

Supplemental material for the paper:

Finite element method for accurate atomic calculations based on density functional theory and Hartree-Fock method, *Comp. Phys. Comm.* 182, 1245-1252 (2011)

by

Taisuke Ozaki and Masayuki Toyoda,

Research Center for Integrated Science (RCIS), Japan Advanced Institute of Science and Technology (JAIST), 1-1 Asahidai, Nomi, Ishikawa 923-1292, Japan

Abstract

The supplemental material provides all the explicit formulas of integrals and MATHEMATICA codes for generating them, which are required for the implementation of the FE method presented in above the paper. The matrix elements for \hat{T}_0 , \hat{T}_1 , $(-\frac{Z}{x^2})$, and overlap integrals are commonly used for both the LDA and HF calculations, which are described in Secs. S-1-12. The integrals required to evaluate $V_H(x_i)$ and $V_H(y_i)$ of Eq. (24) in the paper are presented in Secs. S-13 and 14, which are used for the LDA calculations. The integrals associated with three basis functions which are required to evaluate Eq. (26) in the paper are provided in Secs. S-15-21. In the HF method the two electron integrals $\langle 12|34 \rangle_\lambda$ given by Eq. (55) or (58) are decomposed into the integrals D , Q , L , and R which are defined by Eqs. (56), (59), (60), and (61). All the analytic formulas of the integrals D , Q , L , and R are given in Secs. S-22. Each section consists of a brief description, MATHEMATICA code, and analytic formulas.

Contents

S-1	$\langle S_m^{(i)} \hat{T}_0 S_n^{(i+1)} \rangle$	4
S-1.1	Description	4
S-1.2	MATHEMATICA code	4
S-1.3	Analytic formulas	4
S-2	$\langle S_m^{(i)} \hat{T}_0 S_n^{(i)} \rangle, (i \neq 0)$	5
S-2.1	Description	5
S-2.2	MATHEMATICA code	5
S-2.3	Analytic formulas	5
S-3	$\langle S_m^{(i)} \hat{T}_0 S_n^{(i)} \rangle, (i = 0)$	6
S-3.1	Description	6
S-3.2	MATHEMATICA code	6
S-3.3	Analytic formulas	6
S-4	$\langle S_m^{(i)} \hat{T}_1 S_n^{(i+1)} \rangle$	7
S-4.1	Description	7
S-4.2	MATHEMATICA code	7
S-4.3	Analytic formulas	7
S-5	$\langle S_m^{(i)} \hat{T}_1 S_n^{(i)} \rangle, (i \neq 0)$	8
S-5.1	Description	8
S-5.2	MATHEMATICA code	8
S-5.3	Analytic formulas	8
S-6	$\langle S_m^{(i)} \hat{T}_1 S_n^{(i)} \rangle, (i = 0)$	9
S-6.1	Description	9
S-6.2	MATHEMATICA code	9
S-6.3	Analytic formulas	9
S-7	$\langle S_m^{(i)} (-\frac{Z}{x^2}) S_n^{(i+1)} \rangle$	10
S-7.1	Description	10
S-7.2	MATHEMATICA code	10
S-7.3	Analytic formulas	10
S-8	$\langle S_m^{(i)} (-\frac{Z}{x^2}) S_n^{(i)} \rangle, (i \neq 0)$	11
S-8.1	Description	11
S-8.2	MATHEMATICA code	11
S-8.3	Analytic formulas	11
S-9	$\langle S_m^{(i)} (-\frac{Z}{x^2}) S_n^{(i)} \rangle, (i = 0)$	12
S-9.1	Description	12
S-9.2	MATHEMATICA code	12
S-9.3	Analytic formulas	12
S-10	$\langle S_m^{(i)} S_n^{(i+1)} \rangle$	13
S-10.1	Description	13
S-10.2	MATHEMATICA code	13
S-10.3	Analytic formulas	13

S-11	$\langle S_m^{(i)} S_n^{(i)} \rangle, (i \neq 0)$	14
S-11.1	Description	14
S-11.2	MATHEMATICA code	14
S-11.3	Analytic formulas	14
S-12	$\langle S_m^{(i)} S_n^{(i)} \rangle, (i = 0)$	15
S-12.1	Description	15
S-12.2	MATHEMATICA code	15
S-12.3	Analytic formulas	15
S-13	Integrals in Eq. (24) to evaluate $V_H(x_i)$	16
S-13.1	Description	16
S-13.2	MATHEMATICA code	17
S-13.3	Analytic formulas	17
S-14	Integrals in Eq. (24) to evaluate $V_H(y_i)$	19
S-14.1	Description	19
S-14.2	MATHEMATICA code	20
S-14.3	Analytic formulas	21
S-15	$\langle S_m^{(0)} S_p^{(0)} S_n^{(0)} \rangle$	23
S-15.1	Description	23
S-15.2	MATHEMATICA code	23
S-15.3	Analytic formulas	23
S-16	$\langle S_m^{(0)} S_p^{(1)} S_n^{(0)} \rangle$	24
S-16.1	Description	24
S-16.2	MATHEMATICA code	24
S-16.3	Analytic formulas	24
S-17	$\langle S_m^{(i)} S_p^{(i)} S_n^{(i)} \rangle, (i \neq 0)$	25
S-17.1	Description	25
S-17.2	MATHEMATICA code	25
S-17.3	Analytic formulas	25
S-18	$\langle S_m^{(i)} S_p^{(i-1)} S_n^{(i)} \rangle, (i \neq 0)$	27
S-18.1	Description	27
S-18.2	MATHEMATICA code	27
S-18.3	Analytic formulas	27
S-19	$\langle S_m^{(i)} S_p^{(i+1)} S_n^{(i)} \rangle, (i \neq 0)$	29
S-19.1	Description	29
S-19.2	MATHEMATICA code	29
S-19.3	Analytic formulas	29
S-20	$\langle S_m^{(i)} S_p^{(i)} S_n^{(i+1)} \rangle$	31
S-20.1	Description	31
S-20.2	MATHEMATICA code	31
S-20.3	Analytic formulas	31
S-21	$\langle S_m^{(i)} S_p^{(i+1)} S_n^{(i+1)} \rangle$	33
S-21.1	Description	33
S-21.2	MATHEMATICA code	33
S-21.3	Analytic formulas	33

S-22	Integrals used in the HF calculation	35
S-22.1	Description	35
S-22.2	MATHEMATICA code	37
S-22.3	Analytic formulas of the integrals D	39
S-22.4	Analytic formulas of the integrals Q	54
S-22.5	Analytic formulas of the integrals L	150
S-22.6	Analytic formulas of the integrals R	153

S-1 $\langle S_m^{(i)} | \hat{T}_0 | S_n^{(i+1)} \rangle$

S-1.1 Description

Off-diagonal elements $\langle S_m^{(i)} | \hat{T}_0 | S_n^{(i+1)} \rangle$ of the kinetic operator \hat{T}_0 between mesh points i and $(i+1)$, where \hat{T}_0 is defined in Eq. (4) in the paper.

S-1.2 MATHEMATICA code

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m = 0, m <= 1, ++m,
  For[n = 0, n <= 1, ++n,
    Print["m=", m, " ", "n=", n, " "],
    Simplify[
      Integrate[
        S[m, (x - i*d)/d]*(-1/8/x^2)*D[D[(-1)^n*S[n, -(x - (i + 1)*d)/d], x],
          x]*2*x^5 + S[m, (x - i*d)/d]*(-3/8/x^3)*
          D[(-1)^n*S[n, -(x - (i + 1)*d)/d], x]*2*x^5, {x, i*d, (i + 1)*d}]
      ]
    ]
  ]
```

S-1.3 Analytic formulas

$m=0, n=0,$

$$-\frac{3}{280}d^2 (5 + 24i + 42i^2 + 28i^3)$$

$m=0, n=1,$

$$\frac{1}{560}d^2 (-5 - 12i + 14i^3)$$

$m=1, n=0,$

$$-\frac{1}{560}d^2 (7 + 30i + 42i^2 + 14i^3)$$

$m=1, n=1,$

$$\frac{d^2 (11 + 36i + 42i^2 + 28i^3)}{3360}$$

$$\mathbf{S-2} \quad \langle S_m^{(i)} | \hat{T}_0 | S_n^{(i)} \rangle, (i \neq 0)$$

S-2.1 Description

Diagonal elements $\langle S_m^{(i)} | \hat{T}_0 | S_n^{(i)} \rangle$ of the kinetic operator \hat{T}_0 at a mesh point $i (i \neq 0)$, where \hat{T}_0 is defined in Eq. (4) in the paper.

S-2.2 MATHEMATICA code

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    Print["m=",m," ", "n=",n," "],
    Simplify[
      Integrate[(-1)^m*S[m,-(x-i*d)/d]*(-1/8/x^2)*D[
        D[(-1)^n*S[n,-(x-i*d)/d],x] ,x]*2*x^5+(-1)^m*S[m,-(x-i*d)/
          d]*(-3/8/x^3)*D[(-1)^n*S[n,-(x-i*d)/d],
            x]*2*x^5,{x,i*d-d,i*d}]+Integrate[S[m,(x-i*d)/d]*(-1/
              8/x^2)*D[D[S[n,(x-i*d)/d],x] ,x]*2*x^5+S[m,(x-i*d)/d]*(-3/
                8/x^3)*D[S[n,(x-i*d)/d],x]*2*x^5,{x,i*d,i*d+d}]]
    ]
  ]
]
```

S-2.3 Analytic formulas

m=0, n=0,

$$\frac{3}{35}d^2i(6+7i^2)$$

m=0, n=1,

$$\frac{1}{40}d^2(1+6i^2)$$

m=1, n=0,

$$\frac{1}{40}d^2(1+6i^2)$$

m=1, n=1,

$$\frac{1}{105}d^2i(3+7i^2)$$

S-3 $\langle S_m^{(i)} | \hat{T}_0 | S_n^{(i)} \rangle, (i = 0)$

S-3.1 Description

Diagonal elements $\langle S_m^{(i)} | \hat{T}_0 | S_n^{(i)} \rangle$ of the kinetic operator \hat{T}_0 at the mesh point $i = 0$, where \hat{T}_0 is defined in Eq. (4) in the paper.

S-3.2 MATHEMATICA code

```
S[n_,x_] := Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    Print["m=",m," ", "n=",n," "],
    Simplify[
      Integrate[(-1)^m*S[m,-(x-i*d)/d]*(-1/8/x^2)*D[
        D[(-1)^n*S[n,-(x-i*d)/d],x] ,x]*2*x^5+(-1)^m*S[m,-(x-i*d)/
          d]*(-3/8/x^3)*D[(-1)^n*S[n,-(x-i*d)/d],
            x]*2*x^5,{x,i*d-d,i*d}]+Integrate[S[m,(x-i*d)/d]*(-1/
              8/x^2)*D[D[S[n,(x-i*d)/d],x] ,x]*2*x^5+S[m,(x-i*d)/d]*(-3/
                8/x^3)*D[S[n,(x-i*d)/d],x]*2*x^5,{x,i*d,i*d+d}]]
    ]
  ]
]
```

S-3.3 Analytic formulas

m=0, n=0,

$$\frac{15}{280}d^2$$

m=0, n=1,

$$\frac{7}{560}d^2$$

m=1, n=0,

$$\frac{7}{560}d^2$$

m=1, n=1,

$$\frac{11}{3360}d^2$$

S-4 $\langle S_m^{(i)} | \hat{T}_1 | S_n^{(i+1)} \rangle$

S-4.1 Description

Off-diagonal elements $\langle S_m^{(i)} | \hat{T}_1 | S_n^{(i+1)} \rangle$ of the kinetic operator \hat{T}_1 between mesh points i and $(i+1)$, where \hat{T}_1 is defined in Eq. (5) in the paper.

S-4.2 MATHEMATICA code

```
S[n_,x_]:=Module[{},Which[n==0,1-3*x^2+2*x^3,n==1,x-2*x^2+x^3]];

For[m=0,m<=1,++m,
  For[n=0,n<=1,++n,
    Print["m=",m,"n=",n,""],
    Integrate[S[m,(x-i*d)/d]*(-1)^n*S[n,-(x-(i+1)*d)/d]
      *(1*(1+1)/(2*x^4))*2*x^5,{x,i*d,(i+1)*d}]
  ]
]
```

S-4.3 Analytic formulas

$m=0, n=0,$

$$\frac{9}{140}d^2(1+2i)l(1+l)$$

$m=0, n=1,$

$$-\frac{1}{420}d^2(6+13i)l(1+l)$$

$m=1, n=0,$

$$\frac{1}{420}d^2(7+13i)l(1+l)$$

$m=1, n=1,$

$$-\frac{1}{280}d^2(1+2i)l(1+l)$$

S-5 $\langle S_m^{(i)} | \hat{T}_1 | S_n^{(i)} \rangle, (i \neq 0)$

S-5.1 Description

Diagonal elements $\langle S_m^{(i)} | \hat{T}_0 | S_n^{(i)} \rangle$ of the kinetic operator \hat{T}_0 at a mesh point $i (i \neq 0)$, where \hat{T}_1 is defined in Eq. (5) in the paper.

S-5.2 MATHEMATICA code

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    Print["m=",m," ", "n=",n," "],
    Simplify[Integrate[(-1)^m*S[m,-(x-i*d)/d]*(-1)^n
      *S[n,-(x-i*d)/d]*(1*(1+1)/(2*x^4))*2*x^5,{x,i*d-d,i*d}]+
      Integrate[S[m,(x-i*d)/d]
      *S[n,(x-i*d)/d]*(1*(1+1)/(2*x^4))*2*x^5,{x,i*d,i*d+d}]]
  ]
]
```

S-5.3 Analytic formulas

$m=0, n=0,$

$$\frac{26}{35}d^2il(1+l)$$

$m=0, n=1,$

$$\frac{1}{30}d^2l(1+l)$$

$m=1, n=0,$

$$\frac{1}{30}d^2l(1+l)$$

$m=1, n=1,$

$$\frac{2}{105}d^2il(1+l)$$

S-6 $\langle S_m^{(i)} | \hat{T}_1 | S_n^{(i)} \rangle, (i = 0)$

S-6.1 Description

Diagonal elements $\langle S_m^{(i)} | \hat{T}_1 | S_n^{(i)} \rangle$ of the kinetic operator \hat{T}_1 at the mesh point $i = 0$, where \hat{T}_1 is defined in Eq. (5) in the paper.

S-6.2 MATHEMATICA code

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    Print["m=",m," ", "n=",n," "],
    Integrate[S[m, (x-i*d)/d]*S[n, (x-i*d)/d]*(1*(1+1)/(2*x^4))*2*x^5,
      {x,i*d,i*d+d}]
  ]
]
```

S-6.3 Analytic formulas

m=0, n=0,

$$\frac{3}{35}d^2l(1+l)$$

m=0, n=1,

$$\frac{7}{420}d^2l(1+l)$$

m=1, n=0,

$$\frac{7}{420}d^2l(1+l)$$

m=1, n=1,

$$\frac{3}{840}d^2l(1+l)$$

S-7 $\langle S_m^{(i)} | (-\frac{Z}{x^2}) | S_n^{(i+1)} \rangle$

S-7.1 **Description**

Off-diagonal elements $\langle S_m^{(i)} | (-\frac{Z}{x^2}) | S_n^{(i+1)} \rangle$ of the operator $(-\frac{Z}{x^2})$ between mesh points i and $(i + 1)$.

S-7.2 **MATHEMATICA code**

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    Print["m=",m," ", "n=",n," "],
    Simplify[Integrate[S[m,(x-i*d)/d]*(-1)^n*S[n,-(x-i*d-d)/d]
      *(-Z/x^2)*2*x^5,{x,i*d,i*d+d}]]
  ]
]
```

S-7.3 **Analytic formulas**

m=0, n=0,

$$-\frac{1}{420}d^4 (19 + 92i + 162i^2 + 108i^3) Z$$

m=0, n=1,

$$\frac{d^4 (11 + 57i + 108i^2 + 78i^3) Z}{1260}$$

m=1, n=0,

$$-\frac{d^4 (16 + 75i + 126i^2 + 78i^3) Z}{1260}$$

m=1, n=1,

$$\frac{1}{420}d^4 (1 + 5i + 9i^2 + 6i^3) Z$$

S-8 $\langle S_m^{(i)} | (-\frac{Z}{x^2}) | S_n^{(i)} \rangle, (i \neq 0)$

S-8.1 Description

Diagonal elements $\langle S_m^{(i)} | (-\frac{Z}{x^2}) | S_n^{(i+1)} \rangle$ of the operator $(-\frac{Z}{x^2})$ at a mesh point $i (i \neq 0)$.

S-8.2 MATHEMATICA code

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    Print["m=",m," ", "n=",n," "],
    Simplify[Integrate[(-1)^m*S[m,-(x-i*d)/d]*(-1)^n
      *S[n,-(x-i*d)/d]*(-Z/x^2)*2*x^5,
      {x,i*d-d,i*d}]
      +Integrate[S[m,(x-i*d)/d]*S[n,(x-i*d)/d]*(-Z/x^2)*2*x^5,
      {x,i*d,i*d+d}]]
  ]
]
```

S-8.3 Analytic formulas

m=0, n=0,

$$-\frac{2}{105}d^4i(19+78i^2)Z$$

m=0, n=1,

$$-\frac{1}{315}d^4(4+63i^2)Z$$

m=1, n=0,

$$-\frac{1}{315}d^4(4+63i^2)Z$$

m=1, n=1,

$$-\frac{2}{105}d^4i(1+2i^2)Z$$

S-9 $\langle S_m^{(i)} | (-\frac{Z}{x^2}) | S_n^{(i)} \rangle, (i = 0)$

S-9.1 **Description**

Diagonal elements $\langle S_m^{(i)} | (-\frac{Z}{x^2}) | S_n^{(i+1)} \rangle$ of the operator $(-\frac{Z}{x^2})$ at the mesh point $i(i = 0)$.

S-9.2 **MATHEMATICA code**

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    Print["m=",m," ", "n=",n," "],
    Simplify[Integrate[S[m, (x-i*d)/d] *S[n, (x-i*d)/d] *(-Z/x^2)*2*x^5,
      {x,i*d,i*d+d}]]
  ]
]
```

S-9.3 **Analytic formulas**

m=0, n=0,

$$-\frac{11Zd^4}{420}$$

m=0, n=1,

$$-\frac{8d^4Z}{1260}$$

m=1, n=0,

$$-\frac{8d^4Z}{1260}$$

m=1, n=1,

$$-\frac{2d^4Z}{1260}$$

S-10 $\langle S_m^{(i)} | S_n^{(i+1)} \rangle$

S-10.1 Description

Off-diagonal overlap elements $\langle S_m^{(i)} | S_n^{(i+1)} \rangle$ between mesh points i and $(i+1)$.

S-10.2 MATHEMATICA code

```
S[n_,x_]:=Module[{},Which[n==0,1-3*x^2+2*x^3,n==1,x-2*x^2+x^3]];
For[m=0,m<=1,++m,
  For[n=0,n<=1,++n,
    Print["m=",m," ","n=",n," "],
    Simplify[Integrate[S[m,(x-i*d)/d]*(-1)^n*S[n,-(x-i*d-d)/d]*2*x^5,
      {x,i*d,i*d+d}]]
  ]
]
```

S-10.3 Analytic formulas

$m=0, n=0,$

$$\frac{d^6(1+2i)(287+22i(1+i)(68+81i(1+i)))}{13860}$$

$m=0, n=1,$

$$\frac{d^6(49+375i+1210i^2+2090i^3+1980i^4+858i^5)}{13860}$$

$m=1, n=0,$

$$\frac{d^6(84+595i+1760i^2+2750i^3+2310i^4+858i^5)}{13860}$$

$m=1, n=1,$

$$\frac{d^6(1+2i)(14+11i(1+i)(7+9i(1+i)))}{13860}$$

S-11 $\langle S_m^{(i)} | S_n^{(i)} \rangle, (i \neq 0)$

S-11.1 Description

Diagonal overlap elements $\langle S_m^{(i)} | S_n^{(i)} \rangle$ at a mesh point $i (i \neq 0)$.

S-11.2 MATHEMATICA code

```
S[n_,x_]:=Module[{},Which[n==0,1-3*x^2+2*x^3,n==1,x-2*x^2+x^3]];
For[m=0,m<=1,++m,
  For[n=0,n<=1,++n,
    Print["m=",m," ","n=",n," "],
    Simplify[Integrate[(-1)^m*S[m,-(x-i*d)/d]*(-1)^n*S[n,-(x-i*d)/d]*2*x^5,
      {x,i*d-d,i*d}]
      +
      Integrate[S[m,(x-i*d)/d]*S[n,(x-i*d)/d]*2*x^5,{x,i*d,i*d+d}]]
  ]
]
```

S-11.3 Analytic formulas

$m=0, n=0,$

$$\frac{2d^6 i (225 + 2090i^2 + 2574i^4)}{3465}$$

$m=0, n=1,$

$$\frac{d^6 (13 + 440i^2 + 1155i^4)}{3465}$$

$m=1, n=0,$

$$\frac{d^6 (13 + 440i^2 + 1155i^4)}{3465}$$

$m=1, n=1,$

$$\frac{2d^6 i (15 + 110i^2 + 66i^4)}{3465}$$

S-12 $\langle S_m^{(i)} | S_n^{(i)} \rangle, (i = 0)$

S-12.1 Description

Diagonal overlap elements $\langle S_m^{(i)} | S_n^{(i)} \rangle$ at the mesh point $i(i = 0)$.

S-12.2 MATHEMATICA code

```
S[n_,x_]:=Module[{},Which[n==0,1-3*x^2+2*x^3,n==1,x-2*x^2+x^3]];
```

```
For[m=0,m<=1,++m,  
  For[n=0,n<=1,++n,  
    Print["m=",m," ","n=",n," "],  
    Simplify[Integrate[S[m,(x-i*d)/d]*S[n,(x-i*d)/d]*2*x^5,  
      {x,i*d,(i+1)*d}]]  
  ]  
]
```

S-12.3 Analytic formulas

m=0, n=0,

$$\frac{49d^6}{6930}$$

m=0, n=1,

$$\frac{13d^6}{6930}$$

m=1, n=0,

$$\frac{13d^6}{6930}$$

m=1, n=1,

$$\frac{7d^6}{13860}$$

S-13 Integrals in Eq. (24) to evaluate $V_H(x_i)$

S-13.1 Description

By inserting Eq. (21) into Eq. (24), $V_H(x_i)$ given by Eq. (24) are analytically evaluated as follows:

$$\begin{aligned}
 V_H(x_i) &= \frac{8\pi}{x_i^2} \int_0^{x_i} n(x)x^5 dx + 8\pi \int_{x_i}^{\infty} n(x)x^3 dx, \\
 &= \frac{8\pi}{x_i^2} a_0 A_1 + \frac{8\pi}{x_i^2} b_0 B_1 + \frac{8\pi}{x_i^2} \sum_{k=1}^{i-1} a_k A_{2,k} + \frac{8\pi}{x_i^2} \sum_{k=1}^{i-1} b_k B_{2,k} + \frac{8\pi}{x_i^2} a_i A_3 + \frac{8\pi}{x_i^2} b_i B_3 \\
 &\quad + 8\pi a_i A_4 + 8\pi b_i B_4 + 8\pi \sum_{k=i+1}^{N-1} a_k A_{5,k} + 8\pi \sum_{k=i+1}^{N-1} b_k B_{5,k},
 \end{aligned}$$

where

$$A_1 = \int_0^d S_0^{(0)}\left(\frac{x-x_0}{d}\right)x^5 dx,$$

$$B_1 = \int_0^d S_1^{(0)}\left(\frac{x-x_0}{d}\right)x^5 dx,$$

$$A_{2,k} = \int_{(k-1)d}^{(k+1)d} S_0^{(k)}\left(\frac{x-x_k}{d}\right)x^5 dx,$$

$$B_{2,k} = \int_{(k-1)d}^{(k+1)d} S_1^{(k)}\left(\frac{x-x_k}{d}\right)x^5 dx,$$

$$A_3 = \int_{(i-1)d}^{id} S_0^{(i)}\left(\frac{x-x_i}{d}\right)x^5 dx,$$

$$B_3 = \int_{(i-1)d}^{id} S_1^{(i)}\left(\frac{x-x_i}{d}\right)x^5 dx,$$

$$A_4 = \int_{id}^{(i+1)d} S_0^{(i)}\left(\frac{x-x_i}{d}\right)x^3 dx,$$

$$B_4 = \int_{id}^{(i+1)d} S_1^{(i)}\left(\frac{x-x_i}{d}\right)x^3 dx,$$

$$A_{5,k} = \int_{(k-1)d}^{(k+1)d} S_0^{(k)}\left(\frac{x-x_k}{d}\right)x^3 dx,$$

$$B_{5,k} = \int_{(k-1)d}^{(k+1)d} S_1^{(k)}\left(\frac{x-x_k}{d}\right)x^3 dx.$$

The analytic formulas of all the integrals $A_1, B_1, A_{2,k}, B_{2,k}, A_3, B_3, A_4, B_4, A_{5,k}$, and $B_{5,k}$ are found as shown below:

S-13.2 MATHEMATICA code

```
(* Definition of the FE basis functions *)
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

(* A_1 *)
Integrate[S[0,(x-0*d)/d]*x^5 ,{x,0,d}]

(* B_1 *)
Integrate[S[1,(x-0*d)/d]*x^5 ,{x,0,d}]

(* A_{2,k} *)
Simplify[Integrate[S[0,-(x-k*d)/d]*x^5 ,{x,(k-1)*d,k*d}]
+Integrate[S[0,(x-k*d)/d]*x^5 ,{x,k*d,(k+1)*d}]]

(* B_{2,k} *)
Simplify[Integrate[-S[1,-(x-k*d)/d]*x^5 ,{x,(k-1)*d,k*d}]
+Integrate[ S[1,(x-k*d)/d]*x^5 ,{x,k*d,(k+1)*d}]]

(* A_3 *)
Simplify[Integrate[S[0,-(x-i*d)/d]*x^5 ,{x,(i-1)*d,i*d}]]

(* B_3 *)
Simplify[Integrate[-S[1,-(x-i*d)/d]*x^5 ,{x,(i-1)*d,i*d}]]

(* A_4 *)
Simplify[Integrate[S[0,(x-i*d)/d]*x^3 ,{x,i*d,(i+1)*d}]]

(* B_4 *)
Simplify[Integrate[S[1,(x-i*d)/d]*x^3 ,{x,i*d,(i+1)*d}]]

(* A_{5,k} *)
Simplify[Integrate[S[0,-(x-k*d)/d]*x^3,{x,(k-1)*d,k*d}]
+Integrate[S[0,(x-k*d)/d]*x^3 ,{x,k*d,(k+1)*d}]]

(* B_{5,k} *)
Simplify[Integrate[-S[1,-(x-k*d)/d]*x^3,{x,(k-1)*d,k*d}]
+Integrate[S[1,(x-k*d)/d]*x^3 ,{x,k*d,(k+1)*d}]]
```

S-13.3 Analytic formulas

$$A_1 = \frac{d^6}{72}$$

$$B_1 = \frac{d^6}{252}$$

$$A_{2,k} = \frac{1}{42}d^6k(9 + 56k^2 + 42k^4)$$

$$B_{2,k} = \frac{1}{126}d^6(1 + 24k^2 + 42k^4)$$

$$A_3 = \frac{1}{504}d^6(-7 + 54i - 180i^2 + 336i^3 - 378i^4 + 252i^5)$$

$$B_3 = \frac{1}{504}d^6(2 - 15i + 48i^2 - 84i^3 + 84i^4 - 42i^5)$$

$$A_4 = \frac{1}{140}d^4 (5 + 28i + 63i^2 + 70i^3)$$

$$B_4 = \frac{1}{420}d^4 (4 + 21i + 42i^2 + 35i^3)$$

$$A_{5,k} = \frac{1}{5}d^4 k (2 + 5k^2)$$

$$B_{5,k} = \frac{1}{105}d^4 (2 + 21k^2)$$

S-14 Integrals in Eq. (24) to evaluate $V_{\text{H}}(y_i)$

S-14.1 Description

By inserting Eq. (21) into the corresponding analog of Eq. (24), $V_{\text{H}}(y_i)$ are analytically evaluated as follows:

$$\begin{aligned}
 V_{\text{H}}(y_i) &= \frac{8\pi}{y_i^2} \int_0^{y_i} n(x)x^5 dx + 8\pi \int_{x_i}^{\infty} n(x)x^3 dx, \\
 &= \frac{8\pi}{y_i^2} a_0 C_0 \delta_{i0} + \frac{8\pi}{y_i^2} b_0 D_0 \delta_{i0} + \frac{8\pi}{y_i^2} a_0 C_1 (1 - \delta_{i0}) + \frac{8\pi}{y_i^2} b_0 D_1 (1 - \delta_{i0}) + \frac{8\pi}{y_i^2} \sum_{k=1}^{i-1} a_k C_{2,k} + \frac{8\pi}{y_i^2} \sum_{k=1}^{i-1} b_k D_{2,k} \\
 &\quad + \frac{8\pi}{y_i^2} a_i C_3 (1 - \delta_{i0}) + \frac{8\pi}{y_i^2} b_i D_3 (1 - \delta_{i0}) + 8\pi a_i C_4 + 8\pi b_i D_4 + \frac{8\pi}{y_i^2} a_{i+1} C_5 + \frac{8\pi}{y_i^2} b_{i+1} D_5 \\
 &\quad + 8\pi a_{i+1} C_6 + 8\pi b_{i+1} D_6 + 8\pi \sum_{k=i+2}^{N-1} a_k C_{7,k} + 8\pi \sum_{k=i+2}^{N-1} b_k D_{7,k},
 \end{aligned}$$

where

$$C_0 = \int_0^{d/2} S_0^{(0)} \left(\frac{x-x_0}{d} \right) x^5 dx,$$

$$D_0 = \int_0^{d/2} S_1^{(0)} \left(\frac{x-x_0}{d} \right) x^5 dx,$$

$$C_1 = \int_0^d S_0^{(0)} \left(\frac{x-x_0}{d} \right) x^5 dx,$$

$$D_1 = \int_0^d S_1^{(0)} \left(\frac{x-x_0}{d} \right) x^5 dx,$$

$$C_{2,k} = \int_{(k-1)d}^{(k+1)d} S_0^{(k)} \left(\frac{x-x_k}{d} \right) x^5 dx,$$

$$D_{2,k} = \int_{(k-1)d}^{(k+1)d} S_1^{(k)} \left(\frac{x-x_k}{d} \right) x^5 dx,$$

$$C_3 = \int_{(i-1)d}^{(2i+1)d/2} S_0^{(i)} \left(\frac{x-x_i}{d} \right) x^5 dx,$$

$$D_3 = \int_{(i-1)d}^{(2i+1)d/2} S_1^{(i)} \left(\frac{x-x_i}{d} \right) x^5 dx,$$

$$C_4 = \int_{(2i+1)d/2}^{(i+1)d} S_0^{(i)} \left(\frac{x-x_i}{d} \right) x^3 dx,$$

$$D_4 = \int_{(2i+1)d/2}^{(i+1)d} S_1^{(i)} \left(\frac{x-x_i}{d} \right) x^3 dx,$$

$$C_5 = \int_d^{(2i+1)d/2} S_0^{(i+1)} \left(\frac{x-x_{i+1}}{d} \right) x^5 dx,$$

$$D_5 = \int_d^{(2i+1)d/2} S_1^{(i+1)}\left(\frac{x-x_{i+1}}{d}\right)x^5 dx,$$

$$C_6 = \int_{(2i+1)d/2}^{(i+2)d} S_0^{(i+1)}\left(\frac{x-x_{i+1}}{d}\right)x^3 dx,$$

$$D_6 = \int_{(2i+1)d/2}^{(i+2)d} S_1^{(i+1)}\left(\frac{x-x_{i+1}}{d}\right)x^3 dx,$$

$$C_{7,k} = \int_{(k-1)d}^{(k+1)d} S_0^{(k)}\left(\frac{x-x_k}{d}\right)x^3 dx,$$

$$D_{7,k} = \int_{(k-1)d}^{(k+1)d} S_1^{(k)}\left(\frac{x-x_k}{d}\right)x^3 dx,$$

The analytic formulas of all the integrals $C_0, D_0, C_1, D_1, C_{2,k}, D_{2,k}, C_3, D_3, C_4, D_4, C_5, D_5, C_6, D_6, C_{7,k}$, and $D_{7,k}$ are found as shown below:

S-14.2 MATHEMATICA code

```
(* Definition of the FE basis functions *)
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

(* C_0 *)
Integrate[S[0,(x-0*d)/d]*x^5 ,{x,0,d/2}]

(* D_0 *)
Integrate[S[1,(x-0*d)/d]*x^5 ,{x,0,d/2}]

(* C_1 *)
Integrate[S[0,(x-0*d)/d]*x^5 ,{x,0,d}]

(* D_1 *)
Integrate[S[1,(x-0*d)/d]*x^5 ,{x,0,d}]

(* C_{2,k} *)
Simplify[Integrate[S[0,-(x-k*d)/d]*x^5 ,{x,(k-1)*d,k*d}]
+Integrate[S[0,(x-k*d)/d]*x^5 ,{x,k*d,(k+1)*d}]]

(* D_{2,k} *)
Simplify[Integrate[-S[1,-(x-k*d)/d]*x^5 ,{x,(k-1)*d,k*d}]
+Integrate[S[1,(x-k*d)/d]*x^5 ,{x,k*d,(k+1)*d}]]

(* C_3 *)
Simplify[Integrate[S[0,-(x-i*d)/d]*x^5, {x,(2*i-2)*d/2,2*i*d/2}]
+Integrate[S[0,(x-i*d)/d]*x^5 ,{x,2*i*d/2,(2*i+1)*d/2}]]

(* D_3 *)
Simplify[Integrate[-S[1,-(x-i*d)/d]*x^5 ,{x,(2*i-2)*d/2,2*i*d/2}]
+Integrate[ S[1,(x-i*d)/d]*x^5 ,{x,2*i*d/2,(2*i+1)*d/2}]]

(* C_4 *)
```

```

Simplify[Integrate[S[0,(x-i*d)/d]*x^3 ,{x,(2*i+1)*d/2,(2*i+2)*d/2}]]

(* D_4 *)
Simplify[Integrate[S[1,(x-i*d)/d]*x^3 ,{x,(2*i+1)*d/2,(2*i+2)*d/2}]]

(* C_5 *)
Simplify[Integrate[S[0,-(x-(i+1)*d)/d]*x^5 ,{x,2*i*d/2,(2*i+1)*d/2}]]

(* D_5 *)
Simplify[Integrate[-S[1,-(x-(i+1)*d)/d]*x^5 ,{x,2*i*d/2,(2*i+1)*d/2}]]

(* C_6 *)
Simplify[Integrate[S[0,-(x-(i+1)*d)/d]*x^3 ,{x,(2*i+1)*d/2,(2*i+2)*d/2}]
+Integrate[S[0,(x-(i+1)*d)/d]*x^3 ,{x,(2*i+2)*d/2,(2*i+4)*d/2}]]

(* D_6 *)
Simplify[Integrate[-S[1,-(x-(i+1)*d)/d]*x^3 ,{x,(2*i+1)*d/2,(2*i+2)*d/2}]
+Integrate[S[1,(x-(i+1)*d)/d]*x^3 ,{x,(2*i+2)*d/2,(2*i+4)*d/2}]]

( C_{7,k} *)
Simplify[Integrate[S[0,-(x-k*d)/d]*x^3,{x,(k-1)*d,k*d}]
+Integrate[S[0,(x-k*d)/d]*x^3 ,{x,k*d,(k+1)*d}]]

( * D_{7,k} *)
Simplify[Integrate[-S[1,-(x-k*d)/d]*x^3,{x,(k-1)*d,k*d}]
+Integrate[S[1,(x-k*d)/d]*x^3 ,{x,k*d,(k+1)*d}]]

```

S-14.3 Analytic formulas

$$C_0 = \frac{29d^6}{18432}$$

$$D_0 = \frac{23d^6}{64512}$$

$$C_1 = \frac{d^6}{72}$$

$$D_1 = \frac{d^6}{252}$$

$$C_{2,k} = \frac{1}{42}d^6k(9 + 56k^2 + 42k^4)$$

$$D_{2,k} = \frac{1}{126}d^6(1 + 24k^2 + 42k^4)$$

$$C_3 = \frac{d^6(-1589 + 16326i - 33120i^2 + 122304i^3 - 38304i^4 + 116928i^5)}{129024}$$

$$D_3 = \frac{d^6(186 - 1095i + 5024i^2 - 4704i^3 + 10752i^4 - 1120i^5)}{43008}$$

$$C_4 = \frac{d^4(115 + 518i + 798i^2 + 420i^3)}{4480}$$

$$D_4 = \frac{d^4(99 + 441i + 672i^2 + 350i^3)}{13440}$$

$$C_5 = \frac{d^6(133 + 1530i + 7200i^2 + 17472i^3 + 22176i^4 + 12096i^5)}{129024}$$

$$D_5 = -\frac{d^6 (35 + 405i + 1920i^2 + 4704i^3 + 6048i^4 + 3360i^5)}{129024}$$

$$C_6 = \frac{d^4 (6247 + 15050i + 12978i^2 + 4060i^3)}{4480}$$

$$D_6 = \frac{d^4 (2964 + 5523i + 3066i^2 + 350i^3)}{13440}$$

$$C_{7,k} = \frac{1}{5}d^4k (2 + 5k^2)$$

$$D_{7,k} = \frac{1}{105}d^4 (2 + 21k^2)$$

S-15 $\langle S_m^{(0)} | S_p^{(0)} | S_n^{(0)} \rangle$

S-15.1 Description

The integrals appearing in Eq. (26) in the paper, where $S_m^{(0)}$, $S_n^{(0)}$, and $S_p^{(0)}$ are all located in the mesh point $i = 0$.

S-15.2 MATHEMATICA code

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    For[p=0, p<=1, ++p,
      Print["m=",m," ", "n=",n," ", "p=",p," "],
      Simplify[
        Integrate[ S[m,(x-0*d)/d]*S[n,(x-0*d)/d]
          *S[p,(x-0*d)/d]*2*x^5,{x,0*d,(0+1)*d}]]
    ]
  ]
]
```

S-15.3 Analytic formulas

$m=0, n=0, p=0,$

$$\frac{163d^6}{60060}$$

$m=0, n=0, p=1,$

$$\frac{61d^6}{90090}$$

$m=0, n=1, p=0,$

$$\frac{61d^6}{90090}$$

$m=0, n=1, p=1,$

$$\frac{31d^6}{180180}$$

$m=1, n=0, p=0,$

$$\frac{61d^6}{90090}$$

$m=1, n=0, p=1,$

$$\frac{31d^6}{180180}$$

$m=1, n=1, p=0,$

$$\frac{31d^6}{180180}$$

$m=1, n=1, p=1,$

$$\frac{2d^6}{45045}$$

S-16 $\langle S_m^{(0)} | S_p^{(1)} | S_n^{(0)} \rangle$

S-16.1 Description

The integrals appearing in Eq. (26) in the paper, where $S_m^{(0)}$ and $S_n^{(0)}$ are located in the mesh point $i = 0$, and $S_p^{(1)}$ is located in the mesh point $i = 1$.

S-16.2 MATHEMATICA code

```
S[n_,x_] := Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    For[p=0, p<=1, ++p,
      Print["m=",m," ", "n=",n," ", "p=",p," "],
      Simplify[
        Integrate[S[m,(x-0*d)/d]*S[n,(x-0*d)/d]
          *(-1)^p*S[p,-(x-1*d)/d]*2*x^5,
          {x,0*d,(0+1)*d}]]
    ]
  ]
]
```

S-16.3 Analytic formulas

$m=0, n=0, p=0,$

$$\frac{157d^6}{36036}$$

$m=0, n=0, p=1,$

$$-\frac{163d^6}{180180}$$

$m=0, n=1, p=0,$

$$\frac{6d^6}{5005}$$

$m=0, n=1, p=1,$

$$-\frac{d^6}{4095}$$

$m=1, n=0, p=0,$

$$\frac{6d^6}{5005}$$

$m=1, n=0, p=1,$

$$-\frac{d^6}{4095}$$

$m=1, n=1, p=0,$

$$\frac{d^6}{3003}$$

$m=1, n=1, p=1,$

$$-\frac{d^6}{15015}$$

S-17 $\langle S_m^{(i)} | S_p^{(i)} | S_n^{(i)} \rangle, (i \neq 0)$

S-17.1 Description

The integrals appearing in Eq. (26) in the paper, where $S_m^{(0)}$, $S_n^{(0)}$, and $S_p^{(0)}$ are all located in a mesh point $i (i \neq 0)$.

S-17.2 MATHEMATICA code

```
S[n_,x_]:= Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    For[p=0, p<=1, ++p,
      Print["m=",m," ", "n=",n," ", "p=",p," "],
      Simplify[
        Integrate[(-1)^m*S[m,-(x-i*d)/d]*(-1)^n*S[n,-(x-i*d)/d]
          *(-1)^p*S[p,-(x-i*d)/d]*2*x^5,{x,(i-1)*d,i*d}]
          +
        Integrate[S[m,(x-i*d)/d]*S[n,(x-i*d)/d]*S[p,(x-i*d)/d]*2*x^5,
          {x,i*d,(i+1)*d}]
      ]
    ]
  ]
]
```

S-17.3 Analytic formulas

$m=0, n=0, p=0,$

$$\frac{d^6 i (855 + 10660i^2 + 18447i^4)}{15015}$$

$m=0, n=0, p=1,$

$$\frac{d^6 (61 + 2680i^2 + 9425i^4)}{45045}$$

$m=0, n=1, p=0,$

$$\frac{d^6 (61 + 2680i^2 + 9425i^4)}{45045}$$

$m=0, n=1, p=1,$

$$\frac{2d^6 i (75 + 715i^2 + 572i^4)}{45045}$$

$m=1, n=0, p=0,$

$$\frac{d^6 (61 + 2680i^2 + 9425i^4)}{45045}$$

$m=1, n=0, p=1,$

$$\frac{2d^6 i (75 + 715i^2 + 572i^4)}{45045}$$

$m=1, n=1, p=0,$

$$\frac{2d^6 i (75 + 715i^2 + 572i^4)}{45045}$$

$m=1, n=1, p=1,$

$$\frac{2d^6 (2 + 75i^2 + 195i^4)}{45045}$$

$$\mathbf{S-18} \quad \langle S_m^{(i)} | S_p^{(i-1)} | S_n^{(i)} \rangle, (i \neq 0)$$

S-18.1 Description

The integrals appearing in Eq. (26) in the paper, where $S_m^{(i)}$ and $S_n^{(i)}$ are located in a mesh point $i (i \neq 0)$, and $S_p^{(i-1)}$ is located in a mesh point $(i - 1)$.

S-18.2 MATHEMATICA code

```
S[n_,x_] := Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    For[p=0, p<=1, ++p,
      Print["m=",m," ", "n=",n," ", "p=",p," "],
      Simplify[
        Integrate[(-1)^m*S[m,-(x-i*d)/d]*(-1)^n*S[n,-(x-i*d)/d]
          *S[p,(x-(i-1)*d)/d]*2*x^5,{x,(i-1)*d,i*d}]
      ]
    ]
  ]
]
```

S-18.3 Analytic formulas

m=0, n=0, p=0,

$$\frac{d^6 (-785 + 6570i - 23340i^2 + 44720i^3 - 47385i^4 + 23166i^5)}{180180}$$

m=0, n=0, p=1,

$$\frac{d^6 (-163 + i(1425 + i(-5300 + 13i(820 + i(-915 + 473i))))))}{180180}$$

m=0, n=1, p=0,

$$\frac{d^6 (216 - 1765i + 6080i^2 - 11180i^3 + 11180i^4 - 5005i^5)}{180180}$$

m=0, n=1, p=1,

$$\frac{d^6 (-44 + 375i - 1350i^2 + 2600i^3 - 2730i^4 + 1287i^5)}{180180}$$

m=1, n=0, p=0,

$$\frac{d^6 (216 - 1765i + 6080i^2 - 11180i^3 + 11180i^4 - 5005i^5)}{180180}$$

m=1, n=0, p=1,

$$\frac{d^6 (-44 + 375i - 1350i^2 + 2600i^3 - 2730i^4 + 1287i^5)}{180180}$$

m=1, n=1, p=0,

$$\frac{d^6 (-30 + i(240 + i(-805 + 13i(110 + i(-105 + 44i))))))}{90090}$$

$m=1, n=1, p=1,$

$$\frac{d^6(-6 + i(50 + i(-175 + 13i(25 + i(-25 + 11i))))))}{90090}$$

$$\mathbf{S-19} \quad \langle S_m^{(i)} | S_p^{(i+1)} | S_n^{(i)} \rangle, (i \neq 0)$$

S-19.1 Description

The integrals appearing in Eq. (26) in the paper, where $S_m^{(i)}$ and $S_n^{(i)}$ are located in a mesh point $i (i \neq 0)$, and $S_p^{(i+1)}$ is located in a mesh point $(i + 1)$.

