

NTTRU Estimation

Estimate the drop of bit security caused by multiple information leaked from power side channel.

```
load("../framework/instance_gen.sage")
```

```
## NTRU instance initialization
```

```
n = 768
m = n
q = 7681
```

```
#number of one in f and g In NTTRU , the distribution of -1,0,1 is 5/16,
6/16,6/16
D_e = {-1: 5/16, 0:6/16, 1:5/16}
D_s = D_e
```

```
bit_security_constant = 0.292
A, b, dbdd = initialize_from_LWE_instance(DBDD_predict, n, q, m, D_e, D_s)
```

```
•[4;37m      Build DBDD from LWE      •[0m
•[1;33m n=768      m=768      q=7681 •[0m
```

```
s_key = []

for i in range(n):
    v0 = [0 for i in range(m + n)]
    v0[i]=1
    s_key.append(dbdd.leak(v0))
```

```
## NTT initialization
```

```
R = IntegerModRing(q)
V = VectorSpace(R,n)
```

```
import numpy as np
```

```
NTT_matrix = []
```

```
def add (x,y) : return x +y
```

```
#zetas in the last layer of InvNTT
```

```

zetas=
[-7661,7661,-6212,6212,-6464,6464,7586,-7586,4822,-4822,1618,-1618,3845,-3845,-37
02,3702,4277,-4277,1913,-1913,3326,-3326,-6874,6874,-3446,3446,5741,-5741,-1534,1
534,-2834,2834,1081,-1081,-867,867,5483,-5483,626,-626,-1293,1293,3730,-3730,-148
5,1485,-7300,7300,1894,-1894,6233,-6233,803,-803,-5156,5156,-7289,7289,-5004,5004
,-726,726,5819,-5819,-245,245,-713,713,-5307,5307,3084,-3084,-1462,1462,7063,-706
3,-6776,6776,3104,-3104,3294,-3294,-6152,6152,1502,-1502,-4125,4125,-32,32,722,-7
22,7270,-7270,-7529,7529,4040,-4040,-2821,2821,42,-42,-3828,3828,6238,-6238,4234,
-4234,-6772,6772,-2747,2747,-3999,3999,-5305,5305,-4076,4076,-5968,5968,2879,-287
9,-149,149,5053,-5053,-4074,4074,-2977,2977,1400,-1400,6650,-6650,699,-699,1955,-
1955,7257,-7257,5667,-5667,-7366,7366,4348,-4348,7512,-7512,-2723,2723,2390,-2390
,-2458,2458,4572,-4572,6355,-6355,-7527,7527,-758,758,6541,-6541,2266,-2266,7441,
-7441,-7627,7627,-6019,6019,-3627,3627,-4097,4097,1507,-1507,2003,-2003,-87,87,24
43,-2443,-3046,3046,4397,-4397,-237,237,2947,-2947,3824,-3824,5893,-5893,-812,812
,-2802,2802,-2826,2826,5194,-5194,-2212,2212,1902,-1902,504,-504,-7531,7531,4553,
-4553,-2394,2394,3227,-3227,-2240,2240,4722,-4722,-5727,5727,-2236,2236,-1397,139
7,6806,-6806,-4741,4741,-4502,4502,6524,-6524,265,-265,2182,-2182,-5019,5019,-341
4,3414,2986,-2986,6558,-6558,2749,-2749,-5857,5857,983,-983,384,-384]

```

```

def modular_exponentiation(base, exponent, modulus):
    result = 1
    base = base % modulus
    while exponent > 0:
        if (exponent % 2) == 1:
            result = (result * base) % modulus
        exponent //= 2
        base = (base * base) % modulus
    return result

for x in range(n/3):
    NTT_matrix.append(V(reduce(add,
[[modular_exponentiation(zetas[i],x,7681),0,0] for i in range(n/3)])))
    NTT_matrix.append(V(reduce(add,
[[0,modular_exponentiation(zetas[i],x,7681),0] for i in range(n/3)])))
    NTT_matrix.append(V(reduce(add,
[[0,0,modular_exponentiation(zetas[i],x,7681)] for i in range(n/3)])))

NTT_matrix = matrix(NTT_matrix)

```

```

#Get s_hat
s_hat_list = V(s_key)*NTT_matrix

```

```

v_list = []

# Get nums_z

nums_z = []*256

for i in range(256):
    term1 = s_hat_list[3 * i]          # f[3*i]
    term2 = s_hat_list[3 * i + 1]      # f[3*i+1]
    term3 = s_hat_list[3 * i + 2]      # f[3*i+2]

```

```
# z_i=R(-term2-term3)/R(term1)
z_i = 0 if R(term1) == 0 else R(-term2 - term3) / R(term1)
z_i = R(z_i)

nums_z.append(z_i)
```

```
# Hints are stored in v_list
for i in range(256):

    v=nums_z[i]*NTT_matrix.column(3*i)+NTT_matrix.column(3*i+1)+NTT_matrix.column(3*
i+2)
    v=list(v)
    v_prime = [int(i) for i in list(v)] + [0]*768
    v_list.append(vec(v_prime))
```

```
for v_0 in v_list:
    a=dbdd.leak(v_0)%7681
    #If the hint is not valid, skip it
    if(a!=0):
        continue
    dbdd.integrate_modular_hint(v_0,0,7681,True)
```

```
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00327470, β=527.88 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00327850, β=527.13 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00328170, β=526.38 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00328490, β=525.63 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00328809, β=524.88 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00329189, β=524.13 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00329509, β=523.39 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00329828, β=522.65 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00330148, β=521.91 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00330528, β=521.17 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00330847, β=520.43 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00331166, β=519.69 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00331485, β=518.96 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00331865, β=518.23 •[0m
•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
•[0m •[1;33m dim=1537, δ=1.00332184, β=517.49 •[0m
```

