2-32*a^2*c^2*p^3*x^2-(48*I)*a^3*d*p^3*x+(14*I)
*b^2*c^2*n*q+(2*I)*b*c^3*n*q^2*x+144*c^3*d*n*x+(12*I)*a^3*b*n*q*
x-(4*I)*a^4*p*q*x^2-(4*I)*q*p*b^2*a^2-(80*I)*a*c^2*d*x+(14*I)*
a^2*d^2*n*q+(12*I)*c^3*d*n*q*x-(8*I)*a^3*b*p*q*x+(80*I)*a*b^2*c+
(8*I)*a^2*c^2*q*x^2+(80*I)*a^2*b*c*x-(8*I)*a^2*c^2*p*q*x^2+(8*I)*
a^3*b*q*x+(24*I)*a*c*d^2*p+(2*I)*b*c^2*d*n*q^2+(72*I)*a*b*c*d*
p^2*q-(56*I)*a^3*d*n*x-(112*I)*a*c*d^2*n*p-(2*I)*c^2*d^2*n*p*q-
(24*I)*a^2*b*c*n^2*x-(24*I)*b*c^2*d*p-(2*I)*a*c^2*d*n*q^2*x-(4*I)
*c^3*d*n*p*q*x+(112*I)*a^2*b*c*n*p*x-(80*I)*d*b*a^2+(4*I)*a*b^2*
c*q^2+(2*I)*a*b^2*c*n*q^2-(24*I)*a^2*b*c*p*x+(4*I)*a^2*b*c*q^2*x-
(104*I)*a*b^2*c*p^2+(104*I)*a^3*d*n*p^2*x-(2*I)*a^3*d*n*q^2*x-
(16*I)*a^2*b*c*n^3*x-(104*I)*a*b^2*c*n*p^2+(80*I)*b*c^3*x+(16*I)*
a^3*d*n^3*x+(4*I)*a^4*q*x^2+28*a^2*d^2*n^2+56*a^2*d^2*p^2-160*
c^3*d*p*x+(104*I)*p^2*d*b*a^2+(4*I)*a^2*c^2*n^2*q*x^2-(2*I)*c^4*
n*p*q*x^2+(4*I)*a^3*b*n^2*q*x-(10*I)*a^2*d^2*n^2*q+64*c^3*d*x-(2*
I)*a^2*b*d*n*q^2+(6*I)*a^4*n*q*x^2+24*a^2*c^2*n^3*x^2+44*c^4*n*
p^2*x^2-116*a^4*n*p*x^2+24*a^3*b*n^3*x-32*a^3*b*p^3*x+104*a^2*
c^2*n^2*x^2+(104*I)*a*c^2*d*n*p^2*x+(8*I)*a*b*c^2*q*x-(2*I)*a*b*
c*d*q^3-(56*I)*a*c^2*d*n*x-116*a^2*b^2*n*p+144*a^2*c^2*n*x^2+(48*
I)*b*c^3*p^3*x-4*a^2*d^2*n^3-4*b^2*c^2*n^3+(2*I)*a^2*b*c*n*q^2*x-
(8*I)*c^3*d*p*q*x+32*a^2*d^2*n^2*p-76*a^2*d^2*n*p^2+32*b^2*c^2*
n^2*p-76*b^2*c^2*n*p^2-84*a^2*d^2*n*p-84*b^2*c^2*n*p-116*c^2*d^2*
n*p+12*a^4*n^3*x^2-16*a^4*p^3*x^2-80*c^2*d^2*p+72*c^2*d^2*n+(4*I)
```

```
*b*c^3*q^2*x-(112*I)*a^2*b*d*n*p+(6*I)*c^4*n*q*x^2+(6*I)*a^2*b^2*
n*q+(80*I)*b*c^2*d+12*c^4*n^3*x^2-(112*I)*a^3*d*n*p*x+(16*I)*a*c*
d^2*n^3+6*a^2*d^2*n*q^2-10*a^2*d^2*p*q^2-(104*I)*b*c^2*d*n*p^2-
(24*I)*b*c^3*p*x-(104*I)*a^2*b*c*n*p^2*x-16*a^3*d*q*x-(24*I)*b*
c^3*n^2*x+44*a^4*n*p^2*x^2+(2*I)*a^4*n^2*q*x^2-(24*I)*b*c^2*d*n^2
-80*b^2*c^2*p-80*a^2*d^2*p+32*b^2*c^2*n+(38*I)*b^2*c^2*n*p*q-(8*
I)*a^2*c*d*p*q*x-(8*I)*a*b*c^2*p*q*x-(16*I)*a*b^2*c*n^3-(56*I)*a*
c*d^2*n-(4*I)*c^2*d^2*p*q+32*a^2*b*c*n*q*x-44*a^2*b*c*p*q*x+24*
a^2*b*d*n*p*q-(72*I)*a^3*d*n^2*p*x-232*a^2*c*d*n*p*x-24*a*b^2*c*
n*p*q-232*a*b*c^2*n*p*x-144*a*b*c*d*n^2*p+240*a*b*c*d*n*p^2-12*a*
