

FUNCTION: modforms[briefmfhelp] - brief help for modforms function

CALLING SEQUENCE: briefmfhelp(funcname)

PARAMETERS: funcname - name of modforms function

GLOBAL VARIABLES:

SYNOPSIS:

Return brief help for modforms function

EXAMPLES:

```
> with(modforms):  
> briefmfhelp(makebasisM);
```

FUNCTION: modforms[makebasisM] - make basis of modular forms of given weight using E4,E6

CALLING SEQUENCE: makebasisM(k,T)

PARAMETERS: k - nonnegative even integer  
T - positive integer

GLOBAL VARIABLES: EISENppres

DISCUSSION:

SEE ALSO: mffunctions, mfhelp

FUNCTION: modforms[EISENqmake] - compute q-series expansion of Eisenstein series  
and saved for later use

CALLING SEQUENCE: EISENqmake(LT)

PARAMETERS: LT - positive integer

GLOBAL VARIABLES: \_EISENqpres, \_EISENqLT, E2, E4, E6, E8, E10, E14, DELTA12, P

SYNOPSIS:

Compute q-series expansions of Eisenstein series E2, E4, E6, E8, E10, E14,  
as well as DELTA12, and the partition generating function P up to  $q^{LT}$   
\_EISENqpres is set to true and \_EISENqLT to LT.  
The global vars are save to \_EISENfuncs.m.

EXAMPLES:

DISCUSSION:

SEE ALSO:

FUNCTION: modforms[makeALTbasisM] - make basis of modular forms using DELTA12

CALLING SEQUENCE: makeALTbasisM(k,T)

PARAMETERS: k - nonnegative even integer  
T - positive integer

GLOBAL VARIABLES: \_EISENqpres

SYNOPSIS:

if \_EISENqpres = true then uses stored q-series fo Eisenstein series  
Returns q-series of basis of modular forms of weight k up to  $q^T$   
Basis elements are  $E_s * E_6^{(2*r-2*i)} * \Delta^{12^i}$   $i=0..r$ , where  $k=12*r+s$   
and  $E_s$  is Eisenstein series of weight s, where  $s = 4, 6, 8, 10, 14$   
and  $E_s = 1$  if  $s = 0$ .

EXAMPLES:

```
> with(qseries):
> with(modforms):
> B12:=makeALTbasisM(12,100):
> series(B12[1],q,10);
1 - 1008 q + 220752 q2 + 16519104 q3 + 399517776 q4 + 4624512480 q5 +
34423752384 q6 + 187506813312 q7 + 814794618960 q8 + 2975666040144 q9 +
O(q10)
> series(B12[2],q,10);
q - 24 q2 + 252 q3 - 1472 q4 + 4830 q5 - 6048 q6 - 16744 q7 + 84480 q8 - 113643
q9 + O(q10)
> etamake(B12[2],q,80);
eta(tau)24
```

DISCUSSION:

SEE ALSO:

FUNCTION: modforms[makeALTSYmbasisM] - make symbolic basis of modular forms using DELTA12

CALLING SEQUENCE: makeALTSYmbasisM(k)

PARAMETERS: k - nonnegative even integer

GLOBAL VARIABLES:

SYNOPSIS:

if `_EISENqpres = true` then uses stored q-series for Eisenstein series

Returns symbolic form of basis elements

Symbolic basis elements are  $Es * E6^{(2*r-2*i)} * DELTA12^i$   $i=0..r$ , where  $k=12*r+s$

and  $Es$  is symbolic Eisenstein series of weight  $s$ , where  $s = 4, 6, 8, 10, 14$

and  $Es = 1$  if  $s = 0$ .

EXAMPLES:

```
> with(qseries):
```

```
> with(modforms):
```

```
> SYMB12:=makeALTSYmbasisM(12);
```

```
                2
SYMB12 := [_E6 , _DELTA12]
```

DISCUSSION:

SEE ALSO: makeALTbasisM

FUNCTION: modforms[makebasisM] - make basis of modular forms of given weight using E4,E6

CALLING SEQUENCE: makebasisM(k,T)

PARAMETERS: k - nonnegative even integer  
T - positive integer

GLOBAL VARIABLES: \_EISENqpres

SYNOPSIS:

if \_EISENqpres = true then uses stored q-series fo Eisenstein series  
Returns q-series of basis of modular forms of weight k up to  $q^T$   
Basis elements are  $E4^a * E6^b$  where  $4a+6b=k$ .