S-19.2 MATHEMATICA code

```
S[n_,x_] := Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    For[p=0, p<=1, ++p,
      Print["m=",m," ", "n=",n," ", "p=",p," "],
      Simplify[
        Integrate[S[m,(x-i*d)/d]*S[n,(x-i*d)/d]
          *(-1)^p*S[p,-(x-(i+1)*d)/d]*2*x^5,
          {x,i*d,(i+1)*d}]
      ]
    ]
  ]
]
```

S-19.3 Analytic formulas

$$m=0, n=0, p=0,$$

$$\frac{d^6 (785 + 6570i + 23340i^2 + 44720i^3 + 47385i^4 + 23166i^5)}{180180}$$

$$m=0, n=0, p=1,$$

$$\frac{d^6 (163 + i(1425 + i(5300 + 13i(820 + i(915 + 473i))))))}{180180}$$

$$m=0, n=1, p=0,$$

$$\frac{d^6 (216 + 1765i + 6080i^2 + 11180i^3 + 11180i^4 + 5005i^5)}{180180}$$

$$m=0, n=1, p=1,$$

$$\frac{d^6 (44 + 375i + 1350i^2 + 2600i^3 + 2730i^4 + 1287i^5)}{180180}$$

$$m=1, n=0, p=0,$$

$$\frac{d^6 (216 + 1765i + 6080i^2 + 11180i^3 + 11180i^4 + 5005i^5)}{180180}$$

$$m=1, n=0, p=1,$$

$$\frac{d^6 (44 + 375i + 1350i^2 + 2600i^3 + 2730i^4 + 1287i^5)}{180180}$$

$$m=1, n=1, p=0,$$

$$\frac{d^6 (30 + i(240 + i(805 + 13i(110 + i(105 + 44i))))))}{90090}$$

$m=1, n=1, p=1,$

$$\frac{d^6(6 + i(50 + i(175 + 13i(25 + i(25 + 11i))))))}{90090}$$

S-20 $\langle S_m^{(i)} | S_p^{(i)} | S_n^{(i+1)} \rangle$

S-20.1 Description

The integrals appearing in Eq. (26) in the paper, where $S_m^{(i)}$ and $S_p^{(i)}$ are located in a mesh point i , and $S_n^{(i+1)}$ is located in a mesh point $(i+1)$.

S-20.2 MATHEMATICA code

```
S[n_,x_] := Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    For[p=0, p<=1, ++p,
      Print["m=",m," ", "n=",n," ", "p=",p," "],
      Simplify[
        Integrate[S[m,(x-i*d)/d]*(-1)^n*S[n,-(i+1)*d]/d
          *S[p,(x-i*d)/d]*2*x^5,{x,i*d,(i+1)*d}]
      ]
    ]
  ]
]
```

S-20.3 Analytic formulas

$m=0, n=0, p=0,$

$$\frac{d^6 (785 + 6570i + 23340i^2 + 44720i^3 + 47385i^4 + 23166i^5)}{180180}$$

$m=0, n=0, p=1,$

$$\frac{d^6 (216 + 1765i + 6080i^2 + 11180i^3 + 11180i^4 + 5005i^5)}{180180}$$

$m=0, n=1, p=0,$

$$\frac{d^6 (163 + i(1425 + i(5300 + 13i(820 + i(915 + 473i)))))}{180180}$$

$m=0, n=1, p=1,$

$$\frac{d^6 (44 + 375i + 1350i^2 + 2600i^3 + 2730i^4 + 1287i^5)}{180180}$$

$m=1, n=0, p=0,$

$$\frac{d^6 (216 + 1765i + 6080i^2 + 11180i^3 + 11180i^4 + 5005i^5)}{180180}$$

$m=1, n=0, p=1,$

$$\frac{d^6 (30 + i(240 + i(805 + 13i(110 + i(105 + 44i)))))}{90090}$$

$m=1, n=1, p=0,$

$$\frac{d^6 (44 + 375i + 1350i^2 + 2600i^3 + 2730i^4 + 1287i^5)}{180180}$$

$m=1, n=1, p=1,$

$$\frac{d^6(6 + i(50 + i(175 + 13i(25 + i(25 + 11i))))))}{90090}$$

$$\mathbf{S-21} \quad \langle S_m^{(i)} | S_p^{(i+1)} | S_n^{(i+1)} \rangle$$

S-21.1 Description

The integrals appearing in Eq. (26) in the paper, where $S_m^{(i)}$ is located in a mesh point i , and $S_p^{(i)}$ and $S_n^{(i+1)}$ are located in a mesh point $(i + 1)$.

S-21.2 MATHEMATICA code

```
S[n_,x_] := Module[{}, Which[ n==0, 1-3*x^2+2*x^3, n==1, x-2*x^2+x^3]];

For[m=0, m<=1, ++m,
  For[n=0, n<=1, ++n,
    For[p=0, p<=1, ++p,
      Print["m=",m," ", "n=",n," ", "p=",p," "],
      Simplify[
        Integrate[S[m,(x-i*d)/d]*(-1)^n*S[n,-(x-(i+1)*d)/d]
          *(-1)^p*S[p,-(x-(i+1)*d)/d]*2*x^5,
          {x,i*d,(i+1)*d}]
      ]
    ]
  ]
]
```

S-21.3 Analytic formulas

$m=0, n=0, p=0,$

$$\frac{d^6 (2946 + 20340i + 58170i^2 + 86840i^3 + 68445i^4 + 23166i^5)}{180180}$$

$m=0, n=0, p=1,$

$$\frac{d^6 (474 + 3450i + 10430i^2 + 16510i^3 + 13845i^4 + 5005i^5)}{180180}$$

$m=0, n=1, p=0,$

$$\frac{d^6 (474 + 3450i + 10430i^2 + 16510i^3 + 13845i^4 + 5005i^5)}{180180}$$

$m=0, n=1, p=1,$

$$\frac{d^6 (42 + i(320 + i(1015 + 13i(130 + i(115 + 44i)))))}{90090}$$

$m=1, n=0, p=0,$

$$\frac{d^6 (876 + i(5970 + i(16800 + 13i(1890 + i(1450 + 473i)))))}{180180}$$

$m=1, n=0, p=1,$

$$\frac{d^6 (138 + 990i + 2940i^2 + 4550i^3 + 3705i^4 + 1287i^5)}{180180}$$

$m=1, n=1, p=0,$

$$\frac{d^6 (138 + 990i + 2940i^2 + 4550i^3 + 3705i^4 + 1287i^5)}{180180}$$

$m=1, n=1, p=1,$

$$\frac{d^6(12 + i(90 + i(280 + 13i(35 + i(30 + 11i))))))}{90090}$$

S-22 Integrals used in the HF calculation

S-22.1 Description

In this section, the detailed formula of D , Q , L , and R integrals are derived, which appears in Eqs. (56), (59), (60), and (61), respectively, in the article. D integral (56) is defined as

$$D_{i,k,i',k'}^l \equiv \int_{\sup(i'-1,0)}^{i+1} dt t^l S_k(t-i) S_{k'}(t-i'), \quad (\text{S-1})$$

where $i \leq i'$ is assumed. This integral has non-zero value only when i and i' are at the same mesh point or at the neighboring mesh points with each other. Furthermore, as mentioned in the article text, since the lower limit of the integration range is bounded to be non-negative, the case with $i = i' = 0$ requires special treatment. Consequently, the following three cases should be considered:

Case 1. $i = i' = 0$:

$$D_{0,k,0,k'}^l = D_{k,k'}^{(1),l} \equiv \int_0^1 dt t^l S_k(t) S_{k'}(t). \quad (\text{S-2})$$

Case 2. $i = i' > 0$:

$$D_{i,k,i,k'}^l = D_{i,k,k'}^{(2),l} \equiv \int_{-1}^1 dt (t+i)^l S_k(t) S_{k'}(t). \quad (\text{S-3})$$

Case 3. $i = i' - 1 \geq 0$:

$$D_{i,k,i+1,k'}^l = D_{i,k,k'}^{(3),l} \equiv \int_0^1 dt (t+i)^l S_k(t) S_{k'}(t-1). \quad (\text{S-4})$$

Q integral (59) is defined as

$$Q_{\{i_t\}\{k_t\}}^\lambda \equiv \int_{\sup(i_4-1,0)}^{i_1+1} dt \int_{\sup(i_4-1,0)}^{i_1+1} dt' t_{<}^{5+2\lambda} t_{>}^{3-2\lambda} \\ \times S_{k_1}(t-i_1) S_{k_2}(t'-i_2) S_{k_3}(t-i_3) S_{k_4}(t'-i_4), \quad (\text{S-5})$$

When the ordering between the indices i_1 , i_2 , i_3 , and i_4 is assumed as in Eqs. (51) and (52) in the article, the combinations of the indices which gives non-zero value of Q integral are classified into 6 different cases as follows:

Case 1 $i_1 = i_2 = i_3 = i_4 = i = 0$:

$$Q_{k_1,k_2,k_3,k_4}^{(1),\lambda} \equiv \int_0^1 dt t^{3-2\lambda} S_{k_1}(t) S_{k_3}(t) \int_0^t du u^{5+2\lambda} S_{k_2}(u) S_{k_4}(u) \\ + \int_0^1 dt t^{5+2\lambda} S_{k_1}(t) S_{k_3}(t) \int_t^1 du u^{3-2\lambda} S_{k_2}(u) S_{k_4}(u). \quad (\text{S-6})$$

Case 2: $i_1 = i_2 = i_3 = i_4 = i > 0$: lx,

$$Q_{i,k_1,k_2,k_3,k_4}^{(2),\lambda} \equiv \int_{-1}^1 dt (t+i)^{3-2\lambda} S_{k_1}(t) S_{k_3}(t) \int_{-1}^t du (u+i)^{5+2\lambda} S_{k_2}(u) S_{k_4}(u) \\ + \int_{-1}^1 dt (t+i)^{5+2\lambda} S_{k_1}(t) S_{k_3}(t) \int_t^1 dt' (u+i)^{3-2\lambda} S_{k_2}(u) S_{k_4}(u). \quad (\text{S-7})$$

Case 3: $i_1 = i_2 = i$, and $i_3 = i_4 = i + 1$:

$$Q_{i,k_1,k_2,k_3,k_4}^{(3),\lambda} \equiv \int_0^1 dt t^{3-2\lambda} S_{k_1}(t) S_{k_3}(t-1) \int_0^t du u^{5+2\lambda} S_{k_2}(u) S_{k_4}(u-1) \\ + \int_0^1 dt t^{5+2\lambda} S_{k_1}(t) S_{k_3}(t-1) \int_t^1 du u^{3-2\lambda} S_{k_2}(u) S_{k_4}(u-1). \quad (\text{S-8})$$

Case 4: $i_1 = i_2 = i_3 = i$, and $i_4 = i + 1$:

$$Q_{i,k_1,k_2,k_3,k_4}^{(4),\lambda} \equiv \int_0^1 dt (t+i)^{3-2\lambda} S_{k_1}(t) S_{k_3}(t) \int_0^t du (u+i)^{5+2\lambda} S_{k_2}(u) S_{k_4}(u-1) \\ + \int_0^1 dt (t+i)^{5+2\lambda} S_{k_1}(t) S_{k_3}(t) \int_t^1 du (u+i)^{3-2\lambda} S_{k_2}(u) S_{k_4}(u-1). \quad (\text{S-9})$$

Case 5: $i_1 = i$, and $i_2 = i_3 = i_4 = i + 1$:

$$Q_{i,k_1,k_2,k_3,k_4}^{(5),\lambda} \equiv \int_0^1 dt (t+i)^{3-2\lambda} S_{k_1}(t) S_{k_3}(t-1) \int_0^t du (u+i)^{5+2\lambda} S_{k_2}(u-1) S_{k_4}(u-1) \\ + \int_0^1 dt (t+i)^{5+2\lambda} S_{k_1}(t) S_{k_3}(t-1) \int_t^1 du (u+i)^{3-2\lambda} S_{k_4}(u-1) S_{k_2}(u-1). \quad (\text{S-10})$$

Case 6: $i_1 = i_3 = i$, and $i_2 = i_4 = i + 1$:

$$Q_{i,k_1,k_2,k_3,k_4}^{(6),\lambda} \equiv \int_0^1 dt (t+i)^{3-2\lambda} S_{k_1}(t) S_{k_3}(t) \int_0^t du (u+i)^{5+2\lambda} S_{k_2}(u-1) S_{k_4}(u-1) \\ + \int_0^1 dt (t+i)^{5+2\lambda} S_{k_1}(t) S_{k_3}(t) \int_t^1 du (u+i)^{3-2\lambda} S_{k_2}(u-1) S_{k_4}(u-1). \quad (\text{S-11})$$

L and R integrals are defined as

$$L_{i_1,k_1,i_3,k_3}^{\lambda,i_4} \equiv \int_{\sup(i_3-1,0)}^{i_4-1} dt t^\lambda S_{k_1}(t-i_1) S_{k_3}(t-i_3), \quad (\text{S-12})$$

and

$$R_{i_2,k_2,i_4,k_4}^{\lambda,i_1} \equiv \int_{i_1+1}^{i_4+1} dt t^\lambda S_{k_2}(t-i_2) S_{k_4}(t-i_4). \quad (\text{S-13})$$

It turns out that L is non-zero only when $i_1 = i_3 = i > 0$ and $i_4 = i + 1$, and that R is non-zero only when $i_1 = i$ and $i_2 = i_4 = i + 1$. Therefore, the actual forms that one has to solve are

$$L_{i,k_1,k_3}^\lambda \equiv \int_{-1}^0 dt (t+i)^\lambda S_{k_1}(t) S_{k_3}(t), \quad (\text{S-14})$$

and

$$R_{i,k_2,k_4}^\lambda \equiv \int_0^1 dt (t+i+1)^\lambda S_{k_2}(t) S_{k_4}(t). \quad (\text{S-15})$$

These integrals can be easily solved, especially when one can use an algebraic computing software such as MATHEMATICA. In the following section, we provide MATHEMATICA code to solve each one of the above integrals. It is worth noting here that we have observed a

serious numerical error in the numerical evaluation of the integrated formula for some of the integrals. It is caused by logarithmic terms such as $\log(1 \pm 1/i)$ produced by the integration of the $t^{3-2\lambda}$ term when $2 \leq \lambda \leq 5$. Because the logarithmic terms and the polynomial terms have almost the same value with opposite sign, a large number of significant digits were lost. To avoid this problem, we extracted the first n terms of the logarithmic terms as follows:

$$\log\left(1 \pm \frac{1}{x}\right) = - \sum_{j=1}^n (\mp)^j \frac{1}{jx^j} + \text{Log}_n(x), \quad (\text{S-16})$$

where $\text{LOG}_n(x)$ holds the remaining high order terms

$$\text{Log}_n(x) = - \sum_{j=n+1}^{\infty} (\mp)^j \frac{1}{jx^j}. \quad (\text{S-17})$$

By taking $n = 20$, we have confirmed that the low order terms in Eq. (S-16) exactly cancel out the leading polynomial terms and thus the accurate evaluation were achieved. For large x ($x \geq 10$), $\text{Log}_n(x)$ is efficiently evaluated by taking first 20 terms in Eq. (S-17). For smaller x ($x < 10$), since x is an integer here, the simplest way is looking up in a table of values which are precalculated via a high precision arithmetic programs such as, again, MATHEMATICA.

S-22.2 MATHEMATICA code

```
(* HERMITE SPLINE BASIS FUNCTION *)
S[t_, k_] := Assuming[{t \[Element] Reals, k \[Element] Integers,
  0<=k<=1},
  If[k==0,
    (* even *) If[0<=t<=1, 1-3t^2+2t^3, If[-1<=t<=0, 1-3t^2-2t^3, 0]],
    (* odd *) If[0<=t<=1, t-2t^2+t^3, If[-1<=t<=0, t+2t^2+t^3, 0]]]]

(***** D INTERGALS *****)

(* CASE 1: EQ. (S-2) *)
D1[l_, k1_, k2_] :=
  Assuming[ {l\[Element] Integers},
    Integrate[t^l*S[t,k1]*S[t,k2], {t,0,1} ]

(* CASE 2: EQ. (S-3) *)
D2[l_, i_, k1_, k2_] :=
  Assuming[ {i\[Element] Integers, i>0, l\[Element] Integers},
    Integrate[(t+i)^l*S[t,k1]*S[t,k2], {t,-1,0}]
    + Integrate[(t+i)^l*S[t,k1]*S[t,k2], {t,0,1} ]

(* CASE 3: EQ. (S-4) *)
D3[l_, i_, k1_, k2_] :=
  Assuming[ {i\[Element] Integers, i>=0, l\[Element] Integers},
    Integrate[(t+i)^l*S[t,k1]*S[t-1,k2], {t,0,1} ]

(***** Q INTEGRALS *****)

(* CASE 1: EQ. (S-6) *)
Q1[l_, k1_, k2_, k3_, k4_] :=
  Assuming[ {l\[Element] Integers, l>=0},
    Integrate[t^(3-2l)*S[t,k1]*S[t,k3]
      *Assuming[ {0<=t<=1},
```

```

      Integrate[u^(2l+5)*S[u,k2]*S[u,k4], {u,0,t}] ]
    ,{t,0,1}]
+ Integrate[t^(3-2l)*S[t,k2]*S[t,k4]
  *Assuming[ {0<=t<=1},
    Integrate[u^(2l+5)*S[u,k1]*S[u,k3], {u,0,t}] ]
  ,{t,0,1}] ]

(* CASE 2: EQ. (S-7) *)
Q2[l_,i_,k1_,k2_,k3_,k4_] :=
  Assuming[ {i\[Element] Integers, i>0, l\[Element] Integers, l>=0},
    Integrate[(t+i)^(3-2l)*S[t,k1]*S[t,k3]
      *Assuming[ {-1<=t<=0},
        Integrate[(u+i)^(2l+5)*S[u,k2]*S[u,k4], {u,-1,t}] ]
      ,{t,-1,0}]
+ Integrate[(t+i)^(3-2l)*S[t,k1]*S[t,k3]
  *Assuming[ {0<=t<=1},
    Integrate[(u+i)^(2l+5)*S[u,k2]*S[u,k4], {u,-1,0}] ]
  ,{t,0,1}]
+ Integrate[(t+i)^(3-2l)*S[t,k1]*S[t,k3]
  *Assuming[ {0<=t<=1},
    Integrate[(u+i)^(2l+5)*S[u,k2]*S[u,k4], {u,0,t}] ]
  ,{t,0,1}]
+ Integrate[(t+i)^(3-2l)*S[t,k2]*S[t,k4]
  *Assuming[ {-1<=t<=0},
    Integrate[(u+i)^(2l+5)*S[u,k1]*S[u,k3], {u,-1,t}] ]
  ,{t,-1,0}]
+ Integrate[(t+i)^(3-2l)*S[t,k2]*S[t,k4]
  *Assuming[ {0<=t<=1},
    Integrate[(u+i)^(2l+5)*S[u,k1]*S[u,k3], {u,-1,0}] ]
  ,{t,0,1}]
+ Integrate[(t+i)^(3-2l)*S[t,k2]*S[t,k4]
  *Assuming[ {0<=t<=1},
    Integrate[(u+i)^(2l+5)*S[u,k1]*S[u,k3], {u,0,t}] ]
  ,{t,0,1}] ]

(* CASE 3: EQ. (S-8) *)
Q3[l_,i_,k1_,k2_,k3_,k4_] :=
  Assuming[ {i\[element] Integers, i>=0, l\[Element] Integers, l>=0},
    Integrate[(t+i)^(3-2l)*S[t,k1]*S[t-1,k3]
      *Assuming[ {0<=t<=1},
        Integrate[(u+i)^(2l+5)*S[u,k2]*S[u-1,k4], {u,0,t}] ]
      ,{t,0,1}]
+ Integrate[(t+i)^(3-2l)*S[t,k2]*S[t-1,k4]
  *Assuming[ {0<=t<=1},
    Integrate[(u+i)^(2l+5)*S[u,k1]*S[u-1,k3], {u,0,t}] ]
  ,{t,0,1}] ]

(* CASE 4: EQ. (S-9) *)
Q4[l_,i_,k1_,k2_,k3_,k4_] :=
  Assuming[ {i\[Element] Integers, i>=0, l\[Element] Integers, l>=0},
    Integrate[(t+i)^(3-2l)*S[t,k1]*S[t,k3]
      *Assuming[ {0<=t<=1},
        Integrate[(u+i)^(2l+5)*S[u,k2]*S[u-1,k4], {u,0,t}] ]
      ,{t,0,1}]

```

```

+ Integrate[(t+i)^(3-2l)*S[t,k2]*S[t-1,k4]
  *Assuming[ {0<=t<=1},
    Integrate[(u+i)^(2l+5)*S[u,k1]*S[u,k3], {u,0,t}] ]
  ,{t,0,1}] ]

(* CASE 5: EQ. (S-10) *)
Q5[l_,i_,k1_,k2_,k3_,k4_] :=
  Assuming[{i\ [Element] Integers, i>=0, l\ [Element] Integers, l>=0},
    Integrate[(t+i)^(3-2l)*S[t,k1]*S[t-1,k3]
      *Assuming[ {0<=t<=1},
        Integrate[(u+i)^(2l+5)*S[u-1,k2]*S[u-1,k4], {u,0,t}] ]
      ,{t,0,1}]
  + Integrate[(t+i)^(3-2l)*S[t-1,k2]*S[t-1,k4]
    *Assuming[ {0<=t<=1},
      Integrate[(u+k)^(2l+5)*S[u,k1]*S[u-1,k3], {u,0,t}] ]
    ,{t,0,1}] ]

(* CASE 6: EQ. (S-11) *)
Q6[l_,i_,k1_,k2_,k3_,k4_] :=
  Assuming[ {i\ [Element] Integers, i>=0, l\ [Element] Integers, l>=0},
    Integrate[(t+i)^(3-2l)*S[t,k1]*S[t,k3]
      *Assuming[ {0<=t<=1},
        Integrate[(u+i)^(2l+5)*S[u-1,k2]*S[u-1,k4], {u,0,t}] ]
      ,{t,0,1}]
  + Integrate[(t+i)^(3-2l)*S[t-1,k2]*S[t-1,k4]
    *Assuming[ {0<=t<=1},
      Integrate[(u+i)^(2l+5)*S[u,k1]*S[u,k3], {u,0,t}] ]
    ,{t,0,1}] ]

(***** L INTEGRAL *****)

(* EQ. (S-14) *)
L[l_,i_,k1_,k2_] :=
  Assuming[ {i\ [Element] Integers, i>0, l\ [Element] Integers, l>=0},
    Integrate[(t+i)^(2l+5)*S[t,k3]*S[t,k4], {t,-1,0}] ]

(***** R INTEGRAL *****)

(* EQ. (S-15) *)
R[l_,i_,k2_,k4_] :=
  Assuming[ {i\ [Element] Integers, i>=0, l\ [Element] Integers, l>=0},
    Integrate[(t+i+1)^(3-2l)*S[t,k2]*S[t,k4], {t, 0, 1}] ]

```

S-22.3 Analytic formulas of the integrals D

Case 1: $i_1 = i_2 = 0$

$$\begin{aligned}
 & D1[l, k = 0, k' = 0] \\
 &= \frac{72(13 + 3l)}{(1 + l)(3 + l)(4 + l)(5 + l)(6 + l)(7 + l)}
 \end{aligned}$$

$$\begin{aligned}
 & D1[l, k = 0, k' = 1] \\
 &= \frac{24(11 + 3l)}{(2 + l)(3 + l)(4 + l)(5 + l)(6 + l)(7 + l)}
 \end{aligned}$$

$$\begin{aligned} & \text{D1 } [l, k = 1, k' = 1] \\ &= \frac{24(11 + 3l)}{(2+l)(3+l)(4+l)(5+l)(6+l)(7+l)} \end{aligned}$$

Case 2: $i_1 = i_2 = i > 0$

$$\begin{aligned} & \text{D2 } [l = 5, i, k = 0, k' = 0] \\ &= \frac{5i}{77} + \frac{38i^3}{63} + \frac{26i^5}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2 } [l = 7, i, k = 0, k' = 0] \\ &= \frac{62i}{2145} + \frac{5i^3}{11} + \frac{19i^5}{15} + \frac{26i^7}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2 } [l = 9, i, k = 0, k' = 0] \\ &= \frac{74i}{5005} + \frac{248i^3}{715} + \frac{18i^5}{11} + \frac{76i^7}{35} + \frac{26i^9}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2 } [l = 11, i, k = 0, k' = 0] \\ &= \frac{129i}{15470} + \frac{74i^3}{273} + \frac{124i^5}{65} + \frac{30i^7}{7} + \frac{209i^9}{63} + \frac{26i^{11}}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2 } [l = 13, i, k = 0, k' = 0] \\ &= \frac{49i}{9690} + \frac{129i^3}{595} + \frac{74i^5}{35} + \frac{248i^7}{35} + \frac{65i^9}{7} + \frac{494i^{11}}{105} + \frac{26i^{13}}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2 } [l = 15, i, k = 0, k' = 0] \\ &= \frac{22i}{6783} + \frac{343i^3}{1938} + \frac{387i^5}{170} + \frac{74i^7}{7} + \frac{62i^9}{3} + \frac{195i^{11}}{11} + \frac{19i^{13}}{3} + \frac{26i^{15}}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2 } [l = 17, i, k = 0, k' = 0] \\ &= \frac{366i}{168245} + \frac{176i^3}{1197} + \frac{686i^5}{285} + \frac{516i^7}{35} + \\ & \frac{2516i^9}{63} + \frac{8432i^{11}}{165} + \frac{340i^{13}}{11} + \frac{2584i^{15}}{315} + \frac{26i^{17}}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2 } [l = 19, i, k = 0, k' = 0] \\ &= \frac{67i}{44275} + \frac{1098i^3}{8855} + \frac{88i^5}{35} + \frac{98i^7}{5} + \\ & \frac{2451i^9}{35} + \frac{47804i^{11}}{385} + \frac{80104i^{13}}{715} + \frac{3876i^{15}}{77} + \frac{361i^{17}}{35} + \frac{26i^{19}}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 5, i, k = 0, k' = 1] \\ &= \frac{13}{6930} + \frac{4i^2}{63} + \frac{i^4}{6} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 7, i, k = 0, k' = 1] \\ &= \frac{32}{45045} + \frac{13i^2}{330} + \frac{2i^4}{9} + \frac{7i^6}{30} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 9, i, k = 0, k' = 1] \\ &= \frac{19}{60060} + \frac{128i^2}{5005} + \frac{13i^4}{55} + \frac{8i^6}{15} + \frac{3i^8}{10} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 11, i, k = 0, k' = 1] \\ &= \frac{11}{69615} + \frac{19i^2}{1092} + \frac{64i^4}{273} + \frac{13i^6}{15} + \frac{22i^8}{21} + \frac{11i^{10}}{30} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 13, i, k = 0, k' = 1] \\ &= \frac{1}{11628} + \frac{22i^2}{1785} + \frac{19i^4}{84} + \frac{128i^6}{105} + \frac{169i^8}{70} + \frac{572i^{10}}{315} + \frac{13i^{12}}{30} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 15, i, k = 0, k' = 1] \\ &= \frac{8}{159885} + \frac{35i^2}{3876} + \frac{11i^4}{51} + \frac{19i^6}{12} + \frac{32i^8}{7} + \frac{169i^{10}}{30} + \frac{26i^{12}}{9} + \frac{i^{14}}{2} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 17, i, k = 0, k' = 1] \\ &= \\ & \frac{31}{1009470} + \frac{64i^2}{9405} + \frac{35i^4}{171} + \frac{88i^6}{45} + \frac{323i^8}{42} + \frac{4352i^{10}}{315} + \frac{5746i^{12}}{495} + \frac{272i^{14}}{63} + \frac{17i^{16}}{30} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 19, i, k = 0, k' = 1] \\ &= \frac{34}{1726725} + \frac{93i^2}{17710} + \frac{32i^4}{165} + \frac{7i^6}{3} + \\ & \frac{418i^8}{35} + \frac{6137i^{10}}{210} + \frac{41344i^{12}}{1155} + \frac{8398i^{14}}{385} + \frac{646i^{16}}{105} + \frac{19i^{18}}{30} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 5, i, k = 1, k' = 1] \\ &= \frac{15i + 110i^3 + 66i^5}{3465} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 7, i, k = 1, k' = 1] \\ &= \frac{98i + 1365i^3 + 3003i^5 + 858i^7}{45045} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 9, i, k = 1, k' = 1] \\ &= \frac{18i + 392i^3 + 1638i^5 + 1716i^7 + 286i^9}{15015} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 11, i, k = 1, k' = 1] \\ &= \frac{11i}{15470} + \frac{2i^3}{91} + \frac{28i^5}{195} + \frac{2i^7}{7} + \frac{11i^9}{63} + \frac{2i^{11}}{105} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 13, i, k = 1, k' = 1] \\ &= \frac{13i}{29070} + \frac{11i^3}{595} + \frac{6i^5}{35} + \frac{8i^7}{15} + \frac{13i^9}{21} + \frac{26i^{11}}{105} + \frac{2i^{13}}{105} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 15, i, k = 1, k' = 1] \\ &= \frac{2i}{6783} + \frac{91i^3}{5814} + \frac{33i^5}{170} + \frac{6i^7}{7} + \frac{14i^9}{9} + \frac{13i^{11}}{11} + \frac{i^{13}}{3} + \frac{2i^{15}}{105} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 17, i, k = 1, k' = 1] \\ &= \frac{34i}{168245} + \frac{16i^3}{1197} + \frac{182i^5}{855} + \frac{44i^7}{35} + \frac{68i^9}{21} + \frac{1904i^{11}}{495} + \frac{68i^{13}}{33} + \frac{136i^{15}}{315} + \frac{2i^{17}}{105} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 19, i, k = 1, k' = 1] \\ &= \frac{19i}{132825} + \frac{102i^3}{8855} + \frac{8i^5}{35} + \frac{26i^7}{15} + \\ & \frac{209i^9}{35} + \frac{3876i^{11}}{385} + \frac{18088i^{13}}{2145} + \frac{1292i^{15}}{385} + \frac{19i^{17}}{35} + \frac{2i^{19}}{105} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 3, i, k = 0, k' = 0] \\ &= \frac{1}{105} (19i + 78i^3) \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = 1, i, k = 0, k' = 0] \\ &= \frac{26i}{35} \end{aligned}$$

$$\begin{aligned} & \text{D2}[l = -1, i, k = 0, k' = 0] \\ &= \\ & \frac{1}{29099070i^{19}} (3063060 - 3315312i^2 - 11079068i^4 + 11319i^6 + 22059i^8 + 47804i^{10} + \\ & 120156i^{12} + 377910i^{14} + 1755182i^{16} + 21616452i^{18}) + \\ & (-1 + 6i^2 - 4i^3 - 9i^4 + 12i^5 - 4i^6) \text{Log}20[-i] + \\ & (1 - 6i^2 - 4i^3 + 9i^4 + 12i^5 + 4i^6) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned}
& \text{D2 } [l = -3, i, k = 0, k' = 0] \\
&= \frac{1}{9699690i^{19}} (5513508 - 55175120i^2 + 343343i^4 + 485298i^6 + \\
&717060i^8 + 1121456i^{10} + 1889550i^{12} + 3510364i^{14} + 7205484i^{16}) + \\
&(6 - 12i - 54i^2 + 120i^3 - 60i^4) \text{Log20}[-i] + \\
&(-6 - 12i + 54i^2 + 120i^3 + 60i^4) \text{Log20}[i]
\end{aligned}$$

$$\begin{aligned}
& \text{D2 } [l = -5, i, k = 0, k' = 0] \\
&= \frac{1}{9699690i^{19}} (-49008960 + 6866860i^2 + 7360353i^4 + \\
&7887660i^6 + 8410920i^8 + 8817900i^{10} + 8775910i^{12} + 7205484i^{14}) + \\
&(-9 + 60i - 60i^2) \text{Log20}[-i] + (9 + 60i + 60i^2) \text{Log20}[i]
\end{aligned}$$

$$\begin{aligned}
& \text{D2 } [l = -7, i, k = 0, k' = 0] \\
&= (6126120 - 5405400i^2 + 192192i^4 + 280896i^6 + \\
&434112i^8 + 723520i^{10} + 1343680i^{12} + 2956096i^{14} + 10808226i^{16}) / \\
&\left(14549535i^{19} (-1 + i^2)^2\right) - 4\text{Log20}[-i] + 4\text{Log20}[i]
\end{aligned}$$

$$\begin{aligned}
& \text{D2 } [l = -9, i, k = 0, k' = 0] \\
&= \frac{1 - 9i^2 + 26i^4}{35i^5 (-1 + i^2)^4}
\end{aligned}$$

$$\begin{aligned}
& \text{D2 } [l = -11, i, k = 0, k' = 0] \\
&= \frac{1 - 8i^2 + 27i^4 - 50i^6 + 78i^8}{105i^7 (-1 + i^2)^6}
\end{aligned}$$

$$\begin{aligned}
& \text{D2 } [l = 3, i, k = 0, k' = 1] \\
&= \frac{1}{630} (4 + 63i^2)
\end{aligned}$$

$$\begin{aligned}
& \text{D2 } [l = 1, i, k = 0, k' = 1] \\
&= \frac{1}{30}
\end{aligned}$$

$$\begin{aligned}
& \text{D2 } [l = -1, i, k = 0, k' = 1] \\
&= \frac{1}{58198140i^{18}} (5513508 - 28220192i^2 - 5005i^4 - 9196i^6 - \\
&18411i^8 - 41344i^{10} - 109174i^{12} - 369512i^{14} - 1939938i^{16}) + \\
&(i - 2i^2 - 2i^3 + 8i^4 - 7i^5 + 2i^6) \text{Log20}[-i] + \\
&(-i - 2i^2 + 2i^3 + 8i^4 + 7i^5 + 2i^6) \text{Log20}[i]
\end{aligned}$$

$$\begin{aligned}
& D2 [l = -3, i, k = 0, k' = 1] \\
&= \frac{1}{58198140i^{20}} (11639628 - 229661432i^2 - 525525i^4 - 717288i^6 - \\
&1012605i^8 - 1488384i^{10} - 2292654i^{12} - 3695120i^{14} - 5819814i^{16}) + \\
&(-2 - 6i + 48i^2 - 70i^3 + 30i^4) \text{Log}20[-i] + (-2 + 6i + 48i^2 + 70i^3 + 30i^4) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& D2 [l = -5, i, k = 0, k' = 1] \\
&= \\
&\frac{1}{58198140i^{20}} (-46558512 - 11911900i^2 - 12552540i^4 - 13163865i^6 - 13643520i^8 - \\
&13755924i^{10} - 12932920i^{12} - 9699690i^{14}) + \\
&(8 - 35i + 30i^2) \text{Log}20[-i] + (8 + 35i + 30i^2) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& D2 [l = -7, i, k = 0, k' = 1] \\
&= \frac{-252 + 224i^2 - 7i^4 - 10i^6 - 15i^8 - 24i^{10} - 42i^{12} - 84i^{14} - 294i^{16}}{1260i^{20} (-1 + i^2)^2} + \\
&2\text{Log}20[-i] + 2\text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& D2 [l = -9, i, k = 0, k' = 1] \\
&= \frac{-5 + 32i^2 - 63i^4}{210i^6 (-1 + i^2)^4}
\end{aligned}$$

$$\begin{aligned}
& D2 [l = -11, i, k = 0, k' = 1] \\
&= \frac{-7 + 50i^2 - 150i^4 + 242i^6 - 231i^8}{630i^8 (-1 + i^2)^6}
\end{aligned}$$

$$\begin{aligned}
& D2 [l = 3, i, k = 1, k' = 1] \\
&= \frac{1}{105} (i + 2i^3)
\end{aligned}$$

$$\begin{aligned}
& D2 [l = 1, i, k = 1, k' = 1] \\
&= \frac{2i}{105}
\end{aligned}$$

$$\begin{aligned}
& D2 [l = -1, i, k = 1, k' = 1] \\
&= \frac{1}{29099070i^{17}} (-8576568 - 2770768i^2 + 1001i^4 + \\
&1881i^6 + 3876i^8 + 9044i^{10} + 25194i^{12} + 92378i^{14} + 554268i^{16}) + \\
&(-i^2 + 4i^3 - 6i^4 + 4i^5 - i^6) \text{Log}20[-i] + (i^2 + 4i^3 + 6i^4 + 4i^5 + i^6) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& \text{D2} [l = -3, i, k = 1, k' = 1] \\
&= \frac{1}{29099070i^{19}} (-31855824 - 41501460i^2 + 91091i^4 + 124146i^6 + \\
&174420i^8 + 253232i^{10} + 377910i^{12} + 554268i^{14} + 554268i^{16}) + \\
&(-1 + 12i - 36i^2 + 40i^3 - 15i^4) \text{Log}20[-i] + \\
&(1 + 12i + 36i^2 + 40i^3 + 15i^4) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& \text{D2} [l = -5, i, k = 1, k' = 1] \\
&= \frac{1}{29099070i^{19}} (-39819780 + 1821820i^2 + 1882881i^4 + \\
&1918620i^6 + 1899240i^8 + 1763580i^{10} + 1385670i^{12} + 554268i^{14}) + \\
&(-6 + 20i - 15i^2) \text{Log}20[-i] + (6 + 20i + 15i^2) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& \text{D2} [l = -7, i, k = 1, k' = 1] \\
&= (1531530 - 1351350i^2 + 48048i^4 + 70224i^6 + 108528i^8 + 180880i^{10} + 335920i^{12} + \\
&739024i^{14} + 277134i^{16}) / (14549535i^{19} (-1 + i^2)^2) - \text{Log}20[-i] + \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& \text{D2} [l = -9, i, k = 1, k' = 1] \\
&= \frac{-3 + 7i^2 + 2i^4}{105i^5 (-1 + i^2)^4}
\end{aligned}$$

$$\begin{aligned}
& \text{D2} [l = -11, i, k = 1, k' = 1] \\
&= \frac{-3 + 16i^2 - 33i^4 + 30i^6 + 6i^8}{315i^7 (-1 + i^2)^6}
\end{aligned}$$