b*c*d*n*q^2+20*a*b*c*d*p*q^2-32*a*c^2*d*n*q*x+44*a*c^2*d*p*q*
x+24*a*c*d^2*n*p*q-24*b*c^2*d*n*p*q-64*a*b*c*d*n*p+24*a^3*d*n*p*
q*x+12*a^2*b*c*n^2*q*x+8*a^2*b*c*p^2*q*x-80*a^2*c*d*n^2*p*x+88*
a^2*c*d*n*p^2*x-80*a*b*c^2*n^2*p*x+88*a*b*c^2*n*p^2*x-12*a*c^2*d*
n^2*q*x-8*a*c^2*d*p^2*q*x-24*b*c^3*n*p*q*x-(48*I)*a*c^2*d*p^3*x-
(24*I)*a*b^2*c*n^2+104*c^3*d*n^2*x+(24*I)*a^3*d*n^2*x+(4*I)*b*
c^2*d*q^2+144*a^3*b*n*x+(48*I)*a*b^2*c*p^3+(112*I)*b*c^2*d*n*p-
(104*I)*a^2*b*c*p^2*x-116*c^4*n*p*x^2-(48*I)*a*c*d^2*p^3+(72*I)*
a*b^2*c*n^2*p+(2*I)*c^2*d^2*n^2*q+56*b^2*c^2*p^3+28*b^2*c^2*
n^2+56*b^2*c^2*p^2+32*a^2*d^2*n+56*a^2*d^2*p^3-32*c^3*d*p^3*x+24*
c^3*d*n^3*x-(104*I)*b*c^3*p^2*x+44*a^2*b^2*n*p^2+(24*I)*a^2*b*d*
n^2-16*a^2*b*d*q+64*a^2*c*d*x+128*c^3*d*p^2*x-40*c^2*d^2*n^2*
p+44*c^2*d^2*n*p^2-40*a^4*n^2*p*x^2+16*a*b^2*c*q+64*a*b*c^2*x+(4*
I)*c^4*q*x^2-(2*I)*a*c*d^2*n*q^2-160*a^3*b*p*x-40*a^2*b^2*n^2*
p-24*a^2*b*c*n*p*q*x+24*a*c^2*d*n*p*q*x+(4*I)*c^3*d*n^2*q*x+(16*
I)*a^2*b*d*n^3+(104*I)*a^3*d*p^2*x+88*a^2*c^2*n*p^2*x^2-80*a^3*b*
n^2*p*x-32*a^2*d^2-32*b^2*c^2+32*a^4*x^2+32*c^4*x^2+32*a^2*
b^2+32*c^2*d^2+(104*I)*a*c*d^2*p^2+(24*I)*a*b*c*d*p*q+(8*I)*a^2*
c*d*q*x+128*a^2*c^2*p^2*x^2+128*a^3*b*p^2*x+104*a^3*b*n^2*x-(80*
I)*a^3*d*x+(24*I)*b^2*c^2*q+128*a*b*c*d+16*b*c^2*d*q+(56*I)*b*
c^2*d*n+(72*I)*b*c^3*n^2*p*x+52*a^4*n^2*x^2-(16*I)*b^2*c^2*p*q-
(4*I)*a*c^2*d*q^2*x-(36*I)*a^2*d^2*p^2*q+(2*I)*c^4*n^2*q*x^2-(80*
I)*a*c*d^2-(4*I)*a*c*d^2*q^2-(2*I)*a^4*n*p*q*x^2+(112*I)*a*b^2*c*
n*p-10*b^2*c^2*p*q^2+6*b^2*c^2*n*q^2+(24*I)*a*c*d^2*n^2-(104*I)*
b*c^3*n*p^2*x-(104*I)*b*c^2*d*p^2+(104*I)*a*c*d^2*n*p^2+(56*I)*b*
c^3*n*x+(48*I)*a^2*b*c*p^3*x-(4*I)*a^2*b*d*q^2+(24*I)*a*c^2*d*p*
x-(4*I)*c^4*p*q*x^2-16*a*c*d^2*q+(56*I)*a*b^2*c*n+(104*I)*a*c^2*
d*p^2*x+(6*I)*c^2*d^2*n*q-(48*I)*p^3*d*b*a^2-(2*I)*a^2*b^2*n*p*q-
(10*I)*b^2*c^2*n^2*q+(72*I)*b*c^2*d*n^2*p-(24*I)*a*b^2*c*p-(16*I)
*q*p*d^2*a^2+(12*I)*a^2*c^2*n*q*x^2+(16*I)*a*c^2*d*n^3*x+(2*I)*
a^2*b^2*n^2*q+16*b*c^3*q*x+(48*I)*b*c^2*d*p^3-(16*I)*a*b*c*d*n*q-
(4*I)*a^2*c^2*n*p*q*x^2-(4*I)*a^3*b*n*p*q*x+(72*I)*a^2*b*c*n^2*p*