EXAMPLES:

```
> with(qseries):
> with(modforms):
> B12:=makebasisM(12,100):
> SYMB12:=makeSYMbasisM(12);
                2      3
          SYMB12 := [ _E6 , _E4 ]

> series(B12[1],q,10);
1 - 1008 q + 220752 q2 + 16519104 q3 + 399517776 q4 + 4624512480 q5 +
  34423752384 q6 + 187506813312 q7 + 814794618960 q8 + 2975666040144 q9 +
  O(q10)

> series(B12[2],q,10);
1 + 720 q + 179280 q2 + 16954560 q3 + 396974160 q4 + 4632858720 q5 +
  34413301440 q6 + 187477879680 q7 + 814940600400 q8 + 2975469665040 q9 +
  O(q10)

> etamake(B12[2]-B12[1],q,80);
                24
          1728 eta(tau)
```

DISCUSSION:

SEE ALSO: makeSYMbasisM

FUNCTION: modforms[makebasisPX] - make a basis for the set of  $P*f$  where  
 $f$  is a quasi-modular form of bounded weight

CALLING SEQUENCE: makebasisPX(k,T)

PARAMETERS: k - nonnegative even integer  
 T - positive integer

GLOBAL VARIABLES:

SYNOPSIS:

Calculates  $q$ -series of (up to  $q^T$ ) of constructed basis elements for  $PX[k]$  which the set of  $P*f$  where  $P$  is partition genfunc and  $f$  is a quasi-modular form of weight  $\leq k$ .  
 The forms  $f$  are monomials  $P_1, P_3, P_5$  which are the genfunctions for  $\sigma[k](n)$ , where  $k=1,3,5$ .

EXAMPLES:

```
> with(qseries):
> with(modforms):
> PB12:=makebasisPX(4,100):
> SYMB12:=makeSYMbasisPX(4);
          2
SYMB12 := [ _P, _P _P3, _P _P1, _P _P1 ]

> series(PB12[1],q,10);
      2      3      4      5      6      7      8      9      10
1 + q + 2 q + 3 q + 5 q + 7 q + 11 q + 15 q + 22 q + 30 q + O(q )

> series(PB12[2],q,10);
      2      3      4      5      6      7      8      9
q + 10 q + 39 q + 122 q + 287 q + 660 q + 1281 q + 2486 q + 4392 q +
      10
O(q )

> series(PB12[3],q,10);
      2      3      4      5      6      7      8      9      10
q + 4 q + 9 q + 20 q + 35 q + 66 q + 105 q + 176 q + 270 q + O(q )

> series(PB12[4],q,10);
      2      3      4      5      6      7      8      9      10
q + 7 q + 25 q + 70 q + 165 q + 350 q + 693 q + 1275 q + O(q )
```

DISCUSSION:

SEE ALSO: makeSYMbasisPX

FUNCTION: modforms[makeEISENbasisPX] - make basis for PX[k] using Eisenstein series

CALLING SEQUENCE: makeEISENbasisPX(k,T)

PARAMETERS: k - nonnegative even integer  
T - positive integer

GLOBAL VARIABLES: \_EISENqpres

SYNOPSIS:

if \_EISENqpres = true then uses stored q-series for Eisenstein series  
Returns q-series (up to  $q^T$ ) of basis of constructed basis elements  
for PX[k] which the set of  $P \cdot f$  where P is partition genfunc and  
and f is a quasi-modular form of weight  $\leq k$ .  
The forms f are monomials in the Eisenstein series E2, E4, E6.

EXAMPLES:

```
> with(qseries):
> with(modforms):
> PB12:=makeEISENbasisPX(4,100):
> SYMB12:=makeSYMEISENbasisPX(4);
          2
SYMB12 := [_P, _P _E4, _P _E2, _P _E2 ]

> series(PB12[1],q,10);
      2      3      4      5      6      7      8      9      10
1 + q + 2 q + 3 q + 5 q + 7 q + 11 q + 15 q + 22 q + 30 q + O(q )

> series(PB12[2],q,10);
      2      3      4      5      6      7
1 + 241 q + 2402 q + 9363 q + 29285 q + 68887 q + 158411 q + 307455 q +
      8      9      10
596662 q + 1054110 q + O(q )

> series(PB12[3],q,10);
      2      3      4      5      6      7      8
1 - 23 q - 94 q - 213 q - 475 q - 833 q - 1573 q - 2505 q - 4202 q -
      9      10
6450 q + O(q )

> series(PB12[4],q,10);
      2      3      4      5      6      7
1 - 47 q + 386 q + 3603 q + 13445 q + 38647 q + 91883 q + 196575 q +
      8      9      10
390742 q + 721470 q + O(q )
```

DISCUSSION:

SEE ALSO:

FUNCTION: modforms[makeSYMbasisM] - make basis of modular forms of given weight using E4, E6

CALLING SEQUENCE: makeSYMbasisM(k)

PARAMETERS: k - nonnegative even integer

GLOBAL VARIABLES:

SYNOPSIS:

Returns symbolic basis of modular forms of weight k up to  $q^T$   
 Basis elements are  $\_E4^a\_E6^b$  where  $4a+6b=k$ .

