

```
moorhous@DESKTOP-L7FGI9T:~$ gap
```

```
GAP
```

```
GAP 4.13.1 of 2024-06-11
```

```
https://www.gap-system.org
```

```
Architecture: x86_64-pc-linux-gnu-default64-kv9
```

```
Configuration: gmp 6.2.1, GASMAN, readline
```

```
Loading the library and packages ...
```

```
Packages: AClib 1.3.2, Alnuth 3.2.1, AtlasRep 2.1.8, AutPGrp 1.11,  
Browse 1.8.21, CaratInterface 2.3.6, CRISP 1.4.6, Cryst 4.1.27,  
CrystCat 1.1.10, CTblLib 1.3.9, curlInterface 2.3.2, FactInt  
1.6.3, FGA 1.5.0, Forms 1.2.11, GAPDoc 1.6.7, genss 1.6.8, IO 4.8.2,  
IRREDSOL 1.4.4, LAGUNA 3.9.6, orb 4.9.0, Polenta 1.3.10,  
Polycyclic 2.16, PrimGrp 3.4.4, RadiRoot 2.9, recog 1.4.2,  
ResClasses 4.7.3, SmallGrp 1.5.3, Sophus 1.27, SpinSym 1.5.2,  
StandardFF 1.0, TomLib 1.2.11, TransGrp 3.6.5, utils 0.85
```

```
Try '?help' for help. See also '?copyright', '?cite' and '?authors'
```

```
gap> F:=FreeGroup("a","b","c");
```

```
<free group on the generators [ a, b, c ]>
```

```
gap> a:=F.1; b:=F.2; c:=F.3;
```

```
a
```

```
b
```

```
c
```

```
gap> G:=F/[a^2,b^3,c^4,a*b*c];
```

```
<fp group on the generators [ a, b, c ]>
```

```
gap> Size(G);
```

```
24
```

```
gap> Size(Center(G));
```

```
1
```

```
gap> S4:=SymmetricGroup(4);
```

```
Sym( [ 1 .. 4 ] )
```

```
gap> Size(S4);
```

```
24
```

```
gap> IsomorphismGroups(G,S4);
```

```
[ a, b, c ] -> [ (1,4), (2,3,4), (1,4,3,2) ]
```

```
gap> NrSmallGroups(24);
```

```
15
```

```
gap> List([1..15],i->StructureDescription(SmallGroup(24,i)));
```

```
[ "C3 : C8", "C24", "SL(2,3)", "C3 : Q8", "C4 x S3", "D24", "C2 x (C3 :  
C4)", "(C6 x C2) : C2", "C12 x C2", "C3 x D8", "C3 x Q8", "S4",  
"C2 x A4", "C2 x C2 x S3", "C6 x C2 x C2" ]
```

```
gap> StructureDescription(G);
```

```
"S4"
```

```
gap> quit;
```

```
moorhous@DESKTOP-L7FGI9T:~$ sage
```

```
SageMath version 9.5, Release Date: 2022-01-30
Using Python 3.10.12. Type "help()" for help.
```

```
sage: F.<a,b,c>=FreeGroup()
sage: G=F/[a^2,b^3,c^4,a*b*c]
sage: G
Finitely presented group < a, b, c | a^2, b^3, c^4, a*b*c >
sage: G.order()
24
sage: S4=SymmetricGroup(4)
sage: S4.order()
24
sage: G.is_isomorphic(S4)
True
sage: iso=G.gap().IsomorphismGroups(S4.gap())
sage: iso
[ a, b, c ] -> [ (2,4), (1,2,3), (1,3,4,2) ]
sage: quit
Exiting Sage (CPU time 0m2.22s, Wall time 3m47.01s).
moorhous@DESKTOP-L7FGI9T:~$
```