```
Last login: Sat Aug 10 13:28:57 on ttys002
maleehakhawaja@ra1720161920062 Bristol % ssh smp20mk@magma-somas
Password:
Duo two-factor login for smp20mk

Enter a passcode or select one of the following options:

 1. Duo Push to +XX XXXX XX0187

Passcode or option (1-1): 1
Success. Logging you in...
Success. Logging you in...
******************************************************************************
*                       The University Of Sheffield.                         *
*              Unauthorised use of this system is prohibited.                *
*                             Ubuntu 22.04                                   *
******************************************************************************
Last login: Sat Aug 10 13:29:20 2024 from 172.16.192.17
smp20mk@magma-somas:~$ magma
Magma V2.28-5     Sat Aug 10 2024 14:59:16 on magma-somas [Seed = 533597850]
Type ? for help.  Type <Ctrl>-D to quit.
> Attach("Tim_clusters.m");

> load 'variableswap.m';                                                    Loading "variableswap.m"
                                                  > //We want to investigate the effect of swapping
> //(c^r-2b^p) with (2a^p-c^r) in the constant term
> // of the polynomial;
> //frbminus, frbplus have constant term -2(c^r-2b^p)
> //framinus, fraplus have constant term -2(2a^p-c^r)
>
> //We first look at the difference in cluster
> //pictures at primes q, q ne 2, r
>
> a:=3*5*11; c:=8; r:=7; p:=11;
> framinus:=framinus(a,c,r,p);
> b:=3*5*11; c:=8; r:=7; p:=11;
> frbminus:=frbminus(b,c,r,p);
>
> ClusterPicture(framinus, 3);
(5,(1,2),(3,4),(6,7)) F[[8,9],[9,10]] d=[11/2,11/2,11/2,0]
> ClusterPicture(frbminus, 3);
(1,(2,3),(4,5),(6,7)) F[[8,9],[9,10]] d=[11/2,11/2,11/2,0]
> ClusterPicture(framinus, 5);
(7,(1,2),(3,4),(5,6)) F[[8,9],[9,10]] d=[11/2,11/2,11/2,0]
> ClusterPicture(frbminus, 5);
(1,(2,3),(4,5),(6,7)) F[[8,9],[9,10]] d=[11/2,11/2,11/2,0]
> ClusterPicture(framinus, 11);
(7,(1,2),(3,4),(5,6)) F[[8,9],[9,10]] d=[11/2,11/2,11/2,0]
> ClusterPicture(frbminus, 11);
(1,(2,3),(4,5),(6,7)) F[[8,9],[9,10]] d=[11/2,11/2,11/2,0]
>
> assert Conductor(HyperellipticCurve(framinus)) eq Conductor(HyperellipticCur\
ve(frbminus));
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee

>> assert Conductor(HyperellipticCurve(framinus)) eq Conductor(HyperellipticCu
   ^
Runtime error in assert: Assertion failed
>
> //We check if the cluster picture differs at r;
>
> ClusterPicture(framinus, r);
^C^C^C
[Interrupt twice in half a second; exiting]

Total time: 549.049 seconds, Total memory usage: 106.84MB
smp20mk@magma-somas:~$ magma
Magma V2.28-5     Sat Aug 10 2024 15:18:16 on magma-somas [Seed = 1586449223]
Type ? for help.  Type <Ctrl>-D to quit.
> Attach("Tim_clusters.m");

> load 'variableswap.m';
Loading "variableswap.m"
> a:=3; c:=8; r:=7; p:=11;
> b:=3; c:=8; r:=7; p:=11;
> framinus:=framinus(a,c,r,p);
> frbminus:=framinus(b,c,r,p);
```

```
>> frbminus:=framinus(b,c,r,p);
                   ^
Runtime error: Attempting to call something that is not callable

> frbminus:=frbminus(b,c,r,p);
> ClusterPicture(framinus, r);
^C^C
[Interrupt twice in half a second; exiting]

Total time: 100.489 seconds, Total memory usage: 106.84MB
smp20mk@magma-somas:~$ magma
Magma V2.28-5     Sat Aug 10 2024 15:21:06 on magma-somas [Seed = 1335778220]
Type ? for help.  Type <Ctrl>-D to quit.
