

# examples

Nandor Sieben

10/30/2021

Homework:

1. Create a personal account on cocalc.com
2. Create a pdf file containing the output of the commands below.
3. Identify the automorphism group of the simple graph with vertex set  $V = \{a, b, c, d, e, f\}$  and edge set  $E = \{ac, bc, cd, de, df\}$ .

```
%md
```

```
This is a markdown cell. It allows LaTeX formulas like  $\sum_{i=1}^{10} a_i$ .
```

```
Add your name here: ????
```

```
%latex
```

```
This is a  $\LaTeX$  cell. Let a be the  $\int_0^1 x^2 dx$ .
```

```
%r
```

```
# This is an R cell.  
y<-seq(1, 20, by = 2)  
print(y)  
print(fivenum(y))
```

```
%gap
```

```
# This is GAP cell. GAP is computer algebra system for abstract \  
algebra.  
G:= Group( (1,2), (1,2,3) );  
Print(StructureDescription(G), "\n");  
el:=Elements(G);  
Print(el, "\n");  
ords:=List(el, Order);  
Print(ords, "\n");  
Sort(ords);  
Print(ords, "\n");  
Print(IsAbelian(G));
```

---

```
%sh
date
ls
```

```
# This is a default sage cell.
p=plot(x * sin(1/x), (x, -2, 2))
p.save('figure.pdf')
show(p)
```

```
# Find derivative and antiderivative
f(t)=t^2
diff(f)
diff(f(x),x)
integrate(f(x),x)
```

```
# Work with matrices
v=vector([1, 2, 3])
A=matrix(2, 3, [1,2,3, 4,5,6])
B=matrix([[1,2,3],[4,5,6]])
A*v
view(A*B.transpose())
```

```
# More matrices.
A=matrix(3,2,[1,2,2,4,3,6])
view(A)
view(A.rref())
A.right_kernel().basis()
```

```
# Working with subspaces
V=QQ^3
x=vector(QQ,[1,2,3])
y=vector(QQ,[3,4,5])
z=vector(QQ,[5,6,6])
W = V.span([x, y])
2*x in W
z in W
```

```
# Gram-Schmidt orthogonalization
A=matrix(2,3,[1,2,3,4,5,6])
O,L=A.gram_schmidt()
O
```

```
# basic loop
for i in range(1,4):
    print(i)
```

```
# testing
for i in range(10):
```

---

```

    if is_prime(i):
        print(i)

# list comprehension
primes=[i for i in range(10) if is_prime(i)]
print(primes)

# defining lambda functions
f = lambda a, b: a + b
g = lambda a : a^2
f(1,2)
g(3)
(lambda a : a^2)(4)

# defining more complicated functions
def f(a, b=0):
    return a + b
f(3)
f(3,2)

# Finding the automorphism group of a graph.
g=Graph([(1,2),(1,3),(2,3),(3,5),(3,6)])
# show(g)
g.plot()
aut=g.automorphism_group()
aut.multiplication_table()
aut.structure_description()
# lt=latex(g)
# lt
# latex.eval(str(lt))

# Now work on problem 3.

```