Case 3: $i_1 = i, i_2 = i + 1$

$$\begin{aligned}
& \text{D3} [l = 5, i, k = 0, k' = 0] \\
&= \frac{41}{3960} + \frac{23i}{308} + \frac{19i^2}{84} + \frac{23i^3}{63} + \frac{9i^4}{28} + \frac{9i^5}{70}
\end{aligned}$$

$$\begin{aligned}
& \text{D3} [l = 7, i, k = 0, k' = 0] \\
&= \frac{111}{20020} + \frac{112i}{2145} + \frac{287i^2}{1320} + \frac{23i^3}{44} + \frac{19i^4}{24} + \frac{23i^5}{30} + \frac{9i^6}{20} + \frac{9i^7}{70}
\end{aligned}$$

$$\begin{aligned}
& \text{D3} [l = 9, i, k = 0, k' = 0] \\
&= \frac{3}{910} + \frac{381i}{10010} + \frac{999i^2}{5005} + \frac{448i^3}{715} + \frac{287i^4}{220} + \frac{207i^5}{110} + \frac{19i^6}{10} + \frac{46i^7}{35} + \frac{81i^8}{140} + \frac{9i^9}{70}
\end{aligned}$$

$$D3 [l = 11, i, k = 0, k' = 0]$$

$$= \frac{181}{85680} + \frac{891i}{30940} + \frac{33i^2}{182} + \frac{127i^3}{182} + \frac{333i^4}{182} + \frac{224i^5}{65} + \frac{287i^6}{60} + \frac{69i^7}{14} + \frac{209i^8}{56} + \frac{253i^9}{126} + \frac{99i^{10}}{140} + \frac{9i^{11}}{70}$$

$$D3 [l = 13, i, k = 0, k' = 0]$$

$$= \frac{37}{25840} + \frac{871i}{38760} + \frac{2353i^2}{14280} + \frac{891i^3}{1190} + \frac{33i^4}{14} + \frac{381i^5}{70} + \frac{333i^6}{35} + \frac{64i^7}{5} + \frac{533i^8}{40} + \frac{299i^9}{28} + \frac{2717i^{10}}{420} + \frac{299i^{11}}{105} + \frac{117i^{12}}{140} + \frac{9i^{13}}{70}$$

$$D3 [l = 15, i, k = 0, k' = 0]$$

$$= \frac{89}{87780} + \frac{122i}{6783} + \frac{777i^2}{5168} + \frac{6097i^3}{7752} + \frac{2353i^4}{816} + \frac{2673i^5}{340} + \frac{33i^6}{2} + \frac{381i^7}{14} + \frac{999i^8}{28} + \frac{112i^9}{3} + \frac{3731i^{10}}{120} + \frac{897i^{11}}{44} + \frac{247i^{12}}{24} + \frac{23i^{13}}{6} + \frac{27i^{14}}{28} + \frac{9i^{15}}{70}$$

$$D3 [l = 17, i, k = 0, k' = 0]$$

$$= \frac{79}{106260} + \frac{4947i}{336490} + \frac{3026i^2}{21945} + \frac{976i^3}{1197} + \frac{259i^4}{76} + \frac{6097i^5}{570} + \frac{2353i^6}{90} + \frac{1782i^7}{35} + \frac{561i^8}{7} + \frac{2159i^9}{21} + \frac{3774i^{10}}{35} + \frac{15232i^{11}}{165} + \frac{63427i^{12}}{990} + \frac{391i^{13}}{11} + \frac{323i^{14}}{21} + \frac{1564i^{15}}{315} + \frac{153i^{16}}{140} + \frac{9i^{17}}{70}$$

$$D3 [l = 19, i, k = 0, k' = 0]$$

$$= \frac{369}{657800} + \frac{1083i}{88550} + \frac{4503i^2}{35420} + \frac{14841i^3}{17710} + \frac{1513i^4}{385} + \frac{488i^5}{35} + \frac{777i^6}{20} + \frac{871i^7}{10} + \frac{44707i^8}{280} + \frac{16929i^9}{70} + \frac{10659i^{10}}{35} + \frac{123063i^{11}}{385} + \frac{107559i^{12}}{385} + \frac{144704i^{13}}{715} + \frac{13243i^{14}}{110} + \frac{22287i^{15}}{385} + \frac{6137i^{16}}{280} + \frac{437i^{17}}{70} + \frac{171i^{18}}{140} + \frac{9i^{19}}{70}$$

$$D3 [l = 5, i, k = 0, k' = 1]$$

$$= -\frac{7}{3960} - \frac{25i}{1848} - \frac{11i^2}{252} - \frac{19i^3}{252} - \frac{i^4}{14} - \frac{13i^5}{420}$$

$$D3 [l = 7, i, k = 0, k' = 1]$$

$$= -\frac{17}{20020} - \frac{217i}{25740} - \frac{49i^2}{1320} - \frac{25i^3}{264} - \frac{11i^4}{72} - \frac{19i^5}{120} - \frac{i^6}{10} - \frac{13i^7}{420}$$

$$D3 [l = 9, i, k = 0, k' = 1]$$

$$= -\frac{1}{2184} - \frac{111i}{20020} - \frac{153i^2}{5005} - \frac{217i^3}{2145} - \frac{49i^4}{220} - \frac{15i^5}{44} - \frac{11i^6}{30} - \frac{19i^7}{70} - \frac{9i^8}{70} - \frac{13i^9}{420}$$

$$D3 [l = 11, i, k = 0, k' = 1]$$

$$= -\frac{23}{85680} - \frac{473i}{123760} - \frac{55i^2}{2184} - \frac{37i^3}{364} - \frac{51i^4}{182} - \frac{217i^5}{390} - \frac{49i^6}{60} - \frac{25i^7}{28} - \frac{121i^8}{168} - \frac{209i^9}{504} - \frac{11i^{10}}{70} - \frac{13i^{11}}{420}$$

$$D3 [l = 13, i, k = 0, k' = 1]$$

$$= -\frac{13}{77520} - \frac{637i}{232560} - \frac{299i^2}{14280} - \frac{473i^3}{4760} - \frac{55i^4}{168} - \frac{111i^5}{140} - \frac{51i^6}{35} - \frac{31i^7}{15} - \frac{91i^8}{40} - \frac{325i^9}{168} - \frac{1573i^{10}}{1260} - \frac{247i^{11}}{420} - \frac{13i^{12}}{70} - \frac{13i^{13}}{420}$$

$$D3 [l = 15, i, k = 0, k' = 1]$$

$$= -\frac{29}{263340} - \frac{55i}{27132} - \frac{91i^2}{5168} - \frac{4459i^3}{46512} - \frac{299i^4}{816} - \frac{1419i^5}{1360} - \frac{55i^6}{24} - \frac{111i^7}{28} - \frac{153i^8}{28} - \frac{217i^9}{36} - \frac{637i^{10}}{120} - \frac{325i^{11}}{88} - \frac{143i^{12}}{72} - \frac{19i^{13}}{24} - \frac{3i^{14}}{14} - \frac{13i^{15}}{420}$$

$$D3 [l = 17, i, k = 0, k' = 1]$$

$$= -\frac{2}{26565} - \frac{1037i}{672980} - \frac{986i^2}{65835} - \frac{110i^3}{1197} - \frac{91i^4}{228} - \frac{4459i^5}{3420} - \frac{299i^6}{90} - \frac{473i^7}{70} - \frac{935i^8}{84} - \frac{629i^9}{42} - \frac{578i^{10}}{35} - \frac{7378i^{11}}{495} - \frac{10829i^{12}}{990} - \frac{425i^{13}}{66} - \frac{187i^{14}}{63} - \frac{323i^{15}}{315} - \frac{17i^{16}}{70} - \frac{13i^{17}}{420}$$

$$D3 [l = 19, i, k = 0, k' = 1]$$

$$= -\frac{7}{131560} - \frac{1273i}{1062600} - \frac{114i^2}{8855} - \frac{3111i^3}{35420} - \frac{493i^4}{1155} - \frac{11i^5}{7} - \frac{91i^6}{20} - \frac{637i^7}{60} - \frac{5681i^8}{280} - \frac{8987i^9}{280} - \frac{3553i^{10}}{84} - \frac{35853i^{11}}{770} - \frac{16473i^{12}}{385} - \frac{70091i^{13}}{2145} - \frac{2261i^{14}}{110} - \frac{1615i^{15}}{154} - \frac{3553i^{16}}{840} - \frac{361i^{17}}{280} - \frac{19i^{18}}{70} - \frac{13i^{19}}{420}$$

$$D3 [l = 5, i, k = 1, k' = 0]$$

$$= \frac{1}{330} + \frac{17i}{792} + \frac{4i^2}{63} + \frac{25i^3}{252} + \frac{i^4}{12} + \frac{13i^5}{420}$$

$$D3 [l = 7, i, k = 1, k' = 0]$$

$$= \frac{5}{3003} + \frac{133i}{8580} + \frac{7i^2}{110} + \frac{119i^3}{792} + \frac{2i^4}{9} + \frac{5i^5}{24} + \frac{7i^6}{60} + \frac{13i^7}{420}$$

$$D3 [l = 9, i, k = 1, k' = 0]$$

$$= \frac{11}{10920} + \frac{3i}{260} + \frac{60i^2}{1001} + \frac{133i^3}{715} + \frac{21i^4}{55} + \frac{119i^5}{220} + \frac{8i^6}{15} + \frac{5i^7}{14} + \frac{3i^8}{20} + \frac{13i^9}{420}$$

$$D3 [l = 11, i, k = 1, k' = 0]$$

$$= \frac{1}{1530} + \frac{253i}{28560} + \frac{121i^2}{2184} + \frac{11i^3}{52} + \frac{50i^4}{91} + \frac{133i^5}{130} + \frac{7i^6}{5} + \frac{17i^7}{12} + \frac{22i^8}{21} + \frac{275i^9}{504} + \frac{11i^{10}}{60} + \frac{13i^{11}}{420}$$

$$D3 [l = 13, i, k = 1, k' = 0]$$

$$= \frac{13}{29070} + \frac{325i}{46512} + \frac{13i^2}{255} + \frac{3289i^3}{14280} + \frac{121i^4}{168} + \frac{33i^5}{20} + \frac{20i^6}{7} + \frac{19i^7}{5} + \frac{39i^8}{10} + \frac{221i^9}{72} + \frac{572i^{10}}{315} + \frac{65i^{11}}{84} + \frac{13i^{12}}{60} + \frac{13i^{13}}{420}$$

$$D3 [l = 15, i, k = 1, k' = 0]$$

$$= \frac{1}{3135} + \frac{3i}{532} + \frac{91i^2}{1938} + \frac{11375i^3}{46512} + \frac{91i^4}{102} + \frac{3289i^5}{1360} + \frac{121i^6}{24} + \frac{33i^7}{4} + \frac{75i^8}{7} + \frac{133i^9}{12} + \frac{91i^{10}}{10} + \frac{1547i^{11}}{264} + \frac{26i^{12}}{9} + \frac{25i^{13}}{24} + \frac{i^{14}}{4} + \frac{13i^{15}}{420}$$

$$D3 [l = 17, i, k = 1, k' = 0]$$

$$= \frac{5}{21252} + \frac{493i}{106260} + \frac{136i^2}{3135} + \frac{34i^3}{133} + \frac{182i^4}{171} + \frac{2275i^5}{684} + \frac{364i^6}{45} + \frac{3289i^7}{210} + \frac{2057i^8}{84} + \frac{187i^9}{6} + \frac{680i^{10}}{21} + \frac{4522i^{11}}{165} + \frac{3094i^{12}}{165} + \frac{2023i^{13}}{198} + \frac{272i^{14}}{63} + \frac{85i^{15}}{63} + \frac{17i^{16}}{60} + \frac{13i^{17}}{420}$$

$$D3 [l = 19, i, k = 1, k' = 0]$$

$$= \frac{4}{22425} + \frac{589i}{151800} + \frac{285i^2}{7084} + \frac{9367i^3}{35420} + \frac{68i^4}{55} + \frac{153i^5}{35} + \frac{182i^6}{15} + \frac{325i^7}{12} + \frac{247i^8}{5} + \frac{62491i^9}{840} + \frac{39083i^{10}}{420} + \frac{969i^{11}}{10} + \frac{6460i^{12}}{77} + \frac{42959i^{13}}{715} + \frac{1938i^{14}}{55} + \frac{5491i^{15}}{330} + \frac{646i^{16}}{105} + \frac{95i^{17}}{56} + \frac{19i^{18}}{60} + \frac{13i^{19}}{420}$$

$$D3 [l = 5, i, k = 1, k' = 1]$$

$$= -\frac{1}{1980} - \frac{i}{264} - \frac{i^2}{84} - \frac{5i^3}{252} - \frac{i^4}{56} - \frac{i^5}{140}$$

$$D3 [l = 7, i, k = 1, k' = 1]$$

$$= -\frac{1}{4004} - \frac{7i}{2860} - \frac{7i^2}{660} - \frac{7i^3}{264} - \frac{i^4}{24} - \frac{i^5}{24} - \frac{i^6}{40} - \frac{i^7}{140}$$

$$D3 [l = 9, i, k = 1, k' = 1]$$

$$= -\frac{1}{7280} - \frac{3i}{1820} - \frac{9i^2}{1001} - \frac{21i^3}{715} - \frac{7i^4}{110} - \frac{21i^5}{220} - \frac{i^6}{10} - \frac{i^7}{14} - \frac{9i^8}{280} - \frac{i^9}{140}$$

$$\begin{aligned}
& \text{D3} [l = 11, i, k = 1, k' = 1] \\
&= -\frac{1}{12240} - \frac{11i}{9520} - \frac{11i^2}{1456} - \frac{11i^3}{364} - \\
&\frac{15i^4}{182} - \frac{21i^5}{130} - \frac{7i^6}{30} - \frac{i^7}{4} - \frac{11i^8}{56} - \frac{55i^9}{504} - \frac{11i^{10}}{280} - \frac{i^{11}}{140}
\end{aligned}$$

$$\begin{aligned}
& \text{D3} [l = 13, i, k = 1, k' = 1] \\
&= -\frac{1}{19380} - \frac{13i}{15504} - \frac{13i^2}{2040} - \frac{143i^3}{4760} - \frac{11i^4}{112} - \frac{33i^5}{140} - \\
&\frac{3i^6}{7} - \frac{3i^7}{5} - \frac{13i^8}{20} - \frac{13i^9}{24} - \frac{143i^{10}}{420} - \frac{13i^{11}}{84} - \frac{13i^{12}}{280} - \frac{i^{13}}{140}
\end{aligned}$$

$$\begin{aligned}
& \text{D3} [l = 15, i, k = 1, k' = 1] \\
&= -\frac{1}{29260} - \frac{i}{1596} - \frac{7i^2}{1292} - \frac{455i^3}{15504} - \frac{91i^4}{816} - \frac{429i^5}{1360} - \frac{11i^6}{16} - \\
&\frac{33i^7}{28} - \frac{45i^8}{28} - \frac{7i^9}{4} - \frac{91i^{10}}{60} - \frac{91i^{11}}{88} - \frac{13i^{12}}{24} - \frac{5i^{13}}{24} - \frac{3i^{14}}{56} - \frac{i^{15}}{140}
\end{aligned}$$

$$\begin{aligned}
& \text{D3} [l = 17, i, k = 1, k' = 1] \\
&= -\frac{1}{42504} - \frac{17i}{35420} - \frac{34i^2}{7315} - \frac{34i^3}{1197} - \frac{7i^4}{57} - \frac{91i^5}{228} - \frac{91i^6}{90} - \frac{143i^7}{70} - \frac{187i^8}{56} - \\
&\frac{187i^9}{42} - \frac{34i^{10}}{7} - \frac{238i^{11}}{55} - \frac{1547i^{12}}{495} - \frac{119i^{13}}{66} - \frac{17i^{14}}{21} - \frac{17i^{15}}{63} - \frac{17i^{16}}{280} - \frac{i^{17}}{140}
\end{aligned}$$

$$\begin{aligned}
& \text{D3} [l = 19, i, k = 1, k' = 1] \\
&= -\frac{1}{59800} - \frac{19i}{50600} - \frac{57i^2}{14168} - \frac{969i^3}{35420} - \frac{51i^4}{385} - \frac{17i^5}{35} - \\
&\frac{7i^6}{5} - \frac{13i^7}{4} - \frac{247i^8}{40} - \frac{2717i^9}{280} - \frac{3553i^{10}}{280} - \frac{969i^{11}}{70} - \frac{969i^{12}}{77} - \\
&\frac{6783i^{13}}{715} - \frac{323i^{14}}{55} - \frac{323i^{15}}{110} - \frac{323i^{16}}{280} - \frac{19i^{17}}{56} - \frac{19i^{18}}{280} - \frac{i^{19}}{140}
\end{aligned}$$

$$\begin{aligned}
& \text{D3} [l = 3, i, k = 0, k' = 0] \\
&= \frac{1}{840} (19 + 92i + 162i^2 + 108i^3)
\end{aligned}$$

$$\begin{aligned}
& \text{D3} [l = 1, i, k = 0, k' = 0] \\
&= \frac{1}{140} (9 + 18i)
\end{aligned}$$

$$D3 [l = -1, i, k = 0, k' = 0]$$

$$= \frac{1}{232792560i^{18}} (-34918884 + 13477464i + 90462372i^2 + 44620576i^3 - 333333i^4 + 402402i^5 - 491777i^6 + 609444i^7 - 767448i^8 + 984504i^9 - 1290708i^{10} + 1736448i^{11} - 2410226i^{12} + 3476772i^{13} - 5265546i^{14} + 8498776i^{15} - 14965236i^{16} + 29930472i^{17}) + (3i^2 + 2i^3 - 9i^4 - 12i^5 - 4i^6) \text{Log}20[i]$$

$$D3 [l = -3, i, k = 0, k' = 0]$$

$$= \frac{1}{77597520i^{20}} (-11639628 - 11027016i + 221084864i^2 + 232872640i^3 - 11666655i^4 + 12206194i^5 - 12786202i^6 + 13407768i^7 - 14069880i^8 + 14767560i^9 - 15488496i^{10} + 16206848i^{11} - 16871582i^{12} + 17383860i^{13} - 17551820i^{14} + 16997552i^{15} - 14965236i^{16} + 9976824i^{17}) + (3 + 6i - 54i^2 - 120i^3 - 60i^4) \text{Log}20[i]$$

$$D3 [l = -5, i, k = 0, k' = 0]$$

$$= \frac{1}{77597520i^{20}(1+i)^2} (34918884 + 265873608i + 453537084i^2 + 221661440i^3 + 45045i^4 - 42042i^5 + 35321i^6 - 22572i^7 + 38760i^9 - 104652i^{10} + 217056i^{11} - 411502i^{12} + 755820i^{13} - 1385670i^{14} + 2586584i^{15} - 4988412i^{16} + 9976824i^{17}) + (-9 - 60i - 60i^2) \text{Log}20[i]$$

$$D3 [l = -7, i, k = 0, k' = 0]$$

$$= \frac{1}{58198140i^{20}(1+i)^4} (11639628 + 34306272i + 33761728i^2 + 11083072i^3 + 3003i^4 - 4004i^5 + 5434i^6 - 7524i^7 + 10659i^8 - 15504i^9 + 23256i^{10} - 36176i^{11} + 58786i^{12} - 100776i^{13} + 184756i^{14} - 369512i^{15} + 3741309i^{16} + 7482618i^{17}) - 4\text{Log}20[i]$$

$$D3 [l = -9, i, k = 0, k' = 0]$$

$$= \frac{5 + 28i + 54i^2 + 36i^3}{280i^6(1+i)^6}$$

$$D3 [l = -11, i, k = 0, k' = 0]$$

$$= \frac{7 + 54i + 174i^2 + 296i^3 + 270i^4 + 108i^5}{840i^8(1+i)^8}$$

$$\begin{aligned} & \text{D3} [l = 3, i, k = 0, k' = 1] \\ &= \frac{-11 - 57i - 108i^2 - 78i^3}{2520} \end{aligned}$$

$$\begin{aligned} & \text{D3} [l = 1, i, k = 0, k' = 1] \\ &= \frac{1}{420}(-6 - 13i) \end{aligned}$$

$$\begin{aligned} & \text{D3} [l = -1, i, k = 0, k' = 1] \\ &= \frac{1}{232792560i^{18}} \\ & (11639628 - 612612i - 34238204i^2 - 22202180i^3 + 39039i^4 - 49049i^5 + 62491i^6 - \\ & 80883i^7 + 106590i^8 - 143412i^9 + 197676i^{10} - 280364i^{11} + 411502i^{12} - \\ & 629850i^{13} + 1016158i^{14} - 1755182i^{15} + 3325608i^{16} - 7205484i^{17}) + \\ & (-i^2 - i^3 + 3i^4 + 5i^5 + 2i^6) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3} [l = -3, i, k = 0, k' = 1] \\ &= \\ & \frac{1}{232792560i^{20}} (11639628 + 22666644i - 233337104i^2 - 336336000i^3 + 4099095i^4 - \\ & 4463459i^5 + 4874298i^6 - 5338278i^7 + 5862450i^8 - 6453540i^9 + 7116336i^{10} - \\ & 7850192i^{11} + 8641542i^{12} - 9447750i^{13} + 10161580i^{14} - 10531092i^{15} + \\ & 9976824i^{16} - 7205484i^{17}) + (-1 - 3i + 18i^2 + 50i^3 + 30i^4) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3} [l = -5, i, k = 0, k' = 1] \\ &= \frac{1}{232792560i^{20}(1+i)} \\ & (-34918884 - 289152864i - 335915580i^2 + 3643640i^3 - 3968965i^4 + \\ & 4336332i^5 - 4752033i^6 + 5222910i^7 - 5755860i^8 + 6356640i^9 - 7027188i^{10} + \\ & 7759752i^{11} - 8523970i^{12} + 9237800i^{13} - 9699690i^{14} + \\ & 9422556i^{15} - 7205484i^{16}) + (3 + 25i + 30i^2) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3} [l = -7, i, k = 0, k' = 1] \\ &= \\ & \frac{1}{116396280i^{20}(1+i)^3} (-11639628 - 22666644i - 11095084i^2 + 12012i^3 - 15015i^4 + \\ & 19019i^5 - 24453i^6 + 31977i^7 - 42636i^8 + 58140i^9 - 81396i^{10} + 117572i^{11} - \\ & 176358i^{12} + 277134i^{13} - 461890i^{14} + 831402i^{15} - 3602742i^{16}) + 2\text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3} [l = -9, i, k = 0, k' = 1] \\ &= \frac{-5 - 22i - 26i^2}{840i^6(1+i)^5} \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -11, i, k = 0, k' = 1] \\ &= \frac{-7 - 46i - 120i^2 - 150i^3 - 78i^4}{2520i^8(1+i)^7} \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = 3, i, k = 1, k' = 0] \\ &= \frac{16 + 75i + 126i^2 + 78i^3}{2520} \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = 1, i, k = 1, k' = 0] \\ &= \frac{1}{420}(7 + 13i) \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -1, i, k = 1, k' = 0] \\ &= \frac{1}{232792560i^{17}} \\ & (34918884 + 56360304i + 22258236i^2 - 104104i^3 + 125125i^4 - 152152i^5 + \\ & 187473i^6 - 234498i^7 + 298452i^8 - 387600i^9 + 515508i^{10} - 705432i^{11} + \\ & 999362i^{12} - 1478048i^{13} + 2309450i^{14} - 3879876i^{15} + 7205484i^{16}) + \\ & (-3i^3 - 8i^4 - 7i^5 - 2i^6) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -3, i, k = 1, k' = 0] \\ &= \frac{1}{232792560i^{19}} \\ & (104756652 + 448431984i + 343062720i^2 - 10930920i^3 + 11386375i^4 - \\ & 11867856i^5 + 12373218i^6 - 12897390i^7 + 13430340i^8 - 13953600i^9 + \\ & 14434224i^{10} - 14814072i^{11} + 14990430i^{12} - 14780480i^{13} + 13856700i^{14} - \\ & 11639628i^{15} + 7205484i^{16}) + (-9i - 48i^2 - 70i^3 - 30i^4) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -5, i, k = 1, k' = 0] \\ &= \frac{1}{232792560i^{20}(1+i)^2} \\ & (93117024 + 495603108i + 735678944i^2 + 332552220i^3 + 13013i^5 - 32604i^6 + \\ & 62073i^7 - 106590i^8 + 174420i^9 - 279072i^{10} + 443156i^{11} - 705432i^{12} + \\ & 1133730i^{13} - 1847560i^{14} + 3048474i^{15} - 4988412i^{16} + \\ & 7205484i^{17}) + (-8 - 35i - 30i^2) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -7, i, k = 1, k' = 0] \\ &= \frac{1}{116396280i^{20}(1+i)^4} \\ & (11639628 + 34306272i + 33761728i^2 + 11083072i^3 + 3003i^4 - 4004i^5 + \\ & 5434i^6 - 7524i^7 + 10659i^8 - 15504i^9 + 23256i^{10} - 36176i^{11} + 58786i^{12} - \\ & 100776i^{13} + 184756i^{14} - 369512i^{15} + 831402i^{16} + 3602742i^{17}) - 2\text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -9, i, k = 1, k' = 0] \\ &= \frac{9 + 30i + 26i^2}{840i^5(1+i)^6} \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -11, i, k = 1, k' = 0] \\ &= \frac{9 + 56i + 138i^2 + 162i^3 + 78i^4}{2520i^7(1+i)^8} \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = 3, i, k = 1, k' = 1] \\ &= \frac{1}{840} (-1 - 5i - 9i^2 - 6i^3) \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = 1, i, k = 1, k' = 1] \\ &= \frac{1}{280} (-1 - 2i) \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -1, i, k = 1, k' = 1] \\ &= \frac{1}{232792560i^{17}} \\ & (-11639628 - 22666644i - 11095084i^2 + 12012i^3 - 15015i^4 + 19019i^5 - 24453i^6 + \\ & 31977i^7 - 42636i^8 + 58140i^9 - 81396i^{10} + 117572i^{11} - 176358i^{12} + 277134i^{13} - \\ & 461890i^{14} + 831402i^{15} - 1662804i^{16}) + (i^3 + 3i^4 + 3i^5 + i^6) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -3, i, k = 1, k' = 1] \\ &= \frac{1}{77597520i^{19}} \\ & (-11639628 - 57585528i - 55815760i^2 + 420420i^3 - 455455i^4 + 494494i^5 - \\ & 537966i^6 + 586245i^7 - 639540i^8 + 697680i^9 - 759696i^{10} + 823004i^{11} - \\ & 881790i^{12} + 923780i^{13} - 923780i^{14} + 831402i^{15} - 554268i^{16}) + \\ & (3i + 18i^2 + 30i^3 + 15i^4) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned} & \text{D3 } [l = -5, i, k = 1, k' = 1] \\ &= \\ & \frac{1}{77597520i^{20}(1+i)} (-11639628 - 57585528i - 55815760i^2 + 420420i^3 - 455455i^4 + \\ & 494494i^5 - 537966i^6 + 586245i^7 - 639540i^8 + 697680i^9 - \\ & 759696i^{10} + 823004i^{11} - 881790i^{12} + 923780i^{13} - 923780i^{14} + \\ & 831402i^{15} - 554268i^{16}) + (3 + 15i + 15i^2) \text{Log}20[i] \end{aligned}$$

$$\begin{aligned}
& D3 [l = -7, i, k = 1, k' = 1] \\
& = \\
& \frac{1}{232792560i^{20}(1+i)^3} (-11639628 - 22666644i - 11095084i^2 + 12012i^3 - 15015i^4 + \\
& 19019i^5 - 24453i^6 + 31977i^7 - 42636i^8 + 58140i^9 - 81396i^{10} + 117572i^{11} - \\
& 176358i^{12} + 277134i^{13} - 461890i^{14} + 831402i^{15} - 1662804i^{16}) + \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& D3 [l = -9, i, k = 1, k' = 1] \\
& = \frac{-1 - 2i}{280i^5(1+i)^5}
\end{aligned}$$

$$\begin{aligned}
& D3 [l = -11, i, k = 1, k' = 1] \\
& = \frac{-1 - 5i - 9i^2 - 6i^3}{840i^7(1+i)^7}
\end{aligned}$$

S-22.4 Analytic formulas of the integrals Q

Case 1: $i_1 = i_2 = i_3 = i_4 = 0$

$$\begin{aligned}
& Q1 [l, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{14419218 + 11762731l + 3970469l^2 + 692106l^3 + 61820l^4 + 2248l^5}{12932920(3+l)(4+l)(5+l)(6+l)(9+2l)(11+2l)}
\end{aligned}$$

$$\begin{aligned}
& Q1 [l, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = (78116973 + 87228356l + \\
& 40546448l^2 + 10131560l^3 + 1441420l^4 + 110608l^5 + 3568l^6) / \\
& (38798760(3+l)(4+l)(5+l)(6+l)(7+2l)(9+2l)(11+2l))
\end{aligned}$$

$$\begin{aligned}
& Q1 [l, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{10103280 + 8108438l + 2677539l^2 + 456697l^3 + 39984l^4 + 1428l^5}{58198140(4+l)(5+l)(6+l)(7+2l)(9+2l)(11+2l)}
\end{aligned}$$

$$\begin{aligned}
& Q1 [l, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{5853837 + 4916959l + 1674971l^2 + 292854l^3 + 26180l^4 + 952l^5}{77597520(3+l)(4+l)(5+l)(6+l)(9+2l)(11+2l)}
\end{aligned}$$

$$\begin{aligned}
& Q1 [l, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1770714 + 1443507l + 479012l^2 + 81836l^3 + 7168l^4 + 256l^5}{38798760(4+l)(5+l)(6+l)(7+2l)(9+2l)(11+2l)}
\end{aligned}$$

$$\begin{aligned}
& Q1 [l, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{15378 + 8387l + 1870l^2 + 196l^3 + 8l^4}{8953560(11880 + 12126l + 4925l^2 + 995l^3 + 100l^4 + 4l^5)}
\end{aligned}$$

Case 2: $i_1 = i_2 = i_3 = i_4 = i > 0$

$$\begin{aligned} & \text{Q2 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\ &= \frac{1}{12221609400} (-3256159i + 143605800i^2 - 213050728i^3 + 1923477920i^4 - \\ & 1176239232i^5 + 7119018192i^6 - 2184761664i^7 + 6744333024i^8) \end{aligned}$$

$$\begin{aligned} & \text{Q2 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\ &= \frac{1}{678978300} (-845655i + 14578928i^2 - 59452806i^3 + 229265400i^4 - \\ & 349081376i^5 + 638886248i^6 - 364126944i^7 + 374685168i^8) \end{aligned}$$

$$\begin{aligned} & \text{Q2 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\ &= \frac{1}{291281690700i^{19}} \\ & (-33693660 + 453332880i - 2775420648i^2 + 10144278144i^3 - 24151042916i^4 + \\ & 37022457472i^5 - 27718294989i^6 - 26190987284i^7 + 124496397157i^8 - \\ & 230717277012i^9 + 288930949056i^{10} - 265198213020i^{11} + 177727185372i^{12} - \\ & 81592834868i^{13} + 20742015240i^{14} + 1819784340i^{15} - 5562470017i^{16} + \\ & 4743124204i^{17} - 8261762340i^{18} + 18450573960i^{19} - 45620475472i^{20} + \\ & 112909934280i^{21} - 232712695358i^{22} + 395038258472i^{23} - 468442534560i^{24} + \\ & 482906734024i^{25} - 260350764960i^{26} + 160739937072i^{27}) + \\ & \frac{1}{10010} ((11 - 148i + 852i^2 - 2540i^3 + 2917i^4 + 6660i^5 - 35292i^6 + \\ & 69360i^7 - 56610i^8 - 57256i^9 + 252824i^{10} - 419016i^{11} + 445978i^{12} - \\ & 331160i^{13} + 170136i^{14} - 54672i^{15} + 6375i^{16} + 2556i^{17} - \\ & 940i^{18} - 172i^{19} + 177i^{20} - 44i^{21} + 4i^{22}) \text{Log}_{20}[-i]) + \frac{1}{10010} \\ & ((-11 + 148i - 852i^2 + 2628i^3 - 4101i^4 + 420i^5 + 11068i^6 - 20048i^7 + 8898i^8 + \\ & 19400i^9 - 33592i^{10} + 14040i^{11} + 16198i^{12} - 23424i^{13} + 8328i^{14} + 4816i^{15} - \\ & 6375i^{16} + 2556i^{17} + 940i^{18} - 172i^{19} - 177i^{20} - 44i^{21} - 4i^{22}) \text{Log}_{20}[i]) \end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{5401951354800i^{19}} \\
& \quad (-1648538892 + 25604731152i - 169087318400i^2 + 576085910400i^3 - \\
& \quad 724222295797i^4 - 2469914298852i^5 + 15789614925942i^6 - 45406087414248i^7 + \\
& \quad 86931950486760i^8 - 121064070372624i^9 + 126122854880384i^{10} - \\
& \quad 98209797669104i^{11} + 55349470247544i^{12} - \\
& \quad 20094055628080i^{13} + 1737086057872i^{14} + 4243160439504i^{15} - \\
& \quad 5701174528452i^{16} + 6773181363312i^{17} - 8783170203600i^{18} + \\
& \quad 11695854423968i^{19} - 15546058075990i^{20} + 19988890374960i^{21} - \\
& \quad 23573096744288i^{22} + 24465386832640i^{23} - 20685659065344i^{24} + \\
& \quad 14764843730208i^{25} - 6759652588416i^{26} + 2980995196608i^{27}) + \\
& \quad \frac{1}{92820} ((-299 + 5242i - 40257i^2 + 170504i^3 - 371290i^4 - 79488i^5 + 3625284i^6 - \\
& \quad 14409744i^7 + 35123598i^8 - 61830020i^9 + 82843618i^{10} - 86115744i^{11} + \\
& \quad 69549584i^{12} - 43017208i^{13} + 19617660i^{14} - 6006576i^{15} + 874293i^{16} + \\
& \quad 130842i^{17} - 73769i^{18} - 2600i^{19} + 8370i^{20} - 2200i^{21} + 200i^{22}) \text{Log}20[-i]) + \\
& \quad \frac{1}{92820} ((299 - 4046i + 21681i^2 - 47824i^3 - 46790i^4 + 605808i^5 - 1836612i^6 + \\
& \quad 2959632i^7 - 2173518i^8 - 1314100i^9 + 5238142i^{10} - 5951088i^{11} + \\
& \quad 2697968i^{12} + 1380808i^{13} - 3069180i^{14} + 2267664i^{15} - 874293i^{16} + \\
& \quad 130842i^{17} + 73769i^{18} - 2600i^{19} - 8370i^{20} - 2200i^{21} - 200i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{1315859945400i^{19}} \\
& \quad (1911349440 - 33620146560i + 278152094220i^2 - 1436740865560i^3 + \\
& \quad 5184567360973i^4 - 13849928654562i^5 + 28289625139347i^6 - \\
& \quad 44918290892244i^7 + 55599937073070i^8 - 52786943834808i^9 + \\
& \quad 36069899471616i^{10} - 13038761309256i^{11} - 6871993753288i^{12} + \\
& \quad 18975492849240i^{13} - 24320843570360i^{14} + 26203055971608i^{15} - \\
& \quad 27010865637522i^{16} + 27576524122056i^{17} - 27923405594760i^{18} + \\
& \quad 27773580000816i^{19} - 26756522900277i^{20} + 24456896824152i^{21} - \\
& \quad 20621757158784i^{22} + 15566587890880i^{23} - 10037608858368i^{24} + \\
& \quad 5483286858192i^{25} - 2117034052416i^{26} + 726139855584i^{27}) + \\
& \quad \frac{1}{45220} ((117 - 2838i + 31543i^2 - 215576i^3 + 1021630i^4 - 3580512i^5 + 9647364i^6 - \\
& \quad 20480784i^7 + 34789038i^8 - 47694180i^9 + 52932594i^{10} - 47431904i^{11} + \\
& \quad 33995104i^{12} - 19113848i^{13} + 8120220i^{14} - 2403120i^{15} + 384693i^{16} + \\
& \quad 19722i^{17} - 21489i^{18} + 1080i^{19} + 1546i^{20} - 440i^{21} + 40i^{22}) \text{Log}20[-i]) + \\
& \quad \frac{1}{45220} ((-117 + 1278i - 4103i^2 - 11664i^3 + 154850i^4 - 683088i^5 + \\
& \quad 1825596i^6 - 3240336i^7 + 3660882i^8 - 1686060i^9 - 2544594i^{10} + 6785584i^{11} - \\
& \quad 8465184i^{12} + 7020728i^{13} - 4089180i^{14} + 1627920i^{15} - 384693i^{16} + \\
& \quad 19722i^{17} + 21489i^{18} + 1080i^{19} - 1546i^{20} - 440i^{21} - 40i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{21711689099100i^{19}(1+i)^2} \\
& \quad (-1510088580 + 26630243640i - 219848068440i^2 + 1125481036680i^3 - \\
& \quad 3985229876628i^4 + 10288325711664i^5 - 19815241401648i^6 + \\
& \quad 28412205544800i^7 - 29078473604040i^8 + 17817899661072i^9 + \\
& \quad 928917162544i^{10} - 16500003580368i^{11} + 20890780884600i^{12} - \\
& \quad 14782685702400i^{13} + 4782857363328i^{14} + 3475433291616i^{15} - \\
& \quad 8713896055249i^{16} + 12551269182606i^{17} - 17069488272837i^{18} + \\
& \quad 24068457738628i^{19} - 35535372202538i^{20} + 53203724565668i^{21} - \\
& \quad 76057920652296i^{22} + 99214286241532i^{23} - 109287541297858i^{24} + \\
& \quad 107237570860112i^{25} - 76062684884208i^{26} + \\
& \quad 55982149334232i^{27} - 18730904822784i^{28} + 11981307617136i^{29}) + \\
& \quad \frac{1}{746130} ((493 - 9680i + 90090i^2 - 528220i^3 + 2187185i^4 - 6794172i^5 + \\
& \quad 16414860i^6 - 31550640i^7 + 48924810i^8 - 61680080i^9 + 63371308i^{10} - \\
& \quad 52907400i^{11} + 35565530i^{12} - 18901960i^{13} + 7674480i^{14} - 2217072i^{15} + \\
& \quad 373065i^{16} - 14630i^{18} + 1540i^{19} + 693i^{20} - 220i^{21} + 20i^{22}) \text{Log}20[-i] + \\
& \quad \frac{1}{746130} ((-493 + 9680i - 90090i^2 + 528220i^3 - 2187185i^4 + 6794172i^5 - \\
& \quad 16414860i^6 + 31550640i^7 - 48924810i^8 + 61680080i^9 - 63371308i^{10} + \\
& \quad 52907400i^{11} - 35565530i^{12} + 18901960i^{13} - 7674480i^{14} + 2217072i^{15} - \\
& \quad 373065i^{16} + 14630i^{18} + 1540i^{19} - 693i^{20} - 220i^{21} - 20i^{22}) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \\
& \quad \frac{1}{3603807900i^5(1+i)^4} (-10336 + 182648i - 1427524i^2 + 6276264i^3 - 15489584i^4 + \\
& \quad 11900272i^5 + 57584599i^6 - 228225588i^7 + 403488036i^8 + 95596004i^9 - \\
& \quad 1043924851i^{10} + 4814188880i^{11} - 4811068194i^{12} + 10339640248i^{13} - \\
& \quad 3813464768i^{14} + 7659893320i^{15} - 420065376i^{16} + 1988713584i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{156165009000i^7(1+i)^6} \\
& \quad (-94962 + 1680892i - 13260442i^2 + 59739496i^3 - 158187958i^4 + 188656548i^5 + \\
& \quad 241240302i^6 - 1421582432i^7 + 2411193893i^8 - 356916474i^9 - \\
& \quad 3989251069i^{10} + 18158657180i^{11} + 11873717815i^{12} + 75835847710i^{13} + \\
& \quad 122508462585i^{14} + 333133796760i^{15} + 243083407400i^{16} + 632878397840i^{17} + \\
& \quad 239176672480i^{18} + 438554076880i^{19} + 98319546240i^{20} + 86177588640i^{21})
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \frac{1}{146659312800} (-924835 + 55124472i - 120929244i^2 + 1701669944i^3 - \\
& 1353498345i^4 + 10439083512i^5 - 3367352520i^6 + 14526255744i^7)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \frac{1}{16295479200} (-522807 + 12149968i - 68300526i^2 + 361886616i^3 - \\
& 681036475i^4 + 1689039352i^5 - 1122450840i^6 + 1614028416i^7)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{6990760576800i^{19}} (116396280 - 1907673768i + 14179733568i^2 - 61655818224i^3 + \\
& 166158624632i^4 - 250170951030i^5 + 22049152818i^6 + 895288088948i^7 - \\
& 2471076246894i^8 + 3929473346202i^9 - 4263922743120i^{10} + \\
& 3241870034520i^{11} - 1658791287744i^{12} + 489085041792i^{13} - 628456176i^{14} - \\
& 76858798752i^{15} - 980566288i^{16} + 9319929528i^{17} - 6969923441i^{19} + \\
& 51968167680i^{20} - 188010992598i^{21} + 496078358776i^{22} - 815655694425i^{23} + \\
& 1178601017880i^{24} - 802552350600i^{25} + 692418190464i^{26}) + \\
& \frac{1}{120120} ((-19 + 186i - 402i^2 - 3056i^3 + 25401i^4 - 89226i^5 + 172176i^6 - \\
& 122400i^7 - 314262i^8 + 1235492i^9 - 2304588i^{10} + 2885376i^{11} - \\
& 2598518i^{12} + 1687692i^{13} - 750312i^{14} + 187680i^{15} + 2601i^{16} - \\
& 17406i^{17} + 2126i^{18} + 2544i^{19} - 1347i^{20} + 286i^{21} - 24i^{22}) \text{Log}20[-i]) + \\
& \frac{1}{120120} ((19 - 186i + 666i^2 - 648i^3 - 2409i^4 + 8274i^5 - 7112i^6 - \\
& 10560i^7 + 29142i^8 - 16900i^9 - 22308i^{10} + 40560i^{11} - 13650i^{12} - \\
& 19740i^{13} + 18456i^{14} - 9216i^{15} + 2601i^{16} + 17406i^{17} + \\
& 2126i^{18} - 2544i^{19} - 1347i^{20} - 286i^{21} - 24i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2} [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{64823416257600i^{20}} \\
& \quad (-3480248772 + 56965564656i - 367879768256i^2 + 981993444432i^3 + \\
& \quad 1311839423895i^4 - 21194455622340i^5 + 90954902631450i^6 - 243535587603660 \\
& \quad i^7 + 465770121728175i^8 - 667510216767900i^9 + 729355002216228i^{10} - \\
& \quad 606650178105344i^{11} + 375791991555864i^{12} - 163374440300448i^{13} + \\
& \quad 41727950060560i^{14} - 717764562144i^{15} - 3818927463660i^{16} - \\
& \quad 700124329632i^{17} + 769342654080i^{18} - 1197741610858i^{20} + 3944867853264i^{21} - \\
& \quad 8368708674144i^{22} + 13804422584368i^{23} - 16989663968550i^{24} + \\
& \quad 17243616692016i^{25} - 10418588696880i^{26} + 6420605038848i^{27}) + \\
& \quad \frac{1}{556920} \left((563 - 8334i + 47364i^2 - 72908i^3 - 656295i^4 + 5338566i^5 - \right. \\
& \quad 21591768i^6 + 59439888i^7 - 121555746i^8 + 191651540i^9 - \\
& \quad 236818296i^{10} + 230177688i^{11} - 174580718i^{12} + 100924716i^{13} - \\
& \quad 42142320i^{14} + 11005392i^{15} - 755361i^{16} - 560934i^{17} + 135188i^{18} + \\
& \quad \left. 47700i^{19} - 32475i^{20} + 7150i^{21} - 600i^{22}) \text{Log20}[-i] \right) + \\
& \quad \frac{1}{556920} \left((35 - 2010i + 21840i^2 - 111820i^3 + 319725i^4 - 481950i^5 + \right. \\
& \quad 85680i^6 + 1187280i^7 - 2467890i^8 + 2011100i^9 + 583440i^{10} - 3155880i^{11} + \\
& \quad 3264170i^{12} - 1135260i^{13} - 930240i^{14} + 1405968i^{15} - 755361i^{16} + \\
& \quad \left. 560934i^{17} + 135188i^{18} - 47700i^{19} - 32475i^{20} - 7150i^{21} - 600i^{22}) \text{Log20}[i] \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \frac{1}{15790319344800i^{20}} \\
& (1815781968 - 35369766432i + 324852419892i^2 - 1868727724864i^3 + \\
& 7542188213560i^4 - 22666698552498i^5 + 52524767803365i^6 - \\
& 95839906888110i^7 + 139335714329955i^8 - 162157512588870i^9 + \\
& 150787562943954i^{10} - 111076595628912i^{11} + 63855197679872i^{12} - \\
& 28296093204144i^{13} + 10236831028360i^{14} - 4382867202192i^{15} + \\
& 3266646278310i^{16} - 2850506199216i^{17} + 1642605466320i^{18} - \\
& 2123046851487i^{20} + 4625414530152i^{21} - 6977593192392i^{22} + \\
& 8381781009784i^{23} - 7993871261505i^{24} + 6251319397752i^{25} - \\
& 3262964591880i^{26} + 1563993535104i^{27}) + \frac{1}{271320} \\
& ((-417 + 9386i - 98596i^2 + 644372i^3 - 2943195i^4 + 9995406i^5 - 26194008i^6 + \\
& 54217488i^7 - 89917386i^8 + 120407940i^9 - 130437736i^{10} + 113843288i^{11} - \\
& 79117558i^{12} + 42756156i^{13} - 17131920i^{14} + 4542672i^{15} - 493221i^{16} - \\
& 131214i^{17} + 48108i^{18} + 5300i^{19} - 6175i^{20} + 1430i^{21} - 120i^{22}) \text{Log20}[-i] + \\
& \frac{1}{271320} ((-207 + 2990i - 19080i^2 + 68020i^3 - 131385i^4 + 40698i^5 + \\
& 542640i^6 - 1782960i^7 + 3110490i^8 - 3275220i^9 + 1478048i^{10} + 1511640i^{11} - \\
& 3821090i^{12} + 4205460i^{13} - 3023280i^{14} + 1503888i^{15} - 493221i^{16} + \\
& 131214i^{17} + 48108i^{18} - 5300i^{19} - 6175i^{20} - 1430i^{21} - 120i^{22}) \text{Log20}[i]
\end{aligned}$$

$$Q2 [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

=

$$\begin{aligned} & \frac{1}{1042161076756800i^{20}(1+i)^2} (17215009812 - 292606770456i + 2313819800292i^2 - \\ & 11252648206800i^3 + 37419575238045i^4 - 89192760110454i^5 + \\ & 154233732803007i^6 - 187999409030664i^7 + 140731015727115i^8 - \\ & 14339386674390i^9 - 117513970085715i^{10} + 169377056097340i^{11} - \\ & 124245143300740i^{12} + 39063892534480i^{13} + 23111087535800i^{14} - \\ & 45857674848128i^{15} + 49276109520968i^{16} - 54413879664144i^{17} + \\ & 68576020983624i^{18} - 95019280644288i^{19} + 134907442133978i^{20} - \\ & 189439649614892i^{21} + 242211693580502i^{22} - 254189731953784i^{23} + \\ & 204746382346198i^{24} - 64357467125644i^{25} - 13991010584166i^{26} + \\ & 158589175819536i^{27} - 56765330444592i^{28} + 103223573316864i^{29}) + \\ & \frac{1}{1790712} ((-475 + 9306i - 86394i^2 + 505120i^3 - 2084775i^4 + 6451830i^5 - \\ & 15519504i^6 + 29674656i^7 - 45727110i^8 + 57203300i^9 - 58198140i^{10} + \\ & 47969376i^{11} - 31685654i^{12} + 16414860i^{13} - 6395400i^{14} + 1705440i^{15} - \\ & 223839i^{16} - 26334i^{17} + 14630i^{18} - 1155i^{20} + 286i^{21} - 24i^{22}) \text{Log}20[-i]) + \\ & \frac{1}{8953560} ((-583 + 11550i - 108570i^2 + 643720i^3 - 2699235i^4 + 8505882i^5 - \\ & 20891640i^6 + 40930560i^7 - 64913310i^8 + 84063980i^9 - 89237148i^{10} + \\ & 77597520i^{11} - 54964910i^{12} + 31337460i^{13} - 14069880i^{14} + 4775232i^{15} - \\ & 1119195i^{16} + 131670i^{17} + 73150i^{18} - 5775i^{20} - 1430i^{21} - 120i^{22}) \text{Log}20[i]) \end{aligned}$$

$$Q2 [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

=

$$\begin{aligned} & \frac{1}{86491389600i^6(1+i)^4} \\ & (103360 - 1788536i + 13877304i^2 - 62339272i^3 + 170543048i^4 - 245983608i^5 - \\ & 57866199i^6 + 1121847948i^7 - 2471506344i^8 + 2532485932i^9 + \\ & 1831605598i^{10} - 5217050532i^{11} + 16713822896i^{12} - 2473823788i^{13} + \\ & 18505736451i^{14} + 13270392984i^{15} + 8450695512i^{16} + 8566766208i^{17}) \end{aligned}$$