> Attach("Tim_clusters.m");
> load 'variableswap.m';
Loading "variableswap.m"
> a:=3; c:=2; r:=7; p:=5;
> b:=3; c:=2; r:=7; p:=5;
> framinus:=framinus(a,c,r,p);
> frbminus:=framinus(b,c,r,p);

>> frbminus:=framinus(b,c,r,p);
                   ^
Runtime error: Attempting to call something that is not callable

> frbminus:=frbminus(b,c,r,p);
> ClusterPicture(framinus, r);
(1,2,3,4,5,6,7) d=[1/6]
> ClusterPicture(frbminus, r);
(1,2,3,4,5,6,7) d=[1/6]
> Conductor(HyperellipticCurve(framinus));
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee
316610603753472000
> Factorisation(Integers()!Conductor(HyperellipticCurve(framinus)));
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee
[ <2, 16>, <3, 3>, <5, 3>, <7, 6>, <23, 3> ]
> Factorisation(Integers()!Conductor(HyperellipticCurve(frbminus)));
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee
[ <2, 22>, <3, 3>, <5, 3>, <7, 6>, <23, 3> ]
>
>
> //The conductors only differ at 2.
> //Is this also the case for the plus polynomial?
>
> fraplus:=fraplus(a,c,r,p);
> frbplus:=frbplus(a,c,r,p);
>
> Factorisation(Integers()!Conductor(HyperellipticCurve(fraplus)));
[ <3, 3>, <5, 3>, <7, 6>, <23, 3> ]
> Factorisation(Integers()!Conductor(HyperellipticCurve(frbplus)));
[ <3, 3>, <5, 3>, <7, 6>, <23, 3> ]
>
> //The conductors of the plus curve are the same.
>
> //Now suppose r divides a (and b);
> a:=7; b:=7; c:=2; r:=7; p:=5;
> framinus:=framinus(a,c,r,p);

>> framinus:=framinus(a,c,r,p);
                   ^
Runtime error: Attempting to call something that is not callable

> framinus(a,c,r,p);

>> framinus(a,c,r,p);
           ^
Runtime error in procedure call: Attempting to call something that is not
callable
> exit;

Total time: 10.050 seconds, Total memory usage: 97.16MB
smp20mk@magma-somas:~$ magma
Magma V2.28-5     Sat Aug 10 2024 15:26:44 on magma-somas [Seed = 2742204599]
Type ? for help.  Type <Ctrl>-D to quit.
> Attach("Tim_clusters.m");
> load 'swapvariables.m';
```

```
>> load 'swapvariables.m';
   ^
User error: Could not open file "swapvariables.m" (No such file or directory)
> load 'variableswap.m';
Loading "variableswap.m"
>
> //Now suppose r divies a (and b);
> a:=7; b:=7; c:=2; r:=7; p:=5;
>
> fram:=framinus(a,c,r,p);
> frbm:=framinus(b,c,r,p);
>
> Factorisation(Integers()!Conductor(HyperellipticCurve(fram)));
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee
[ <2, 16>, <7, 6>, <13, 3>, <1283, 3> ]
> Factorisation(Integers()!Conductor(HyperellipticCurve(frbm)));
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee
[ <2, 16>, <7, 6>, <13, 3>, <1283, 3> ]
>
> //The conductor at r is the same.
>
> ClusterPicture(fram, r);
(1,(2,3),(4,5),(6,7)) d=[5/3,5/3,5/3,1/3]
> ClusterPicture(frbm, r);
(1,(2,3),(4,5),(6,7)) d=[5/3,5/3,5/3,1/3]
>
> //The cluster picture at r is the same.
> //Let's check the plus polynomial.
>
> frap:=fraplus(a,c,r,p);
> frbp:=fraplus(a,c,r,p);
>
> Factorisation(Integers()!Conductor(HyperellipticCurve(frap)));
[ <7, 5>, <13, 3>, <1283, 3> ]
> Factorisation(Integers()!Conductor(HyperellipticCurve(frbp)));
[ <7, 5>, <13, 3>, <1283, 3> ]
>
> //The conductors are equal.
> //Let's check the cluster pictures.
>
> ClusterPicture(frap, r);
((1,2),(3,4),(5,6),(7,8)) d=[3,5/3,5/3,5/3,1/3]
> ClusterPicture(frbp, r);
((1,2),(3,4),(5,6),(7,8)) d=[3,5/3,5/3,5/3,1/3]
>
> //woops.
> frap:=fraplus(a,c,r,p);
> frbp:=frbplus(a,c,r,p); //this wasn't defined correctly before!