x+I*b^2*c^2*q^3+(56*I)*a^2*b*c*n*x-(40*I)*a*b*c*d*q-(72*I)*a^2*b*
d*n^2*p+(24*I)*a^3*d*p*x-(72*I)*a*c^2*d*n^2*p*x+64*a^4*p^2*x^2-
(36*I)*b^2*c^2*p^2*q+52*c^4*n^2*x^2+64*c^4*p^2*x^2+72*a^4*n*x^2
-80*a^4*p*x^2+12*a^2*b^2*n^3+16*a^2*b*c*q*x-32*a^2*b*d*n*q+44*
a^2*b*d*p*q+144*a^2*c*d*n*x-160*a^2*c*d*p*x+32*a*b^2*c*n*q-44*a*
b^2*c*p*q+144*a*b*c^2*n*x-160*a*b*c^2*p*x+48*a*b*c*d*n^2+16*a*b*
c*d*p^2-16*a*c^2*d*q*x-32*a*c*d^2*n*q+44*a*c*d^2*p*q+32*b*c^2*d*
n*q-44*b*c^2*d*p*q+80*a*b*c*d*n-232*a^3*b*n*p*x-32*a^3*d*n*q*
x+44*a^3*d*p*q*x-12*a^2*b*d*n^2*q-8*a^2*b*d*p^2*q+104*a^2*c*d*
n^2*x+128*a^2*c*d*p^2*x+12*a*b^2*c*n^2*q+8*a*b^2*c*p^2*q+104*a*b*
c^2*n^2*x+128*a*b*c^2*p^2*x+32*a*b*c*d*n^3-144*a*b*c*d*p^3-12*a*
c*d^2*n^2*q-8*a*c*d^2*p^2*q+32*b*c^3*n*q*x-44*b*c^3*p*q*x+12*b*
c^2*d*n^2*q+8*b*c^2*d*p^2*q-232*c^3*d*n*p*x+88*a^3*b*n*p^2*x-12*
a^3*d*n^2*q*x-8*a^3*d*p^2*q*x-232*a^2*c^2*n*p*x^2+24*a^2*c*d*n^3*
x-32*a^2*c*d*p^3*x+24*a*b*c^2*n^3*x-32*a*b*c^2*p^3*x+12*b*c^3*
```

```
n^2*q*x+8*b*c^3*p^2*q*x-80*c^3*d*n^2*p*x+88*c^3*d*n*p^2*x-16*a^2*
b^2*p^3+72*c^4*n*x^2-80*c^4*p*x^2+12*c^2*d^2*n^3-16*c^2*d^2*
p^3+52*a^2*b^2*n^2+64*a^2*b^2*p^2+64*a^2*c^2*x^2-(16*I)*b*c^2*d*
n^3-(56*I)*a^2*b*d*n+52*c^2*d^2*n^2+64*c^2*d^2*p^2+64*a^3*b*x+72*
a^2*b^2*n-80*a^2*b^2*p-(4*I)*a^2*c*d*n*p*q*x-(4*I)*a*b*c^2*n*p*q*
x-(80*I)*a*b*c*d*n*p*q)*(I*q+2*n-2*p-2)*(I*q+2*n-2*p)*(I*q-2*
n-4+2*p)*(I*c*x+I*d-a*x-b)^2*(a+I*c)^2*(I*q+4*n-6*p+6)^5), S,
factor);
```

$$REMJ6f := (\mathrm{I}\,q - 2\,n + 2\,p - 2)\,(\mathrm{I}\,q + 2\,n - 2\,p + 2)\,(-p + 2 + n)\,(n + 1)\,(a\,d - b\,c)^2\,S(n) + (3 + 2\,n - 2\,p)\,\big(2\,a^2\,x\,n^2 - 4\,a^2\,x\,p\,n + 2\,a^2\,p^2\,x + 2\,c^2\,x\,n^2 - 4\,c^2\,x\,p\,n + 2\,c^2\,p^2\,x + 6\,a^2\,x\,n - 6\,a^2\,x\,p + 2\,a\,b\,n^2 - 4\,a\,b\,p\,n + 2\,a\,b\,p^2 - a\,d\,p\,q + b\,c\,p\,q + 6\,c^2\,x\,n - 6\,c^2\,x\,p + 2\,c\,d\,n^2 - 4\,c\,d\,p\,n + 2\,c\,d\,p^2 + 4\,a^2\,x + 6\,a\,b\,n - 6\,a\,b\,p + 4\,c^2\,x + 6\,c\,d\,n - 6\,c\,d\,p + 4\,a\,b + 4\,c\,d\big)\,S(n+1) + (1 + n - p)\,(n - 2\,p + 2)\,S(n+2) = 0 \tag{196}$$

```
> simplify(REMJ1-[REMJ6f, REMJ6[2], REMJ6[3]]);
```

$$[0 = 0, 0, 0] \tag{197}$$