[illegible]

[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00341893,	β =496.95	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00342273,	β =496.26	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00342589,	β =495.58	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00342905,	β =494.89	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00343285,	β =494.21	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00343601,	β =493.53	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00343917,	β =492.85	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00344297,	β =492.18	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00344613,	β =491.50	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00344929,	β =490.82	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00345309,	β =490.15	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00345624,	β =489.48	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00345939,	β =488.81	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00346320,	β =488.14	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00346635,	β =487.47	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00346950,	β =486.81	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00347330,	β =486.14	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00347645,	β =485.48	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00347960,	β =484.82	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00348340,	β =484.16	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00348655,	β =483.50	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00348969,	β =482.84	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00349349,	β =482.18	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00349664,	β =481.53	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00349978,	β =480.87	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00350358,	β =480.22	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00350672,	β =479.57	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00350986,	β =478.92	[0m		

[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00351366$, $\beta=478.27$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00351680$, $\beta=477.62$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00351994$, $\beta=476.98$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00352374$, $\beta=476.33$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00352688$, $\beta=475.69$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00353068$, $\beta=475.05$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00353382$, $\beta=474.41$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00353695$, $\beta=473.77$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00354075$, $\beta=473.13$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00354388$, $\beta=472.49$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00354701$, $\beta=471.86$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00355081$, $\beta=471.22$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00355395$, $\beta=470.59$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00355707$, $\beta=469.96$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00356087$, $\beta=469.33$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00356400$, $\beta=468.70$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00356780$, $\beta=468.07$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00357093$, $\beta=467.45$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00357405$, $\beta=466.82$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00357785$, $\beta=466.20$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00358098$, $\beta=465.57$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00358410$, $\beta=464.95$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00358790$, $\beta=464.33$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00359102$, $\beta=463.71$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00359482$, $\beta=463.10$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00359794$, $\beta=462.48$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00360106$, $\beta=461.87$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00360486$, $\beta=461.25$	[0m			

[illegible]

[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00370253,	β =443.98	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00370634,	β =443.40	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00370943,	β =442.82	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00371323,	β =442.25	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00371631,	β =441.67	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00372012,	β =441.10	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00372320,	β =440.53	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00372629,	β =439.95	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00373009,	β =439.38	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00373317,	β =438.82	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00373697,	β =438.25	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00374005,	β =437.68	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00374386,	β =437.11	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00374694,	β =436.55	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00375001,	β =435.99	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00375381,	β =435.42	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00375689,	β =434.86	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00376069,	β =434.30	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00376377,	β =433.74	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00376757,	β =433.19	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00377064,	β =432.63	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00377444,	β =432.07	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00377752,	β =431.52	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00378059,	β =430.96	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00378439,	β =430.41	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00378746,	β =429.86	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00379126,	β =429.31	[0m		
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, δ =1.00379433,	β =428.76	[0m		

[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00379813$, $\beta=428.21$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00380119$, $\beta=427.66$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00380499$, $\beta=427.12$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00380806$, $\beta=426.57$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00381186$, $\beta=426.03$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00381492$, $\beta=425.49$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00381798$, $\beta=424.94$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00382178$, $\beta=424.40$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00382484$, $\beta=423.86$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00382864$, $\beta=423.32$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00383170$, $\beta=422.79$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00383550$, $\beta=422.25$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00383856$, $\beta=421.71$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00384236$, $\beta=421.18$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00384541$, $\beta=420.64$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00384922$, $\beta=420.11$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00385227$, $\beta=419.58$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00385607$, $\beta=419.05$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00385912$, $\beta=418.52$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00386217$, $\beta=417.99$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00386597$, $\beta=417.46$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00386902$, $\beta=416.94$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00387282$, $\beta=416.41$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00387586$, $\beta=415.88$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00387967$, $\beta=415.36$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00388271$, $\beta=414.84$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00388651$, $\beta=414.32$	[0m			
[1;37m integrate modular hint	[0m	[0m (smooth)	[0m	[3;32m	worthy hint !
[0m	[1;33m dim=1537, $\delta=1.00388955$, $\beta=413.80$	[0m			

[illegible]

[illegible]

•[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00408423$, $\beta=385.66$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00408804$, $\beta=385.20$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00409102$, $\beta=384.73$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00409483$, $\beta=384.26$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00409781$, $\beta=383.80$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00410161$, $\beta=383.33$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00410460$, $\beta=382.87$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00410840$, $\beta=382.41$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00411138$, $\beta=381.95$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00411518$, $\beta=381.48$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00411898$, $\beta=381.02$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00412196$, $\beta=380.57$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00412577$, $\beta=380.11$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00412874$, $\beta=379.65$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00413255$, $\beta=379.19$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00413552$, $\beta=378.74$ •[0m
 •[1;37m integrate modular hint •[0m •[0m (smooth) •[0m •[3;32m worthy hint !
 •[0m •[1;33m dim=1537, $\delta=1.00413932$, $\beta=378.28$ •[0m

378.28*0.292

110.457760000000