$$Q2 [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

=

$$\begin{aligned} & \frac{1}{1873980108000i^8(1+i)^6} \\ & (664734 - 11590532i + 90298526i^2 - 404008400i^3 + 10794444036i^4 - \\ & 1411701216i^5 - 939988140i^6 + 7770266296i^7 - 13874847529i^8 + 5513593914i^9 + \\ & 24082479029i^{10} - 44325650260i^{11} + 48439885750i^{12} + 102963921520i^{13} + \\ & 106306307970i^{14} + 419529266700i^{15} + 743613310385i^{16} + 754376463410i^{17} + \\ & 1094130960475i^{18} + 748966521400i^{19} + 468270374040i^{20} + 185613267840i^{21}) \end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{73329656400} (873392 - 3004297i + 43316884i^2 - 41124974i^3 + \\
& 543182640i^4 - 223709895i^5 + 1222160940i^6 + 180373536i^7)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{24443218800} (578816 - 5391891i + 32097156i^2 - \\
& 62428898i^3 + 181060880i^4 - 37621311i^5 + 190113924i^6 + 180373536i^7)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{3495380288400i^{18}} (104756652 - 1389404016i + 7932564640i^2 - 24227291088i^3 + \\
& 34923449561i^4 + 21927565660i^5 - 224013019780i^6 + 547969052708i^7 - \\
& 804692328845i^8 + 788731063904i^9 - 508791350864i^{10} + \\
& 186192650504i^{11} - 711687608i^{12} - 37156456000i^{13} - 1517066096i^{14} + \\
& 2179345376i^{15} - 3810323764i^{16} + 8552211148i^{17} - 12467334880i^{18} + \\
& 23878004865i^{19} - 41342665364i^{20} + 63553431942i^{21} - 68797961232i^{22} + \\
& 79735812585i^{23} - 34953802884i^{24} + 42989026080i^{25}) + \\
& \frac{1}{60060} ((19i - 290i^2 + 2002i^3 - 8100i^4 + 20343i^5 - 28050i^6 - 2856i^7 + \\
& 113424i^8 - 299370i^9 + 476476i^{10} - 531284i^{11} + 426088i^{12} - \\
& 237354i^{13} + 78540i^{14} - 2856i^{15} - 10608i^{16} + 3927i^{17} + \\
& 678i^{18} - 1070i^{19} + 412i^{20} - 77i^{21} + 6i^{22}) \text{Log}20[-i]) + \\
& \frac{1}{60060} ((-19i + 214i^2 - 994i^3 + 2260i^4 - 1639i^5 - 4082i^6 + 11368i^7 - 8272i^8 - \\
& 8534i^9 + 20748i^{10} - 10764i^{11} - 9672i^{12} + 14898i^{13} - 6468i^{14} - 2856i^{15} + \\
& 10608i^{16} + 3927i^{17} - 678i^{18} - 1070i^{19} - 412i^{20} - 77i^{21} - 6i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{32411708128800i^{20}} \\
& (1024287264 - 15748416684i + 92577789304i^2 - 187909746024i^3 - \\
& 705795690600i^4 + 6465264859053i^5 - 24371722611522i^6 + 59498951040672i^7 - \\
& 104133933028488i^8 + 135458417960745i^9 - 131974051530090i^{10} + \\
& 94806950871952i^{11} - 47697434364672i^{12} + \\
& 14497576557000i^{13} - 1231421200400i^{14} - 261341795328i^{15} - \\
& 1791303477600i^{16} + 1968649212348i^{17} - 2720571167496i^{18} + \\
& 3481671808680i^{19} - 4184896331616i^{20} + 4972303814322i^{21} - \\
& 5433064634712i^{22} + 5227387237436i^{23} - 4150070564640i^{24} + \\
& 2762390058246i^{25} - 1188429298056i^{26} + 558075720384i^{27}) + \\
& \frac{1}{278460} ((-88 + 1089i - 3519i^2 - 21782i^3 + 279195i^4 - 1489401i^5 + 5165178i^6 - \\
& 13007448i^7 + 24934716i^8 - 37217590i^9 + 43626726i^{10} - 40042548i^{11} + \\
& 28291978i^{12} - 14753586i^{13} + 5085720i^{14} - 697272i^{15} - 298044i^{16} + \\
& 167589i^{17} - 6223i^{18} - 22950i^{19} + 10035i^{20} - 1925i^{21} + 150i^{22}) \text{Log}_{20}[-i]) + \\
& \frac{1}{278460} ((-88 + 1617i - 11637i^2 + 42518i^3 - 72555i^4 - 27741i^5 + \\
& 427074i^6 - 972264i^7 + 983076i^8 + 69530i^9 - 1550094i^{10} + 2023476i^{11} - \\
& 986986i^{12} - 459306i^{13} + 1040400i^{14} - 697272i^{15} + 298044i^{16} + \\
& 167589i^{17} + 6223i^{18} - 22950i^{19} - 10035i^{20} - 1925i^{21} - 150i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{23685479017200i^{20}} \\
& \quad (-1629547920 + 28447250832i - 233954412692i^2 + 1204157838884i^3 - \\
& \quad 4346133251460i^4 + 11682918743496i^5 - 24258955671951i^6 + \\
& \quad 39873015184431i^7 - 52878669564732i^8 + 57749349893235i^9 - \\
& \quad 53620469219043i^{10} + 44895359883520i^{11} - 37204213677840i^{12} + \\
& \quad 33260585204000i^{13} - 32412198249000i^{14} + 32849436863160i^{15} - \\
& \quad 33411704547312i^{16} + 33392611098054i^{17} - 33229833545844i^{18} + \\
& \quad 32224714985580i^{19} - 30091837151376i^{20} + 26558628196977i^{21} - \\
& \quad 21514291119412i^{22} + 15468883407054i^{23} - 9449127607920i^{24} + \\
& \quad 4759270472115i^{25} - 1710617929020i^{26} + 524345869152i^{27}) + \frac{1}{406980} \\
& \quad ((280 - 6113i + 62563i^2 - 399546i^3 + 1786665i^4 - 5946639i^5 + 15277254i^6 - \\
& \quad 30984744i^7 + 50283348i^8 - 65720810i^9 + 69191122i^{10} - 58265324i^{11} + \\
& \quad 38572014i^{12} - 19362558i^{13} + 6783000i^{14} - 1248072i^{15} - 143412i^{16} + \\
& \quad 148827i^{17} - 21869i^{18} - 10730i^{19} + 5809i^{20} - 1155i^{21} + 90i^{22}) \text{Log2}[-i] + \\
& \quad \frac{1}{406980} ((280 - 3663i + 19793i^2 - 48426i^3 - 12825i^4 + 497211i^5 - \\
& \quad 1815906i^6 + 3744216i^7 - 4794612i^8 + 3058810i^9 + 1587222i^{10} - 6533644i^{11} + \\
& \quad 8591154i^{12} - 7017498i^{13} + 3798480i^{14} - 1248072i^{15} + 143412i^{16} + \\
& \quad 148827i^{17} + 21869i^{18} - 10730i^{19} - 5809i^{20} - 1155i^{21} - 90i^{22}) \text{Log2}[i]
\end{aligned}$$

$$Q2 [l = 5, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\begin{aligned} & \frac{1}{146659312800i^{20}(1+i)^2} (-1467648 + 25713324i - 210665728i^2 + 1068749500i^3 - \\ & 3742921000i^4 + 9530122147i^5 - 18022828096i^6 + 25171379857i^7 - \\ & 24627379530i^8 + 13357928025i^9 + 3739852116i^{10} - 16706659333i^{11} + \\ & 19017255166i^{12} - 12427051000i^{13} + 3461604640i^{14} + 3098346056i^{15} - \\ & 6688242704i^{16} + 9020642904i^{17} - 11804426088i^{18} + 15965201616i^{19} - \\ & 22837452456i^{20} + 33145392174i^{21} - 46232877084i^{22} + \\ & 58540567658i^{23} - 63720811616i^{24} + 58820556410i^{25} - \\ & 42103413660i^{26} + 26235326502i^{27} - 9173817576i^{28} + 3968217792i^{29}) + \\ & \frac{1}{4476780} ((448 - 8745i + 80850i^2 - 470470i^3 + 1931160i^4 - 5938317i^5 + \\ & 14176470i^6 - 26860680i^7 + 40930560i^8 - 50488130i^9 + 50438388i^{10} - \\ & 40562340i^{11} + 25865840i^{12} - 12684210i^{13} + 4476780i^{14} - 937992i^{15} + \\ & 65835i^{17} - 14630i^{18} - 2310i^{19} + 1848i^{20} - 385i^{21} + 30i^{22}) \text{Log}20[-i]) + \\ & \frac{1}{4476780} ((448 - 8745i + 80850i^2 - 470470i^3 + 1931160i^4 - 5938317i^5 + \\ & 14176470i^6 - 26860680i^7 + 40930560i^8 - 50488130i^9 + 50438388i^{10} - \\ & 40562340i^{11} + 25865840i^{12} - 12684210i^{13} + 4476780i^{14} - 937992i^{15} + \\ & 65835i^{17} + 14630i^{18} - 2310i^{19} - 1848i^{20} - 385i^{21} - 30i^{22}) \text{Log}20[i]) \end{aligned}$$

$$Q2 [l = 6, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\begin{aligned} & \frac{1}{43245694800i^6(1+i)^4} \\ & (-31620 + 555560i - 4392392i^2 + 20196136i^3 - 56911648i^4 + \\ & 85680408i^5 + 16321224i^6 - 408172929i^7 + 981765144i^8 - 991287252i^9 - \\ & 422348908i^{10} + 4040664610i^{11} - 6932409116i^{12} + 10432285076i^{13} - \\ & 7284854676i^{14} + 7135263021i^{15} - 1820313012i^{16} + 1382863776i^{17}) \end{aligned}$$

$$Q2 [l = 7, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\begin{aligned} & \frac{1}{2810970162000i^8(1+i)^6} \\ & (-614992 + 10830190i - 85414120i^2 + 388294450i^3 - 1062159660i^4 + \\ & 1463996208i^5 + 725259032i^6 - 7598562080i^7 + 14546372184i^8 - 7434599501i^9 - \\ & 21840865778i^{10} + 54025436807i^{11} - 33349208740i^{12} + 5813352360i^{13} + \\ & 120280932480i^{14} + 151486906060i^{15} + 29699470360i^{16} + 630111939095i^{17} - \\ & 86848475410i^{18} + 506496335055i^{19} - 30481038420i^{20} + 103714783200i^{21}) \end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{73329656400} (-1012536i + 51395760i^2 - 67211347i^3 + 584500800i^4 - \\
& 270843993i^5 + 1671672288i^6 - 430259256i^7 + 1037589696i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{8147739600} (-454500i + 8826944i^2 - 32697483i^3 + 126977760i^4 - \\
& 172361483i^5 + 300043744i^6 - 143419752i^7 + 115287744i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{6990760576800i^{19}} \\
& (-33693660 + 441080640i - 1477908432i^2 - 6103633536i^3 + 74417483140i^4 - \\
& 334108879104i^5 + 934209115455i^6 - 1837386194336i^7 + 2677106860131i^8 - \\
& 2965266252384i^9 + 2524501158408i^{10} - 1647181758816i^{11} + \\
& 804057453888i^{12} - 271170039584i^{13} + 40820349816i^{14} + 3149742240i^{15} + \\
& 55802552i^{16} + 7889385504i^{17} - 10033664316i^{18} + 27818207040i^{19} - \\
& 63210098952i^{20} + 144881221056i^{21} - 278017523498i^{22} + 443511951168i^{23} - \\
& 481226155410i^{24} + 453580414144i^{25} - 205090245360i^{26} + 98916884352i^{27}) + \\
& \frac{1}{240240} ((11 - 144i + 930i^2 - 4532i^3 + 20895i^4 - 89172i^5 + 314160i^6 - \\
& 864144i^7 + 1839366i^8 - 3045040i^9 + 3938220i^{10} - 3972696i^{11} + \\
& 3090022i^{12} - 1802136i^{13} + 740520i^{14} - 181968i^{15} + 10863i^{16} + \\
& 3168i^{17} + 4802i^{18} - 4500i^{19} + 1659i^{20} - 308i^{21} + 24i^{22}) \text{Log}20[-i]) + \\
& \frac{1}{240240} ((-11 + 144i - 930i^2 + 3564i^3 - 7839i^4 + 6636i^5 + 11728i^6 - \\
& 39696i^7 + 36858i^8 + 19472i^9 - 74412i^{10} + 53352i^{11} + 21658i^{12} - \\
& 58680i^{13} + 28248i^{14} + 14800i^{15} - 10863i^{16} + 3168i^{17} - \\
& 4802i^{18} - 4500i^{19} - 1659i^{20} - 308i^{21} - 24i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2} [l = 3, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{32411708128800i^{19}} \\
& (9094837752 - 141388399152i + 1042583461920i^2 - 4864780000080i^3 + \\
& 16168075400477i^4 - 40812194070648i^5 + 81307215062073i^6 - \\
& 130703251963152i^7 + 171177785581770i^8 - 182423855198016i^9 + \\
& 156332408202776i^{10} - 105090993210816i^{11} + 52821031376376i^{12} - \\
& 17688372886240i^{13} + 2103825207048i^{14} + 1849413184416i^{15} - \\
& 2259839793588i^{16} + 2816510624928i^{17} - 3444942072780i^{18} + \\
& 4473263093312i^{19} - 5593473437760i^{20} + 6706015973280i^{21} - \\
& 7331209556762i^{22} + 7027102417920i^{23} - 5409199139526i^{24} + \\
& 3467048325312i^{25} - 1331222138064i^{26} + 458614645632i^{27}) + \\
& \frac{1}{1113840} ((143 - 5544i + 79974i^2 - 651428i^3 + 3515055i^4 - 13632084i^5 + \\
& 39846912i^6 - 90402192i^7 + 162094014i^8 - 232010560i^9 + \\
& 265961124i^{10} - 243310392i^{11} + 175523062i^{12} - 97386744i^{13} + \\
& 39529080i^{14} - 10463568i^{15} + 1206099i^{16} + 106056i^{17} + 69158i^{18} - \\
& 101700i^{19} + 40635i^{20} - 7700i^{21} + 600i^{22}) \text{Log}20[-i] + \\
& \frac{1}{1113840} ((-143 - 1008i + 21978i^2 - 119252i^3 + 280785i^4 - 88956i^5 - \\
& 1253376i^6 + 3591216i^7 - 4442814i^8 + 1021360i^9 + 5179356i^{10} - 8385624i^{11} + \\
& 5293834i^{12} + 641784i^{13} - 3886200i^{14} + 3220752i^{15} - 1206099i^{16} + \\
& 106056i^{17} - 69158i^{18} - 101700i^{19} - 40635i^{20} - 7700i^{21} - 600i^{22}) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{15790319344800i^{19}} \\
& (4135131000 - 72471999600i + 597408591780i^2 - 3074846494720i^3 + \\
& 11059358899589i^4 - 29465289669816i^5 + 60107647908066i^6 - \\
& 95598467199312i^7 + 119328586525125i^8 - 116188793626944i^9 + \\
& 85741115450568i^{10} - 43397485502688i^{11} + 7622113609496i^{12} + \\
& 12993765809760i^{13} - 21021487860480i^{14} + 22930449581664i^{15} - \\
& 23089480028316i^{16} + 22934443660128i^{17} - 22393662461820i^{18} + \\
& 21311980913088i^{19} - 19433387000736i^{20} + 16648294332576i^{21} - \\
& 13036937160942i^{22} + 9056892299520i^{23} - 5297035695714i^{24} + \\
& 2575146864576i^{25} - 833842438128i^{26} + 223427647872i^{27}) + \frac{1}{542640} \\
& ((531 - 11304i + 113374i^2 - 712468i^3 + 3146115i^4 - 10373316i^5 + 26480832i^6 - \\
& 53535312i^7 + 86905734i^8 - 114109440i^9 + 121384692i^{10} - 104168792i^{11} + \\
& 71290622i^{12} - 38039064i^{13} + 15155160i^{14} - 4108560i^{15} + 572679i^{16} + \\
& 18696i^{17} + 798i^{18} - 17460i^{19} + 7903i^{20} - 1540i^{21} + 120i^{22}) \text{Log}20[-i] + \\
& \frac{1}{542640} ((-531 + 7344i - 43934i^2 + 139428i^3 - 191235i^4 - 285684i^5 + \\
& 2046528i^6 - 5069808i^7 + 7358586i^8 - 5814000i^9 - 453492i^{10} + 8095672i^{11} - \\
& 12168702i^{12} + 10829544i^{13} - 6472920i^{14} + 2558160i^{15} - 572679i^{16} + \\
& 18696i^{17} - 798i^{18} - 17460i^{19} - 7903i^{20} - 1540i^{21} - 120i^{22}) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{260540269189200i^{19}(1+i)^2} \\
& (-3098285190 + 54452017620i - 447779552220i^2 + 2281944204540i^3 - \\
& 8036690515854i^4 + 20611535256312i^5 - 39366314300544i^6 + \\
& 55799994964560i^7 - 56067373139820i^8 + 32859881249496i^9 + \\
& 4184902608152i^{10} - 33735751230104i^{11} + 40731228243860i^{12} - \\
& 27619791240800i^{13} + 7893894690704i^{14} + 7741507259728i^{15} - \\
& 17408274195312i^{16} + 24554327704368i^{17} - 32862175311966i^{18} + \\
& 44522911460804i^{19} - 59956238288834i^{20} + 77838538390664i^{21} - \\
& 93810867664723i^{22} + 102387762022546i^{23} - \\
& 96060658413874i^{24} + 80270969598666i^{25} - 50228136251139i^{26} + \\
& 30820070264016i^{27} - 9442710122472i^{28} + 3686556189888i^{29}) + \\
& \frac{1}{17907120} ((2023 - 39600i + 367290i^2 - 2145220i^3 + 8843835i^4 - \\
& 27334692i^5 + 65659440i^6 - 125349840i^7 + 192821310i^8 - \\
& 240751280i^9 + 244432188i^{10} - 201048120i^{11} + 132562430i^{12} - \\
& 68643960i^{13} + 26860680i^{14} - 7333392i^{15} + 1119195i^{16} - \\
& 14630i^{18} - 13860i^{19} + 7623i^{20} - 1540i^{21} + 120i^{22}) \text{Log}20[-i] + \\
& \frac{1}{17907120} ((-2023 + 39600i - 367290i^2 + 2145220i^3 - 8843835i^4 + 27334692i^5 - \\
& 65659440i^6 + 125349840i^7 - 192821310i^8 + 240751280i^9 - 244432188i^{10} + \\
& 201048120i^{11} - 132562430i^{12} + 68643960i^{13} - 26860680i^{14} + 7333392i^{15} - \\
& 1119195i^{16} + 14630i^{18} - 13860i^{19} - 7623i^{20} - 1540i^{21} - 120i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{43245694800i^5(1+i)^4} \\
& (56202 - 994296i + 8195938i^2 - 41592608i^3 + 144097338i^4 - 354040504i^5 + \\
& 605932262i^6 - 603992304i^7 - 99716517i^8 + 2003546652i^9 - \\
& 4301152743i^{10} + 7614546520i^{11} - 7273215227i^{12} + 8929383564i^{13} - \\
& 4160754349i^{14} + 4203031040i^{15} - 851006808i^{16} + 611911872i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{936990054000i^7(1+i)^6} \\
& (257754 - 4567220i + 36837504i^2 - 176271436i^3 + 540021116i^4 - 1025012076i^5 + \\
& 835801260i^6 + 1351544404i^7 - 5504187696i^8 + 8097121404i^9 - \\
& 2877695101i^{10} - 5696482890i^{11} + 23621193050i^{12} + 19067541190i^{13} + \\
& 10542936420i^{14} + 154383989970i^{15} - 15909205570i^{16} + 210004095090i^{17} - \\
& 8752264405i^{18} + 93487130320i^{19} - 2917814040i^{20} + 13258090560i^{21})
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{73329656400} (-37085 + 1662804i - 2924868i^2 + \\
& 46743268i^3 - 28344105i^4 + 223370004i^5 - 25911060i^6 + 186234048i^7)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{24443218800} (-63762 + 1051688i - 4271421i^2 + \\
& 21515676i^3 - 27084785i^4 + 78890812i^5 - 25911060i^6 + 62078016i^7)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{13981521153600i^{18}} (-60648588 + 142125984i + 4191931744i^2 - 39678358720i^3 + \\
& 180026829983i^4 - 520285593828i^5 + 1052046728788i^6 - \\
& 1550352479764i^7 + 1688566040733i^8 - 1347963643808i^9 + \\
& 757106340736i^{10} - 264255925728i^{11} + 24033609992i^{12} + 66400992i^{13} - \\
& 5330739808i^{14} + 96420896i^{15} + 13406198468i^{16} + 1091702872i^{18} + \\
& 11824384i^{19} - 2648850204i^{20} + 14382146064i^{21} - 23419724900i^{22} + \\
& 50198205200i^{23} - 24701877200i^{24} + 35508625152i^{25}) + \\
& \frac{1}{240240} ((-11i + 128i^2 - 474i^3 - 828i^4 + 15873i^5 - 80172i^6 + \\
& 249288i^7 - 549168i^8 + 902394i^9 - 1127984i^{10} + 1072292i^{11} - \\
& 758472i^{12} + 375258i^{13} - 107304i^{14} + 1224i^{15} + 8976i^{16} + 2193i^{17} - \\
& 5616i^{18} + 3238i^{19} - 988i^{20} + 165i^{21} - 12i^{22}) \text{Log}_{20}[-i]) + \\
& \frac{1}{240240} ((11i - 84i^2 + 202i^3 + 76i^4 - 1233i^5 + 1904i^6 + 760i^7 - 5328i^8 + \\
& 4550i^9 + 3432i^{10} - 8580i^{11} + 3432i^{12} + 4550i^{13} - 3200i^{14} + 7928i^{15} + \\
& 8976i^{16} - 2193i^{17} - 5616i^{18} - 3238i^{19} - 988i^{20} - 165i^{21} - 12i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{64823416257600i^{20}} \left(-302630328 - 997332336i + 59523900436i^2 - \right. \\
& 573147006432i^3 + 3058516791330i^4 - 11002941289340i^5 + \\
& 28946700120195i^6 - 58106577171060i^7 + 91082257883430i^8 - \\
& 112671318371700i^9 + 109981251818037i^{10} - 83676392272096i^{11} + \\
& 48081885517776i^{12} - 19374462796992i^{13} + 4333881109640i^{14} + \\
& 38985668064i^{15} - 625232478360i^{16} + 34422259872i^{17} + 284293325940i^{18} + \\
& 56884831588i^{20} - 67914357264i^{21} + 61421333064i^{22} + 26473384912i^{23} - \\
& 128637288780i^{24} + 268015182864i^{25} - 160337639280i^{26} + 164630898432i^{27} \left. \right) + \\
& \frac{1}{371280} \left((-12 + 591i - 9036i^2 + 74842i^3 - 404020i^4 + 1554291i^5 - 4481268i^6 + \right. \\
& 9980088i^7 - 17477496i^8 + 24280590i^9 - 26779896i^{10} + 23255388i^{11} - \\
& 15560168i^{12} + 7649966i^{13} - 2454120i^{14} + 305592i^{15} + 100164i^{16} - \\
& 18909i^{17} - 34812i^{18} + 25050i^{19} - 8100i^{20} + 1375i^{21} - 100i^{22}) \text{Log20}[-i] \left. \right) + \\
& \frac{1}{1113840} \left((140 - 1245i + 3360i^2 + 4130i^3 - 48300i^4 + 124695i^5 - \right. \\
& 114240i^6 - 136680i^7 + 507960i^8 - 541450i^9 + 649740i^{11} - 733720i^{12} + \\
& 239190i^{13} + 248880i^{14} - 280296i^{15} + 300492i^{16} + 56727i^{17} - \\
& 104436i^{18} - 75150i^{19} - 24300i^{20} - 4125i^{21} - 300i^{22}) \text{Log20}[i] \left. \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{94741916068800i^{20}} \\
& (977728752 - 22522067568i + 235569121788i^2 - 1503637431296i^3 + \\
& 6607042181740i^4 - 21306030717972i^5 + 52367617827525i^6 - \\
& 100381383864300i^7 + 152012970871740i^8 - 182740337705580i^9 + \\
& 173803686754611i^{10} - 128951916909408i^{11} + 72185096680288i^{12} - \\
& 28039756781376i^{13} + 5400344326440i^{14} + 1450072344672i^{15} - \\
& 1843777657080i^{16} + 840886634016i^{17} - 278388913140i^{18} + 407726738532i^{20} - \\
& 612357813552i^{21} + 539536804632i^{22} - 188728657104i^{23} - 183151523340i^{24} + \\
& 460461466608i^{25} - 301293805680i^{26} + 240614390016i^{27}) + \frac{1}{1627920} \\
& \left((-588 + 12379i - 122764i^2 + 762498i^3 - 3325380i^4 + 10816719i^5 - 27197892i^6 + \right. \\
& 54039192i^7 - 85946424i^8 + 110068710i^9 - 113440184i^{10} + 93335372i^{11} - \\
& 60163272i^{12} + 29230854i^{13} - 9806280i^{14} + 1697688i^{15} + 158916i^{16} - 113601 \\
& i^{17} - 34428i^{18} + 40450i^{19} - 14260i^{20} + 2475i^{21} - 180i^{22}) \text{Log20}[-i] \left. \right) + \\
& \frac{1}{1627920} \left((252 - 3755i + 25200i^2 - 98610i^3 + 238260i^4 - 316863i^5 + \right. \\
& 969000i^7 - 2209320i^8 + 2645370i^9 - 1478048i^{10} - 755820i^{11} + \\
& 2519400i^{12} - 2781030i^{13} + 1860480i^{14} - 767448i^{15} + 158916i^{16} + \\
& 113601i^{17} - 34428i^{18} - 40450i^{19} - 14260i^{20} - 2475i^{21} - 180i^{22}) \text{Log20}[i] \left. \right)
\end{aligned}$$

$$\begin{aligned}
& Q2 [l = 5, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{1042161076756800i^{20}(1+i)^2} \\
& (1582989408 - 24818137344i + 176119891948i^2 - 733930036840i^3 + \\
& 1911450721180i^4 - 2830694762896i^5 + 460027134853i^6 + 8782242768134i^7 - \\
& 23711688880605i^8 + 34964764669140i^9 - 31175356456545i^{10} + \\
& 11285224547870i^{11} + 11931927287665i^{12} - 23529449732800i^{13} + \\
& 19874195103400i^{14} - 8746114769392i^{15} - 976825920488i^{16} + \\
& 6396301495584i^{17} - 9349446729084i^{18} + 11649009540168i^{19} - \\
& 13822146724868i^{20} + 14457993280592i^{21} - 11559841083932i^{22} + \\
& 5354934960584i^{23} + 2134674746512i^{24} - 4784021809336i^{25} + 6491955660036 \\
& i^{26} + 555649576944i^{27} + 1242788748432i^{28} + 2646758290176i^{29}) + \\
& \frac{1}{1193808} ((-48 + 935i - 8624i^2 + 50050i^3 - 204820i^4 + 627627i^5 - \\
& 1492260i^6 + 2813976i^7 - 4263600i^8 + 5222910i^9 - 5173168i^{10} + \\
& 4115020i^{11} - 2586584i^{12} + 1243550i^{13} - 426360i^{14} + 85272i^{15} - \\
& 4389i^{17} + 770i^{19} - 308i^{20} + 55i^{21} - 4i^{22}) \text{Log}20[-i]) + \\
& \frac{1}{17907120} ((176 - 3465i + 32340i^2 - 190190i^3 + 790020i^4 - 2462229i^5 + \\
& 5969040i^6 - 11511720i^7 + 17907120i^8 - 22632610i^9 + 23279256i^{10} - \\
& 19399380i^{11} + 12932920i^{12} - 6715170i^{13} + 2558160i^{14} - 596904i^{15} + \\
& 65835i^{17} - 11550i^{19} - 4620i^{20} - 825i^{21} - 60i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& Q2 [l = 6, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{43245694800i^6(1+i)^4} \\
& (4845 - 103632i + 998138i^2 - 5741784i^3 + 21891036i^4 - 57374456i^5 + \\
& 101128972i^6 - 100763824i^7 - 14216253i^8 + 256021464i^9 - \\
& 455964489i^{10} + 574003916i^{11} - 183141663i^{12} + 263280264i^{13} + \\
& 418764427i^{14} + 160852708i^{15} + 240669884i^{16} + 109830336i^{17})
\end{aligned}$$

$$\begin{aligned}
& Q2 [l = 7, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{2810970162000i^8(1+i)^6} \\
& (94962 - 1927664i + 17685219i^2 - 95889010i^3 + 333553379i^4 - 733618272i^5 + \\
& 807644058i^6 + 559561324i^7 - 3831777831i^8 + 6482382750i^9 - \\
& 3332389615i^{10} - 6425822100i^{11} + 17935849460i^{12} - 6215482280i^{13} + \\
& 10230857700i^{14} + 54693769080i^{15} + 24647340155i^{16} + 77063110230i^{17} + \\
& 60316498925i^{18} + 40531881100i^{19} + 27934971540i^{20} + 7138971840i^{21})
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 0, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{36664828200} (-19287i + 1511640i^2 - 1604869i^3 + \\
& 14108640i^4 - 2825091i^5 + 28821936i^6 - 6209352i^7 + 13302432i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 1, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{12221609400} (-11310i + 506464i^2 - 1473843i^3 + \\
& 7054320i^4 - 7792603i^5 + 15519504i^6 - 6209352i^7 + 4434144i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 2, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{3495380288400i^{17}} \\
& (94342248 - 1235025792i + 7440633200i^2 - 27295107840i^3 + 67953218333i^4 - \\
& 121076331376i^5 + 158541178125i^6 - 154043859376i^7 + 110595558920i^8 - \\
& 57640716624i^9 + 21362011768i^{10} - 6287669360i^{11} + 4024024392i^{12} + \\
& 110893680i^{13} + 5004168312i^{14} + 268336848i^{15} + 241428356i^{16} + 832678496i^{17} - \\
& 1642982484i^{18} + 3315261664i^{19} - 5698069806i^{20} + 8588936928i^{21} - \\
& 8450168870i^{22} + 7820351968i^{23} - 2959791120i^{24} + 1268165184i^{25}) + \frac{1}{120120} \\
& ((11i^2 - 188i^3 + 1506i^4 - 7500i^5 + 25959i^6 - 66096i^7 + 127704i^8 - 190128i^9 + \\
& 218790i^{10} - 192712i^{11} + 126412i^{12} - 58344i^{13} + 17238i^{14} - 4080i^{15} + \\
& 3672i^{16} - 4080i^{17} + 2703i^{18} - 1116i^{19} + 290i^{20} - 44i^{21} + 3i^{22}) \text{Log}20[-i]) + \\
& \frac{1}{120120} ((-11i^2 + 100i^3 - 354i^4 + 500i^5 + 281i^6 - 1968i^7 + 2216i^8 + \\
& 848i^9 - 4134i^{10} + 2808i^{11} + 1716i^{12} - 3432i^{13} + 1066i^{14} + 496i^{15} - \\
& 3672i^{16} - 4080i^{17} - 2703i^{18} - 1116i^{19} - 290i^{20} - 44i^{21} - 3i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 3, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{16205854064400i^{19}} \\
& (828251424 - 12614906304i + 90434624280i^2 - 406349863920i^3 + \\
& 1286155084214i^4 - 3055388331996i^5 + 5663275490301i^6 - 8386523352504i^7 + \\
& 10035824586750i^8 - 9692499658512i^9 + 7430458535672i^{10} - \\
& 4346871263472i^{11} + 1779476985192i^{12} - 394438456720i^{13} - \\
& 20265128664i^{14} + 65887525872i^{15} + 31153964244i^{16} + 95796254736i^{17} - \\
& 98480654220i^{18} + 137715509984i^{19} - 158410450770i^{20} + \\
& 171953081040i^{21} - 168714956774i^{22} + 146101013760i^{23} - \\
& 100957724322i^{24} + 59776695264i^{25} - 19211735088i^{26} + 5879674944i^{27}) + \\
& \frac{1}{556920} ((26 - 708i + 8493i^2 - 61196i^3 + 300810i^4 - 1079388i^5 + 2943159i^6 - \\
& 6249744i^7 + 10482948i^8 - 13973320i^9 + 14775618i^{10} - 12257544i^{11} + \\
& 7780084i^{12} - 3590808i^{13} + 1081710i^{14} - 172176i^{15} + 46818i^{16} - \\
& 73908i^{17} + 59681i^{18} - 26700i^{19} + 7170i^{20} - 1100i^{21} + 75i^{22}) \text{Log}20[-i] + \\
& \frac{1}{556920} ((-26 + 84i + 1011i^2 - 8204i^3 + 24630i^4 - 26292i^5 - 44727i^6 + \\
& 193392i^7 - 266628i^8 + 76840i^9 + 287742i^{10} - 461448i^{11} + 253708i^{12} + \\
& 90168i^{13} - 233070i^{14} + 146064i^{15} - 46818i^{16} - 73908i^{17} - \\
& 59681i^{18} - 26700i^{19} - 7170i^{20} - 1100i^{21} - 75i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 4, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{23685479017200i^{19}} \\
& (836215380 - 14494399920i + 117987569700i^2 - 598544906960i^3 + \\
& 2116755760119i^4 - 5528192706036i^5 + 11009870596956i^6 - 17003002888872 \\
& i^7 + 20453116516065i^8 - 18981224422224i^9 + 13116630350808i^{10} - \\
& 5993458133328i^{11} + 698381411296i^{12} + 1823522727600i^{13} - \\
& 2476669348080i^{14} + 2466117263664i^{15} - 2373233834556i^{16} + \\
& 2340165651408i^{17} - 2186876739060i^{18} + 1980050910048i^{19} - \\
& 1683763347906i^{20} + 1323724682736i^{21} - 938540258262i^{22} + 585911664000i^{23} - \\
& 305236226754i^{24} + 133197251616i^{25} - 36101172528i^{26} + 8593371072i^{27}) + \\
& \frac{1}{813960} ((126 - 2604i + 25379i^2 - 155028i^3 + 665190i^4 - 2128836i^5 + 5264577i^6 - \\
& 10279152i^7 + 16042764i^8 - 20116440i^9 + 20230782i^{10} - 16157752i^{11} + \\
& 10027212i^{12} - 4627944i^{13} + 1443810i^{14} - 232560i^{15} + 5814i^{16} - \\
& 23484i^{17} + 29583i^{18} - 15060i^{19} + 4238i^{20} - 660i^{21} + 45i^{22}) \text{Log}20[-i]) + \\
& \frac{1}{813960} ((-126 + 1764i - 10819i^2 + 36468i^3 - 63270i^4 - 2964i^5 + \\
& 316863i^6 - 883728i^7 + 1321716i^8 - 1046520i^9 - 75582i^{10} + 1377272i^{11} - \\
& 1965132i^{12} + 1604664i^{13} - 823650i^{14} + 232560i^{15} - 5814i^{16} - \\
& 23484i^{17} - 29583i^{18} - 15060i^{19} - 4238i^{20} - 660i^{21} - 45i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 5, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{130270134594600i^{19}(1+i)^2} \\
& \quad (-208288080 + 3626663040i - 29501862390i^2 + 148430662380i^3 - \\
& \quad 514711425228i^4 + 1294761672204i^5 - 2410863049518i^6 + 3295421661840i^7 - \\
& \quad 3112415683440i^8 + 1533257939472i^9 + 697881716084i^{10} - \\
& \quad 2246436464888i^{11} + 2348764229240i^{12} - 1361440671800i^{13} + \\
& \quad 179902161428i^{14} + 632089330576i^{15} - 1084924353744i^{16} + \\
& \quad 1441925473296i^{17} - 1898809374462i^{18} + 2547180208028i^{19} - \\
& \quad 3287889079388i^{20} + 3958809136628i^{21} - 4269138654451i^{22} + \\
& \quad 4035601339462i^{23} - 3215821742518i^{24} + 2245986647982i^{25} - \\
& \quad 1169921895153i^{26} + 609578488992i^{27} - 148153022424i^{28} + 47263540896i^{29}) + \\
& \quad \frac{1}{8953560} ((136 - 2640i + 24255i^2 - 140140i^3 + 570570i^4 - 1738044i^5 + \\
& \quad 4103715i^6 - 7674480i^7 + 11511720i^8 - 13927760i^9 + 13579566i^{10} - \\
& \quad 10581480i^{11} + 6466460i^{12} - 2984520i^{13} + 959310i^{14} - 170544i^{15} + \\
& \quad 7315i^{18} - 4620i^{19} + 1386i^{20} - 220i^{21} + 15i^{22}) \text{Log}20[-i]) + \\
& \quad \frac{1}{8953560} ((-136 + 2640i - 24255i^2 + 140140i^3 - 570570i^4 + 1738044i^5 - \\
& \quad 4103715i^6 + 7674480i^7 - 11511720i^8 + 13927760i^9 - 13579566i^{10} + \\
& \quad 10581480i^{11} - 6466460i^{12} + 2984520i^{13} - 959310i^{14} + 170544i^{15} - \\
& \quad 7315i^{18} - 4620i^{19} - 1386i^{20} - 220i^{21} - 15i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 6, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{21622847400i^5(1+i)^4} \\
& \quad (5814 - 101592i + 821406i^2 - 4048176i^3 + 13419766i^4 - 30800328i^5 + \\
& \quad 46870544i^6 - 34290168i^7 - 37300899i^8 + 174210924i^9 - \\
& \quad 308744571i^{10} + 414074520i^{11} - 350308929i^{12} + 310516468i^{13} - \\
& \quad 129045663i^{14} + 93308240i^{15} - 16224936i^{16} + 7845024i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q2 } [l = 7, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{1405485081000i^7(1+i)^6} \\
& \quad (81396 - 1426368i + 11327610i^2 - 52986212i^3 + 156499314i^4 - 276064224i^5 + \\
& \quad 160852062i^6 + 539326020i^7 - 1661300025i^8 + 1994035854i^9 - \\
& \quad 49815576i^{10} - 3059499150i^{11} + 5382999955i^{12} + 1514020080i^{13} - \\
& \quad 4482407325i^{14} + 22094976450i^{15} - 11339922990i^{16} + 21668037570i^{17} - \\
& \quad 4105905605i^{18} + 6368733120i^{19} - 510818040i^{20} + 509926560i^{21})
\end{aligned}$$

Case 3: $i_1 = i_2 = i, i_3 = i_4 = i + 1$

$$\begin{aligned} & \text{Q3 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\ &= \frac{1}{97772875200} \\ & (17497207 + 213996674i + 1180193754i^2 + 3849919976i^3 + 8165874340i^4 + \\ & 11597731632i^5 + 10834338612i^6 + 6124204032i^7 + 1616245488i^8) \end{aligned}$$

$$\begin{aligned} & \text{Q3 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\ &= \frac{1}{5431826400} (681183 + 8425842i + 47140058i^2 + 156679012i^3 + \\ & 340812500i^4 + 501530764i^5 + 493770746i^6 + 302369344i^7 + 89791416i^8) \end{aligned}$$

$$\begin{aligned} & \text{Q3 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\ &= \frac{1}{16295479200i^6} \\ & (22221108 - 5157936i - 63281820i^2 - 37508408i^3 + 7740341i^4 + 10548216i^5 + \\ & 4907812i^6 + 19264112i^7 + 109000806i^8 + 364295012i^9 + 805580962i^{10} + \\ & 1208175648i^{11} + 1230064750i^{12} + 793515392i^{13} + 269374248i^{14}) + \\ & \frac{1}{10010} ((-273i^{14} - 224i^{15} + 845i^{16} + 1278i^{17} + 389i^{18} - \\ & 230i^{19} - 177i^{20} - 44i^{21} - 4i^{22}) \text{Log}_{20}[i]) \end{aligned}$$

$$\begin{aligned} & \text{Q3 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\ &= \frac{1}{97772875200i^6} (80582040 + 87085152i - 1532496042i^2 - \\ & 1832464788i^3 + 90380598i^4 + 257629680i^5 + 177379745i^6 + \\ & 29942110i^7 + 600370650i^8 + 1691791480i^9 + 4027685360i^{10} + \\ & 5912056872i^{11} + 6311883828i^{12} + 4079536512i^{13} + 1616245488i^{14}) + \\ & \frac{1}{185640} ((-3060i^{14} - 6528i^{15} + 54723i^{16} + 130842i^{17} + 69638i^{18} - \\ & 13400i^{19} - 16740i^{20} - 4400i^{21} - 400i^{22}) \text{Log}_{20}[i]) \end{aligned}$$

$$\begin{aligned} & \text{Q3 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\ &= \\ & \frac{1}{32590958400i^4(1+i)^2} (-52378326 - 404972568i - 721062342i^2 - 363447084i^3 + \\ & 59572149i^4 + 98552496i^5 + 215017813i^6 + 810965470i^7 + \\ & 2236347630i^8 + 4396123072i^9 + 6272640088i^{10} + 6476362344i^{11} + \\ & 4698188748i^{12} + 2210157216i^{13} + 538748496i^{14}) + \\ & \frac{(2907i^{16} + 19722i^{17} + 21318i^{18} - 120i^{19} - 3092i^{20} - 880i^{21} - 80i^{22}) \text{Log}_{20}[i]}{90440} \end{aligned}$$

$$Q3 [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0]$$

=

$$\frac{1}{537750813600i^2(1+i)^4} \left(-263603340 - 804683880i - 792783589i^2 + 223734990i^3 + 3724483651i^4 + 17466562548i^5 + 57258228672i^6 + 137080260108i^7 + 245998634266i^8 + 334736471388i^9 + 344547508448i^{10} + 263409644652i^{11} + 143302431294i^{12} + 50497737312i^{13} + 8889350184i^{14} \right) + \frac{(7315i^{18} + 770i^{19} - 693i^{20} - 220i^{21} - 20i^{22}) \text{Log}20[i]}{746130}$$

$$Q3 [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{28830463200(1+i)^6}$$

$$\left(1331897 + 24719620i + 215784435i^2 + 1175671610i^3 + 4472587933i^4 + 12587691168i^5 + 27077215635i^6 + 45321215490i^7 + 59464765800i^8 + 61052582392i^9 + 48469381292i^{10} + 28997038860i^{11} + 12441569170i^{12} + 3459536720i^{13} + 476585208i^{14} \right)$$

$$Q3 [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{1249320072000(1+i)^8}$$

$$\left(50902047 + 1047075594i + 10198615802i^2 + 62484512936i^3 + 269765250066i^4 + 871091019084i^5 + 2178675364080i^6 + 4310767069200i^7 + 6829235283945i^8 + 8706128907630i^9 + 8919537468930i^{10} + 7284506731080i^{11} + 4663585794480i^{12} + 2271881875320i^{13} + 798726706300i^{14} + 182508540160i^{15} + 20652025680i^{16} \right)$$

$$Q3 [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

$$= \frac{1}{293318625600}$$

$$\left(-9420775 - 119057934i - 679211340i^2 - 2294538776i^3 - 5046032445i^4 - 7439442210i^5 - 7222313592i^6 - 4247010720i^7 - 1167288408i^8 \right)$$

$$Q3 [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

$$= \frac{1}{32590958400} \left(-723750 - 9257340i - 53619475i^2 - 184738204i^3 - 417136545i^4 - 638172570i^5 - 654288180i^6 - 417987840i^7 - 129698712i^8 \right)$$

