A large 3-group:

```
gap> G;
Group( g1, g2, g3, g4, a5, a6, a7, a8, a9, a10, a18, a22,
       a26, a39, a40, a41, a42, a43, a44, a45, a46, a48,
       a49, a50, a62, a95, a96, a97, a98 )
```

The layers of its lower p-central series have dimensions 4, 6, 3, 11, 1 and 4.

In particular, G has 4 generators and p-class 6.

Thus $Aut(G/\phi(G)) \cong GL(4,3)$.

```
gap> Size( GL(4,3) );
24261120
```

Compute the automorphism group of G:

```
gap> A := AutomorphismGroupPGroup(G);;

init automorphisms
OVER: compute minimal overgroups
OVER: compute partition
OVER: got [ [ 2, 5, 8, 11, 14, 17, 20, 23, 26, 29,
              32, 35, 38 ],
            [ 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16,
              18, 19, 21, 22, 24, 25, 27, 28, 30, 31,
              33, 34, 36, 37, 39, 40 ] ]
OVER: compute stabiliser
OVER: got stab of size 303264
OVER: set up automorphisms


step 2 automorphism group has size 606528

  dim(M): 10, dim(U): 4, dim(N): 10

  calculating orbit and stabilizer

   OS: 1. step
    OS: found series in N with dimensions [ 0, 3, 6, 9, 10 ]

    OS: orbit of length 1
    OS: orbit of length 1
```

```
step 3 automorphism group has size 171301421902747968

  dim(M): 24, dim(U): 21, dim(N): 20

  calculating orbit and stabilizer

   OS: 1. step
    OS: found series in N with dimensions
        [ 0, 7, 8, 11, 17, 20 ]
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1

   OS: 2. step
    OS: found series in M / N with dimensions
        [ 20, 23, 24 ]
    OS: orbit of length 1
    OS: orbit of length 1
```

```
step 4 automorphism group has size 9103659895741828286188

  dim(M): 32, dim(U): 21, dim(N): 11

  calculating orbit and stabilizer

   OS: 2. step
    OS: found series in M / N with dimensions
        [ 11, 18, 24, 27, 28, 31, 32 ]
    OS: found series in N with dimensions
        [ 0, 7, 8, 11 ]
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 6561
    OS: orbit of length 1
    OS: orbit of length 729
    OS: orbit of length 27
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 27
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
```

```
step 5 automorphism group has size
       25711424446350333485117973980536128

  dim(M): 35, dim(U): 34, dim(N): 14

  calculating orbit and stabilizer

   OS: 1. step
    OS: found series in N with dimensions
        [ 0, 6, 13, 14 ]
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1

   OS: 2. step
    OS: found series in M / N with dimensions
        [ 14, 21, 27, 30, 31, 32, 35 ]
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
```

```
step 6 automorphism group has size
       2082625380154377012294555892423426368

  dim(M): 38, dim(U): 34, dim(N): 4

  calculating orbit and stabilizer

   OS: 2. step
    OS: found series in M / N with dimensions
        [ 4, 10, 17, 24, 30, 33, 36, 37, 38 ]
    OS: found series in N with dimensions [ 0, 3, 4 ]
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 729
    OS: orbit of length 1
    OS: orbit of length 27
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 1
    OS: orbit of length 3
    OS: orbit of length 1
    OS: orbit of length 27
    OS: orbit of length 1
    OS: orbit of length 1
```

```
gap> time;
135700

gap> Size(A);
56230885264168179331953009095432511936

gap> 6561*729*27*27;
3486784401
```