>
> Factorisation(Integers()!Conductor(HyperellipticCurve(frap)));
[ <7, 5>, <13, 3>, <1283, 3> ]
> Factorisation(Integers()!Conductor(HyperellipticCurve(frbp)));
[ <7, 6>, <13, 3>, <1283, 3> ]
> //The conductor at r differs!!!
> //Let's check the cluster picture.
>
> ClusterPicture(frap, r);
((1,2),(3,4),(5,6),(7,8)) d=[3,5/3,5/3,5/3,1/3]
> ClusterPicture(frbp, r);
(1,(2,(3,4),(5,6),(7,8))) d=[5/3,5/3,5/3,1/3,0]
>
> //The cluster picture at r differs.
>
> ClusterPicture(frap, 13);
(3,6,(1,2),(4,5),(7,8)) d=[1/2,1/2,1/2,0]
> ClusterPicture(frbp, r);
(1,(2,(3,4),(5,6),(7,8))) d=[5/3,5/3,5/3,1/3,0]
> ClusterPicture(frbp, 13);
((1,2),(3,4),(5,6),(7,8)) d=[1/2,1/2,1,1/2,0]
>
> ClusterPicture(frap, 1283);
(1,2,(3,4),(5,6),(7,8)) F[[9,10],[10,11]] d=[1/2,1/2,1/2,0]
> ClusterPicture(frbp, 1283);
((1,2),(3,4),(5,6),(7,8)) F[[10,11],[11,12]] d=[1,1/2,1/2,1/2,0]
>
> //The cluster picture at q (q ne r) differs but
> //the conductor exponents are equal for both curves.
>
```

```
> Factorisation(Integers()!Conductor(HyperellipticCurve(fram)));
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee
[ <2, 16>, <7, 6>, <13, 3>, <1283, 3> ]
> Factorisation(Integers()!Conductor(HyperellipticCurve(frbm)));
WARNING: Using Ogg's formula when v_2(D)>=12, no correctness guarantee
[ <2, 16>, <7, 6>, <13, 3>, <1283, 3> ]
> client_loop: send disconnect: Broken pipe
maleehakhawaja@ra1720161920062 Bristol % ssh smp20mk@magma-somas
Password:
Duo two-factor login for smp20mk

Enter a passcode or select one of the following options:

 1. Duo Push to +XX XXXX XX0187

Passcode or option (1-1): 1
Success. Logging you in...
Success. Logging you in...
******************************************************************************
*                       The University Of Sheffield.                         *
*               Unauthorised use of this system is prohibited.               *
*                              Ubuntu 22.04                                  *
******************************************************************************
Last login: Sat Aug 10 14:56:32 2024 from 172.16.192.62
smp20mk@magma-somas:~$ magma
Magma V2.28-5     Sat Aug 10 2024 17:25:47 on magma-somas [Seed = 1569499744]
Type ? for help.  Type <Ctrl>-D to quit.
> Attach("Tim_clusters.m");
> load 'variableswap.m';
Loading "variableswap.m"
> a:=3; c:=8; r:=5; p:=7;
> Factorisation(c^r-a^p);
[ <53, 1>, <577, 1> ]
> Factorisation(c^7-a^5);
[ <2096909, 1> ]
> Factorisation(c^7-a^3);
[ <5, 3>, <19, 1>, <883, 1> ]
> a:=3; c:=8; r:=7; p:=3;
> Factorisation(c^r-a^p);
[ <5, 3>, <19, 1>, <883, 1> ]
> Factorisation(c^5-a^p);
[ <29, 1>, <1129, 1> ]
> Factorisation(7^5-a^p);
[ <2, 2>, <5, 1>, <839, 1> ]
> a:=3; c:=7; r:=5; p:=3;
> Factorisation(c^r-a^p);
[ <2, 2>, <5, 1>, <839, 1> ]
> frap:=fraplus(a,c,r,p);
> ClusterPicture(frap, r);
(1,(2,3,4,5,6)) d=[7/20,0]
> IsSemistable;
Intrinsic 'IsSemistable'

Signatures:

    (T::ClPic) -> BoolElt

        Semistability criterion.

    (F::TorFan) -> BoolElt

        True if and only if the complete fan F is semistable.


> IsSemistable(HyperellipticCurve(frap));

>> IsSemistable(HyperellipticCurve(frap));
               ^
Runtime error in 'IsSemistable': Bad argument types
Argument types given: CrvHyp[FldRat]

>
```