In [2]:
```
N(exp(pi*sqrt(163))-(640320)^3)
```

Out[2]:
```
256.000000000000
```

In [3]:
```
def Collatz(n):
    if n%2==0:
        return n/2
    if n%2==1:
        return 3*n+1
```

In [9]:
```
def Collatz_print(n):
    print(n)
    while n>1:
        print(Collatz(n))
        n=Collatz(n)
```

In [10]:
```
Collatz_print(4)
```

```
4
2
1
```

In [11]:
```
Collatz_print(5)
```

```
5
16
8
4
2
1
```

In [12]:
```
Collatz_print(100)
```

```
100
50
25
76
38
19
58
29
88
44
22
11
34
17
52
26
13
40
20
10
5
16
8
4
2
1
```

In [54]:
```
R=Integers(78)
```

In [55]:
```
a=R(91);a
```

Out[55]:
```
13
```

In [56]:
```
b=R(5);b
```

Out[56]:
```
5
```

In [57]:
```
a*b^3
```

Out[57]:
```
65
```

In [58]:
```
(13*5^3-65)/78
```

Out[58]:
```
20
```

In [59]:
```
S.<x>=PolynomialRing(R,'x')
```

In [60]:
```
f=5*x^2-1;g=5*x^2+77
```

In [61]:
```
f==g
```

Out[61]:
```
True
```

In [62]:
```
(x+3)*f
```

Out[62]:
```
5*x^3 + 15*x^2 + 77*x + 75
```

In [63]:
```
t=var('t')
```

In [64]:
```
expand((t+3)*(5*t^2-1))
```

Out[64]:
```
5*t^3 + 15*t^2 - t - 3
```

In [65]:
```
h=x^2+1;(4*x^6+3*x^3-27).quo_rem(h)
```

Out[65]:
```
(4*x^4 + 74*x^2 + 3*x + 4, 75*x + 47)
```

In [66]:
```
Out[65][0]*(x^2+1)+75*x+47
```

Out[66]:
```
4*x^6 + 3*x^3 + 51
```

In [67]:
```
R(2).is_unit()
```

Out[67]:
```
False
```

In [68]:
```
(4*x^6+3*x^3-27).quo_rem(2*x^2+1) #returns an error because 2 is not a unit
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Input In [68], in <cell line: 1>()
----> 1 (Integer(4)*x**Integer(6)+Integer(3)*x**Integer(3)-Integer(27)).quo_
rem(Integer(2)*x**Integer(2)+Integer(1))

File /private/var/tmp/sage-9.7-current/local/var/lib/sage/venv-python3.10.5/
lib/python3.10/site-packages/sage/structure/element.pyx:4494, in sage.struct
ure.element.coerce_binop.new_method (build/cythonized/sage/structure/element
.c:28193)()
   4492 def new_method(self, other, *args, **kwargs):
   4493     if have_same_parent(self, other):
-> 4494         return method(self, other, *args, **kwargs)
   4495     else:
   4496         a, b = coercion_model.canonical_coercion(self, other)

File /private/var/tmp/sage-9.7-current/local/var/lib/sage/venv-python3.10.5/
lib/python3.10/site-packages/sage/rings/polynomial/polynomial_template.pxi:5
00, in sage.rings.polynomial.polynomial_zmod_flint.Polynomial_template.quo_r
em (build/cythonized/sage/rings/polynomial/polynomial_zmod_flint.cpp:11199)(
)
    498 r._cparent = (<Polynomial_template>self)._cparent
    499
--> 500 celement_quorem(&q.x, &r.x, &(<Polynomial_template>self).x, &right.x
, (<Polynomial_template>self)._cparent)
    501 return q,r
    502

File /private/var/tmp/sage-9.7-current/local/var/lib/sage/venv-python3.10.5/
lib/python3.10/site-packages/sage/libs/flint/nmod_poly_linkage.pxi:462, in s
age.rings.polynomial.polynomial_zmod_flint.celement_quorem (build/cythonized
/sage/rings/polynomial/polynomial_zmod_flint.cpp:5755)()
    460 modulus = nmod_poly_modulus(b)
    461 if (leadcoeff > 1 and n_gcd(modulus,leadcoeff) != 1):
--> 462     raise ValueError("Leading coefficient of a must be invertible.")
    463
    464 nmod_poly_divrem(q, r, a, b)

ValueError: Leading coefficient of a must be invertible.
```

In [ ]:
```
S.<x1,x2,x3>=PolynomialRing(QQ,'x1,x2,x3')
```

In [71]:
```
(5*x1^3+3*x2-4/3)^3
```

Out[71]:
```
125*x1^9 + 225*x1^6*x2 - 100*x1^6 + 135*x1^3*x2^2 - 120*x1^3*x2 + 80/3*x1^3
+ 27*x2^3 - 36*x2^2 + 16*x2 - 64/27
```

In [ ]:
```

```