EXAMPLES:

```
> with(qseries):
> with(modforms):
> B12:=makebasisM(12,100):
> SYMB12:=makeSYMbasisM(12):
```

$$\text{SYMB12} := [\_E6^2, \_E4^3]$$

```
> series(B12[1],q,10);
```

$$1 - 1008 q^2 + 220752 q^3 + 16519104 q^4 + 399517776 q^5 + 4624512480 q^6 + 34423752384 q^7 + 187506813312 q^8 + 814794618960 q^9 + 2975666040144 q^{10} + O(q^{10})$$

```
> series(B12[2],q,10);
```

$$1 + 720 q^2 + 179280 q^3 + 16954560 q^4 + 396974160 q^5 + 4632858720 q^6 + 34413301440 q^7 + 187477879680 q^8 + 814940600400 q^9 + 2975469665040 q^{10} + O(q^{10})$$

```
> etamake(B12[2]-B12[1],q,80);
```

$$1728 \text{ eta}(\tau)^{24}$$

DISCUSSION:

SEE ALSO: makebasisM



FUNCTION: modforms[makeSYMBasisPX] - symbolic form of makebasisPX

CALLING SEQUENCE: makeSYMBasisPX(k)

PARAMETERS: k - nonnegative even integer

GLOBAL VARIABLES:

SYNOPSIS:

Construct symbolic basis for  $PX[k]$  which the set of  $P*f$  where  $P$  is partition genfunc and  $f$  is a quasi-modular form of weight  $\leq k$ .  
It returns a list of monomials involving  $\_P, \_P1, \_P3, \_P5$

EXAMPLES:

```
> with(qseries):
> with(modforms):
> PB12:=makebasisPX(4,100):
> SYMB12:=makeSYMBasisPX(4);
          2
SYMB12 := [\_P, \_P \_P3, \_P \_P1, \_P \_P1 ]

> series(PB12[1],q,10);
      2      3      4      5      6      7      8      9      10
1 + q + 2 q + 3 q + 5 q + 7 q + 11 q + 15 q + 22 q + 30 q + O(q )

> series(PB12[2],q,10);
      2      3      4      5      6      7      8      9
q + 10 q + 39 q + 122 q + 287 q + 660 q + 1281 q + 2486 q + 4392 q +
      10
O(q )

> series(PB12[3],q,10);
      2      3      4      5      6      7      8      9      10
q + 4 q + 9 q + 20 q + 35 q + 66 q + 105 q + 176 q + 270 q + O(q )

> series(PB12[4],q,10);
      2      3      4      5      6      7      8      9      10
q + 7 q + 25 q + 70 q + 165 q + 350 q + 693 q + 1275 q + O(q )
```

DISCUSSION:

SEE ALSO: makebasisPX

FUNCTION: modforms[makeSYMEISENbasisPX] - symbolic form of makeEISENbasisPX

CALLING SEQUENCE: makeSYMEISENbasisPX(k)

PARAMETERS: k - nonnegative even integer

GLOBAL VARIABLES:

SYNOPSIS:

Construct symbolic basis for  $PX[k]$  which the set of  $P*f$  where  $P$  is partition genfunc and  $f$  is a quasi-modular form of weight  $\leq k$ .  
It returns a list of monomials involving  $_P, _E2, _E4, _E6$

EXAMPLES:

```
> with(qseries):
> with(modforms):
> PB12:=makeEISENbasisPX(4,100):
> SYMB12:=makeSYMEISENbasisPX(4);
          2
SYMB12 := [ _P, _P _E4, _P _E2, _P _E2 ]

> series(PB12[1],q,10);
      2      3      4      5      6      7      8      9      10
1 + q + 2 q + 3 q + 5 q + 7 q + 11 q + 15 q + 22 q + 30 q + O(q )

> series(PB12[2],q,10);
      2      3      4      5      6      7
1 + 241 q + 2402 q + 9363 q + 29285 q + 68887 q + 158411 q + 307455 q +
      8      9      10
596662 q + 1054110 q + O(q )

> series(PB12[3],q,10);
      2      3      4      5      6      7      8
1 - 23 q - 94 q - 213 q - 475 q - 833 q - 1573 q - 2505 q - 4202 q -
      9      10
6450 q + O(q )

> series(PB12[4],q,10);
      2      3      4      5      6      7
1 - 47 q + 386 q + 3603 q + 13445 q + 38647 q + 91883 q + 196575 q +
      8      9      10
390742 q + 721470 q + O(q )
```