$$\begin{aligned}
& \text{Q3 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{97772875200i^6} \\
& \quad (-44442216 + 1199520i + 133880712i^2 + 96589136i^3 - 11963868i^4 - 25937856i^5 - \\
& \quad 10445400i^6 - 21502824i^7 - 123068319i^8 - 426138556i^9 - 979058847i^{10} - \\
& \quad 1527198150i^{11} - 1621015552i^{12} - 1092256800i^{13} - 389096136i^{14}) + \\
& \quad \frac{1}{120120} ((1092i^{14} + 1120i^{15} - 3324i^{16} - 5832i^{17} - 2199i^{18} + \\
& \quad 948i^{19} + 885i^{20} + 242i^{21} + 24i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{293318625600i^6} (-80582040 - 130062240i + 1566990810i^2 + \\
& \quad 2253917820i^3 + 34008282i^4 - 350713440i^5 - 186849625i^6 - \\
& \quad 16664010i^7 - 345621870i^8 - 975811600i^9 - 2442230265i^{10} - \\
& \quad 3710910330i^{11} - 4145672700i^{12} - 2791650240i^{13} - 1167288408i^{14}) + \\
& \quad \frac{1}{556920} ((3060i^{14} + 8160i^{15} - 54315i^{16} - 148230i^{17} - 91198i^{18} + \\
& \quad 12000i^{19} + 20925i^{20} + 6050i^{21} + 600i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{97772875200i^4(1+i)^2} (52378326 + 450161712i + 866575710i^2 + \\
& \quad 476143668i^3 - 57894291i^4 - 104205780i^5 - 132466085i^6 - \\
& \quad 464379450i^7 - 1317390285i^8 - 2677212020i^9 - 3950065059i^{10} - \\
& \quad 4222772838i^{11} - 3172273440i^{12} - 1547035632i^{13} - 389096136i^{14}) + \\
& \quad \frac{1}{271320} ((-2907i^{16} - 22230i^{17} - 27018i^{18} - 720i^{19} + 3865i^{20} + 1210i^{21} + 120i^{22}) \\
& \quad \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{3226504881600i^2(1+i)^4} \\
& \quad (659008350 + 2025583560i + 2064676120i^2 + 157990408i^3 - \\
& \quad 4169995593i^4 - 19726718920i^5 - 66246497305i^6 - 163096848750i^7 - \\
& \quad 301203444773i^8 - 421960158092i^9 - 447271870155i^{10} - 352133438910i^{11} - \\
& \quad 197172953340i^{12} - 71396199072i^{13} - 12840172488i^{14}) + \\
& \quad \frac{(-7315i^{18} - 924i^{19} + 693i^{20} + 242i^{21} + 24i^{22}) \text{Log}20[i]}{1790712}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{57660926400(1+i)^6} \\
& (-460250 - 8742640i - 78140925i^2 - 436092602i^3 - 1700026192i^4 - \\
& 4904613480i^5 - 10818415010i^6 - 18572554740i^7 - 24997993578i^8 - \\
& 26328268728i^9 - 21436499675i^{10} - 13144518630i^{11} - \\
& 5773521640i^{12} - 1639491152i^{13} - 229466952i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{3747960216000(1+i)^8} \\
& (-26337675 - 553262046i - 5504793412i^2 - 34462814712i^3 - 152078259111i^4 - \\
& 502065768006i^5 - 1284111794760i^6 - 2598681253440i^7 - 4211167549095i^8 - \\
& 5491471692630i^9 - 5754166913220i^{10} - 4804868165880i^{11} - 3143399861715i^{12} - \\
& 1563386129310i^{13} - 560322667300i^{14} - 130198871040i^{15} - 14915351880i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{293318625600} (1706341 + 22245438i + 131054917i^2 + 457731002i^3 + \\
& 1042021560i^4 + 1592484126i^5 + 1604989584i^6 + 981426456i^7 + 281013876i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{48886437600} (196587 + 2593842i + 15514282i^2 + 55260807i^3 + \\
& 129162285i^4 + 204830241i^5 + 218019186i^6 + 144849996i^7 + 46835646i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{48886437600i^6} \\
& (7407036 + 1319472i - 23343040i^2 - 19893496i^3 + 994833i^4 + 5169906i^5 + \\
& 2086917i^6 + 2153340i^7 + 11867867i^8 + 42480851i^9 + 101028567i^{10} + \\
& 163345109i^{11} + 179994980i^{12} + 126128916i^{13} + 46835646i^{14}) + \\
& \frac{1}{60060} ((-182i^{14} - 224i^{15} + 540i^{16} + 1092i^{17} + 489i^{18} - \\
& 153i^{19} - 181i^{20} - 55i^{21} - 6i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{293318625600i^6} \\
& (26860680 + 57679776i - 532037814i^2 - 893675244i^3 - 69111504i^4 + \\
& 147096180i^5 + 70820665i^6 + 7743450i^7 + 66739035i^8 + 194430850i^9 + \\
& 504047580i^{10} + 793556166i^{11} + 920553876i^{12} + 644447016i^{13} + 281013876i^{14}) + \\
& \frac{1}{556920} ((-1020i^{14} - 3264i^{15} + 17901i^{16} + 55206i^{17} + 38281i^{18} - \\
& 2850i^{19} - 8520i^{20} - 2750i^{21} - 300i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{293318625600i^4(1+i)} \\
& (-52378326 - 442972530i - 574251678i^2 - 29723694i^3 + 77572677i^4 + \\
& 41797707i^5 + 52246645i^6 + 223989685i^7 + 575731230i^8 + 1099828338i^9 + \\
& 1447109502i^{10} + 1361987640i^{11} + 813134412i^{12} + 281013876i^{13}) + \\
& (2907i^{16} + 24738i^{17} + 33003i^{18} + 2130i^{19} - 4688i^{20} - 1650i^{21} - 180i^{22}) \text{Log}20[i] \\
& \underline{\hspace{10em}} \\
& 813960
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{1613252440800i^2(1+i)^3} (-131801670 - 277477200i - 150982637i^2 + 53699901i^3 + \\
& 357870108i^4 + 1577772941i^5 + 5039069475i^6 + 11664710904i^7 + \\
& 19992131005i^8 + 25529047368i^9 + 23996821761i^{10} + \\
& 16006833480i^{11} + 6945596262i^{12} + 1545576318i^{13}) + \\
& (7315i^{18} + 1155i^{19} - 693i^{20} - 275i^{21} - 30i^{22}) \text{Log}20[i] \\
& \underline{\hspace{10em}} \\
& 4476780
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{28830463200(1+i)^5} (41657 + 766687i + 6616432i^2 + 35503687i^3 + 132394925i^4 + \\
& 363044903i^5 + 754930403i^6 + 1208749843i^7 + 1495351348i^8 + 1417750360i^9 + \\
& 1006953317i^{10} + 511323212i^{11} + 168326282i^{12} + 27621022i^{13})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{11243880648000(1+i)^7} \\
& (14302575 + 292003275i + 2815877708i^2 + 17030333738i^3 + 72319163604i^4 + \\
& 228679091770i^5 + 556999012300i^6 + 1065801412320i^7 + 1618168009205i^8 + \\
& 1953451492685i^9 + 1864441390680i^{10} + 1386032484850i^{11} + \\
& 780170484550i^{12} + 315769347840i^{13} + 82885798740i^{14} + 10772198580i^{15})
\end{aligned}$$

$$Q3 [l = 0, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{293318625600} (15169700 + 183432132i + 998284338i^2 + 3205851736i^3 + 6673639515i^4 + 9266724270i^5 + 8423365836i^6 + 4606176384i^7 + 1167288408i^8)$$

$$Q3 [l = 1, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{32590958400} (1189344 + 14554632i + 80413557i^2 + 263319924i^3 + 562581355i^4 + 809764382i^5 + 775287856i^6 + 457895136i^7 + 129698712i^8)$$

$$Q3 [l = 2, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{97772875200i^5} (-82047168 - 123636240i - 4900896i^2 + 71780982i^3 + 42217056i^4 + 13227872i^5 + 33956664i^6 + 186708729i^7 + 615952964i^8 + 1338116097i^9 + 1965391578i^{10} + 1946662860i^{11} + 1211978688i^{12} + 389096136i^{13}) + \frac{1}{120120} ((2016i^{15} + 5160i^{16} + 3312i^{17} - 1639i^{18} - 2892i^{19} - 1347i^{20} - 286i^{21} - 24i^{22}) \text{Log}20[i])$$

$$Q3 [l = 3, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{293318625600i^5} (-386793792 - 1639632456i - 900340056i^2 + 919123128i^3 + 614053440i^4 + 216337380i^5 + 48669060i^6 + 499741440i^7 + 1451851280i^8 + 3343507995i^9 + 4848954318i^{10} + 5010559464i^{11} + 3150815904i^{12} + 1167288408i^{13}) + \frac{1}{556920} ((14688i^{15} + 77724i^{16} + 99684i^{17} + 948i^{18} - 60000i^{19} - 32475i^{20} - 7150i^{21} - 600i^{22}) \text{Log}20[i])$$

$$Q3 [l = 4, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{97772875200i^4(1+i)^2} (-69837768 - 366053688i - 473489016i^2 - 23183160i^3 + 262293486i^4 + 157508260i^5 + 198354160i^6 + 694376100i^7 + 1888512025i^8 + 3657447100i^9 + 5127649377i^{10} + 5182621602i^{11} + 3662661084i^{12} + 1666757520i^{13} + 389096136i^{14}) + \frac{(3876i^{16} + 16644i^{17} + 10488i^{18} - 8720i^{19} - 6175i^{20} - 1430i^{21} - 120i^{22}) \text{Log}20[i]}{271320}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0] \\
&= \frac{1}{3226504881600i^2(1+i)^4} \\
& \quad (-395405010 - 1082161080i - 747038370i^2 + 1026310116i^3 + \\
& \quad 6802364673i^4 + 30139536280i^5 + 97496060155i^6 + 230674591290i^7 + \\
& \quad 408477229699i^8 + 547359865492i^9 + 553462427265i^{10} + 414423142650i^{11} + \\
& \quad 220024783440i^{12} + 75347021376i^{13} + 12840172488i^{14}) + \\
& \quad \frac{(4389i^{18} - 924i^{19} - 1155i^{20} - 286i^{21} - 24i^{22}) \text{Log}20[i]}{1790712}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0] \\
&= \frac{1}{172982779200(1+i)^6} \\
& \quad (2349676 + 43330824i + 375590691i^2 + 2030493574i^3 + 7658242626i^4 + \\
& \quad 21347584344i^5 + 45430890576i^6 + 75132751464i^7 + 97256051586i^8 + \\
& \quad 98342577704i^9 + 76741982091i^{10} + 45028751814i^{11} + \\
& \quad 18903268796i^{12} + 5130289104i^{13} + 688400856i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0] \\
&= \frac{1}{3747960216000(1+i)^8} \\
& \quad (44927736 + 918900956i + 8894551850i^2 + 54125400888i^3 + 231944189127i^4 + \\
& \quad 742878177606i^5 + 1841414349360i^6 + 3607638290880i^7 + 5653359437430i^8 + \\
& \quad 7120847132520i^9 + 7199049718410i^{10} + 5793794795880i^{11} + 3649812325545i^{12} + \\
& \quad 1746797887290i^{13} + 602361446760i^{14} + 134788210080i^{15} + 14915351880i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{195545750400} (-1773317 - 22123348i - 124325481i^2 - 412617634i^3 - \\
& \quad 888449405i^4 - 1277108712i^5 - 1202835204i^6 - 682245768i^7 - 179582832i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{21727305600} (-137682 - 1740072i - 9938229i^2 - 33675026i^3 - \\
& \quad 74523225i^4 - 111218856i^5 - 110508636i^6 - 67786072i^7 - 19953648i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{65181916800i^5} (18232704 + 32738328i + 6618304i^2 - 17066042i^3 - 11764620i^4 - \\
& 3464412i^5 - 4232816i^6 - 22943859i^7 - 78375374i^8 - 176503255i^9 - \\
& 269059608i^{10} - 276887228i^{11} - 179301176i^{12} - 59860944i^{13}) + \\
& \frac{(-448i^{15} - 1276i^{16} - 1008i^{17} + 249i^{18} + 730i^{19} + 381i^{20} + 88i^{21} + 8i^{22}) \text{Log}20[i]}{80080}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^5} (85954176 + 418531806i + 330448272i^2 - 198683562i^3 - 176784300i^4 - \\
& 56451815i^5 - 8847740i^6 - 61248165i^7 - 183967850i^8 - 439513225i^9 - \\
& 661951944i^{10} - 711087084i^{11} - 465732408i^{12} - 179582832i^{13}) + \\
& \frac{1}{371280} ((-3264i^{15} - 19329i^{16} - 29268i^{17} - 5627i^{18} + 14650i^{19} + \\
& 9165i^{20} + 2200i^{21} + 200i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{65181916800i^4(1+i)^2} (17459442 + 102810708i + 154750596i^2 + 33969936i^3 - 65153907i^4 - \\
& 40790386i^5 - 28950608i^6 - 86947520i^7 - 242388670i^8 - 484634012i^9 - \\
& 701268587i^{10} - 732258024i^{11} - 534186444i^{12} - 250908984i^{13} - 59860944i^{14}) + \\
& \frac{(-969i^{16} - 4788i^{17} - 4047i^{18} + 1970i^{19} + 1737i^{20} + 440i^{21} + 40i^{22}) \text{Log}20[i]}{180880}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{2151003254400i^2(1+i)^4} (131801670 + 374594220i + 306536828i^2 - 105212432i^3 - \\
& 880848241i^4 - 3733282526i^5 - 12306525029i^6 - 29902729956i^7 - \\
& 54420851485i^8 - 74961770202i^9 - 77909820131i^{10} - 59934323064i^{11} - \\
& 32648218548i^{12} - 11436936456i^{13} - 1975411152i^{14}) + \\
& \frac{(-7315i^{18} + 770i^{19} + 1617i^{20} + 440i^{21} + 40i^{22}) \text{Log}20[i]}{5969040}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{115321852800(1+i)^6} (-266658 - 5029876i - 44611149i^2 - 246857040i^3 - 953286334i^4 - 2721510612i^5 - \\
& 5932926084i^6 - 10051996176i^7 - 13330125180i^8 - 13805554776i^9 - 11028179633 \\
& i^{10} - 6617057496i^{11} - 2835173844i^{12} - 782422280i^{13} - 105907824i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{2498640144000(1+i)^8} \\
& (-5090841 - 106271852i - 1050182365i^2 - 6525925666i^3 - 28564299543i^4 - \\
& 93463231632i^5 - 236712695010i^6 - 473888118780i^7 - 758822925645i^8 - \\
& 976547479380i^9 - 1008419790675i^{10} - 828539057670i^{11} - 532406598195i^{12} - \\
& 259575535320i^{13} - 90989351940i^{14} - 20619635240i^{15} - 2294669520i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{293318625600} (-2715076 - 33933224i - 191095883i^2 - 635804322i^3 - \\
& 1373049915i^4 - 1980384516i^5 - 1871883192i^6 - 1065179064i^7 - 281013876i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{97772875200} (-627864 - 7945600i - 45453331i^2 - 154323834i^3 - \\
& 342391875i^4 - 512694252i^5 - 511709520i^6 - 315808728i^7 - 93671292i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \\
& \frac{1}{97772875200i^5} (27349056 + 44630712i + 3895584i^2 - 27545546i^3 - 17838660i^4 - \\
& 5226494i^5 - 6379184i^6 - 34845635i^7 - 119045802i^8 - 268798035i^9 - \\
& 410744508i^{10} - 424584792i^{11} - 276557768i^{12} - 93671292i^{13}) + \\
& \frac{1}{120120} ((-672i^{15} - 1804i^{16} - 1248i^{17} + 577i^{18} + 1150i^{19} + \\
& 577i^{20} + 132i^{21} + 12i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{293318625600i^5} \\
& (128931264 + 562660560i + 331497936i^2 - 357663306i^3 - 267844500i^4 - \\
& 88264190i^5 - 9771960i^6 - 96175035i^7 - 275089650i^8 - 670062075i^9 - \\
& 1003044276i^{10} - 1087760640i^{11} - 711920424i^{12} - 281013876i^{13}) + \\
& \frac{1}{556920} ((-4896i^{15} - 26520i^{16} - 35064i^{17} + 379i^{18} + 24450i^{19} + \\
& 13995i^{20} + 3300i^{21} + 300i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
& = \frac{1}{293318625600i^4(1+i)^2} \\
& (69837768 + 370161792i + 472245774i^2 - 26882856i^3 - 338164008i^4 - \\
& 187527704i^5 - 131036637i^6 - 393708480i^7 - 1099576130i^8 - 2200482828i^9 - \\
& 3190547583i^{10} - 3339184716i^{11} - 2446496316i^{12} - \\
& 1156195296i^{13} - 281013876i^{14}) + \frac{1}{813960} \\
& ((-3876i^{16} - 16872i^{17} - 10203i^{18} + 11230i^{19} + 8053i^{20} + 1980i^{21} + 180i^{22}) \\
& \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
& = \\
& \frac{1}{3226504881600i^2(1+i)^4} (131801670 + 346846500i + 205202894i^2 - 287676376i^3 - \\
& 1352414973i^4 - 5630269258i^5 - 18566272807i^6 - 45148734048i^7 - \\
& 82252265865i^8 - 113454350526i^9 - 118143634323i^{10} - \\
& 91142448012i^{11} - 49870220664i^{12} - 17605171848i^{13} - 3091152636i^{14}) + \\
& \frac{(-7315i^{18} + 2310i^{19} + 2541i^{20} + 660i^{21} + 60i^{22}) \text{Log}20[i]}{8953560}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
& = \frac{1}{172982779200(1+i)^6} \\
& (-401212 - 7569832i - 67158543i^2 - 371754940i^3 - 1436215792i^4 - \\
& 4102356648i^5 - 8949033798i^6 - 15174775872i^7 - 20145598800i^8 - \\
& 20895093728i^9 - 16726341497i^{10} - 10066974972i^{11} - \\
& 4334167748i^{12} - 1205875280i^{13} - 165726132i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
& = \frac{1}{11243880648000(1+i)^8} \\
& (-22965600 - 479499448i - 4739462913i^2 - 29458944078i^3 - 128982140781i^4 - \\
& 422185926084i^5 - 1069732934490i^6 - 2142720727500i^7 - 3433423773270i^8 - \\
& 4422450757560i^9 - 4572106738155i^{10} - 3762490606530i^{11} - 2423115721695i^{12} - \\
& 1185266054100i^{13} - 417574580880i^{14} - 95412429960i^{15} - 10772198580i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{586637251200} (960869 + 12369513i + 71810265i^2 + 246516799i^3 + 549795495i^4 + \\
& 819790929i^5 + 802076184i^6 + 473201460i^7 + 129698712i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{65181916800} (74322 + 968986i + 5715605i^2 + 20026811i^3 + \\
& 45894975i^4 + 71045541i^5 + 73364928i^6 + 46880220i^7 + 14410968i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^5} (-18232704 - 35017416i - 8614648i^2 + 19160442i^3 + 14649390i^4 + \\
& 4438896i^5 + 2638692i^6 + 13168947i^7 + 46470989i^8 + 108376665i^9 + \\
& 171276507i^{10} + 183177176i^{11} + 123547500i^{12} + 43232904i^{13}) + \\
& \frac{1}{240240} ((448i^{15} + 1332i^{16} + 1116i^{17} - 249i^{18} - 855i^{19} - 483i^{20} - 121i^{21} - 12i^{22}) \\
& \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200i^5} \\
& (-85954176 - 429276078i - 355400430i^2 + 224915922i^3 + 223527150i^4 + \\
& 72601235i^5 + 8970555i^6 + 35780085i^7 + 108187475i^8 + 270024675i^9 + \\
& 419722749i^{10} + 469817712i^{11} + 319363020i^{12} + 129698712i^{13}) + \\
& \frac{1}{1113840} ((3264i^{15} + 19737i^{16} + 30645i^{17} + 5627i^{18} - 17475i^{19} - \\
& 11655i^{20} - 3025i^{21} - 300i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400i^4(1+i)} \\
& (-17459442 - 86378292i - 69345276i^2 + 44108064i^3 + 37921611i^4 + \\
& 12751466i^5 + 10402260i^6 + 40989080i^7 + 104487610i^8 + 195219984i^9 + \\
& 251635107i^{10} + 229742148i^{11} + 132594084i^{12} + 43232904i^{13}) + \\
& \frac{(969i^{16} + 4845i^{17} + 4047i^{18} - 2455i^{19} - 2219i^{20} - 605i^{21} - 60i^{22}) \text{Log}_{20}[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{6453009763200i^2(1+i)^3} (-131801670 - 235855620i - 44567276i^2 + 153898056i^3 + \\
& 435269289i^4 + 1759217498i^5 + 5529126405i^6 + 12613882512i^7 + \\
& 21259718557i^8 + 26622772374i^9 + 24455789523i^{10} + \\
& 15873169620i^{11} + 6664902156i^{12} + 1426685832i^{13}) + \\
& \frac{(7315i^{18} - 1155i^{19} - 2079i^{20} - 605i^{21} - 60i^{22}) \text{Log}_{20}[i]}{17907120}
\end{aligned}$$

$$\text{Q3 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1]$$

=

$$\frac{1}{115321852800(1+i)^5} (47726 + 871588i + 7457495i^2 + 39638268i^3 + 146257050i^4 + 396338484i^5 + 813279172i^6 + 1282796480i^7 + 1560256612i^8 + 1451102200i^9 + 1008413771i^{10} + 499615108i^{11} + 160020660i^{12} + 25496328i^{13})$$

$$\text{Q3 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1]$$

$$= \frac{1}{7495920432000(1+i)^7}$$

$$(2732625 + 55403188i + 530234433i^2 + 3180350770i^3 + 13382993983i^4 + 41896609380i^5 + 100928201570i^6 + 190781773100i^7 + 285774638325i^8 + 339875003380i^9 + 319083173695i^{10} + 232940905350i^{11} + 128538801995i^{12} + 50916137300i^{13} + 13060627740i^{14} + 1657261320i^{15})$$

$$\text{Q3 } [l = 0, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{293318625600} (4387656 + 52456040i + 281706139i^2 + 890513002i^3 + 1819079190i^4 + 2468750826i^5 + 2182711260i^6 + 1154358072i^7 + 281013876i^8)$$

$$\text{Q3 } [l = 1, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{48886437600} (520100 + 6298144i + 34370609i^2 + 110910667i^3 + 232787240i^4 + 327769855i^5 + 305126472i^6 + 173671932i^7 + 46835646i^8)$$

$$\text{Q3 } [l = 2, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 0]$$

=

$$\frac{1}{48886437600i^4} (15383844 + 36551088i + 32142852i^2 + 13309506i^3 + 3187737i^4 + 5043556i^5 + 26728520i^6 + 87093079i^7 + 185944032i^8 + 267614031i^9 + 257922606i^{10} + 154950852i^{11} + 46835646i^{12}) + \frac{(-378i^{16} - 1296i^{17} - 1734i^{18} - 1157i^{19} - 412i^{20} - 77i^{21} - 6i^{22}) \text{Log}_{20}[i]}{60060}$$

$$\text{Q3 } [l = 3, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{293318625600i^4}$$

$$(145047672 + 717604272i + 913832766i^2 + 410436180i^3 + 99228990i^4 + 22656480i^5 + 138320325i^6 + 417677810i^7 + 928693590i^8 + 1333750410i^9 + 1333041672i^{10} + 817378632i^{11} + 281013876i^{12}) + \frac{1}{556920} ((-5508i^{16} - 33048i^{17} - 63369i^{18} - 52050i^{19} - 20070i^{20} - 3850i^{21} - 300i^{22}) \text{Log}_{20}[i])$$

$$\begin{aligned}
& \text{Q3 } [l = 4, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 0] \\
& = \frac{1}{293318625600i^3(1+i)^2} \\
& (73945872 + 437386950i + 827530704i^2 + 666441958i^3 + 263483584i^4 + \\
& 191836827i^5 + 597673780i^6 + 1602440455i^7 + 3060050808i^8 + 4218675906i^9 + \\
& 4178228250i^{10} + 2878395120i^{11} + 1267079904i^{12} + 281013876i^{13}) + \\
& \frac{(-4104i^{17} - 20387i^{18} - 26590i^{19} - 11618i^{20} - 2310i^{21} - 180i^{22}) \text{Log}20[i]}{813960}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 0] \\
& = \frac{1}{1613252440800i(1+i)^4} (62432370 + 224743428i + 407446962i^2 + 1098018519i^3 + \\
& 4366060049i^4 + 13903129061i^5 + 32527070169i^6 + 56881349756i^7 + \\
& 75128674313i^8 + 74699470824i^9 + 54832136271i^{10} + \\
& 28419750612i^{11} + 9442296468i^{12} + 1545576318i^{13}) + \\
& \frac{(-3465i^{19} - 1848i^{20} - 385i^{21} - 30i^{22}) \text{Log}20[i]}{4476780}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 6, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 0] \\
& = \frac{1}{86491389600(1+i)^6} \\
& (346500 + 6351212i + 54686929i^2 + 293486333i^3 + 1097990811i^4 + 3033309420i^5 + \\
& 6391048893i^6 + 10451645556i^7 + 13359765027i^8 + 13317736644i^9 + 10224891040 \\
& i^{10} + 5887963637i^{11} + 2417812624i^{12} + 638834568i^{13} + 82863066i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 7, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 0] \\
& = \frac{1}{11243880648000(1+i)^8} \\
& (39779768 + 809217920i + 7787003145i^2 + 47084019174i^3 + 200369459250i^4 + \\
& 636883249014i^5 + 1565565502470i^6 + 3039227846700i^7 + 4714811891280i^8 + \\
& 5872869443100i^9 + 5864541395295i^{10} + 4655431322730i^{11} + 2887949394450i^{12} + \\
& 1358295413130i^{13} + 459054253800i^{14} + 100287042600i^{15} + 10772198580i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 0, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200} (-1534624 - 18933915i - 105030432i^2 - 343275059i^3 - \\
& 725686950i^4 - 1020170439i^5 - 935104380i^6 - 513108756i^7 - 129698712i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 1, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{65181916800} (-119680 - 1496814i - 8445248i^2 - 28206311i^3 - \\
& 61346250i^4 - 89617395i^5 - 86668652i^6 - 51314364i^7 - 14410968i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 2, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^4} \left(-20511792 - 53130168i - 50928192i^2 - 22788990i^3 - 5394508i^4 - \right. \\
& 3860556i^5 - 19549824i^6 - 65935729i^7 - 145985550i^8 - \\
& 218131533i^9 - 218656788i^{10} - 136849932i^{11} - 43232904i^{12} \left. \right) + \\
& \frac{(504i^{16} + 1836i^{17} + 2624i^{18} + 1875i^{19} + 714i^{20} + 143i^{21} + 12i^{22}) \text{Log}20[i]}{240240}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 3, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200i^4} \\
& \left(-96698448 - 514664766i - 723841272i^2 - 355197150i^3 - 86535540i^4 - \right. \\
& 12154065i^5 - 50936160i^6 - 156612775i^7 - 363189750i^8 - 540357435i^9 - \\
& 562961868i^{10} - 359270316i^{11} - 129698712i^{12} \left. \right) + \frac{1}{1113840} \\
& \left((3672i^{16} + 23409i^{17} + 48048i^{18} + 42375i^{19} + 17430i^{20} + 3575i^{21} + 300i^{22}) \right. \\
& \left. \text{Log}20[i] \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 4, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^3(1+i)^2} \left(-17459442 - 109657548i - 219399180i^2 - 185578120i^3 - \right. \\
& 73375757i^4 - 31129826i^5 - 74251540i^6 - 203376140i^7 - 400771634i^8 - \\
& 570393528i^9 - 583697841i^{10} - 415557588i^{11} - 189129420i^{12} - 43232904i^{13} \left. \right) + \\
& \frac{(969i^{17} + 5168i^{18} + 7275i^{19} + 3374i^{20} + 715i^{21} + 60i^{22}) \text{Log}20[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{6453009763200i(1+i)^4} \\
& \left(-104053950 - 369972564i - 570350196i^2 - 960747840i^3 - \right. \\
& 3236907947i^4 - 10405383158i^5 - 24983507967i^6 - 44891916608i^7 - \\
& 60943807991i^8 - 62291325162i^9 - 46999254753i^{10} - \\
& 25026095556i^{11} - 8530568244i^{12} - 1426685832i^{13} \left. \right) + \\
& \frac{(5775i^{19} + 3234i^{20} + 715i^{21} + 60i^{22}) \text{Log}20[i]}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 6, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{345965558400(1+i)^6} \\
& \left(-233240 - 4371486i - 38501628i^2 - 211422311i^3 - 809587404i^4 - 2289835530i^5 - \right. \\
& 4940626044i^6 - 8275362372i^7 - 10834833744i^8 - 11062280836i^9 - \\
& 8696597160i^{10} - 5124988731i^{11} - 2151527548i^{12} - 580086036i^{13} - 76488984i^{14} \left. \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 7, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{7495920432000(1+i)^8} \\
& (-4454408 - 92454103i - 907978552i^2 - 5604390591i^3 - 24351852726i^4 - \\
& 79047749373i^5 - 198471021900i^6 - 393577570830i^7 - 623719056780i^8 - \\
& 793618267035i^9 - 809399603760i^{10} - 656031783345i^{11} - 415313197650i^{12} - \\
& 199190894985i^{13} - 68566846980i^{14} - 15227815620i^{15} - 1657261320i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 0, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{97772875200} (45136 + 573755i + 3282201i^2 + 11073389i^3 + \\
& 24189565i^4 + 35178291i^5 + 33396585i^6 + 19004028i^7 + 4988412i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 1, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{10863652800} (3520 + 45358i + 263914i^2 + 909881i^3 + \\
& 2044875i^4 + 3090255i^5 + 3095309i^6 + 1900532i^7 + 554268i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 2, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{32590958400i^4} (1139544 + 3195864i + 3313912i^2 + \\
& 1604610i^3 + 398062i^4 + 141652i^5 + 610932i^6 + 2126959i^7 + \\
& 4866185i^8 + 7521777i^9 + 7809171i^{10} + 5068516i^{11} + 1662804i^{12}) + \\
& \frac{(-28i^{16} - 108i^{17} - 164i^{18} - 125i^{19} - 51i^{20} - 11i^{21} - i^{22}) \text{Log}20[i]}{40040}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 3, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{97772875200i^4} (5372136 + 30607038i + 46879602i^2 + \\
& 25121250i^3 + 6417810i^4 + 767305i^5 + 1591755i^6 + 5052025i^7 + \\
& 12106325i^8 + 18633015i^9 + 20105781i^{10} + 13306308i^{11} + 4988412i^{12}) + \\
& \frac{(-204i^{16} - 1377i^{17} - 3003i^{18} - 2825i^{19} - 1245i^{20} - 275i^{21} - 25i^{22}) \text{Log}20[i]}{185640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 4, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{32590958400i^3(1+i)} (1027026 + 5765760i + 8492484i^2 + \\
& 4160884i^3 + 1042769i^4 + 540540i^5 + 1877920i^6 + 4776090i^7 + \\
& 8714236i^8 + 11034516i^9 + 9766551i^{10} + 5465160i^{11} + 1662804i^{12}) + \\
& \frac{(-57i^{17} - 323i^{18} - 485i^{19} - 241i^{20} - 55i^{21} - 5i^{22}) \text{Log}20[i]}{90440}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 5, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{1075501627200i(1+i)^3} \\
& (6936930 + 17818476i + 18085808i^2 + 23730876i^3 + 82401137i^4 + \\
& 254298990i^5 + 572187693i^6 + 949353944i^7 + 1167179101i^8 + 1049075082i^9 + \\
& 663043095i^{10} + 269203704i^{11} + 54872532i^{12}) + \\
& \frac{(-385i^{19} - 231i^{20} - 55i^{21} - 5i^{22}) \text{Log}_{20}[i]}{2984520}
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 6, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{57660926400(1+i)^5} \\
& (6860 + 124362i + 1055496i^2 + 5560289i^3 + 20313900i^4 + 54443070i^5 + \\
& 110341488i^6 + 171633084i^7 + 205483656i^8 + 187691500i^9 + \\
& 127743840i^{10} + 61757277i^{11} + 19196536i^{12} + 2941884i^{13})
\end{aligned}$$

$$\begin{aligned}
& \text{Q3 } [l = 7, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{1249320072000(1+i)^7} \\
& (131012 + 2638867i + 25075746i^2 + 149239887i^3 + 622691234i^4 + \\
& 1931316335i^5 + 4605129780i^6 + 8607334390i^7 + 12733449520i^8 + \\
& 14936577315i^9 + 13809547070i^{10} + 9910253225i^{11} + \\
& 5363890950i^{12} + 2078002735i^{13} + 519138520i^{14} + 63740820i^{15})
\end{aligned}$$

Case 4: $i_1 = i_2 = i_3 = i, i_4 = i + 1$

$$\begin{aligned}
& \text{Q4 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{195545750400} \\
& (13766151 + 195126738i + 1268224968i^2 + 4983556088i^3 + 13121297020i^4 + \\
& 24169915656i^5 + 30664989504i^6 + 24408660384i^7 + 9338307264i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{10863652800} (472383 + 6720438i + 43879486i^2 + 173435276i^3 + \\
& 460180000i^4 + 856818984i^5 + 1131187344i^6 + 1035155568i^7 + 518794848i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{32590958400i^8} (496271412 - 195341832i - 1349792248i^2 - \\
&610613248i^3 + 193629513i^4 + 107808778i^5 - 4102140i^6 - 29628648i^7 + \\
&5025906i^8 + 419952i^9 + 110382342i^{10} + 345419860i^{11} + 1014339054i^{12} + \\
&1789546692i^{13} + 2512867648i^{14} + 2142823344i^{15} + 1556384544i^{16}) + \\
&\frac{1}{20020} ((-6097i^{12} - 4018i^{13} + 19128i^{14} + 24928i^{15} + 5502i^{16} - \\
&3834i^{17} - 1329i^{18} + 402i^{19} + 354i^{20} + 88i^{21} + 8i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \\
&\frac{1}{195545750400i^8} (2444321880 + 2315673360i - 46750149600i^2 - 49251595008i^3 + \\
&7117417692i^4 + 2860506264i^5 + 2709173544i^6 - 3330890640i^7 + 2620372725i^8 - \\
&2913441210i^9 + 3531263040i^{10} - 1557638120i^{11} + 7900222040i^{12} + \\
&4972904352i^{13} + 14812490592i^{14} + 7081079904i^{15} + 9338307264i^{16}) + \\
&\frac{1}{371280} ((-92820i^{12} - 185640i^{13} + 1683000i^{14} + 3738912i^{15} + 1693047i^{16} - \\
&392526i^{17} - 217176i^{18} + 18600i^{19} + 33480i^{20} + 8800i^{21} + 800i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{65181916800i^6(1+i)^2} \\
&(-2095133040 - 15952416480i - 27055090062i^2 - 12084768696i^3 + \\
&2166646482i^4 + 1141944804i^5 - 76772793i^6 - 116598912i^7 + 117581539i^8 + \\
&695282650i^9 + 2241284580i^{10} + 5141237416i^{11} + 8826522580i^{12} + \\
&11142886680i^{13} + 10505324352i^{14} + 6660611424i^{15} + 3112769088i^{16}) + \\
&\frac{1}{180880} ((116280i^{14} + 775200i^{15} + 766479i^{16} - 59166i^{17} - 64296i^{18} - \\
&2040i^{19} + 6184i^{20} + 1760i^{21} + 160i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{537750813600i^4(1+i)^4} \\
&(-6721885170 - 19811872080i - 19101992910i^2 - 5193448260i^3 + 1251283554i^4 + \\
&571688562i^5 + 1257536469i^6 + 6981914582i^7 + 26041189068i^8 + \\
&71085694042i^9 + 147005404007i^{10} + 233963068482i^{11} + 286876942132i^{12} + \\
&268234841028i^{13} + 185593911096i^{14} + 90427118760i^{15} + 25680344976i^{16}) + \\
&\frac{(373065i^{16} - 21945i^{18} - 2310i^{19} + 1386i^{20} + 440i^{21} + 40i^{22}) \text{Log}20[i]}{1492260}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{19220308800(1+i)^6} \\
& (257229 + 5215128i + 49961157i^2 + 300291466i^3 + 1267660373i^4 + \\
& 3985359096i^5 + 9649873307i^6 + 18343204858i^7 + 27622192884i^8 + \\
& 32967560692i^9 + 30927863054i^{10} + 22378701828i^{11} + \\
& 12063269632i^{12} + 4500072176i^{13} + 917867808i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \\
& \frac{1}{2498640144000(1+i)^8} (29192499 + 650282802i + 6883842524i^2 + 46021317368i^3 + \\
& 217759955598i^4 + 774413949612i^5 + 2144709070140i^6 + 4727393663040i^7 + \\
& 8400101931645i^8 + 12104353247910i^9 + 14143572839880i^{10} + \\
& 13318143548040i^{11} + 9973049181080i^{12} + 5803896006720i^{13} + \\
& 2520312617120i^{14} + 749852355360i^{15} + 119322815040i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{586637251200} \\
& (-7646555 - 111428253i - 744951876i^2 - 3012475508i^3 - 8165116050i^4 - \\
& 15485835240i^5 - 20287697184i^6 - 16791483168i^7 - 6744333024i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{32590958400} (-270180 - 3953151i - 26560772i^2 - 108083906i^3 - \\
& 295349775i^4 - 566352570i^5 - 769572048i^6 - 723401136i^7 - 374685168i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{97772875200i^8} \\
& (-496271412 + 31817268i + 1521923368i^2 + 936179160i^3 - 204696975i^4 - \\
& 148508087i^5 + 2490516i^6 + 29461068i^7 + 3603505i^8 - 1780992i^9 - \\
& 65400528i^{10} - 222819478i^{11} - 659456199i^{12} - 1213356720i^{13} - \\
& 1738685744i^{14} - 1541826288i^{15} - 1124055504i^{16}) + \\
& \frac{1}{120120} ((12194i^{12} + 12054i^{13} - 38256i^{14} - 62320i^{15} - 19125i^{16} + \\
& 8946i^{17} + 3760i^{18} - 774i^{19} - 885i^{20} - 242i^{21} - 24i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$Q4 [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

=

$$\frac{1}{586637251200i^8} (-2444321880 - 4759995240i + 49323120000i^2 + 71150808960i^3 - 5666209164i^4 - 6063506988i^5 - 1440114984i^6 + 1864086840i^7 - 911273725i^8 + 1294391745i^9 - 1705184460i^{10} + 500661980i^{11} - 4744569990i^{12} - 3871758060i^{13} - 10027149984i^{14} - 5480695008i^{15} - 6744333024i^{16}) + \frac{1}{1113840} ((92820i^{12} + 278460i^{13} - 1683000i^{14} - 4673640i^{15} - 2622879i^{16} + 457947i^{17} + 295076i^{18} - 11700i^{19} - 41850i^{20} - 12100i^{21} - 1200i^{22}) \text{Log}20[i])$$

$$Q4 [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

=

$$\frac{1}{195545750400i^6(1+i)} (2095133040 + 17349171840i + 19997799822i^2 - 1454076624i^3 - 1254347094i^4 - 328696368i^5 + 407449545i^6 - 270731580i^7 + 253473535i^8 - 733086880i^9 - 699624050i^{10} - 2829860190i^{11} - 3245047848i^{12} - 4782611904i^{13} - 2818255104i^{14} - 2248111008i^{15}) + \frac{1}{542640} ((-116280i^{14} - 969000i^{15} - 1154079i^{16} + 69027i^{17} + 85956i^{18} + 4860i^{19} - 7730i^{20} - 2420i^{21} - 240i^{22}) \text{Log}20[i])$$

$$Q4 [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

=

$$\frac{1}{3226504881600i^4(1+i)^3} (20165655510 + 39269960730i + 18167819670i^2 - 2199006810i^3 - 1169817925i^4 - 184843497i^5 - 1321386465i^6 - 7540101185i^7 - 26514586725i^8 - 68802219255i^9 - 133095043543i^{10} - 196092522615i^{11} - 216920512710i^{12} - 177740104080i^{13} - 99952427520i^{14} - 37093831632i^{15}) + \frac{(-223839i^{16} + 11704i^{18} + 1386i^{19} - 693i^{20} - 242i^{21} - 24i^{22}) \text{Log}20[i]}{1790712}$$

$$Q4 [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1]$$

=

$$\frac{1}{57660926400(1+i)^5} (-153790 - 3029543i - 28115821i^2 - 163121108i^3 - 661787065i^4 - 1988673380i^5 - 4570634497i^6 - 8171790704i^7 - 11430840817i^8 - 12450827015i^9 - 10382158600i^{10} - 6408195968i^{11} - 2741479296i^{12} - 662904528i^{13})$$

$$\begin{aligned}
& \text{Q4}[l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{7495920432000(1+i)^7} \\
&(-17497935 - 379745082i - 3907035526i^2 - 25314605330i^3 - 115696700098i^4 - \\
&395801222660i^5 - 1049197266400i^6 - 2199703025540i^7 - 3687821813665i^8 - \\
&4960593656150i^9 - 5332722723790i^{10} - 4526892260030i^{11} - \\
&2967354711060i^{12} - 1443735219040i^{13} - 480571906560i^{14} - 86177588640i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 0, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200} \\
&(10827098 + 149655543i + 942463728i^2 + 3554674708i^3 + 8850572970i^4 + \\
&15024761784i^5 + 17080694784i^6 + 11933676864i^7 + 3950822304i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 1, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{32590958400} (382338 + 5330863i + 33955271i^2 + 130071466i^3 + \\
&331191945i^4 + 582279054i^5 + 704536644i^6 + 552283488i^7 + 219490128i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 2, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{97772875200i^7} (-155547756 - 17453016i + 440500872i^2 + \\
&417369288i^3 + 75665233i^4 - 63713664i^5 - 43838676i^6 - 7679364i^7 + \\
&8388522i^8 + 76269435i^9 + 279823582i^{10} + 734419863i^{11} + \\
&1295636448i^{12} + 1629488488i^{13} + 1324754784i^{14} + 658470384i^{15}) + \\
&\frac{1}{120120} ((3822i^{13} + 4452i^{14} - 10384i^{15} - 21636i^{16} - 12636i^{17} - \\
&381i^{18} + 2718i^{19} + 1347i^{20} + 286i^{21} + 24i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 3, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200i^7} \\
&(-564074280 - 856714320i + 11225313792i^2 + 17700497892i^3 + 4717150284i^4 - \\
&1019411316i^5 - 1763241480i^6 + 145906430i^7 - 473629035i^8 + 863278260i^9 + \\
&769602020i^{10} + 3989929890i^{11} + 5542399332i^{12} + \\
&8366508792i^{13} + 5955954624i^{14} + 3950822304i^{15}) + \\
&\frac{1}{1113840} ((21420i^{13} + 55080i^{14} - 392088i^{15} - 1120878i^{16} - 885321i^{17} - \\
&149356i^{18} + 107700i^{19} + 64950i^{20} + 14300i^{21} + 1200i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 4, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{195545750400i^5(1+i)^2} \\
& (419026608 + 3434915484i + 6981416442i^2 + 5037904872i^3 + \\
& 831945114i^4 - 461669502i^5 - 246610325i^6 + 67961980i^7 + 550987155i^8 + \\
& 1732106890i^9 + 3883404688i^{10} + 6405950814i^{11} + 7763394072i^{12} + \\
& 6775992192i^{13} + 3955008384i^{14} + 1316940768i^{15}) + \\
& \frac{1}{542640} ((-23256i^{15} - 168606i^{16} - 227601i^{17} - 63156i^{18} + \\
& 14020i^{19} + 12350i^{20} + 2860i^{21} + 240i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 5, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{3226504881600i^3(1+i)^4} \\
& (2372430060 + 7915037130i + 9559089540i^2 + 4722408692i^3 + \\
& 679345220i^4 + 1723478037i^5 + 11079083470i^6 + 40978445245i^7 + \\
& 109532651778i^8 + 220894116905i^9 + 340747481558i^{10} + 401761551675i^{11} + \\
& 356435097810i^{12} + 228892090812i^{13} + 97757526240i^{14} + 21729522672i^{15}) + \\
& \frac{(-26334i^{17} - 10241i^{18} + 462i^{19} + 1155i^{20} + 286i^{21} + 24i^{22}) \text{Log}20[i]}{1790712}
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 6, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{57660926400(1+i)^6} \\
& (215014 + 4314513i + 40858107i^2 + 242394391i^3 + 1008180768i^4 + 3116079621i^5 + \\
& 7397571512i^6 + 13739719323i^7 + 20126164674i^8 + 23226569872i^9 + 20888804079 \\
& i^{10} + 14290644648i^{11} + 7099806152i^{12} + 2327832576i^{13} + 388328688i^{14})
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 7, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \\
& \frac{1}{7495920432000(1+i)^8} (24436098 + 539328659i + 5651260712i^2 + 37354148664i^3 + \\
& 174517581006i^4 + 611821887018i^5 + 1667196141000i^6 + 3607554326580i^7 + \\
& 6275315210250i^8 + 8821587004725i^9 + 10011462291600i^{10} + \\
& 9101848383660i^{11} + 6523149844950i^{12} + 3582213518780i^{13} + \\
& 1433362254920i^{14} + 378123024960i^{15} + 50482729440i^{16})
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 0, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200} (-1997934 - 28403531i - 184108877i^2 - 715296786i^3 - \\
& 1836262410i^4 - 3218098476i^5 - 3786204708i^6 - 2749115016i^7 - 951123888i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 1, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{97772875200} (-217050 - 3112286i - 20400422i^2 - 80469711i^3 - \\
&211100925i^4 - 382553220i^5 - 477224748i^6 - 385743396i^7 - 158520648i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 2, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{97772875200i^7} \\
&(51849252 + 21201516i - 156949576i^2 - 175311472i^3 - 37884861i^4 + 23978493i^5 + \\
&18084906i^6 + 4280724i^7 - 1491661i^8 - 15371479i^9 - 58813179i^{10} - \\
&158316493i^{11} - 288637702i^{12} - 373299498i^{13} - 313300956i^{14} - 158520648i^{15}) + \\
&\frac{1}{120120} ((-1274i^{13} - 1862i^{14} + 3312i^{15} + 8364i^{16} + 5457i^{17} + \\
&387i^{18} - 1063i^{19} - 577i^{20} - 132i^{21} - 12i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 3, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{195545750400i^7} \\
&(62674920 + 157865400i - 1294129760i^2 - 2551101476i^3 - 747680472i^4 + \\
&162001224i^5 + 205650060i^6 + 28443010i^7 + 25413465i^8 - 49796385i^9 - \\
&63802030i^{10} - 280791310i^{11} - 424984400i^{12} - \\
&638516736i^{13} - 481717032i^{14} - 317041296i^{15}) + \\
&\frac{1}{371280} ((-2380i^{13} - 8500i^{14} + 42840i^{15} + 148614i^{16} + 130203i^{17} + \\
&23629i^{18} - 14250i^{19} - 9330i^{20} - 2200i^{21} - 200i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 4, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200i^5(1+i)} \\
&(-419026608 - 3714266556i - 5508336834i^2 - 1384407024i^3 + \\
&271993722i^4 + 317362794i^5 + 16426609i^6 - 12559960i^7 - 337387685i^8 - \\
&781608180i^9 - 1814964702i^{10} - 2562642480i^{11} - \\
&2901104604i^{12} - 1961620344i^{13} - 951123888i^{14}) + \\
&\frac{1}{1627920} ((23256i^{15} + 207366i^{16} + 315267i^{17} + 82821i^{18} - \\
&17330i^{19} - 16106i^{20} - 3960i^{21} - 360i^{22}) \text{Log}20[i])
\end{aligned}$$