DISCUSSION:

SEE ALSO: makeEISENbasisPX

FUNCTION: modforms[mffunctions] - list functions in modforms package

CALLING SEQUENCE: mffunctions()

PARAMETERS: NONE

GLOBAL VARIABLES:

SYNOPSIS:

List functions in modforms package

EXAMPLES:

```
> with(modforms):
> mffunctions();
[briefmfhelp, EISENmake, makeALTBasisM, makeALTSYMBasisM, makebasisM,
  makebasisPX, makeEISENbasisPX, makeSYMBasisM, makeSYMBasisPX,
  makeSYMEISENbasisPX, mffunctions, mfhelp, modformschanges, modformspversion
]
```

DISCUSSION:

SEE ALSO: mfhelp, mfbriefhelp

FUNCTION: modforms[mfhelp] - modforms function help

CALLING SEQUENCE: mfhelp(funcname)

PARAMETERS: funcname - name of modforms function

-

GLOBAL VARIABLES:

SYNOPSIS:

Returns help for modforms function

EXAMPLES:

```
> with(modforms):
> mfhelp(makebasisM);
```

FUNCTION: modforms[makebasisM] - make basis of modular forms of given weight using E4,E6

CALLING SEQUENCE: makebasisM(k,T)

PARAMETERS: k - nonnegative even integer  
T - positive integer

GLOBAL VARIABLES: `_EISENqpres`

SYNOPSIS:

if `_EISENqpres = true` then uses stored q-series for Eisenstein series  
Returns q-series of basis of modular forms of weight k up to  $q^T$   
Basis elements are  $E4^a * E6^b$  where  $4a+6b=k$ .

EXAMPLES:

```
> with(qseries):
> with(modforms):
> B12:=makebasisM(12,100):
> SYMB12:=makeSYMBasisM(12);
```

$$\text{SYMB12} := [ \_E6^2, \_E4^3 ]$$

```
> series(B12[1],q,10);
```

$$1 - 1008 q^2 + 220752 q^3 + 16519104 q^4 + 399517776 q^5 + 4624512480 q^6 + 34423752384 q^7 + 187506813312 q^8 + 814794618960 q^9 + 2975666040144 q^{10} + O(q^{10})$$

```
> series(B12[2],q,10);
```

$$1 + 720 q^2 + 179280 q^3 + 16954560 q^4 + 396974160 q^5 + 4632858720 q^6 + 34413301440 q^7 + 187477879680 q^8 + 814940600400 q^9 + 2975469665040 q^{10} + O(q^{10})$$

```
> etamake(B12[2]-B12[1],q,80);
```

$$1728 \text{ eta}(\tau)^{24}$$

DISCUSSION:

SEE ALSO: `makeSYMBasisM`

DISCUSSION:

SEE ALSO: briefmfhelp

FUNCTION: modforms[modformschanges] - list changes to modforms package

CALLING SEQUENCE: modformschanges()

PARAMETERS: NONE

GLOBAL VARIABLES:

SYNOPSIS:

lists changes to the modforms package

EXAMPLES:

```
> with(modforms):
```

```
> modformschanges();
```

```
*****
```

```
*
```

```
*
```

```
* modforms package version 0.1 - Fri, Jan 22, 2021 3:06:18 PM
```

```
* modforms package version 0.1b - Fri, Jan 29, 2021 10:24:34 PM
```

```
*
```

```
* This version tested on MAPLE 2020
```

```
*
```

```
* Changes since version 0.1
```

```
*
```

```
* * Fixed minor bug in makeALTSYMBasisM
```

```
* * In makebasisPX changed Phiq --> misc[Phiq]
```

```
*
```

```
* Please report any problems to fgarvan@ufl.edu
```

```
*
```

```
*****
```

DISCUSSION:

SEE ALSO: modformspversion

FUNCTION: modforms[modformspversion] - package version

CALLING SEQUENCE: modformspversion()

PARAMETERS: NONE

GLOBAL VARIABLES:

SYNOPSIS:

Returns details of package version

EXAMPLES:

```
> with(modforms):
```

```
> modformspversion();
```

```
*****
```

```
*
```

```
* modforms package version 0.1b
```

```
* Fri, Jan 29, 2021 10:24:34 PM
```

```
* This version tested on MAPLE 2020
```

```
*
```

```
*PREVIOUS VERSIONS:
```

```
* version 0.1 - Fri, Jan 22, 2021 3:06:18 PM
```

```
*
```

```
* Please report any problems to fgarvan@ufl.edu
```

```
*****
```

DISCUSSION:

SEE ALSO: modformschanges