$$Q4 [l = 5, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\frac{1}{1075501627200i^3(1+i)^3} (-395405010 - 901800900i - 626636010i^2 - 97375346i^3 + 23887979i^4 - 107556928i^5 - 653853081i^6 - 2280463020i^7 - 5755995091i^8 - 10834167190i^9 - 15354353663i^{10} - 16213936596i^{11} - 12367424520i^{12} - 6286891380i^{13} - 1743727128i^{14}) + \frac{(21945i^{17} + 7315i^{18} - 385i^{19} - 847i^{20} - 220i^{21} - 20i^{22}) \text{Log}20[i]}{2984520}$$

$$Q4 [l = 6, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\frac{1}{57660926400(1+i)^5} (-42330 - 824446i - 7553952i^2 - 43193361i^3 - 172340330i^4 - 507985935i^5 - 1141411524i^6 - 1986538543i^7 - 2689589364i^8 - 2812888155i^9 - 2224679600i^{10} - 1273434606i^{11} - 481310052i^{12} - 93486536i^{13})$$

$$Q4 [l = 7, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\frac{1}{22487761296000(1+i)^7} (-14466450 - 310780459i - 3161569808i^2 - 20227499626i^3 - 91142943452i^4 - 306826089910i^5 - 798542450960i^6 - 1639172395000i^7 - 2681364078470i^8 - 3503925540445i^9 - 3638556154640i^{10} - 2959575180250i^{11} - 1834945152920i^{12} - 825352688040i^{13} - 243968657160i^{14} - 36459749040i^{15})$$

$$Q4 [l = 0, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

=

$$\frac{1}{586637251200} (11812780 + 165653277i + 1063615860i^2 + 4121733508i^3 + 10680471330i^4 + 19318075200i^5 + 23962889376i^6 + 18485729280i^7 + 6744333024i^8)$$

$$Q4 [l = 1, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

=

$$\frac{1}{32590958400} (402687 + 5662831i + 36485330i^2 + 142009546i^3 + 370126365i^4 + 674961966i^5 + 869960448i^6 + 775200000i^7 + 374685168i^8)$$

$$\begin{aligned}
& \text{Q4 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0] \\
& = \frac{1}{97772875200i^7} (-1471721076 - 2365641936i - \\
& 773476200i^2 + 254414034i^3 + 60933131i^4 - 58751784i^5 - 49964796i^6 + \\
& 28727i^7 - 954576i^8 + 92528286i^9 + 279358462i^{10} + 812191803i^{11} + \\
& 1392850404i^{12} + 1914718160i^{13} + 1570245120i^{14} + 1124055504i^{15}) + \\
& \frac{1}{120120} ((36162i^{13} + 96192i^{14} + 80080i^{15} + 13707i^{16} - 8082i^{17} - \\
& 106i^{18} + 2718i^{19} + 1347i^{20} + 286i^{21} + 24i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0] \\
& = \\
& \frac{1}{586637251200i^7} (-21998896920 - 94170716640i - 70495996032i^2 + 8854023024i^3 + \\
& 2189293260i^4 + 922166784i^5 - 3784861080i^6 + 2249752680i^7 - \\
& 2658128385i^8 + 3138877860i^9 - 1510958860i^{10} + 6544252650i^{11} + \\
& 3572290548i^{12} + 11449952064i^{13} + 4889341440i^{14} + 6744333024i^{15}) + \\
& \frac{1}{1113840} ((835380i^{13} + 4455360i^{14} + 6438648i^{15} + 2473704i^{16} - 435915i^{17} - \\
& 122916i^{18} + 107700i^{19} + 64950i^{20} + 14300i^{21} + 1200i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0] \\
& = \frac{1}{195545750400i^6(1+i)^2} \\
& (-5587021440 - 29736186480i - 43861385568i^2 - 18461188746i^3 + \\
& 2137955820i^4 + 674239566i^5 - 459316272i^6 - 250311275i^7 + 77210230i^8 + \\
& 555475905i^9 + 1804665610i^{10} + 4017909640i^{11} + 6792767862i^{12} + \\
& 8290460304i^{13} + 7667658240i^{14} + 4615292736i^{15} + 2248111008i^{16}) + \\
& \frac{1}{542640} ((310080i^{14} + 1356600i^{15} + 1147296i^{16} - 68115i^{17} - \\
& 54036i^{18} + 14020i^{19} + 12350i^{20} + 2860i^{21} + 240i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0] \\
& = \frac{1}{3226504881600i^4(1+i)^4} \\
& (-20165655510 - 59435616240i - 57701383740i^2 - 16912235340i^3 + \\
& 2076088785i^4 + 563758518i^5 + 1749637632i^6 + 11303792570i^7 + \\
& 41880699290i^8 + 112538230200i^9 + 228371757152i^{10} + \\
& 355855121798i^{11} + 425895872655i^{12} + 388082947890i^{13} + \\
& 261455890080i^{14} + 125413282368i^{15} + 37093831632i^{16}) + \\
& \frac{(223839i^{16} - 8778i^{18} + 462i^{19} + 1155i^{20} + 286i^{21} + 24i^{22}) \text{Log}_{20}[i]}{1790712}
\end{aligned}$$

$$Q4 [l = 6, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{57660926400(1+i)^6} (217091 + 4361139i + 41357253i^2 + 245783073i^3 + 1024544808i^4 + 3175829619i^5 + 7568710326i^6 + 14133326097i^7 + 20863842087i^8 + 24362463972i^9 + 22329346611i^{10} + 15788955084i^{11} + 8359942848i^{12} + 3121606368i^{13} + 662904528i^{14})$$

$$Q4 [l = 7, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 0]$$

$$= \frac{1}{7495920432000(1+i)^8} (24623172 + 543904049i + 5704846412i^2 + 37753980864i^3 + 176650709106i^4 + 620477659638i^5 + 1694936376600i^6 + 3679512232380i^7 + 6428877949800i^8 + 9094037910375i^9 + 10415682056340i^{10} + 9604063641660i^{11} + 7043742963150i^{12} + 4026173530380i^{13} + 1732036285120i^{14} + 520253464320i^{15} + 86177588640i^{16})$$

$$Q4 [l = 0, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1]$$

$$= \frac{1}{195545750400} (-711648 - 10244349i - 67542846i^2 - 268831616i^3 - 715536295i^4 - 1329249348i^5 - 1698199632i^6 - 1358569008i^7 - 518794848i^8)$$

$$Q4 [l = 1, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1]$$

$$= \frac{1}{21727305600} (-50121 - 723886i - 4791654i^2 - 19164544i^3 - 51324035i^4 - 96123888i^5 - 127086288i^6 - 115861392i^7 - 57643872i^8)$$

$$Q4 [l = 2, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1]$$

$$= \frac{1}{65181916800i^7} (327049128 + 634443264i + 274760528i^2 - 66370374i^3 - 25408110i^4 + 14285040i^5 + 12449304i^6 + 2150171i^7 - 101616i^8 - 11886618i^9 - 39189520i^{10} - 114327237i^{11} - 204165108i^{12} - 285134064i^{13} - 242312016i^{14} - 172931616i^{15}) + \frac{1}{80080} ((-8036i^{13} - 24048i^{14} - 23136i^{15} - 5457i^{16} + 2340i^{17} + 302i^{18} - 672i^{19} - 381i^{20} - 88i^{21} - 8i^{22}) \text{Log}20[i])$$

$$\begin{aligned}
& \text{Q4 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{195545750400i^7} \\
& (2444321880 + 12092960880i + 11549401248i^2 - 925351812i^3 - 674036748i^4 + \\
& 43361472i^5 + 289757160i^6 - 67581710i^7 + 129884865i^8 - 164099910i^9 + \\
& 56747840i^{10} - 423575075i^{11} - 308893032i^{12} - \\
& 833076432i^{13} - 411119568i^{14} - 518794848i^{15}) + \\
& \frac{1}{371280} ((-92820i^{13} - 556920i^{14} - 921672i^{15} - 425442i^{16} + 62667i^{17} + \\
& 25102i^{18} - 12600i^{19} - 9165i^{20} - 2200i^{21} - 200i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{65181916800i^6(1+i)} (698377680 + 3455131680i + 3314026716i^2 - 199008810i^3 - \\
& 135957822i^4 - 3459456i^5 + 61121538i^6 - 27317747i^7 + \\
& 30206905i^8 - 72682730i^9 - 51828765i^{10} - 248940793i^{11} - \\
& 256203372i^{12} - 390700800i^{13} - 204699312i^{14} - 172931616i^{15}) + \\
& \frac{1}{180880} ((-38760i^{14} - 193800i^{15} - 191862i^{16} + 9747i^{17} + 9462i^{18} - \\
& 1400i^{19} - 1737i^{20} - 440i^{21} - 40i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{2151003254400i^4(1+i)^3} \\
& (6721885170 + 13089986910i + 6143807670i^2 - 520269750i^3 - 215316853i^4 + \\
& 21556149i^5 - 206754813i^6 - 1343607951i^7 - 4619644315i^8 - \\
& 11801267709i^9 - 22263285275i^{10} - 32015852473i^{11} - 34272903456i^{12} - \\
& 27295567200i^{13} - 14694582672i^{14} - 5706743328i^{15}) + \\
& \frac{(-373065i^{16} + 14630i^{18} - 1617i^{20} - 440i^{21} - 40i^{22}) \text{Log}20[i]}{5969040}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{38440617600(1+i)^5} (-28413 - 553923i - 5081442i^2 - 29100692i^3 - 116347460i^4 - \\
& 343885282i^5 - 775650942i^6 - 1357485668i^7 - 1853584513i^8 - 1965558265i^9 - \\
& 1593059028i^{10} - 957092928i^{11} - 404494192i^{12} - 101985312i^{13})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 7, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{2498640144000(1+i)^7} \\
& (-1616076 - 34741957i - 353731105i^2 - 2265556939i^3 - 10222200428i^4 - \\
& 34473003670i^5 - 89930220770i^6 - 185197136890i^7 - 304340470280i^8 - \\
& 400422046255i^9 - 420256153295i^{10} - 347935731385i^{11} - \\
& 222681862760i^{12} - 106489068960i^{13} - 35514780240i^{14} - 6629045280i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 0, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200} (3100864 + 42403394i + 263772235i^2 + 980808106i^3 + \\
& 2401734900i^4 + 3997213236i^5 + 4434326172i^6 + 3001070520i^7 + 951123888i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 1, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{97772875200} (326872 + 4506581i + 28336945i^2 + 106939371i^3 + \\
& 267577380i^4 + 460842606i^5 + 544105128i^6 + 414169980i^7 + 158520648i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 2, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{97772875200i^6} (138454596 + 268401168i + 135948456i^2 - 35705082i^3 - \\
& 60534411i^4 - 27081474i^5 - 4776408i^6 + 2107981i^7 + 21194378i^8 + 76270303i^9 + \\
& 196899432i^{10} + 339612270i^{11} + 416776590i^{12} + 328161540i^{13} + 158520648i^{14}) + \\
& \frac{1}{120120} ((-3402i^{14} - 10176i^{15} - 10272i^{16} - 2631i^{17} + 2412i^{18} + \\
& 2227i^{19} + 824i^{20} + 154i^{21} + 12i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 3, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200i^6} (1692222840 + 7759626336i + 7405630848i^2 + \\
& 178613820i^3 - 1527097572i^4 - 973484820i^5 - 34344800i^6 - \\
& 149702190i^7 + 249954705i^8 + 197046050i^9 + 1078799100i^{10} + \\
& 1433252916i^{11} + 2142412488i^{12} + 1452918600i^{13} + 951123888i^{14}) + \\
& \frac{1}{1113840} ((-64260i^{14} - 362304i^{15} - 591192i^{16} - 302130i^{17} + \\
& 50923i^{18} + 97950i^{19} + 40140i^{20} + 7700i^{21} + 600i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200i^5(1+i)^2} \\
& (1117404288 + 6226588368i + 10191713532i^2 + 5454078630i^3 - \\
& 462666204i^4 - 1240661786i^5 - 468256538i^6 + 15873021i^7 + 447731590i^8 + \\
& 1399411225i^9 + 3077047542i^{10} + 4979084976i^{11} + 5886626436i^{12} + \\
& 5014749420i^{13} + 2839115736i^{14} + 951123888i^{15}) + \\
& \frac{1}{1627920} ((-62016i^{15} - 286824i^{16} - 293550i^{17} - 23351i^{18} + \\
& 48050i^{19} + 23236i^{20} + 4620i^{21} + 360i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{3226504881600i^3(1+i)^4} \\
& (1186215030 + 3759816060i + 4113599490i^2 + 1524789448i^3 - 189640757i^4 + \\
& 259966512i^5 + 2979700407i^6 + 11077504488i^7 + 29195592393i^8 + \\
& 57901940096i^9 + 87658513019i^{10} + 101220156312i^{11} + \\
& 87822908118i^{12} + 55182069360i^{13} + 23239220796i^{14} + 5231181384i^{15}) + \\
& \frac{(-65835i^{17} - 14630i^{18} + 5775i^{19} + 3696i^{20} + 770i^{21} + 60i^{22}) \text{Log}20[i]}{8953560}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{57660926400(1+i)^6} \\
& (60792 + 1209503i + 11346851i^2 + 66621856i^3 + 273934701i^4 + 835961998i^5 + \\
& 1956718077i^6 + 3577804054i^7 + 5151308459i^8 + 5834977709i^9 + \\
& 5146210762i^{10} + 3454491118i^{11} + 1690350086i^{12} + 551558676i^{13} + 93486536i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{22487761296000(1+i)^8} \\
& (20717024 + 453694118i + 4713708453i^2 + 30868865502i^3 + 142758406680i^4 + \\
& 494927187552i^5 + 1332252812370i^6 + 2844383326860i^7 + 4875898997340i^8 + \\
& 6746666621970i^9 + 7528706837355i^{10} + 6726477658050i^{11} + 4739283432660i^{12} + \\
& 2564086496340i^{13} + 1016134756920i^{14} + 268245440520i^{15} + 36459749040i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200} (-558662 - 7845654i - 50147451i^2 - 191704996i^3 - \\
& 482927370i^4 - 827646669i^5 - 947612232i^6 - 664609968i^7 - 219490128i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 1, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{65181916800} (-40396 - 572001i - 3695524i^2 - 14334404i^3 - \\
&36871590i^4 - 65279193i^5 - 79198308i^6 - 61907472i^7 - 24387792i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 2, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{195545750400i^6} \\
&(-92303064 - 208887840i - 129102624i^2 + 17281474i^3 + 47456262i^4 + \\
&22915116i^5 + 4873008i^6 - 602601i^7 - 8357034i^8 - 31356716i^9 - 82806978i^{10} - \\
&147278367i^{11} - 185184944i^{12} - 149908176i^{13} - 73163376i^{14}) + \\
&\frac{1}{240240} ((2268i^{14} + 7520i^{15} + 8568i^{16} + 2907i^{17} - 1614i^{18} - \\
&1788i^{19} - 714i^{20} - 143i^{21} - 12i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 3, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200i^6} \\
&(-564074280 - 2962591632i - 3434538492i^2 - 318476928i^3 + 627486552i^4 + \\
&376007940i^5 + 63115990i^6 + 25524840i^7 - 41844165i^8 - 49469300i^9 - \\
&221698650i^{10} - 322777377i^{11} - 475922412i^{12} - 342281808i^{13} - 219490128i^{14}) + \\
&\frac{1}{1113840} ((21420i^{14} + 135048i^{15} + 248778i^{16} + 149112i^{17} - 11183i^{18} - \\
&39300i^{19} - 17430i^{20} - 3575i^{21} - 300i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 4, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \\
&\frac{1}{195545750400i^5(1+i)} (-139675536 - 725945220i - 828167340i^2 - 85447362i^3 + \\
&108222114i^4 + 62821486i^5 + 6607966i^6 + 386485i^7 - 31222995i^8 - 67064530i^9 - \\
&156712437i^{10} - 212130231i^{11} - 236242200i^{12} - 151443072i^{13} - 73163376i^{14}) + \\
&\frac{1}{542640} ((7752i^{15} + 40698i^{16} + 47652i^{17} + 5377i^{18} - 6420i^{19} - \\
&3374i^{20} - 715i^{21} - 60i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 5, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{6453009763200i^3(1+i)^3} \\
& \left(-1186215030 - 2573601030i - 1560809250i^2 - 31206214i^3 + 177926511i^4 - \right. \\
& 130287021i^5 - 1047889937i^6 - 3617838345i^7 - 8977723755i^8 - \\
& 16553067223i^9 - 22928119071i^{10} - 23575263327i^{11} - \\
& 17491205820i^{12} - 8644534272i^{13} - 2414391408i^{14} \left. + \right. \\
& \left. (65835i^{17} + 14630i^{18} - 4620i^{19} - 3234i^{20} - 715i^{21} - 60i^{22}) \text{Log}20[i] \right) \\
& \frac{17907120}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 6, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \\
& \frac{1}{115321852800(1+i)^5} \left(-23588 - 454993i - 4124417i^2 - 23303862i^3 - 91752240i^4 - \right. \\
& 266444052i^5 - 588749722i^6 - 1005636038i^7 - 1333400068i^8 - 1363048885i^9 - \\
& \left. 1052583983i^{10} - 589208848i^{11} - 219660672i^{12} - 43147632i^{13} \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 7, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{7495920432000(1+i)^7} \\
& \left(-1343422 - 28608124i - 288241627i^2 - 1824731657i^3 - 8126676937i^4 - \right. \\
& 27007614800i^5 - 69295536730i^6 - 140022444050i^7 - 225117588520i^8 - \\
& 288678566000i^9 - 293787214105i^{10} - 234057862055i^{11} - \\
& \left. 142273878055i^{12} - 62997474260i^{13} - 18514256640i^{14} - 2804596080i^{15} \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 0, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200} \left(2881697 + 39005736i + 239493351i^2 + 875518846i^3 + \right. \\
& \left. 2096020245i^4 + 3384906012i^5 + 3619110348i^6 + 2353809528i^7 + 718331328i^8 \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 1, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{65181916800} \left(208362 + 2854032i + 17794889i^2 + 66401174i^3 + \right. \\
& \left. 163564065i^4 + 275375436i^5 + 313998636i^6 + 225901032i^7 + 79814592i^8 \right)
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 2, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{195545750400i^6} \\
& (88884432 + 161695296i + 26883528i^2 - 133613536i^3 - 129666642i^4 - \\
& 54005868i^5 - 10288908i^6 + 4910304i^7 + 39641907i^8 + 146898746i^9 + \\
& 369588399i^{10} + 632859828i^{11} + 750046052i^{12} + 570803016i^{13} + 239443776i^{14}) + \\
& \frac{1}{240240} ((-2184i^{14} - 6272i^{15} - 4836i^{16} + 2592i^{17} + 6639i^{18} + \\
& 4674i^{19} + 1659i^{20} + 308i^{21} + 24i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 3, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200i^6} (161164080 + 1033712064i + 632804634i^2 - \\
& 1533801192i^3 - 1856168622i^4 - 889631820i^5 - 134367085i^6 - \\
& 46301640i^7 + 140010255i^8 + 295912550i^9 + 928841505i^{10} + \\
& 1464253164i^{11} + 1891561644i^{12} + 1391708808i^{13} + 718331328i^{14}) + \\
& \frac{1}{1113840} ((-6120i^{14} - 45696i^{15} - 65331i^{16} + 33048i^{17} + 131753i^{18} + \\
& 107850i^{19} + 40635i^{20} + 7700i^{21} + 600i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 4, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{195545750400i^4(1+i)^2} \\
& (52378326 + 24972948i - 340396056i^2 - 646557912i^3 - 470596581i^4 - 158701914 \\
& i^5 + 4376698i^6 + 146231220i^7 + 453282540i^8 + 992717932i^9 + 1588712835i^{10} + \\
& 1855223460i^{11} + 1536868884i^{12} + 835890408i^{13} + 239443776i^{14}) + \\
& \frac{1}{542640} ((-2907i^{16} + 1368i^{17} + 17613i^{18} + 19170i^{19} + 7903i^{20} + 1540i^{21} + 120i^{22}) \\
& \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& Q4 [l = 5, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{6453009763200i^2(1+i)^4} \\
& (-131801670 - 679819140i - 1370520788i^2 - 1262892704i^3 + \\
& 412357017i^4 + 5853895106i^5 + 21734269349i^6 + 57069127896i^7 + \\
& 112619226181i^8 + 169264384366i^9 + 193355359131i^{10} + \\
& 164857970244i^{11} + 100511939748i^{12} + 39859970040i^{13} + 7901644608i^{14}) + \\
& \frac{(7315i^{18} + 16170i^{19} + 7623i^{20} + 1540i^{21} + 120i^{22}) \text{Log}20[i]}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 6, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{115321852800(1+i)^6} \\
& (120526 + 2395652i + 22448403i^2 + 131614084i^3 + 540193382i^4 + 1644695124i^5 + \\
& 3838051768i^6 + 6989120952i^7 + 10005611616i^8 + 11239873128i^9 + 9788460451 \\
& i^{10} + 6437864772i^{11} + 3041521748i^{12} + 931715464i^{13} + 141210432i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 7, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{7495920432000(1+i)^8} \\
& (6857781 + 150077424i + 1557945539i^2 + 10192298430i^3 + 47077822335i^4 + \\
& 162962451324i^5 + 437809334430i^6 + 932369437860i^7 + 1592928767385i^8 + \\
& 2194016070840i^9 + 2432555710365i^{10} + 2152884812730i^{11} + 1495140339675i^{12} + \\
& 790592440740i^{13} + 301741167140i^{14} + 74821024920i^{15} + 9178678080i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 0, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200} (-530075 - 7382337i - 46679039i^2 - 175911607i^3 - \\
& 434656635i^4 - 725595465i^5 - 803750616i^6 - 543248532i^7 - 172931616i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 1, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{195545750400} (-117450 - 1654494i - 10616683i^2 - 40801929i^3 - \\
& 103594365i^4 - 179911095i^5 - 211792392i^6 - 157478004i^7 - 57643872i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 2, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{195545750400i^6} \\
& (-29628144 - 59976000i - 11680088i^2 + 53730040i^3 + 53501994i^4 + 23268546i^5 + \\
& 4969020i^6 - 697284i^7 - 7964627i^8 - 30510437i^9 - 78984273i^{10} - \\
& 139550915i^{11} - 170448392i^{12} - 133873164i^{13} - 57643872i^{14}) + \\
& \frac{1}{240240} ((728i^{14} + 2240i^{15} + 1836i^{16} - 1020i^{17} - 2703i^{18} - \\
& 1953i^{19} - 725i^{20} - 143i^{21} - 12i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 3, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200i^6} \\
& \quad (-53721360 - 373222080i - 223752606i^2 + 721149198i^3 + 812970774i^4 + \\
& \quad 376389090i^5 + 76162375i^6 + 11424765i^7 - 26137815i^8 - 64299275i^9 - \\
& \quad 198021135i^{10} - 327944085i^{11} - 431654616i^{12} - 330804972i^{13} - 172931616i^{14}) + \\
& \quad \frac{1}{1113840} ((2040i^{14} + 16320i^{15} + 23409i^{16} - 18477i^{17} - 59681i^{18} - \\
& \quad 46725i^{19} - 17925i^{20} - 3575i^{21} - 300i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 4, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \quad \frac{1}{586637251200i^4(1+i)} (-52378326 + 108540432i + 524395872i^2 + 456419964i^3 + \\
& \quad 186149145i^4 + 31167780i^5 - 10872950i^6 - 79077650i^7 - 211073970i^8 - \\
& \quad 442676820i^9 - 629503041i^{10} - 656295948i^{11} - 432922068i^{12} - 172931616i^{13}) + \\
& \quad \frac{1}{1627920} ((2907i^{16} - 5871i^{17} - 29583i^{18} - 26355i^{19} - \\
& \quad 10595i^{20} - 2145i^{21} - 180i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 5, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \quad \frac{1}{6453009763200i^2(1+i)^3} (131801670 + 402341940i + 470228720i^2 + 246894564i^3 - \\
& \quad 125672565i^4 - 1033439270i^5 - 3568898685i^6 - 8817196080i^7 - \\
& \quad 16189368349i^8 - 22247872350i^9 - 22619918475i^{10} - \\
& \quad 16407825060i^{11} - 7787678580i^{12} - 1902247776i^{13}) + \\
& \quad \frac{(-1463i^{18} - 1617i^{19} - 693i^{20} - 143i^{21} - 12i^{22}) \text{Log}20[i]}{3581424}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 6, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \quad \frac{1}{115321852800(1+i)^5} (-23450 - 451984i - 4093243i^2 - 23099944i^3 - 90808550i^4 - \\
& \quad 263164160i^5 - 579884096i^6 - 986609932i^7 - 1300635556i^8 - 1317694840i^9 - \\
& \quad 1002571955i^{10} - 546447524i^{11} - 193243148i^{12} - 33995104i^{13})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 7, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{22487761296000(1+i)^7} \\
& (-4011525 - 85377858i - 859645519i^2 - 5437510546i^3 - 24191381361i^4 - \\
& 80288699120i^5 - 205644210470i^6 - 414566866740i^7 - 664364273485i^8 - \\
& 848027954950i^9 - 857134218105i^{10} - 675596821550i^{11} - \\
& 403491751145i^{12} - 173293459980i^{13} - 48225947820i^{14} - 6629045280i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 0, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200} (826280 + 11064703i + 67100470i^2 + 241783467i^3 + \\
& 569038980i^4 + 900257715i^5 + 938453244i^6 + 591031860i^7 + 172931616i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 1, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{195545750400} (178608 + 2419874i + 14899430i^2 + 54790869i^3 + \\
& 132667500i^4 + 218831949i^5 + 243401172i^6 + 169788180i^7 + 57643872i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 2, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{195545750400i^5} (-54698112 - 150796800i - 167181672i^2 - 97693484i^3 - \\
& 32689650i^4 - 5730536i^5 + 1176700i^6 + 11041798i^7 + 40284417i^8 + \\
& 99639420i^9 + 167094417i^{10} + 193199220i^{11} + 142565740i^{12} + 57643872i^{13}) + \\
& \frac{1}{240240} ((1344i^{15} + 5120i^{16} + 8004i^{17} + 6718i^{18} + 3325i^{19} + \\
& 988i^{20} + 165i^{21} + 12i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 3, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200i^5} \\
& (-257862528 - 1415416464i - 2206990170i^2 - 1456197204i^3 - 529902450i^4 - \\
& 83078240i^5 - 16918275i^6 + 39541590i^7 + 80340975i^8 + 250554900i^9 + \\
& 385016247i^{10} + 486635676i^{11} + 346029900i^{12} + 172931616i^{13}) + \\
& \frac{1}{1113840} ((9792i^{15} + 64056i^{16} + 140355i^{17} + 143386i^{18} + \\
& 78225i^{19} + 24300i^{20} + 4125i^{21} + 300i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 4, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200i^4(1+i)^2} \\
& \quad (-139675536 - 897458562i - 1931409480i^2 - 1920826908i^3 - \\
& \quad 993875064i^4 - 285326405i^5 - 18095160i^6 + 119153100i^7 + 368767000i^8 + \\
& \quad 794020950i^9 + 1247553414i^{10} + 1425088863i^{11} + \\
& \quad 1152974340i^{12} + 610225812i^{13} + 172931616i^{14}) + \frac{1}{1627920} \\
& \quad ((7752i^{16} + 42465i^{17} + 66918i^{18} + 43015i^{19} + 14260i^{20} + 2475i^{21} + 180i^{22}) \\
& \quad \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 5, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{6453009763200i^2(1+i)^4} \\
& \quad (-263603340 - 1005854850i - 1520323480i^2 - 1135697836i^3 - 177413574i^4 + \\
& \quad 1549814675i^5 + 5916396140i^6 + 15346944195i^7 + 29828781906i^8 + \\
& \quad 44077277079i^9 + 49413293160i^{10} + 41287131765i^{11} + \\
& \quad 24662154660i^{12} + 9618638964i^{13} + 1902247776i^{14}) + \\
& \quad \frac{(2926i^{18} + 2541i^{19} + 924i^{20} + 165i^{21} + 12i^{22}) \text{Log}20[i]}{3581424}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 6, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{345965558400(1+i)^6} \\
& \quad (102704 + 2025206i + 18812202i^2 + 109242947i^3 + 443669372i^4 + 1335206706i^5 + \\
& \quad 3076189464i^6 + 5523464628i^7 + 7786696368i^8 + 8603344948i^9 + 7362891514i^{10} + \\
& \quad 4758983751i^{11} + 2213752852i^{12} + 671492452i^{13} + 101985312i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 7, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 0] \\
&= \frac{1}{22487761296000(1+i)^8} \\
& \quad (5841528 + 126911969i + 1307118858i^2 + 8478372837i^3 + 38797607028i^4 + \\
& \quad 132942107811i^5 + 353226671880i^6 + 743243317530i^7 + 1253376035520i^8 + \\
& \quad 1702337111805i^9 + 1859617042470i^{10} + 1620695162955i^{11} + 1108412664540i^{12} + \\
& \quad 577814053335i^{13} + 218047538940i^{14} + 53774519340i^{15} + 6629045280i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4} [l = 0, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200} (-148421 - 2041923i - 12730647i^2 - 47195797i^3 - \\
& \quad 114383325i^4 - 186581691i^5 - 200937654i^6 - 131128956i^7 - 39907296i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 1, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{65181916800} (-10962 - 152542i - 965153i^2 - 3648953i^3 - \\
&9087225i^4 - 15420951i^5 - 17649366i^6 - 12670644i^7 - 4434144i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 2, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \\
&\frac{1}{195545750400i^5} (18232704 + 55529208i + 66140200i^2 + 40489974i^3 + 14233590i^4 + \\
&2726220i^5 - 88956i^6 - 2172171i^7 - 8185727i^8 - 20785335i^9 - \\
&35884521i^{10} - 42612098i^{11} - 32314212i^{12} - 13302432i^{13}) + \frac{1}{240240} \\
&((-448i^{15} - 1836i^{16} - 3060i^{17} - 2703i^{18} - 1395i^{19} - 435i^{20} - 77i^{21} - 6i^{22}) \\
&\text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 3, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200i^5} \\
&(85954176 + 525974526i + 906327114i^2 + 618916914i^3 + 228655350i^4 + \\
&42919345i^5 + 4840935i^6 - 7128495i^7 - 17251025i^8 - 52110825i^9 - \\
&84328479i^{10} - 107913654i^{11} - 79849476i^{12} - 39907296i^{13}) + \\
&\frac{1}{1113840} ((-3264i^{15} - 23409i^{16} - 55431i^{17} - 59681i^{18} - \\
&33375i^{19} - 10755i^{20} - 1925i^{21} - 150i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 4, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{195545750400i^4(1+i)} \\
&(17459442 + 104864760i + 173128956i^2 + 108756648i^3 + 36974301i^4 + 6018376i^5 - \\
&672540i^6 - 7186520i^7 - 18517990i^8 - 38363736i^9 - 53013819i^{10} - \\
&53944230i^{11} - 34221204i^{12} - 13302432i^{13}) + \\
&\frac{(-969i^{16} - 5871i^{17} - 9861i^{18} - 6275i^{19} - 2119i^{20} - 385i^{21} - 30i^{22}) \text{Log}_{20}[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4}[l = 5, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{6453009763200i^2(1+i)^3} \\
&(131801670 + 360720360i + 365299844i^2 + 171646488i^3 - 8113521i^4 - \\
&275997032i^5 - 951744585i^6 - 2314504038i^7 - 4171347565i^8 - 5613548556i^9 - \\
&5572438047i^{10} - 3938393910i^{11} - 1819235484i^{12} - 438980256i^{13}) + \\
&\frac{(-7315i^{18} - 5775i^{19} - 2079i^{20} - 385i^{21} - 30i^{22}) \text{Log}_{20}[i]}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 6, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{115321852800(1+i)^5} (-6566 - 125416i - 1124519i^2 - 6276534i^3 - 24373650i^4 - \\
& 69680064i^5 - 151230244i^6 - 252997976i^7 - 327354676i^8 - 324953200i^9 - \\
& 241950731i^{10} - 129071446i^{11} - 44841444i^{12} - 7845024i^{13})
\end{aligned}$$

$$\begin{aligned}
& \text{Q4 } [l = 7, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{7495920432000(1+i)^7} \\
& (-374409 - 7903582i - 78871005i^2 - 494032804i^3 - 2174551771i^4 - \\
& 7132915350i^5 - 18035865530i^6 - 35849754080i^7 - 56572546965i^8 - \\
& 71016611710i^9 - 70511326435i^{10} - 54556347300i^{11} - \\
& 31988764895i^{12} - 13512088070i^{13} - 3716134380i^{14} - 509926560i^{15})
\end{aligned}$$

Case 5: $i_1 = i, i_2 = i_3 = i_4 = i + 1$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{195545750400} \\
& (368671121 + 4003849486i + 19455389616i^2 + 55412719208i^3 + 101514697960i^4 + \\
& 122879193696i^5 + 96169017408i^6 + 44521937568i^7 + 9338307264i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{10863652800} (13489065 + 148369694i + 732781182i^2 + 2132275236i^3 + \\
& 4021955910i^4 + 5074931540i^5 + 4226695312i^6 + 2152559856i^7 + 518794848i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \\
& \frac{1}{16295479200i^4} (35529354 + 14612724i - 6034014i^2 - 14814324i^3 + 15905176i^4 + \\
& 156984296i^5 + 812432181i^6 + 2370131902i^7 + 4558905752i^8 + \\
& 5870954628i^9 + 5084288736i^{10} + 2747518104i^{11} + 778192272i^{12}) + \\
& \frac{(-873i^{16} - 1278i^{17} - 227i^{18} + 518i^{19} + 354i^{20} + 88i^{21} + 8i^{22}) \text{Log}_{20}[i]}{20020}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{195545750400i^4(1+i)^2} \\
& (1462564026 + 4831180200i + 4889074806i^2 + 619605756i^3 - 1621825961i^4 + \\
& 704922400i^5 + 10429007075i^6 + 38843109690i^7 + 95253688420i^8 + \\
& 164981868680i^9 + 205783220276i^{10} + 184164717720i^{11} + \\
& 114688886496i^{12} + 45870971616i^{13} + 9338307264i^{14}) + \\
& \frac{1}{371280} ((-55539i^{16} - 130842i^{17} - 61376i^{18} + 35000i^{19} + \\
& 33480i^{20} + 8800i^{21} + 800i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{65181916800i^4(1+i)^4} \\
& (52378326 + 509729220i + 1577223648i^2 + 2149138992i^3 + 1225734237i^4 + \\
& 418382874i^5 + 3407205022i^6 + 16541991936i^7 + 49740615729i^8 + \\
& 107309770526i^9 + 172607624280i^{10} + 209581752696i^{11} + 191717522632i^{12} + \\
& 129861580608i^{13} + 62545182528i^{14} + 19590575328i^{15} + 3112769088i^{16}) + \\
& \frac{1}{180880} ((-2907i^{16} - 19722i^{17} - 20976i^{18} + 2520i^{19} + 6184i^{20} + 1760i^{21} + 160i^{22}) \\
& \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{1075501627200i^2(1+i)^6} \\
& (263603340 + 1331890560i + 3168863893i^2 + 11133474092i^3 + \\
& 69898380903i^4 + 344894924226i^5 + 1202784223992i^6 + 3093179898780i^7 + \\
& 6060015255456i^8 + 9210914359812i^9 + 10946392470684i^{10} + \\
& 10159985558668i^{11} + 7286714625938i^{12} + 3943960589052i^{13} + \\
& 1539182964528i^{14} + 394198641936i^{15} + 51360689952i^{16}) + \\
& \frac{(-7315i^{18} - 770i^{19} + 1386i^{20} + 440i^{21} + 40i^{22}) \text{Log}20[i]}{1492260}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{57660926400(1+i)^8} \\
& (22864135 + 438151546i + 3967130546i^2 + 22543952796i^3 + 90069777782i^4 + \\
& 268533171940i^5 + 618711512208i^6 + 1125325459224i^7 + 1635636686949i^8 + \\
& 1910146973798i^9 + 1791159417890i^{10} + 1339148225332i^{11} + 786335985576i^{12} + \\
& 352971545896i^{13} + 115394122112i^{14} + 24938261520i^{15} + 2753603424i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{2498640144000(1+i)^{10}} \\
& (862626681 + 18261257784i + 183711793145i^2 + 1167607479126i^3 + \\
& 5256713924622i^4 + 17814408610976i^5 + 47131137342702i^6 + \\
& 99625332659772i^7 + 170744417332755i^8 + 239347720704240i^9 + \\
& 275506401584475i^{10} + 260305217300730i^{11} + 200889493966260i^{12} + \\
& 125343802431960i^{13} + 62128975312140i^{14} + 23764207478760i^{15} + \\
& 6671162361120i^{16} + 1245500971680i^{17} + 119322815040i^{18})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{586637251200} \\
& (-106327585 - 1201100901i - 6079197696i^2 - 18063797468i^3 - 34589687910i^4 - \\
& 43873213500i^5 - 36113304408i^6 - 17680327488i^7 - 3950822304i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{32590958400} (-4129665 - 47173629i - 242179707i^2 - 733114746i^3 - \\
& 1439574045i^4 - 1891999480i^5 - 1641829672i^6 - 871541856i^7 - 219490128i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \\
& \frac{1}{97772875200i^4} (-71058708 - 51934932i + 17292366i^2 + 27559476i^3 - 2426060i^4 - \\
& 104935488i^5 - 559071543i^6 - 1701171098i^7 - 3395801733i^8 - \\
& 4547637270i^9 - 4081145052i^{10} - 2282529888i^{11} - 658470384i^{12}) + \\
& \frac{(1746i^{16} + 3114i^{17} + 913i^{18} - 1122i^{19} - 885i^{20} - 242i^{21} - 24i^{22}) \text{Log}20[i]}{120120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{586637251200i^4(1+i)} \\
& (-1462564026 - 4175621604i - 2393881182i^2 + 936098856i^3 + 1029323505i^4 - \\
& 269969490i^5 - 3155457855i^6 - 10965619720i^7 - 24840409990i^8 - 39169479450 \\
& i^9 - 43117075896i^{10} - 32617718304i^{11} - 15653427552i^{12} - 3950822304i^{13}) + \\
& \frac{1}{1113840} ((55539i^{16} + 161487i^{17} + 96156i^{18} - 36300i^{19} - \\
& 41850i^{20} - 12100i^{21} - 1200i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{195545750400i^4(1+i)^3} \\
& \quad (-52378326 - 544648104i - 1474737264i^2 - 1482208728i^3 - 339673425i^4 + \\
& \quad 169293852i^5 - 986805950i^6 - 4919772080i^7 - 13907512575i^8 - \\
& \quad 27924902810i^9 - 41186265086i^{10} - 44878139574i^{11} - \\
& \quad 35679187164i^{12} - 19940074248i^{13} - 7187499360i^{14} - 1316940768i^{15}) + \\
& \quad \frac{(2907i^{16} + 24567i^{17} + 31236i^{18} - 1980i^{19} - 7730i^{20} - 2420i^{21} - 240i^{22}) \text{Log}20[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{3226504881600i^2(1+i)^5} \\
& \quad (-395405010 - 1602430830i - 2587072995i^2 - 4365455484i^3 - 22287458544i^4 - \\
& \quad 106150640617i^5 - 353203906775i^6 - 858227031685i^7 - 1573151525341i^8 - \\
& \quad 2209262847011i^9 - 2385357186553i^{10} - 1964752656735i^{11} - \\
& \quad 1207830503880i^{12} - 529925146344i^{13} - 151093627344i^{14} - 21729522672i^{15}) + \\
& \quad \frac{(4389i^{18} + 462i^{19} - 693i^{20} - 242i^{21} - 24i^{22}) \text{Log}20[i]}{1790712}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{172982779200(1+i)^7} \\
& \quad (-8040235 - 149502136i - 1309185585i^2 - 7168042261i^3 - 27467985646i^4 - \\
& \quad 78118674534i^5 - 170555818164i^6 - 291540810660i^7 - 394121880459i^8 - \\
& \quad 422364141314i^9 - 356978343581i^{10} - 234652679361i^{11} - \\
& \quad 116805148790i^{12} - 41932871636i^{13} - 9843008976i^{14} - 1164986064i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{7495920432000(1+i)^9} \\
& \quad (-307185585 - 6329158038i - 61810716673i^2 - 380219937940i^3 - \\
& \quad 1651011744864i^4 - 5374372352406i^5 - 13591797477738i^6 - 27303788884680i^7 - \\
& \quad 44158151769615i^8 - 57904519356990i^9 - 61668857296035i^{10} - \\
& \quad 53153966668380i^{11} - 36728723819490i^{12} - 19996506552510i^{13} - \\
& \quad 8329668868920i^{14} - 2522225138880i^{15} - 502035179040i^{16} - 50482729440i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{586637251200} \\
& \quad (-191532705 - 2162303871i - 10937155164i^2 - 32469726668i^3 - 62074791510i^4 - \\
& \quad 78469769340i^5 - 64115427648i^6 - 30936805632i^7 - 6744333024i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{32590958400} (-6523665 - 74822999i - 386094618i^2 - 1176361186i^3 - \\
& 2329051445i^4 - 3093268780i^5 - 2719964912i^6 - 1466926464i^7 - 374685168i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \\
& \frac{1}{97772875200i^4} (-71058708 - 35818524i + 11519676i^2 + 33685596i^3 - 13018180i^4 - \\
& 145633488i^5 - 819355602i^6 - 2490247178i^7 - 5055233613i^8 - \\
& 6866609310i^9 - 6322655232i^{10} - 3645424512i^{11} - 1124055504i^{12}) + \\
& \frac{(1746i^{16} + 2718i^{17} + 638i^{18} - 1122i^{19} - 885i^{20} - 242i^{21} - 24i^{22}) \text{Log}20[i]}{120120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{586637251200i^4(1+i)^2} \\
& (-1462564026 - 4939965954i - 5211760554i^2 - 794074050i^3 + 1949698961i^4 + \\
& 552751465i^5 - 4749881245i^6 - 19258245325i^7 - 49330168910i^8 - \\
& 89363386840i^9 - 116898150066i^{10} - 110093727984i^{11} - \\
& 72470285184i^{12} - 30829083840i^{13} - 6744333024i^{14}) + \\
& \frac{1}{1113840} ((55539i^{16} + 134973i^{17} + 69716i^{18} - 36300i^{19} - \\
& 41850i^{20} - 12100i^{21} - 1200i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{195545750400i^4(1+i)^4} \\
& (-52378326 - 512810298i - 1606845240i^2 - 2228346120i^3 - 1268321145i^4 - \\
& 65893191i^5 - 1203878078i^6 - 7681393930i^7 - 24456866855i^8 - \\
& 54870322355i^9 - 91821465856i^{10} - 116222738948i^{11} - 111103586610i^{12} - \\
& 78891571620i^{13} - 39995358720i^{14} - 13261873536i^{15} - 2248111008i^{16}) + \\
& \frac{(2907i^{16} + 19893i^{17} + 22116i^{18} - 1980i^{19} - 7730i^{20} - 2420i^{21} - 240i^{22}) \text{Log}20[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{3226504881600i^2(1+i)^6} \\
& (-263603340 - 1345764420i - 2935380955i^2 - 6338324889i^3 - \\
& 31646569695i^4 - 158089532973i^5 - 569551733337i^6 - 1513818781140i^7 - \\
& 3067645003611i^8 - 4828917973110i^9 - 5952592376907i^{10} - \\
& 5741473667908i^{11} - 4289011510575i^{12} - 2425160742444i^{13} - \\
& 992658173760i^{14} - 268081865568i^{15} - 37093831632i^{16}) + \\
& \frac{(2926i^{18} + 462i^{19} - 693i^{20} - 242i^{21} - 24i^{22}) \text{Log}20[i]}{1790712}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{172982779200(1+i)^8} \\
& (-9450035 - 185806201i - 1727200070i^2 - 10083611318i^3 - 41418471319i^4 - \\
& 127049972864i^5 - 301431573228i^6 - 565070814600i^7 - 847396340427i^8 - \\
& 1022260491751i^9 - 991611591626i^{10} - 768256983742i^{11} - 468511351135i^{12} - \\
& 219054428018i^{13} - 74886221824i^{14} - 17013717504i^{15} - 1988713584i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{7495920432000(1+i)^{10}} \\
& (-352097025 - 7628413233i - 78580740727i^2 - 511650190703i^3 - \\
& 2361137097904i^4 - 8206468300770i^5 - 22281041720544i^6 - \\
& 48364475783598i^7 - 85181869507695i^8 - 122808031681755i^9 - \\
& 145522835546625i^{10} - 141697735653165i^{11} - 112849942770930i^{12} - \\
& 72785701684200i^{13} - 37375874175030i^{14} - 14854117692000i^{15} - \\
& 4349837589120i^{16} - 851705728320i^{17} - 86177588640i^{18})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200} (18639803 + 218343762i + 1147525873i^2 + 3545552366i^3 + \\
& 7069053360i^4 + 9345907188i^5 + 8021366496i^6 + 4091869944i^7 + 951123888i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{97772875200} (2068425 + 24538614i + 131060398i^2 + 413566881i^3 + 848457540i^4 + \\
& 1168092450i^5 + 1065025962i^6 + 595969884i^7 + 158520648i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{97772875200i^4} (23686236 + 19509336i - 4957302i^2 - 10802274i^3 - \\
& 1832376i^4 + 17050992i^5 + 97921589i^6 + 309680021i^7 + 647565942i^8 + \\
& 909221478i^9 + 860778204i^{10} + 509961444i^{11} + 158520648i^{12}) + \\
& \frac{(-582i^{16} - 1092i^{17} - 381i^{18} + 393i^{19} + 362i^{20} + 110i^{21} + 12i^{22}) \text{Log}20[i]}{120120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200i^4(1+i)} \\
& (487521342 + 1428135786i + 887562522i^2 - 308145222i^3 - 429705535i^4 - \\
& 42635005i^5 + 522818505i^6 + 1934877505i^7 + 4556181850i^8 + 7508272560i^9 + \\
& 8649322272i^{10} + 6888624876i^{11} + 3494841912i^{12} + 951123888i^{13}) + \\
& \frac{1}{1113840} ((-18513i^{16} - 55206i^{17} - 35527i^{18} + 11850i^{19} + \\
& 17040i^{20} + 5500i^{21} + 600i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{586637251200i^4(1+i)^3} (52378326 + 547729182i + 1506412908i^2 + 1555145592i^3 + \\
& 366839109i^4 - 317325099i^5 + 315196648i^6 + 2472502086i^7 + \\
& 7354085805i^8 + 15305200429i^9 + 23424626418i^{10} + 26541553644i^{11} + \\
& 22000732092i^{12} + 12867242472i^{13} + 4881039048i^{14} + 951123888i^{15}) + \\
& \frac{(-2907i^{16} - 24738i^{17} - 32661i^{18} + 870i^{19} + 9376i^{20} + 3300i^{21} + 360i^{22}) \text{Log}20[i]}{1627920}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{3226504881600i^2(1+i)^5} (131801670 + 541080540i + 854432189i^2 + 972083593i^3 + \\
& 3610031672i^4 + 17573673969i^5 + 60438171285i^6 + 151416575910i^7 + \\
& 286303919407i^8 + 415226645108i^9 + 463647476941i^{10} + 395646837630i^{11} + \\
& 252573464484i^{12} + 115455324798i^{13} + 34469799012i^{14} + 5231181384i^{15}) + \\
& \frac{(-7315i^{18} - 1155i^{19} + 1386i^{20} + 550i^{21} + 60i^{22}) \text{Log}20[i]}{8953560}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{57660926400(1+i)^7} \\
& (406735 + 7744499i + 69483411i^2 + 389993456i^3 + 1532913100i^4 + \\
& 4474600286i^5 + 10033949866i^6 + 17629447284i^7 + 24517437029i^8 + \\
& 27056521385i^9 + 23577658409i^{10} + 16004693244i^{11} + \\
& 8244948046i^{12} + 3072812696i^{13} + 752260540i^{14} + 93486536i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{22487761296000(1+i)^9} \\
& (138850425 + 2922539655i + 29168925869i^2 + 183448437249i^3 + \\
& 814777813584i^4 + 2714080442478i^5 + 7027238403882i^6 + 14459886426870i^7 + \\
& 23967817361175i^8 + 32231190180285i^9 + 35228199089655i^{10} + \\
& 31189065272715i^{11} + 22161583668690i^{12} + 12425909659560i^{13} + \\
& 5341844125200i^{14} + 1674369266940i^{15} + 346519167480i^{16} + 36459749040i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200} (14379547 + 167754132i + 877639347i^2 + 2698144766i^3 + \\
& 5351234385i^4 + 7039470132i^5 + 6021214836i^6 + 3072140856i^7 + 718331328i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{65181916800} (1139550 + 13448616i + 71383053i^2 + 223564614i^3 + \\
& 454453685i^4 + 618559060i^5 + 555997988i^6 + 305715624i^7 + 79814592i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^4} (47372472 + 49762944i - 10032414i^2 - 21447468i^3 - 4723964i^4 + \\
& 29817984i^5 + 166922727i^6 + 526527562i^7 + 1087702899i^8 + \\
& 1509246684i^9 + 1401340668i^{10} + 810246792i^{11} + 239443776i^{12}) + \\
& \frac{(-1164i^{16} - 2448i^{17} - 1037i^{18} + 786i^{19} + 735i^{20} + 220i^{21} + 24i^{22}) \text{Log}_{20}[i]}{240240}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200i^4} \\
& (487521342 + 1173354336i + 50094198i^2 - 362951820i^3 - 75391575i^4 + \\
& 17708460i^5 + 448249395i^6 + 1247991910i^7 + 2731396965i^8 + 3740341140i^9 + \\
& 3621335172i^{10} + 2110040136i^{11} + 718331328i^{12}) + \\
& \frac{1}{1113840} ((-18513i^{16} - 64044i^{17} - 48747i^{18} + 11850i^{19} + \\
& 17535i^{20} + 5500i^{21} + 600i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^4(1+i)^2} (17459442 + 193188996i + 445777332i^2 + 259363104i^3 - \\
& 61798191i^4 - 52096954i^5 + 136152848i^6 + 606224520i^7 + \\
& 1595526020i^8 + 2953188092i^9 + 3943881471i^{10} + 3774920988i^{11} + \\
& 2517644172i^{12} + 1075334184i^{13} + 239443776i^{14}) + \\
& \frac{(-969i^{16} - 9804i^{17} - 15447i^{18} + 290i^{19} + 3283i^{20} + 1100i^{21} + 120i^{22}) \text{Log}20[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{6453009763200i^2(1+i)^4} \\
& (395405010 + 1207025820i + 1264754712i^2 + 1105708344i^3 + \\
& 5677095177i^4 + 26679529826i^5 + 84233395049i^6 + 192224612976i^7 + \\
& 327166796033i^8 + 420063799166i^9 + 405736473351i^{10} + \\
& 289437377724i^{11} + 146215599948i^{12} + 47761614648i^{13} + 7901644608i^{14}) + \\
& \frac{(-21945i^{18} - 2310i^{19} + 3003i^{20} + 1100i^{21} + 120i^{22}) \text{Log}20[i]}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{345965558400(1+i)^6} \\
& (2299430 + 41392764i + 349681041i^2 + 1839273788i^3 + 6736908246i^4 + \\
& 18201573180i^5 + 37465446396i^6 + 59797537344i^7 + 74540976552i^8 + \\
& 72435162424i^9 + 54230347485i^{10} + 30503986164i^{11} + \\
& 12289972996i^{12} + 3218777688i^{13} + 423631296i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{7495920432000(1+i)^8} \\
& \quad (44037903 + 881355244i + 8337462415i^2 + 49517470782i^3 + 206809682367i^4 + \\
& \quad 644587270524i^5 + 1552414443630i^6 + 2950283512740i^7 + 4477312544055i^8 + \\
& \quad 5452766950620i^9 + 5322321320745i^{10} + 4130738072730i^{11} + 2507965267335i^{12} + \\
& \quad 1157415956700i^{13} + 385818726060i^{14} + 83999703000i^{15} + 9178678080i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200} (-2547545 - 30757909i - 166760971i^2 - 532058247i^3 - \\
& \quad 1096713345i^4 - 1501396245i^5 - 1337537832i^6 - 710753748i^7 - 172931616i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400} (-586830 - 7170326i - 39466217i^2 - 128406369i^3 - \\
& \quad 271728975i^4 - 385978635i^5 - 363134688i^6 - 209695476i^7 - 57643872i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \quad \frac{1}{195545750400i^4} (-15790824 - 18052776i + 2390234i^2 + 8270850i^3 + 2863700i^4 - \\
& \quad 4842292i^5 - 30184429i^6 - 98678637i^7 - 212466075i^8 - \\
& \quad 307659495i^9 - 299638056i^{10} - 182473036i^{11} - 57643872i^{12}) + \\
& \quad \frac{(388i^{16} + 852i^{17} + 407i^{18} - 265i^{19} - 295i^{20} - 99i^{21} - 12i^{22}) \text{Log}20[i]}{240240}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200i^4} \\
& \quad (-162507114 - 403205418i - 40578846i^2 + 134892450i^3 + 41275325i^4 + \\
& \quad 7367745i^5 - 85009815i^6 - 225616875i^7 - 530050125i^8 - 746920305i^9 - \\
& \quad 766068144i^{10} - 465751788i^{11} - 172931616i^{12}) + \\
& \quad \frac{(6171i^{16} + 21807i^{17} + 17639i^{18} - 3525i^{19} - 6975i^{20} - 2475i^{21} - 300i^{22}) \text{Log}20[i]}{1113840}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{586637251200i^4(1+i)^2} (-17459442 - 194216022i - 457020564i^2 - 280900620i^3 + \\
& 61939059i^4 + 81002285i^5 - 53689740i^6 - 324894900i^7 - \\
& 889862050i^8 - 1703597310i^9 - 2359399347i^{10} - 2345974137i^{11} - \\
& 1631966544i^{12} - 729947700i^{13} - 172931616i^{14}) + \\
& \frac{(969i^{16} + 9861i^{17} + 16017i^{18} + 365i^{19} - 3865i^{20} - 1485i^{21} - 180i^{22}) \text{Log}20[i]}{1627920}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{6453009763200i^2(1+i)^4} \\
& (-131801670 - 409278870i - 430862900i^2 - 247360412i^3 - 937327911i^4 - \\
& 4677078155i^5 - 15267513905i^6 - 35868441345i^7 - 62883728523i^8 - \\
& 83261228259i^9 - 83051582955i^{10} - 61298018595i^{11} - \\
& 32126226000i^{12} - 10935579732i^{13} - 1902247776i^{14}) + \\
& \frac{(1463i^{18} + 231i^{19} - 231i^{20} - 99i^{21} - 12i^{22}) \text{Log}20[i]}{3581424}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{345965558400(1+i)^6} \\
& (-372890 - 6865838i - 59355339i^2 - 319648013i^3 - 1199373722i^4 - \\
& 3321353490i^5 - 7011508692i^6 - 11484870876i^7 - 14703719772i^8 - \\
& 14687958148i^9 - 11317039255i^{10} - 6561690033i^{11} - \\
& 2731613584i^{12} - 742097668i^{13} - 101985312i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{22487761296000(1+i)^8} \\
& (-21337575 - 435776579i - 4208187237i^2 - 25522621329i^3 - 108894178785i^4 - \\
& 346855421901i^5 - 854042570430i^6 - 1660051682970i^7 - 2577839843715i^8 - \\
& 3214054739775i^9 - 3213589882635i^{10} - 2556764501655i^{11} - 1592914077285i^{12} - \\
& 755437654545i^{13} - 259358276400i^{14} - 58363858380i^{15} - 6629045280i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \\
& \frac{1}{586637251200} \\
& (322686000 + 3462222855i + 16583187348i^2 + 46423273468i^3 + 83285587050i^4 + \\
& 98289811620i^5 + 74647418880i^6 + 33392918304i^7 + 6744333024i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{32590958400} (12039480 + 131072255i + 639438436i^2 + 1832966226i^3 + \\
& 3393354685i^4 + 4180493240i^5 + 3373412000i^6 + 1645703088i^7 + 374685168i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{97772875200i^3} (-59337684 - 75261312i - 45740268i^2 + 19743612i^3 + \\
& 285323136i^4 + 1433488056i^5 + 4147331266i^6 + 7830585159i^7 + \\
& 9884598570i^8 + 8301771840i^9 + 4308732144i^{10} + 1124055504i^{11}) + \\
& \frac{(1458i^{17} + 3384i^{18} + 3066i^{19} + 1347i^{20} + 286i^{21} + 24i^{22}) \text{Log}20[i]}{120120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{586637251200i^3(1+i)^2} \\
& (-979071786 - 4064553108i - 6461619318i^2 - 4899516216i^3 - \\
& 400380015i^4 + 9174756150i^5 + 34479133205i^6 + 83647498990i^7 + \\
& 142931080160i^8 + 175299250650i^9 + 153506749704i^{10} + \\
& 92823657312i^{11} + 35570796192i^{12} + 6744333024i^{13}) + \\
& \frac{(37179i^{17} + 119124i^{18} + 132300i^{19} + 64950i^{20} + 14300i^{21} + 1200i^{22}) \text{Log}20[i]}{1113840}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{195545750400i^3(1+i)^4} \\
& (-27729702 - 299459160i - 1098016920i^2 - 1955023980i^3 - \\
& 1504631765i^4 + 2337037248i^5 + 14651314470i^6 + 44231815730i^7 + \\
& 94574643075i^8 + 150415327560i^9 + 180159248308i^{10} + 162040728030i^{11} + \\
& 107408505180i^{12} + 50249394240i^{13} + 15096399840i^{14} + 2248111008i^{15}) + \\
& \frac{(1539i^{17} + 12084i^{18} + 20860i^{19} + 12350i^{20} + 2860i^{21} + 240i^{22}) \text{Log}20[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{3226504881600i(1+i)^6} \\
& (-124864740 - 263651310i + 6059403675i^2 + 60261922032i^3 + 309912216029i^4 + \\
& 1079013706467i^5 + 2756114615040i^6 + 5355250643425i^7 + 8061847774398i^8 + \\
& 9473076922221i^9 + 8674030094048i^{10} + 6117967626375i^{11} + \\
& 3241673867520i^{12} + 1229713139952i^{13} + 302541815664i^{14} + 37093831632i^{15}) + \\
& \frac{(1386i^{19} + 1155i^{20} + 286i^{21} + 24i^{22}) \text{Log}20[i]}{1790712}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{172982779200(1+i)^8} \\
& (21023940 + 401308425i + 3617966604i^2 + 20462930006i^3 + 81330368179i^4 + \\
& 241077778196i^5 + 551869567764i^6 + 996457552176i^7 + 1436359991154i^8 + \\
& 1661468982711i^9 + 1540650987144i^{10} + 1136588932806i^{11} + 656567371189i^{12} + \\
& 288663950006i^{13} + 91802946304i^{14} + 19085873616i^{15} + 1988713584i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{7495920432000(1+i)^{10}} \\
& (794584728 + 16763289599i + 168017491026i^2 + 1063568060127i^3 + \\
& 4767352125782i^4 + 16078663508574i^5 + 42315161104902i^6 + \\
& 88925711281758i^7 + 151422472602900i^8 + 210726821417565i^9 + \\
& 240576716556570i^{10} + 225172505357685i^{11} + 171880654231530i^{12} + \\
& 105853921884480i^{13} + 51637945263390i^{14} + 19355944597800i^{15} + \\
& 5289881853600i^{16} + 951234121440i^{17} + 86177588640i^{18})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200} \\
& (-30929808 - 345309965i - 1723621991i^2 - 5037133686i^3 - 9453377610i^4 - \\
& 11701139208i^5 - 9353446920i^6 - 4425221448i^7 - 951123888i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \frac{1}{97772875200} (-3659160 - 41375455i - 209856661i^2 - 626026401i^3 - \\
& 1207207085i^4 - 1550472770i^5 - 1305388350i^6 - 665094468i^7 - 158520648i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{97772875200i^3} (19779228 + 30703428i + 18084906i^2 + 1677396i^3 - 31088512i^4 - \\
& 162967336i^5 - 490822449i^6 - 962754453i^7 - 1263846408i^8 - \\
& 1101753000i^9 - 592652028i^{10} - 158520648i^{11}) + \\
& \frac{(-486i^{17} - 1266i^{18} - 1237i^{19} - 577i^{20} - 132i^{21} - 12i^{22}) \text{Log}_{20}[i]}{120120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^3(1+i)} (108785754 + 397737648i + 468355734i^2 + 232275540i^3 - \\
& 731465i^4 - 308826980i^5 - 1064599525i^6 - 2384577360i^7 - 3697847450i^8 - \\
& 3992403120i^9 - 2936422716i^{10} - 1357460472i^{11} - 317041296i^{12}) + \\
& \frac{(-4131i^{17} - 15321i^{18} - 18350i^{19} - 9330i^{20} - 2200i^{21} - 200i^{22}) \text{Log}20[i]}{371280}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{586637251200i^3(1+i)^3} (27729702 + 317945628i + 1037548512i^2 + 1498705572i^3 + \\
& 949026169i^4 - 654182438i^5 - 4307904666i^6 - 12163184330i^7 - \\
& 24159710069i^8 - 35166742812i^9 - 37707096570i^{10} - \\
& 29373887976i^{11} - 15977988288i^{12} - 5539974552i^{13} - 951123888i^{14}) + \\
& \frac{(-1539i^{17} - 14649i^{18} - 27590i^{19} - 16106i^{20} - 3960i^{21} - 360i^{22}) \text{Log}20[i]}{1627920}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{1075501627200i(1+i)^5} (20810790 + 80030652i - 100729265i^2 - 2021526208i^3 - \\
& 10411943958i^4 - 34604153660i^5 - 83418621915i^6 - 151450222220i^7 - \\
& 210327340487i^8 - 224110225262i^9 - 181660652525i^{10} - \\
& 109456751008i^{11} - 46771798590i^{12} - 12847207428i^{13} - 1743727128i^{14}) + \\
& \frac{(-1155i^{19} - 847i^{20} - 220i^{21} - 20i^{22}) \text{Log}20[i]}{2984520}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{172982779200(1+i)^7} \\
& (-2428860 - 44957255i - 391729618i^2 - 2133069839i^3 - 8124625314i^4 - \\
& 22951653048i^5 - 49735350270i^6 - 84299389872i^7 - 112868874786i^8 - \\
& 119621101971i^9 - 99793022932i^{10} - 64575924815i^{11} - \\
& 31522647148i^{12} - 11031440964i^{13} - 2499085884i^{14} - 280459608i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 1, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{22487761296000(1+i)^9} \\
& (-278768280 - 5720672839i - 55626479860i^2 - 340572436875i^3 - \\
& 1471298189832i^4 - 4762643464440i^5 - 11970989816472i^6 - 23885465468610i^7 - \\
& 38340274434600i^8 - 49854211426665i^9 - 52592484169500i^{10} - \\
& 44839305121785i^{11} - 30591545781240i^{12} - 16403186704950i^{13} - \\
& 6704799369840i^{14} - 1980884160900i^{15} - 381138901800i^{16} - 36459749040i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{195545750400} (-18193448 - 202584655i - 1008119112i^2 - 2935035116i^3 - \\
& 5480710075i^4 - 6735048408i^5 - 5324228640i^6 - 2475973296i^7 - 518794848i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \\
& \frac{1}{21727305600} (-1268520 - 14381390i - 73187968i^2 - 219263044i^3 - 425112555i^4 - \\
& 549707620i^5 - 466670400i^6 - 240017424i^7 - 57643872i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{65181916800i^3} (13186152 + 18678240i + 12449304i^2 - \\
& 237860i^3 - 29247008i^4 - 156994824i^5 - 474328660i^6 - 942001817i^7 - \\
& 1252324656i^8 - 1113962400i^9 - 614780112i^{10} - 172931616i^{11}) + \\
& \frac{(-324i^{17} - 800i^{18} - 788i^{19} - 381i^{20} - 88i^{21} - 8i^{22}) \text{Log}20[i]}{80080}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
&= \frac{1}{195545750400i^3(1+i)^2} \\
& (108785754 + 467733420i + 785893878i^2 + 653423652i^3 + 207256735i^4 - \\
& 436953790i^5 - 1861783605i^6 - 4715497435i^7 - 8414074790i^8 - 10801772555i^9 - \\
& 9929469996i^{10} - 6325632000i^{11} - 2566113552i^{12} - 518794848i^{13}) + \\
& \frac{(-4131i^{17} - 13848i^{18} - 16700i^{19} - 9165i^{20} - 2200i^{21} - 200i^{22}) \text{Log}20[i]}{371280}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{65181916800i^3(1+i)^4} \\
& (3081078 + 33729696i + 127351224i^2 + 239054634i^3 + 232140181i^4 - \\
& 16713788i^5 - 723839558i^6 - 2368508357i^7 - 5266899363i^8 - 8703646142i^9 - \\
& 10850029320i^{10} - 10178349001i^{11} - 7054812024i^{12} - \\
& 3462446304i^{13} - 1095962256i^{14} - 172931616i^{15}) + \\
& \frac{(-171i^{17} - 1368i^{18} - 2540i^{19} - 1737i^{20} - 440i^{21} - 40i^{22}) \text{Log}20[i]}{180880}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{2151003254400i(1+i)^6} (27747720 + 124283562i - 316063618i^2 - 5502527706i^3 - \\
& 30776706194i^4 - 111445303953i^5 - 294188374350i^6 - 590720097895i^7 - \\
& 919962846924i^8 - 1119819207111i^9 - 1063879550822i^{10} - 780066127753i^{11} - \\
& 430718505228i^{12} - 170797087296i^{13} - 44106259824i^{14} - 5706743328i^{15}) + \\
& \frac{(-1540i^{19} - 1617i^{20} - 440i^{21} - 40i^{22}) \text{Log}20[i]}{5969040}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{115321852800(1+i)^8} \\
& (-1902460 - 37240770i - 344509032i^2 - 2000647132i^3 - 8169765429i^4 - \\
& 24898644780i^5 - 58647407196i^6 - 109050726888i^7 - 162029911158i^8 - \\
& 193395625166i^9 - 185275790220i^{10} - 141424422804i^{11} - 84685684187i^{12} - \\
& 38686708032i^{13} - 12823761504i^{14} - 2790332400i^{15} - 305955936i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{2498640144000(1+i)^{10}} \\
& (-35506884 - 766305631i - 7860804826i^2 - 50951346463i^3 - 233971912383i^4 - \\
& 808840399796i^5 - 2183133185343i^6 - 4708106800698i^7 - 8232490597230i^8 - \\
& 11773391549385i^9 - 13824143814840i^{10} - 13320627963765i^{11} - \\
& 10480137879525i^{12} - 6661977642090i^{13} - 3360605515785i^{14} - \\
& 1305731851380i^{15} - 371069635200i^{16} - 69679859760i^{17} - 6629045280i^{18})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200} (5297656 + 61232535i + 316780737i^2 + 960532586i^3 + \\
& 1872200625i^4 + 2408490711i^5 + 2001391980i^6 + 983868336i^7 + 219490128i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{65181916800} (399480 + 4685110i + 24684338i^2 + 76619634i^3 + \\
& 154022645i^4 + 206641435i^5 + 182146160i^6 + 97380624i^7 + 24387792i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^3} (-13186152 - 22422456i - 14775516i^2 - 3238844i^3 + 9870756i^4 + \\
& 55898808i^5 + 175084078i^6 + 358789863i^7 + 492891597i^8 + \\
& 451612140i^9 + 256327632i^{10} + 73163376i^{11}) + \\
& \frac{(324i^{17} + 892i^{18} + 942i^{19} + 483i^{20} + 121i^{21} + 12i^{22}) \text{Log}20[i]}{240240}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{586637251200i^3(1+i)} (-108785754 - 413854056i - 525442302i^2 - 293784120i^3 - \\
& 48911415i^4 + 149055060i^5 + 552551065i^6 + 1286166475i^7 + 2079495660i^8 + \\
& 2345314875i^9 + 1809495096i^{10} + 881030304i^{11} + 219490128i^{12}) + \\
& \frac{(4131i^{17} + 15933i^{18} + 20550i^{19} + 11655i^{20} + 3025i^{21} + 300i^{22}) \text{Log}20[i]}{1113840}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400i^3(1+i)^3} (-3081078 - 35783748i - \\
& 120576456i^2 - 183942486i^3 - 137132177i^4 - 2178358i^5 + 232579334i^6 + \\
& 701219695i^7 + 1442500961i^8 + 2175638018i^9 + 2421313830i^{10} + \\
& 1961929113i^{11} + 1113144564i^{12} + 404189280i^{13} + 73163376i^{14}) + \\
& \frac{(171i^{17} + 1653i^{18} + 3310i^{19} + 2219i^{20} + 605i^{21} + 60i^{22}) \text{Log}20[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{6453009763200i(1+i)^5} (-41621580 - 186013074i - 135660330i^2 + 1684093086i^3 + \\
& 10069469228i^4 + 34886997505i^5 + 86697573320i^6 + 162203058215i^7 + \\
& 232340788174i^8 + 255644317907i^9 + 214283432220i^{10} + \\
& 133750162161i^{11} + 59346753840i^{12} + 16985159136i^{13} + 2414391408i^{14}) + \\
& \frac{(2310i^{19} + 2079i^{20} + 605i^{21} + 60i^{22}) \text{Log}20[i]}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{345965558400(1+i)^7} \\
& (726740 + 13767530i + 122838492i^2 + 685277090i^3 + 2675527049i^4 + \\
& 7751921796i^5 + 17238945360i^6 + 30005596128i^7 + 41285419290i^8 + \\
& 45001964266i^9 + 38649912724i^{10} + 25779333570i^{11} + \\
& 12991831267i^{12} + 4704191380i^{13} + 1106148384i^{14} + 129442896i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{7495920432000(1+i)^9} (13804140 + 289256807i + 2873086132i^2 + 17975117023i^3 + \\
& 79383032319i^4 + 262793944314i^5 + 675803842827i^6 + 1380195376350i^7 + \\
& 2268742503270i^8 + 3022610281245i^9 + 3268978245390i^{10} + \\
& 2859300465765i^{11} + 2003050703805i^{12} + 1104073726500i^{13} + \\
& 464621828265i^{14} + 141628536120i^{15} + 28202861280i^{16} + 2804596080i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200} (4171440 + 48110335i + 248320982i^2 + 751200827i^3 + \\
& 1461097530i^4 + 1876990335i^5 + 1560109380i^6 + 769389876i^7 + 172931616i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{195545750400} (1003280 + 11721250i + 61475204i^2 + 189785869i^3 + 379032710i^4 + \\
& 504522865i^5 + 440488020i^6 + 232858452i^7 + 57643872i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^3} (-13186152 - 24213168i - 15128946i^2 - 3432576i^3 + 8592556i^4 + \\
& 48264608i^5 + 150565129i^6 + 305819478i^7 + 416061525i^8 + \\
& 375720060i^9 + 209253612i^{10} + 57643872i^{11}) + \\
& \frac{(324i^{17} + 936i^{18} + 997i^{19} + 494i^{20} + 121i^{21} + 12i^{22}) \text{Log}20[i]}{240240}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200i^3} (-108785754 - 343858284i - 244719090i^2 - \\
& 61148640i^3 + 8850765i^4 + 123832170i^5 + 365517295i^6 + 767817930i^7 + \\
& 1046428515i^8 + 977197740i^9 + 556946316i^{10} + 172931616i^{11}) + \\
& \frac{(4131i^{17} + 17406i^{18} + 23025i^{19} + 12150i^{20} + 3025i^{21} + 300i^{22}) \text{Log}20[i]}{1113840}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200i^3(1+i)^2} \\
& (-9243234 - 112144032i - 319531212i^2 - 337319164i^3 - 133414645i^4 + \\
& 103505220i^5 + 527083700i^6 + 1374495650i^7 + 2513156910i^8 + 3303810060i^9 + \\
& 3103175931i^{10} + 2016771948i^{11} + 831995028i^{12} + 172931616i^{13}) + \\
& \frac{(513i^{17} + 5738i^{18} + 12295i^{19} + 7130i^{20} + 1815i^{21} + 180i^{22}) \text{Log}20[i]}{1627920}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \\
& \frac{1}{6453009763200i(1+i)^4} (-62432370 - 210943980i - 81262740i^2 + 1509830556i^3 + \\
& 7753516355i^4 + 24396366770i^5 + 55157756775i^6 + 92849649200i^7 + \\
& 117683273279i^8 + 111923907810i^9 + 78330780825i^{10} + \\
& 38600715780i^{11} + 12177481140i^{12} + 1902247776i^{13}) + \\
& \frac{(693i^{19} + 462i^{20} + 121i^{21} + 12i^{22}) \text{Log}20[i]}{3581424}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{345965558400(1+i)^6} \\
& (686280 + 12290390i + 103242832i^2 + 539678399i^3 + 1963201032i^4 + \\
& 5263731090i^5 + 10742317440i^6 + 16980495108i^7 + 20934558876i^8 + \\
& 20084104068i^9 + 14809772680i^{10} + 8176888355i^{11} + \\
& 3216667852i^{12} + 815080164i^{13} + 101985312i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 1, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{22487761296000(1+i)^8} \\
& (39469864 + 786348913i + 7402199322i^2 + 43728523029i^3 + 181572243966i^4 + \\
& 562336753671i^5 + 1344891807840i^6 + 2536257555930i^7 + 3816152271540i^8 + \\
& 4603174482885i^9 + 4444486356750i^{10} + 3406576595355i^{11} + 2038080010050i^{12} + \\
& 923872771395i^{13} + 301006884780i^{14} + 63523744620i^{15} + 6629045280i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 0, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200} (-722176 - 8606325i - 45950814i^2 - 143954057i^3 - \\
& 290274780i^4 - 386961201i^5 - 333965850i^6 - 171036252i^7 - 39907296i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 1, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{65181916800} (-56320 - 680370i - 3694796i^2 - 11828453i^3 - \\
& 24538500i^4 - 33992805i^5 - 30953090i^6 - 17104788i^7 - 4434144i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 2, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400i^3} (4395384 + 8722224i + 6093990i^2 + \\
& 1770608i^3 - 1310820i^4 - 8553048i^5 - 27650467i^6 - 58394220i^7 - \\
& 82739547i^8 - 78091710i^9 - 45616644i^{10} - 13302432i^{11}) + \\
& \frac{(-108i^{17} - 328i^{18} - 375i^{19} - 204i^{20} - 55i^{21} - 6i^{22}) \text{Log20}[i]}{240240}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 3, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{586637251200i^3} (36261918 + 119991564i + 96985350i^2 + 28985040i^3 + 1657425i^4 - \\
& 22284570i^5 - 65676325i^6 - 145275900i^7 - 204963165i^8 - \\
& 201057810i^9 - 119756772i^{10} - 39907296i^{11}) + \\
& \frac{(-1377i^{17} - 6006i^{18} - 8475i^{19} - 4980i^{20} - 1375i^{21} - 150i^{22}) \text{Log20}[i]}{1113840}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 4, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400i^3(1+i)^2} \\
& (1027026 + 12612600i + 37249212i^2 + 42182504i^3 + 20289997i^4 - \\
& 2630264i^5 - 30719260i^6 - 83603960i^7 - 157945766i^8 - 214915992i^9 - \\
& 209278635i^{10} - 141386790i^{11} - 60826068i^{12} - 13302432i^{13}) + \\
& \frac{(-57i^{17} - 646i^{18} - 1455i^{19} - 964i^{20} - 275i^{21} - 30i^{22}) \text{Log20}[i]}{542640}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 5, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{6453009763200i(1+i)^4} \\
& (20810790 + 75624744i + 75926916i^2 - 208047528i^3 - 1326531713i^4 - 4344780872 \\
& i^5 - 10106747673i^6 - 17504167142i^7 - 22846213181i^8 - 22398749868i^9 - \\
& 16181127567i^{10} - 8245653174i^{11} - 2697195996i^{12} - 438980256i^{13}) + \\
& \frac{(-1155i^{19} - 924i^{20} - 275i^{21} - 30i^{22}) \text{Log20}[i]}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 6, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{345965558400(1+i)^6} \\
& (-109760 - 2009490i - 17264184i^2 - 92338181i^3 - 343852002i^4 - 944210070i^5 - \\
& 1974504000i^6 - 3199820076i^7 - 4046732424i^8 - 3985128028i^9 - \\
& 3018761040i^{10} - 1713968625i^{11} - 694358914i^{12} - 181594476i^{13} - 23535072i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q5 } [l = 7, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{7495920432000(1+i)^8} \\
& (-2096192 - 42596281i - 409115518i^2 - 2466709197i^3 - 10457092548i^4 - \\
& 33075613131i^5 - 80814991830i^6 - 155753215770i^7 - 239584946400i^8 - \\
& 295557784005i^9 - 291969364830i^{10} - 229075378035i^{11} - 140378602500i^{12} - \\
& 65236808655i^{13} - 21818304390i^{14} - 4735987500i^{15} - 509926560i^{16})
\end{aligned}$$

Case 6: $i_1 = i_3 = i, i_2 = i_4 = i + 1$

$$\begin{aligned}
& \text{Q6 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{97772875200} \\
& (65113867 + 834389234i + 4879525674i^2 + 17164677656i^3 + 40234813060i^4 + \\
& 65584442592i^5 + 71728992432i^6 + 46630109472i^7 + 13488666048i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{2715913200} (879840 + 11316983i + 66517724i^2 + 235659886i^3 + \\
& 558246885i^4 + 925217160i^5 + 1086555204i^6 + 888361112i^7 + 374685168i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{16295479200i^6} (734029128 + 205392096i + 40948614i^2 - \\
& 149167648i^3 + 127933106i^4 - 119541744i^5 + 148175431i^6 - \\
& 115357120i^7 + 408247386i^8 + 642669332i^9 + 2200572742i^{10} + \\
& 3043709712i^{11} + 4193643368i^{12} + 2888648432i^{13} + 2248111008i^{14}) + \\
& \frac{1}{20020} ((-18036i^{14} - 24032i^{15} - 6263i^{16} + 2556i^{17} + 778i^{18} - \\
& 460i^{19} - 354i^{20} - 88i^{21} - 8i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{97772875200i^6(1+i)^2} \\
& (21998896920 + 69727497840i + 69422770494i^2 + 18460087800i^3 - \\
& 5120309964i^4 - 1378984992i^5 + 771050273i^6 + 740895680i^7 + 1381243615i^8 + \\
& 5434122890i^9 + 15532280530i^{10} + 32329771040i^{11} + 49665654884i^{12} + \\
& 57033388320i^{13} + 48720839376i^{14} + 29660113248i^{15} + 13488666048i^{16}) + \\
& \frac{1}{185640} ((-835380i^{14} - 1856400i^{15} - 872661i^{16} + 130842i^{17} + \\
& 69638i^{18} - 13400i^{19} - 16740i^{20} - 4400i^{21} - 400i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{32590958400i^6(1+i)^4} \\
& (1047566520 + 10071341280i + 30553717194i^2 + 41328547260i^3 + \\
& 25323764466i^4 + 4440740304i^5 - 1387466301i^6 - 127684770i^7 + \\
& 617390944i^8 + 2083335192i^9 + 6713782623i^{10} + 16624025402i^{11} + \\
& 31250977242i^{12} + 45253599192i^{13} + 50719388044i^{14} + \\
& 43873490976i^{15} + 28765640976i^{16} + 13996111968i^{17} + 4496222016i^{18}) + \\
& \frac{1}{90440} ((-58140i^{14} - 387600i^{15} - 384693i^{16} + 19722i^{17} + 21318i^{18} - \\
& 120i^{19} - 3092i^{20} - 880i^{21} - 80i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{537750813600i^4(1+i)^6} \\
& (6721885170 + 33255642420i + 65579423910i^2 + 63875251440i^3 + \\
& 29645173961i^4 + 4445597902i^5 + 5312172267i^6 + 36298828640i^7 + \\
& 141319822969i^8 + 407247653250i^9 + 903350470249i^{10} + 1572572513468i^{11} + \\
& 2171726524440i^{12} + 2388051489736i^{13} + 2085127017446i^{14} + \\
& 1431465287472i^{15} + 758395609752i^{16} + 298741072080i^{17} + 74187663264i^{18}) + \\
& \frac{(-373065i^{16} + 14630i^{18} + 1540i^{19} - 1386i^{20} - 440i^{21} - 40i^{22}) \text{Log}20[i]}{1492260}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
& = \frac{1}{14415231600(1+i)^8} \\
& (861525 + 17882207i + 176008612i^2 + 1091708558i^3 + 4782515267i^4 + \\
& 15715810198i^5 + 40152193082i^6 + 81560357688i^7 + 133542600207i^8 + \\
& 177589504653i^9 + 192299352982i^{10} + 169204319558i^{11} + 120156760057i^{12} + \\
& 67999517848i^{13} + 30003264572i^{14} + 9825833128i^{15} + 1988713584i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 0] \\
&= \frac{1}{1249320072000(1+i)^{10}} \\
& (62785863 + 1427494320i + 15466465337i^2 + 106189463334i^3 + 518186510940i^4 + \\
& 1910524957832i^5 + 5522384120274i^6 + 12814898587644i^7 + 24246575436225i^8 + \\
& 37773476840520i^9 + 48717855351195i^{10} + 52110955740090i^{11} + \\
& 46154648186370i^{12} + 33678330490560i^{13} + 20063643662220i^{14} + \\
& 9617916289120i^{15} + 3617744109680i^{16} + 1009099493920i^{17} + 172355177280i^{18})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{293318625600} \\
& (-19397105 - 256633419i - 1550503194i^2 - 5638383356i^3 - 13672438665i^4 - \\
& 23076427770i^5 - 26364210912i^6 - 18208215432i^7 - 5706743328i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \\
& \frac{1}{32590958400} (-1184595 - 15680442i - 94839766i^2 - 345630964i^3 - 841616685i^4 - \\
& 1432054890i^5 - 1723370376i^6 - 1440158808i^7 - 634082592i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{97772875200i^6} (-1468058256 - 899811360i + \\
& 106917930i^2 + 143496304i^3 - 53155788i^4 + 21269304i^5 - 65752025i^6 + \\
& 32823192i^7 - 260793258i^8 - 579511876i^9 - 1744355667i^{10} - \\
& 2632827150i^{11} - 3522389936i^{12} - 2571547704i^{13} - 1902247776i^{14}) + \\
& \frac{1}{120120} ((36072i^{14} + 60080i^{15} + 20535i^{16} - 6228i^{17} - 2474i^{18} + \\
& 948i^{19} + 885i^{20} + 242i^{21} + 24i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{293318625600i^6(1+i)} \\
& (-21998896920 - 59950210320i - 33272536374i^2 + 3969615804i^3 + \\
& 2843734740i^4 - 571237128i^5 - 247761465i^6 - 555798810i^7 - 93443955i^8 - \\
& 2296053670i^9 - 4410336625i^{10} - 10068346335i^{11} - 12264908994i^{12} - \\
& 14002577136i^{13} - 8174600280i^{14} - 5706743328i^{15}) + \\
& \frac{1}{556920} ((835380i^{14} + 2320500i^{15} + 1336761i^{16} - 161487i^{17} - \\
& 104418i^{18} + 12000i^{19} + 20925i^{20} + 6050i^{21} + 600i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{97772875200i^6(1+i)^3} \\
& \left(-1047566520 - 10769718960i - 28421827434i^2 - 28175563416i^3 - \right. \\
& 8497018530i^4 + 1544118576i^5 + 494844753i^6 - 164406276i^7 - 270090140i^8 - \\
& 752830310i^9 - 2333349900i^{10} - 5401008905i^{11} - 9371330039i^{12} - 12302556981 \\
& \left. i^{13} - 12205441350i^{14} - 9065475624i^{15} - 4780433592i^{16} - 1902247776i^{17} \right) + \\
& \frac{1}{271320} \left((58140i^{14} + 484500i^{15} + 578493i^{16} - 24567i^{17} - 31578i^{18} - \right. \\
& \left. 720i^{19} + 3865i^{20} + 1210i^{21} + 120i^{22}) \text{Log}20[i] \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{3226504881600i^4(1+i)^5} \\
& \left(-20165655510 - 79601271750i - 117136999980i^2 - 74488754340i^3 - \right. \\
& 14350477635i^4 + 2638610133i^5 - 4736699232i^6 - 28712540528i^7 - \\
& 105238116880i^8 - 286741378670i^9 - 596420758538i^{10} - 962690060728i^{11} - \\
& 1215231908627i^{12} - 1198359527805i^{13} - 914914569030i^{14} - \\
& \left. 529549011552i^{15} - 225588013992i^{16} - 62774176608i^{17} \right) + \\
& \frac{(223839i^{16} - 8778i^{18} - 924i^{19} + 693i^{20} + 242i^{21} + 24i^{22}) \text{Log}20[i]}{1790712}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{57660926400(1+i)^7} \\
& \left(-519435 - 10457251i - 99519655i^2 - 594663469i^3 - 2498783162i^4 - \right. \\
& 7835449252i^5 - 18982932984i^6 - 36283967400i^7 - 55370574831i^8 - \\
& 67804326623i^9 - 66571579063i^{10} - 52055541821i^{11} - \\
& \left. 31987434230i^{12} - 15104464504i^{13} - 5243744792i^{14} - 1121838432i^{15} \right)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 0, k_4 = 1] \\
&= \frac{1}{3747960216000(1+i)^9} \\
& \left(-29054865 - 642673584i - 6757287853i^2 - 44891669974i^3 - \right. \\
& 211254199023i^4 - 748143841467i^5 - 2067447486756i^6 - 4561035751800i^7 - \\
& 8148898499685i^8 - 11889034812150i^9 - 14214383520975i^{10} - \\
& 13916005316430i^{11} - 11100621540795i^{12} - 7145748235125i^{13} - \\
& \left. 3654838325910i^{14} - 1447482406640i^{15} - 419640140040i^{16} - 72919498080i^{17} \right)
\end{aligned}$$

$$\text{Q6 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0]$$

$$= \frac{1}{293318625600} (51719031 + 645213699i + 3646264824i^2 + 12257493916i^3 + 26968569315i^4 + 39956923278i^5 + 38732604432i^6 + 22198945032i^7 + 5706743328i^8)$$

$$\text{Q6 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0]$$

$$= \frac{1}{32590958400} (2921270 + 36845432i + 211323196i^2 + 725377884i^3 + 1646730855i^4 + 2568207390i^5 + 2742267416i^6 + 1883573208i^7 + 634082592i^8)$$

$$\text{Q6 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0]$$

$$= \frac{1}{97772875200i^5} (-404375328 - 251719272i - 56407428i^2 + 115585512i^3 - 4990104i^4 + 66983812i^5 + 11915790i^6 + 449132340i^7 + 1270725644i^8 + 3153014337i^9 + 4802856138i^{10} + 5512974336i^{11} + 3901790904i^{12} + 1902247776i^{13}) + \frac{1}{120120} ((9936i^{15} + 16644i^{16} + 7866i^{17} - 1364i^{18} - 2892i^{19} - 1347i^{20} - 286i^{21} - 24i^{22}) \text{Log}_{20}[i])$$

$$\text{Q6 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0]$$

$$= \frac{1}{293318625600i^5(1+i)^2} (-5076668520 - 17553525066i - 20645405550i^2 - 8505506394i^3 + 1222823448i^4 + 2365167833i^5 + 1164088135i^6 + 1270097615i^7 + 4488204545i^8 + 12609886495i^9 + 25533336680i^{10} + 37932247539i^{11} + 41539720710i^{12} + 32932069656i^{13} + 17872073208i^{14} + 5706743328i^{15}) + \frac{1}{556920} ((192780i^{15} + 483939i^{16} + 324387i^{17} + 14168i^{18} - 60000i^{19} - 32475i^{20} - 7150i^{21} - 600i^{22}) \text{Log}_{20}[i])$$

$$\text{Q6 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0]$$

$$= \frac{1}{97772875200i^5(1+i)^4} (-209513304 - 2066646582i - 6615542934i^2 - 9792662880i^3 - 7059362310i^4 - 1863395079i^5 + 595728523i^6 + 896812446i^7 + 1856170530i^8 + 5595213260i^9 + 13579588701i^{10} + 24992733918i^{11} + 35221911196i^{12} + 38096984265i^{13} + 31318869450i^{14} + 19025252976i^{15} + 8012924568i^{16} + 1902247776i^{17}) + \frac{1}{271320} ((11628i^{15} + 80427i^{16} + 96387i^{17} + 15048i^{18} - 8720i^{19} - 6175i^{20} - 1430i^{21} - 120i^{22}) \text{Log}_{20}[i])$$

$$\begin{aligned}
& \text{Q6 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{3226504881600i^3(1+i)^6} \\
& (-2372430060 - 12264492240i - 25763758020i^2 - 27593459972i^3 - \\
& 13870461930i^4 + 8467992144i^5 + 63197995830i^6 + 239000249253i^7 + \\
& 678612821562i^8 + 1482726761295i^9 + 2535429092856i^{10} + \\
& 3425393015055i^{11} + 3662990694352i^{12} + 3081661272393i^{13} + \\
& 2006838091170i^{14} + 978669899064i^{15} + 332260216200i^{16} + 62774176608i^{17}) + \\
& \frac{(26334i^{17} + 5852i^{18} - 924i^{19} - 1155i^{20} - 286i^{21} - 24i^{22}) \text{Log}20[i]}{1790712}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{172982779200(1+i)^8} \\
& (3026030 + 62405668i + 609877748i^2 + 3753008852i^3 + 16296241873i^4 + \\
& 53019732842i^5 + 133930929948i^6 + 268516596192i^7 + 432977153628i^8 + \\
& 565358410672i^9 + 598607041208i^{10} + 511881220612i^{11} + 349854770563i^{12} + \\
& 187402802942i^{13} + 75849733408i^{14} + 21450256872i^{15} + 3365515296i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{3747960216000(1+i)^{10}} \\
& (55255851 + 1249209845i + 13451642325i^2 + 91735080639i^3 + 444341912153i^4 + \\
& 1624874117898i^5 + 4653999309909i^6 + 10689661785216i^7 + 19992015978075i^8 + \\
& 30733230087735i^9 + 39026807820705i^{10} + 40979026976265i^{11} + \\
& 35479053872985i^{12} + 25146766937160i^{13} + 14405118460785i^{14} + \\
& 6525964221090i^{15} + 2249017720680i^{16} + 543552294120i^{17} + 72919498080i^{18})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 0, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{293318625600} (-5123573 - 66043718i - 386010233i^2 - 1343658822i^3 - \\
& 3066280515i^4 - 4725952992i^5 - 4798367844i^6 - 2913410904i^7 - 804797136i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 1, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{97772875200} (-976590 - 12678937i - 74857636i^2 - 264479754i^3 - \\
& 617781675i^4 - 990732960i^5 - 1086989316i^6 - 767285208i^7 - 268265712i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 2, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{97772875200i^5} \\
& (134791776 + 128511432i + 16658334i^2 - 29920996i^3 - 15135960i^4 - \\
& 8504944i^5 - 5211539i^6 - 54337070i^7 - 172302042i^8 - 424031835i^9 - \\
& 671618688i^{10} - 775537212i^{11} - 563433448i^{12} - 268265712i^{13}) + \\
& \frac{1}{120120} ((-3312i^{15} - 6644i^{16} - 3723i^{17} + 302i^{18} + 1150i^{19} + \\
& 577i^{20} + 132i^{21} + 12i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 3, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{293318625600i^5(1+i)} \\
& (1692222840 + 5099075982i + 3882495078i^2 + 317447130i^3 - 639102156i^4 - \\
& 340980115i^5 - 120111775i^6 - 116104395i^7 - 522622485i^8 - \\
& 1282848225i^9 - 2454077715i^{10} - 3174077148i^{11} - \\
& 3074043972i^{12} - 1883542200i^{13} - 804797136i^{14}) + \\
& \frac{1}{556920} ((-64260i^{15} - 197013i^{16} - 154044i^{17} - 12841i^{18} + \\
& 24450i^{19} + 13995i^{20} + 3300i^{21} + 300i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 4, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{293318625600i^5(1+i)^3} \\
& (209513304 + 2206322118i + 6224083866i^2 + 7056293244i^3 + 3038441406i^4 - \\
& 130677729i^5 - 528568157i^6 - 343297016i^7 - 644423742i^8 - \\
& 1900965710i^9 - 4313927534i^{10} - 7297499151i^{11} - 9270777483i^{12} - \\
& 8796274884i^{13} - 6082990524i^{14} - 2881581192i^{15} - 804797136i^{16}) + \\
& \frac{1}{813960} ((-11628i^{15} - 99807i^{16} - 139992i^{17} - 23883i^{18} + \\
& 11230i^{19} + 8053i^{20} + 1980i^{21} + 180i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 5, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{3226504881600i^3(1+i)^5} \\
& (1186215030 + 4946031090i + 7935847920i^2 + 5891717728i^3 + 1530250631i^4 - \\
& 1736810279i^5 - 8225051126i^6 - 29069714215i^7 - 77925174134i^8 - \\
& 159267782091i^9 - 251713745646i^{10} - 309429789669i^{11} - 294747812535i^{12} - \\
& 214314867492i^{13} - 115147428924i^{14} - 42675822024i^{15} - 8852768496i^{16}) + \\
& \frac{(-65835i^{17} - 14630i^{18} + 2310i^{19} + 2541i^{20} + 660i^{21} + 60i^{22}) \text{Log}20[i]}{8953560}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{172982779200(1+i)^7} \\
& (-449330 - 8979811i - 84768005i^2 - 501954689i^3 - 2087902582i^4 - \\
& 6472158632i^5 - 15474894144i^6 - 29129771400i^7 - 43656347196i^8 - \\
& 52300344943i^9 - 49955447333i^{10} - 37668986161i^{11} - \\
& 21984220180i^{12} - 9570899564i^{13} - 2876568232i^{14} - 474623952i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 0, k_2 = 0, k_3 = 1, k_4 = 1] \\
&= \frac{1}{11243880648000(1+i)^9} \\
& (-25186035 - 553517953i - 5779014721i^2 - 38096770941i^3 - \\
& 177755030409i^4 - 623575580115i^5 - 1705071335274i^6 - 3716986767990i^7 - \\
& 6551226544695i^8 - 9409017312405i^9 - 11042727420615i^{10} - \\
& 10570746774435i^{11} - 8196711661125i^{12} - 5081108964495i^{13} - \\
& 2461857390780i^{14} - 895692688740i^{15} - 225235096440i^{16} - 30850556880i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{586637251200} \\
& (5407948 + 73454136i + 455730246i^2 + 1702248964i^3 + 4240644675i^4 + \\
& 7354831068i^5 + 8679092688i^6 + 6258608208i^7 + 2075179392i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{65181916800} (354285 + 4810688i + 29845774i^2 + 111538196i^3 + \\
& 278336415i^4 + 484808940i^5 + 596144304i^6 + 507647472i^7 + 230575488i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
&= \frac{1}{195545750400i^6} \\
& (978705504 + 925892352i - 88505298i^2 - 106806728i^3 + 11061792i^4 + 12114144 \\
& i^5 + 19408993i^6 - 2823696i^7 + 78077010i^8 + 206011244i^9 + 595438473i^{10} + \\
& 948214836i^{11} + 1263229744i^{12} + 959682096i^{13} + 691726464i^{14}) + \\
& \frac{1}{240240} ((-24048i^{14} - 48064i^{15} - 21699i^{16} + 4896i^{17} + 2506i^{18} - \\
& 612i^{19} - 735i^{20} - 220i^{21} - 24i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{586637251200i^6} (14665931280 + 33448615200i + 525856716i^2 - \\
& 3877037472i^3 + 1312420032i^4 - 1177046640i^5 + 1641517290i^6 - \\
& 1489164600i^7 + 1661978670i^8 - 1000228300i^9 + 2732076975i^{10} + \\
& 792253260i^{11} + 3952264176i^{12} + 1189265328i^{13} + 2075179392i^{14}) + \\
& \frac{1}{1113840} ((-556920i^{14} - 1856400i^{15} - 1355274i^{16} + 128088i^{17} + \\
& 103002i^{18} - 5700i^{19} - 17535i^{20} - 5500i^{21} - 600i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{195545750400i^6(1+i)^2} \\
& (698377680 + 7645397760i + 17061039996i^2 + 9573972408i^3 - \\
& 876743868i^4 - 580515936i^5 + 59642466i^6 + 53922844i^7 + 103212652i^8 + \\
& 173193480i^9 + 684062155i^{10} + 1310983618i^{11} + 2246470377i^{12} + \\
& 2468322756i^{13} + 2309057232i^{14} + 1216614384i^{15} + 691726464i^{16}) + \\
& \frac{1}{542640} ((-38760i^{14} - 387600i^{15} - 579462i^{16} + 19608i^{17} + 31122i^{18} + \\
& 1420i^{19} - 3283i^{20} - 1100i^{21} - 120i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{6453009763200i^4(1+i)^4} \\
& (20165655510 + 59435616240i + 57701383740i^2 + 16787370600i^3 - 2468101857i^4 - \\
& 616329300i^5 + 1832487288i^6 + 8654320264i^7 + 30092128186i^8 + \\
& 77288252184i^9 + 150162537448i^{10} + 223198003864i^{11} + 255192941949i^{12} + \\
& 222049659876i^{13} + 145000431312i^{14} + 67214630736i^{15} + 22826973312i^{16}) + \\
& \frac{(-1119195i^{16} + 43890i^{18} + 4620i^{19} - 3003i^{20} - 1100i^{21} - 120i^{22}) \text{Log}20[i]}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{115321852800(1+i)^6} \\
& (178465 + 3481254i + 31996221i^2 + 183926940i^3 + 740056248i^4 + 2209564560i^5 + \\
& 5061594636i^6 + 9068422704i^7 + 12828052545i^8 + 14352642942i^9 + 12631137585 \\
& i^{10} + 8626542564i^{11} + 4465601616i^{12} + 1684897200i^{13} + 407941248i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 0, k_4 = 1] \\
& = \frac{1}{7495920432000(1+i)^8} \\
& (10078488 + 216681752i + 2208588854i^2 + 14180388468i^3 + 64260892803i^4 + \\
& 218220822756i^5 + 575307356640i^6 + 1203366013440i^7 + 2023039485270i^8 + \\
& 2751175261560i^9 + 3029578260390i^{10} + 2690336679540i^{11} + 1908184615845i^{12} + \\
& 1063635144900i^{13} + 454001642320i^{14} + 140959034640i^{15} + 26516181120i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 0, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{586637251200} (1424878 + 18866432i + 113329882i^2 + 405693118i^3 + 952952790i^4 + \\
& 1514273229i^5 + 1591489476i^6 + 1007240616i^7 + 292653504i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 1, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400} (290180 + 3865153i + 23414174i^2 + 84869106i^3 + \\
& 203310450i^4 + 334172475i^5 + 375425484i^6 + 271172712i^7 + 97551168i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 2, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400i^5} \\
& (-89861184 - 115410960i - 19565742i^2 + 21299964i^3 + 14582400i^4 + \\
& 5066208i^5 + 2408159i^6 + 17317654i^7 + 58470458i^8 + 145377930i^9 + \\
& 237389439i^{10} + 277998348i^{11} + 206598552i^{12} + 97551168i^{13}) + \\
& \frac{1}{240240} ((2208i^{15} + 5160i^{16} + 3459i^{17} - 18i^{18} - 910i^{19} - 494i^{20} - 121i^{21} - 12i^{22}) \\
& \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 3, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200i^5} \\
& (-1128148560 - 2897984628i - 776816964i^2 + 355362084i^3 + 154539000i^4 + \\
& 155003170i^5 - 73127670i^6 + 124422210i^7 + 48638150i^8 + 413703150i^9 + \\
& 464920785i^{10} + 714645252i^{11} + 426073176i^{12} + 292653504i^{13}) + \\
& \frac{1}{1113840} ((42840i^{15} + 155142i^{16} + 145206i^{17} + 17374i^{18} - \\
& 19950i^{19} - 12150i^{20} - 3025i^{21} - 300i^{22}) \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 4, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200i^5(1+i)^2} \\
& \quad (-139675536 - 1563998436i - 3795299508i^2 - 2768453688i^3 - \\
& \quad 257693436i^4 + 298730614i^5 + 156608530i^6 + 78823080i^7 + 170203000i^8 + \\
& \quad 514823500i^9 + 1063054839i^{10} + 1659500964i^{11} + 1851274557i^{12} + \\
& \quad 1525581972i^{13} + 817657704i^{14} + 292653504i^{15}) + \\
& \quad \frac{1}{1627920} ((7752i^{15} + 79458i^{16} + 135318i^{17} + 25042i^{18} - \\
& \quad 9730i^{19} - 7130i^{20} - 1815i^{21} - 180i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 5, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{6453009763200i^3(1+i)^4} \\
& \quad (-1186215030 - 3759816060i - 4176031860i^2 - 1726467496i^3 + 60879377i^4 + \\
& \quad 662851494i^5 + 2424869940i^6 + 8157824130i^7 + 20604498486i^8 + \\
& \quad 39211507258i^9 + 56873467156i^{10} + 62930165430i^{11} + 52446408795i^{12} + \\
& \quad 31956918444i^{13} + 13301664552i^{14} + 3219188544i^{15}) + \\
& \quad \frac{(13167i^{17} + 2926i^{18} - 462i^{19} - 462i^{20} - 121i^{21} - 12i^{22}) \text{Log}20[i]}{3581424}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \quad \frac{1}{115321852800(1+i)^6} (50820 + 983263i + 8955472i^2 + 50958875i^3 + 202701096i^4 + \\
& \quad 597335120i^5 + 1347854832i^6 + 2372450828i^7 + 3285508600i^8 + 3580608559i^9 + \\
& \quad 3045522920i^{10} + 1983603743i^{11} + 954091612i^{12} + 314692440i^{13} + 57530176i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 0, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{22487761296000(1+i)^8} \\
& \quad (8626226 + 184130204i + 1862060694i^2 + 11852105946i^3 + 53195729334i^4 + \\
& \quad 178718561919i^5 + 465524448600i^6 + 960521499840i^7 + 1589638704210i^8 + \\
& \quad 2122501231290i^9 + 2286514816410i^{10} + 1975871972610i^{11} + 1352297771670i^{12} + \\
& \quad 716644325505i^{13} + 282529178820i^{14} + 76375766040i^{15} + 11218384320i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 0, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{586637251200} \\
& \quad (27791673 + 339041976i + 1864083156i^2 + 6054410624i^3 + 12748400835i^4 + \\
& \quad 17854333668i^5 + 16197369888i^6 + 8653045968i^7 + 2075179392i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 1, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \\
& \frac{1}{65181916800} (1630650 + 20213488i + 113497524i^2 + 379354976i^3 + 832089895i^4 + \\
& 1239168980i^5 + 1239896224i^6 + 773696112i^7 + 230575488i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 2, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{195545750400i^4} \\
& (142117416 + 190312416i + 145064808i^2 + 44672544i^3 + 23895620i^4 + \\
& 28043904i^5 + 225757788i^6 + 711536416i^7 + 1632450873i^8 + 2462296716i^9 + \\
& 2619648864i^{10} + 1757828016i^{11} + 691726464i^{12}) + \\
& \frac{(-3492i^{16} - 8352i^{17} - 8476i^{18} - 4848i^{19} - 1659i^{20} - 308i^{21} - 24i^{22}) \text{Log}20[i]}{240240}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 3, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{586637251200i^4(1+i)^2} \\
& (1462564026 + 5919037740i + 9421361334i^2 + 7867118952i^3 + 3931113907i^4 + \\
& 1312559150i^5 + 817297135i^6 + 2502192880i^7 + 6890691995i^8 + \\
& 13636713730i^9 + 19682197071i^{10} + 20728498020i^{11} + \\
& 15539597184i^{12} + 7734061872i^{13} + 2075179392i^{14}) + \\
& \frac{1}{1113840} ((-55539i^{16} - 172152i^{17} - 194348i^{18} - 114000i^{19} - \\
& 40635i^{20} - 7700i^{21} - 600i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 4, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \\
& \frac{1}{195545750400i^4(1+i)^4} (52378326 + 540540000i + 1910412504i^2 + 3374507136i^3 + \\
& 3419812851i^4 + 2155154820i^5 + 1053453986i^6 + 1166837908i^7 + 3140291642i^8 + \\
& 7468228088i^9 + 13488650578i^{10} + 18572475068i^{11} + 19498445601i^{12} + \\
& 15398263404i^{13} + 8833341984i^{14} + 3398213232i^{15} + 691726464i^{16}) + \\
& \frac{1}{542640} ((-2907i^{16} - 21432i^{17} - 34428i^{18} - 20880i^{19} - \\
& 7903i^{20} - 1540i^{21} - 120i^{22}) \text{Log}20[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 5, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{6453009763200i^2(1+i)^6} \\
& (527206680 + 2941258320i + 6989313968i^2 + 9832077216i^3 + \\
& 13770390036i^4 + 39188710200i^5 + 136095731097i^6 + 379942193130i^7 + \\
& 818809126167i^8 + 1378170323904i^9 + 1826811889815i^{10} + \\
& 1908031378418i^{11} + 1557427871373i^{12} + 973854937836i^{13} + \\
& 448142561856i^{14} + 139207392720i^{15} + 22826973312i^{16}) + \\
& \frac{(-29260i^{18} - 18480i^{19} - 7623i^{20} - 1540i^{21} - 120i^{22}) \text{Log}20[i]}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{345965558400(1+i)^8} \\
& (1777930 + 36445472i + 353818852i^2 + 2161398448i^3 + 9309053777i^4 + \\
& 30012142708i^5 + 75036481692i^6 + 148685087208i^7 + 236523480432i^8 + \\
& 303960357008i^9 + 315741071272i^{10} + 263694162248i^{11} + 174851544587i^{12} + \\
& 89928483748i^{13} + 34358590112i^{14} + 8914443408i^{15} + 1223823744i^{16})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 0] \\
& = \frac{1}{7495920432000(1+i)^{10}} \\
& (32535069 + 731662554i + 7833497293i^2 + 53088072536i^3 + 255389886457i^4 + \\
& 926904702606i^5 + 2632843052457i^6 + 5991514577316i^7 + 11089454132625i^8 + \\
& 16847507737290i^9 + 21105541213065i^{10} + 21812083979280i^{11} + \\
& 18528701855205i^{12} + 12827902905390i^{13} + 7130424532965i^{14} + \\
& 3102531029580i^{15} + 1010210872320i^{16} + 224586990480i^{17} + 26516181120i^{18})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 0, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200} (-2746835 - 34646157i - 197183662i^2 - 663954608i^3 - \\
& 1452451485i^4 - 2120435055i^5 - 2017190556i^6 - 1140264936i^7 - 292653504i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 1, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400} (-541530 - 6911238i - 39961754i^2 - 137557056i^3 - \\
& 310711275i^4 - 476411985i^5 - 490736484i^6 - 315514152i^7 - 97551168i^8)
\end{aligned}$$

$$\text{Q6 } [l = 2, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\frac{1}{195545750400i^4} (-47372472 - 78577128i - 57352764i^2 - 22722000i^3 - 6051780i^4 - 4489716i^5 - 28146754i^6 - 94107808i^7 - 218762295i^8 - 339768165i^9 - 366719988i^{10} - 250939992i^{11} - 97551168i^{12}) + \frac{(1164i^{16} + 3156i^{17} + 3438i^{18} + 2040i^{19} + 725i^{20} + 143i^{21} + 12i^{22}) \text{Log}20[i]}{240240}$$

$$\text{Q6 } [l = 3, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\frac{1}{586637251200i^4(1+i)} (-487521342 - 1754493048i - 2129124690i^2 - 1268181684i^3 - 451646825i^4 - 104099240i^5 - 75653325i^6 - 277224310i^7 - 697682425i^8 - 1269785580i^9 - 1613377647i^{10} - 1460139588i^{11} - 851751000i^{12} - 292653504i^{13}) + \frac{1}{1113840} ((18513i^{16} + 67599i^{17} + 83326i^{18} + 49800i^{19} + 17925i^{20} + 3575i^{21} + 300i^{22}) \text{Log}20[i])$$

$$\text{Q6 } [l = 4, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\frac{1}{586637251200i^4(1+i)^3} (-52378326 - 575458884i - 1828466640i^2 - 2640333696i^3 - 2022321483i^4 - 916864494i^5 - 334801870i^6 - 379288080i^7 - 1043108550i^8 - 2322691780i^9 - 3843884256i^{10} - 4749729174i^{11} - 4343370075i^{12} - 2848941396i^{13} - 1243335528i^{14} - 292653504i^{15}) + \frac{1}{1627920} ((2907i^{16} + 26277i^{17} + 47538i^{18} + 28920i^{19} + 10595i^{20} + 2145i^{21} + 180i^{22}) \text{Log}20[i])$$

$$\text{Q6 } [l = 5, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1]$$

=

$$\frac{1}{6453009763200i^2(1+i)^5} (-263603340 - 1207025820i - 2266903600i^2 - 2351148176i^3 - 2167784086i^4 - 4938940254i^5 - 16215350055i^6 - 42740431860i^7 - 85998664169i^8 - 133430925694i^9 - 160362000161i^{10} - 148443378600i^{11} - 103896442485i^{12} - 52870388076i^{13} - 17984120616i^{14} - 3219188544i^{15}) + \frac{(2926i^{18} + 1848i^{19} + 693i^{20} + 143i^{21} + 12i^{22}) \text{Log}20[i]}{3581424}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{115321852800(1+i)^7} \\
& (-86730 - 1721468i - 16128330i^2 - 94709822i^3 - 390299151i^4 - 1197278776i^5 - \\
& 2828954372i^6 - 5253298440i^7 - 7749454768i^8 - 9111078504i^9 - 8505404094i^{10} - \\
& 6230052918i^{11} - 3498064825i^{12} - 1441434012i^{13} - 398372696i^{14} - 57530176i^{15})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 1, k_2 = 0, k_3 = 1, k_4 = 1] \\
& = \frac{1}{22487761296000(1+i)^9} \\
& (-14613165 - 319228392i - 3311150681i^2 - 21672384042i^3 - \\
& 100330522713i^4 - 348934943652i^5 - 945003818439i^6 - 2038128039720i^7 - \\
& 3549134831745i^8 - 5027697649080i^9 - 5807394881145i^{10} - \\
& 5455361080830i^{11} - 4134127334445i^{12} - 2489246121060i^{13} - \\
& 1160247670815i^{14} - 399712441860i^{15} - 92693415960i^{16} - 11218384320i^{17})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 0, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{586637251200} (381017 + 4938934i + 28908529i^2 + 100196076i^3 + \\
& 225889005i^4 + 340512642i^5 + 335640282i^6 + 197644992i^7 + 53209728i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 1, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \frac{1}{195545750400} (79950 + 1046996i + 6213053i^2 + 21950292i^3 + \\
& 50882475i^4 + 80043390i^5 + 84556878i^6 + 55752384i^7 + 17736576i^8)
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 2, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
& = \\
& \frac{1}{195545750400i^4} (15790824 + 31238928i + 23776438i^2 + 10011120i^3 + 2448124i^4 + \\
& 909832i^5 + 4525285i^6 + 15727236i^7 + 37283415i^8 + \\
& 59440854i^9 + 65362926i^{10} + 45623104i^{11} + 17736576i^{12}) + \\
& \frac{(-388i^{16} - 1176i^{17} - 1391i^{18} - 860i^{19} - 317i^{20} - 66i^{21} - 6i^{22}) \text{Log}20[i]}{240240}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 3, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200i^4} \\
& (162507114 + 511991172i + 400553538i^2 + 156063600i^3 + 45679795i^4 - \\
& 2395470i^5 + 18156105i^6 + 28587900i^7 + 94222425i^8 + 132030810i^9 + \\
& 162894714i^{10} + 106481472i^{11} + 53209728i^{12}) + \frac{1}{1113840} \\
& ((-6171i^{16} - 25938i^{17} - 35657i^{18} - 21900i^{19} - 7965i^{20} - 1650i^{21} - 150i^{22}) \\
& \text{Log}_{20}[i])
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 4, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{586637251200i^4(1+i)^2} \\
& (17459442 + 203459256i + 570533964i^2 + 616143528i^3 + 317703477i^4 + \\
& 101607688i^5 + 30017364i^6 + 48421560i^7 + 137426410i^8 + 282085416i^9 + \\
& 425155419i^{10} + 462466422i^{11} + 359485434i^{12} + 182513088i^{13} + 53209728i^{14}) + \\
& (-969i^{16} - 10374i^{17} - 21831i^{18} - 13460i^{19} - 4811i^{20} - 990i^{21} - 90i^{22}) \text{Log}_{20}[i] \\
& \frac{1627920}{1627920}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 5, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \\
& \frac{1}{6453009763200i^2(1+i)^4} (131801670 + 471711240i + 657737132i^2 + 475141160i^3 + \\
& 313185327i^4 + 697483016i^5 + 2233171289i^6 + 5548198326i^7 + \\
& 10371227097i^8 + 14722588716i^9 + 15855333351i^{10} + \\
& 12754635894i^{11} + 7389266478i^{12} + 2843991744i^{13} + 585307008i^{14}) + \\
& (-7315i^{18} - 4620i^{19} - 1617i^{20} - 330i^{21} - 30i^{22}) \text{Log}_{20}[i] \\
& \frac{17907120}{17907120}
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 6, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \\
& \frac{1}{345965558400(1+i)^6} (43610 + 837368i + 7562787i^2 + 42633470i^3 + 167817716i^4 + \\
& 488723280i^5 + 1087996692i^6 + 1885410648i^7 + 2563522500i^8 + 2732574064i^9 + \\
& 2260756135i^{10} + 1419784158i^{11} + 648536842i^{12} + 197314240i^{13} + 31380096i^{14})
\end{aligned}$$

$$\begin{aligned}
& \text{Q6 } [l = 7, k_1 = 1, k_2 = 1, k_3 = 1, k_4 = 1] \\
&= \frac{1}{22487761296000(1+i)^8} \\
& (2471847 + 52410050i + 526147575i^2 + 3322238556i^3 + 14780345853i^4 + \\
& 49174903722i^5 + 126707643960i^6 + 258272741040i^7 + 421575326115i^8 + \\
& 554034683730i^9 + 585865599165i^{10} + 495086099340i^{11} + 329506654785i^{12} + \\
& 168306376650i^{13} + 62993536890i^{14} + 15739970880i^{15} + 2039706240i^{16})
\end{aligned}$$

S-22.5 Analytic formulas of the integrals L

$$\begin{aligned} L[l = 0, i, k = 0, k' = 0] \\ = \frac{-49 + 450i - 1815i^2 + 4180i^3 - 5940i^4 + 5148i^5}{13860} \end{aligned}$$

$$\begin{aligned} L[l = 1, i, k = 0, k' = 0] \\ = \frac{-153 + 1736i - 8918i^2 + 27300i^3 - 55055i^4 + 76076i^5 - 72072i^6 + 44616i^7}{120120} \end{aligned}$$

$$\begin{aligned} L[l = 2, i, k = 0, k' = 0] \\ = \frac{1}{20020} (-11 + 148i - 918i^2 + 3472i^3 - \\ 8918i^4 + 16380i^5 - 22022i^6 + 21736i^7 - 15444i^8 + 7436i^9) \end{aligned}$$

$$\begin{aligned} L[l = 3, i, k = 0, k' = 0] \\ = \frac{1}{1113840} (-299 + 4644i - 33660i^2 + 150960i^3 - 468180i^4 + 1062432i^5 - \\ 1819272i^6 + 2386800i^7 - 2406690i^8 + 1847560i^9 - 1050192i^{10} + 413712i^{11}) \end{aligned}$$

$$\begin{aligned} L[l = 4, i, k = 0, k' = 0] \\ = \frac{1}{271320} (-39 + 686i - 5681i^2 + 29412i^3 - 106590i^4 + 286824i^5 - 593028i^6 + 961248i^7 - \\ 1234506i^8 + 1259700i^9 - 1016158i^{10} + 638248i^{11} - 302328i^{12} + 100776i^{13}) \end{aligned}$$

$$\begin{aligned} L[l = 5, i, k = 0, k' = 0] \\ = \frac{1}{5969040} (-493 + 9680i - 90090i^2 + 528220i^3 - 2187185i^4 + 6794172i^5 - 16414860i^6 + \\ 31550640i^7 - 48924810i^8 + 61680080i^9 - 63371308i^{10} + 52907400i^{11} - \\ 35565530i^{12} + 18901960i^{13} - 7674480i^{14} + 2217072i^{15}) \end{aligned}$$

$$\begin{aligned} L[l = 6, i, k = 0, k' = 0] \\ = \frac{1}{3028410} (-152 + 3294i - 34017i^2 + 222640i^3 - \\ 1036035i^4 + 3644718i^5 - 10061051i^6 + 22323708i^7 - 40450905i^8 + \\ 60472060i^9 - 75018042i^{10} + 77380464i^{11} - 66251822i^{12} + \\ 46802700i^{13} - 26967270i^{14} + 12421288i^{15} - 4412826i^{16} + 1124838i^{17}) \end{aligned}$$

$$\begin{aligned}
L[l = 7, i, k = 0, k' = 0] &= \frac{1}{4604600} \\
&(-147 + 3484i - 39520i^2 + 285480i^3 - 1474070i^4 + 5788640i^5 - 17957940i^6 + \\
&45125080i^7 - 93424045i^8 + 161226780i^9 - 233716340i^{10} + 285867920i^{11} - \\
&295525620i^{12} + 257934880i^{13} - 189290920i^{14} + 115892400i^{15} - \\
&58429085i^{16} + 23746580i^{17} - 7498920i^{18} + 1710280i^{19})
\end{aligned}$$

$$\begin{aligned}
L[l = 0, i, k = 0, k' = 1] &= \frac{13 - 115i + 440i^2 - 935i^3 + 1155i^4 - 726i^5}{13860}
\end{aligned}$$

$$\begin{aligned}
L[l = 1, i, k = 0, k' = 1] &= \frac{128 - 1421i + 7098i^2 - 20930i^3 + 40040i^4 - 51051i^5 + 42042i^6 - 18876i^7}{360360}
\end{aligned}$$

$$\begin{aligned}
L[l = 2, i, k = 0, k' = 1] &= \frac{1}{120120} (19 - 252i + 1536i^2 - 5684i^3 + \\
&14196i^4 - 25116i^5 + 32032i^6 - 29172i^7 + 18018i^8 - 6292i^9)
\end{aligned}$$

$$\begin{aligned}
L[l = 3, i, k = 0, k' = 1] &= \frac{1}{1113840} (88 - 1353i + 9690i^2 - 42840i^3 + 130560i^4 - 289884i^5 + \\
&482664i^6 - 609960i^7 + 583440i^8 - 413270i^9 + 204204i^{10} - 58344i^{11})
\end{aligned}$$

$$\begin{aligned}
L[l = 4, i, k = 0, k' = 1] &= \frac{1}{813960} \\
&(35 - 611i + 5016i^2 - 25707i^3 + 92055i^4 - 244188i^5 + 496128i^6 - 786828i^7 + \\
&982566i^8 - 965770i^9 + 739024i^{10} - 428298i^{11} + 176358i^{12} - 42636i^{13})
\end{aligned}$$

$$\begin{aligned}
L[l = 5, i, k = 0, k' = 1] &= \frac{1}{17907120} \\
&(448 - 8745i + 80850i^2 - 470470i^3 + 1931160i^4 - 5938317i^5 + 14176470i^6 - \\
&26860680i^7 + 40930560i^8 - 50488130i^9 + 50438388i^{10} - 40562340i^{11} + \\
&25865840i^{12} - 12684210i^{13} + 4476780i^{14} - 937992i^{15})
\end{aligned}$$

$$\begin{aligned}
& L[l = 6, i, k = 0, k' = 1] \\
& = \\
& = \frac{1}{6056820} (93 - 2006i + 20608i^2 - 134090i^3 + 619850i^4 - 2164162i^5 + 5922224i^6 - \\
& 13007742i^7 + 23289915i^8 - 34321980i^9 + 41840128i^{10} - \\
& 42226436i^{11} + 35154028i^{12} - 23921380i^{13} + \\
& 13075040i^{14} - 5556892i^{15} + 1716099i^{16} - 317262i^{17})
\end{aligned}$$

$$\begin{aligned}
& L[l = 7, i, k = 0, k' = 1] \\
& = \frac{1}{13813800} \\
& (136 - 3211i + 36270i^2 - 260780i^3 + 1339520i^4 - 5229510i^5 + 16116100i^6 - \\
& 40191580i^7 + 82488120i^8 - 140917205i^9 + 201845930i^{10} - 243374040i^{11} + \\
& 247237120i^{12} - 211132180i^{13} + 150660120i^{14} - 88850840i^{15} + \\
& 42493880i^{16} - 15935205i^{17} + 4374370i^{18} - 723580i^{19})
\end{aligned}$$

$$\begin{aligned}
& L[l = 0, i, k = 1, k' = 1] \\
& = \frac{-7 + 60i - 220i^2 + 440i^3 - 495i^4 + 264i^5}{27720}
\end{aligned}$$

$$\begin{aligned}
& L[l = 1, i, k = 1, k' = 1] \\
& = \frac{-36 + 392i - 1911i^2 + 5460i^3 - 10010i^4 + 12012i^5 - 9009i^6 + 3432i^7}{360360}
\end{aligned}$$

$$\begin{aligned}
& L[l = 2, i, k = 1, k' = 1] \\
& = \frac{1}{240240} (-11 + 144i - 864i^2 + 3136i^3 - \\
& 7644i^4 + 13104i^5 - 16016i^6 + 13728i^7 - 7722i^8 + 2288i^9)
\end{aligned}$$

$$\begin{aligned}
& L[l = 3, i, k = 1, k' = 1] \\
& = \frac{1}{1113840} (-26 + 396i - 2805i^2 + 12240i^3 - 36720i^4 + 79968i^5 - \\
& 129948i^6 + 159120i^7 - 145860i^8 + 97240i^9 - 43758i^{10} + 10608i^{11})
\end{aligned}$$

$$\begin{aligned}
& L[l = 4, i, k = 1, k' = 1] \\
& = \frac{1}{1627920} \\
& (-21 + 364i - 2964i^2 + 15048i^3 - 53295i^4 + 139536i^5 - 279072i^6 + 434112i^7 - \\
& 529074i^8 + 503880i^9 - 369512i^{10} + 201552i^{11} - 75582i^{12} + 15504i^{13})
\end{aligned}$$

$$\begin{aligned}
L[l = 5, i, k = 1, k' = 1] \\
&= \frac{1}{17907120} \\
&(-136 + 2640i - 24255i^2 + 140140i^3 - 570570i^4 + 1738044i^5 - 4103715i^6 + \\
&7674480i^7 - 11511720i^8 + 13927760i^9 - 13579566i^{10} + 10581480i^{11} - \\
&6466460i^{12} + 2984520i^{13} - 959310i^{14} + 170544i^{15})
\end{aligned}$$

$$\begin{aligned}
L[l = 6, i, k = 1, k' = 1] \\
&= \frac{1}{12113640} \\
&(-57 + 1224i - 12512i^2 + 80960i^3 - 371910i^4 + 1289288i^5 - 3499496i^6 + 7614288 \\
&i^7 - 13483635i^8 + 19612560i^9 - 23535072i^{10} + 23297344i^{11} - 18929092i^{12} + \\
&12480720i^{13} - 6537520i^{14} + 2615008i^{15} - 735471i^{16} + 115368i^{17})
\end{aligned}$$

$$\begin{aligned}
L[l = 7, i, k = 1, k' = 1] \\
&= \\
&\frac{1}{13813800} (-42 + 988i - 11115i^2 + 79560i^3 - 406640i^4 + 1578720i^5 - 4834830i^6 + \\
&11971960i^7 - 24371490i^8 + 41244060i^9 - 58429085i^{10} + \\
&69535440i^{11} - 69535440i^{12} + 58243360i^{13} - 40562340i^{14} + \\
&23178480i^{15} - 10623470i^{16} + 3749460i^{17} - 937365i^{18} + 131560i^{19})
\end{aligned}$$

S-22.6 Analytic formulas of the integrals R

$$\begin{aligned}
R[l = 0, i, k = 0, k' = 0] \\
&= \frac{1}{840} (11 + 76i + 216i^2 + 312i^3)
\end{aligned}$$

$$\begin{aligned}
R[l = 1, i, k = 0, k' = 0] \\
&= \frac{1}{35} (3 + 13i)
\end{aligned}$$

$$\begin{aligned}
R[l = 2, i, k = 0, k' = 0] \\
&= \frac{1}{232792560i^{20}} \\
&(-11639628 + 12252240i + 56904848i^2 - 13261248i^3 - 90717627i^4 - \\
&44316272i^5 - 33462i^6 + 45276i^7 - 62491i^8 + 88236i^9 - 127908i^{10} + \\
&191216i^{11} - 296514i^{12} + 480624i^{13} - 823004i^{14} + 1511640i^{15} - \\
&3048474i^{16} + 7020728i^{17} - 19953648i^{18} + 86465808i^{19}) + \\
&(1 - 6i^2 - 4i^3 + 9i^4 + 12i^5 + 4i^6) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& R[l = 3, i, k = 0, k' = 0] \\
& = \\
& \frac{1}{38798760i^{20}} \left(-11639628 - 11027016i + 116328212i^2 + 110350240i^3 + 585585i^4 - \right. \\
& 686686i^5 + 812383i^6 - 970596i^7 + 1172490i^8 - 1434120i^9 + \\
& 1779084i^{10} - 2242912i^{11} + 2880514i^{12} - 3779100i^{13} + 5080790i^{14} - \\
& 7020728i^{15} + 9976824i^{16} - 14410968i^{17} + 38798760i^{18} + \\
& 1086365280i^{20} - 1086365280i^{21} - 6983776800i^{22} - 4655851200i^{23} \left. + \right. \\
& \left. (6 + 12i - 54i^2 - 120i^3 - 60i^4) \text{Log}20[i] \right)
\end{aligned}$$

$$\begin{aligned}
& R[l = 4, i, k = 0, k' = 0] \\
& = \\
& \frac{1}{77597520i^{20}} \\
& \left(-34918884 - 196035840i - 26546520i^2 + 27467440i^3 - 28433405i^4 + \right. \\
& 29441412i^5 - 30484740i^6 + 31550640i^7 - 32616540i^8 + 33643680i^9 - \\
& 34566168i^{10} + 35271600i^{11} - 35565530i^{12} + 35103640i^{13} - \\
& 33256080i^{14} + 28821936i^{15} \left. + (9 + 60i + 60i^2) \text{Log}20[i] \right)
\end{aligned}$$

$$\begin{aligned}
& R[l = 5, i, k = 0, k' = 0] \\
& = \\
& \left(-11639628 - 11027016i - 68068i^2 + 80080i^3 - 95095i^4 + 114114i^5 - 138567i^6 + \right. \\
& 170544i^7 - 213180i^8 + 271320i^9 - 352716i^{10} + 470288i^{11} - 646646i^{12} + \\
& 923780i^{13} + 8314020i^{14} + 21616452i^{15} \left. \right) / (58198140i^{20}(1+i)^2) + 4\text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& R[l = 6, i, k = 0, k' = 0] \\
& = \frac{35 + 140i + 200i^2 + 104i^3}{280i^8(1+i)^4}
\end{aligned}$$

$$\begin{aligned}
& R[l = 7, i, k = 0, k' = 0] \\
& = \frac{42 + 252i + 623i^2 + 800i^3 + 540i^4 + 156i^5}{420i^{10}(1+i)^6}
\end{aligned}$$

$$\begin{aligned}
& R[l = 0, i, k = 0, k' = 1] \\
& = \frac{8 + 51i + 126i^2 + 132i^3}{2520}
\end{aligned}$$

$$\begin{aligned}
& R[l = 1, i, k = 0, k' = 1] \\
& = \frac{1}{420}(7 + 22i)
\end{aligned}$$

$$\begin{aligned}
& R[l = 2, i, k = 0, k' = 1] \\
&= \frac{1}{232792560i^{19}} \\
& (-11639628 - 11027016i + 34850816i^2 + 56440384i^3 + 22163141i^4 + \\
& 10010i^5 - 13442i^6 + 18392i^7 - 25707i^8 + 36822i^9 - 54264i^{10} + 82688i^{11} - \\
& 131138i^{12} + 218348i^{13} - 386308i^{14} + 739024i^{15} - 1570426i^{16} + \\
& 3879876i^{17} - 12193896i^{18} + 124156032i^{19} + 783734952i^{20} + \\
& 77597520i^{21} - 2405523120i^{22} - 2793510720i^{23} - 931170240i^{24}) + \\
& (i + 2i^2 - 2i^3 - 8i^4 - 7i^5 - 2i^6) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& R[l = 3, i, k = 0, k' = 1] \\
&= \frac{1}{116396280i^{20}} \\
& (-11639628 + 47171124i + 229661432i^2 + 165825660i^3 + 525525i^4 - \\
& 611611i^5 + 717288i^6 - 848331i^7 + 1012605i^8 - 1220940i^9 + 1488384i^{10} - \\
& 1835932i^{11} + 2292654i^{12} - 2897310i^{13} + 3695120i^{14} - 4711278i^{15} + \\
& 5819814i^{16} - 6096948i^{17} + 116396280i^{19} + 504383880i^{20} - \\
& 5354228880i^{21} - 12803590800i^{22} - 6983776800i^{23}) + \\
& (2 - 6i - 48i^2 - 70i^3 - 30i^4) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& R[l = 4, i, k = 0, k' = 1] \\
&= \frac{1}{232792560i^{20}} \\
& (-93117024 - 309369060i - 23823800i^2 + 24464440i^3 - 25105080i^4 + \\
& 25732707i^5 - 26327730i^6 + 26860680i^7 - 27287040i^8 + 27538980i^9 - \\
& 27511848i^{10} + 27041560i^{11} - 25865840i^{12} + 23556390i^{13} - \\
& 19399380i^{14} + 12193896i^{15}) + (8 + 35i + 30i^2) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& R[l = 5, i, k = 0, k' = 1] \\
&= \\
& (-11639628 - 11027016i - 68068i^2 + 80080i^3 - 95095i^4 + 114114i^5 - 138567i^6 + \\
& 170544i^7 - 213180i^8 + 271320i^9 - 352716i^{10} + 470288i^{11} - 646646i^{12} + \\
& 923780i^{13} - 1385670i^{14} + 6096948i^{15}) / (116396280i^{20}(1 + i)^2) + 2\text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
& R[l = 6, i, k = 0, k' = 1] \\
&= \frac{15 + 50i + 44i^2}{840i^7(1 + i)^4}
\end{aligned}$$

$$\begin{aligned}
& R[l = 7, i, k = 0, k' = 1] \\
&= \frac{14 + 77i + 165i^2 + 165i^3 + 66i^4}{1260i^9(1 + i)^6}
\end{aligned}$$

$$\begin{aligned}
R[l = 0, i, k = 1, k' = 1] \\
&= \frac{2 + 12i + 27i^2 + 24i^3}{2520}
\end{aligned}$$

$$\begin{aligned}
R[l = 1, i, k = 1, k' = 1] \\
&= \frac{1}{840}(3 + 8i)
\end{aligned}$$

$$\begin{aligned}
R[l = 2, i, k = 1, k' = 1] \\
&= \frac{1}{232792560i^{18}} \\
&\quad (-11639628 - 34306272i - 33761728i^2 - 11083072i^3 - 3003i^4 + 4004i^5 - \\
&\quad 5434i^6 + 7524i^7 - 10659i^8 + 15504i^9 - 23256i^{10} + 36176i^{11} - 58786i^{12} + \\
&\quad 100776i^{13} - 184756i^{14} + 369512i^{15} - 831402i^{16} + 2217072i^{17}) + \\
&\quad (i^2 + 4i^3 + 6i^4 + 4i^5 + i^6) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
R[l = 3, i, k = 1, k' = 1] \\
&= \frac{1}{232792560i^{20}} \\
&\quad (-11639628 - 127423296i - 284932648i^2 - 166005840i^3 - 315315i^4 + \\
&\quad 364364i^5 - 423852i^6 + 496584i^7 - 586245i^8 + 697680i^9 - 837216i^{10} + \\
&\quad 1012928i^{11} - 1234506i^{12} + 1511640i^{13} - 1847560i^{14} + 2217072i^{15} - \\
&\quad 2494206i^{16} + 2217072i^{17}) + (1 + 12i + 36i^2 + 40i^3 + 15i^4) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
R[l = 4, i, k = 1, k' = 1] \\
&= \\
&\quad \frac{1}{232792560i^{20}} (-69837768 - 159279120i - 7147140i^2 + 7287280i^3 - 7417410i^4 + \\
&\quad 7531524i^5 - 7621185i^6 + 7674480i^7 - 7674480i^8 + 7596960i^9 - \\
&\quad 7407036i^{10} + 7054320i^{11} - 6466460i^{12} + 5542680i^{13} - \\
&\quad 4157010i^{14} + 2217072i^{15}) + (6 + 20i + 15i^2) \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
R[l = 5, i, k = 1, k' = 1] \\
&= \\
&\quad (-11639628 - 11027016i - 68068i^2 + 80080i^3 - 95095i^4 + 114114i^5 - 138567i^6 + \\
&\quad 170544i^7 - 213180i^8 + 271320i^9 - 352716i^{10} + 470288i^{11} - 646646i^{12} + \\
&\quad 923780i^{13} - 1385670i^{14} + 2217072i^{15}) / (232792560i^{20}(1 + i)^2) + \text{Log}20[i]
\end{aligned}$$

$$\begin{aligned}
R[l = 6, i, k = 1, k' = 1] \\
&= \frac{5 + 8i}{840i^6(1 + i)^4}
\end{aligned}$$

$$\begin{aligned} R[l = 7, i, k = 1, k' = 1] \\ = \frac{7 + 30i + 45i^2 + 24i^3}{2520i^8(1+i)^6} \end{aligned}$$