solutions

```
K.<d> = QQ[]
E = EllipticCurve([1+d-d^2, d^2-d^3, d^2-d^3,
0, 0])
E
```

```
Elliptic Curve defined by y^2 + (-d^2+d+1)*x
+ (-d^3+d^2)*x^2 over Univariate Polynomial
Field
```

```
E.short_weierstrass_model()
```

```
Elliptic Curve defined by y^2 = x^3 +
(-27*d^8+324*d^7-1134*d^6+1512*d^5-945*d^4+3
(54*d^12-972*d^11+6318*d^10-19116*d^9+30780*
11988*d^5+9396*d^4-2484*d^3-810*d^2+324*d+54
Polynomial Ring in d over Rational Field
```

```
show(E.short_weierstrass_model())
```

$$y^2 = x^3 + (-27d^8 + 324d^7 - 1134d^6 + 1512d^5 - 945d^4 -$$

```

```

```
for d in [1..1000]:
    if is_fundamental_discriminant(d):
        K = QuadraticField(d)
        if K.class_number() == 5:
            print "d = ", d
            break
```

```
d =  401
```

```
for d in [-1,-2,..,-1000]:
    if is_fundamental_discriminant(d):
        K = QuadraticField(d)
        if K.class_number() == 5:
            print "d = ", d
            break
```

```
d =  -47
```

```
R.<x> = QQ[]
for d in [1..500]:
    f = x^3 + d
    if not f.is_irreducible(): continue
    K = NumberField(f, 'a')
    if K.class_number() == 5:
        print K
        break
```

```
Number Field in a with defining polynomial x
```

```

```

```
def E(a):
    return EllipticCurve([0,(a-1),1,-a,0])

for a in [0..80]:
    print a, E(a).rank()
```

```
0 0
1 1
2 2
3 2
4 3
5 2
6 2
7 3
```

```
8  3
9  3
10  2
11  3
12  3
13  3
14  3
15  2
16  4
17  3
18  2
19  3
20  3
21  2
22  3
23  4
24  3
25  3
26  3
27  2
28  3
29  3
30  2
31  3
32  3
33  2
34  4
35  2
36  3
37  4
38  3
39  2
40  3
```

```
41 2
42 4
43 3
44 2
45 2
46 4
47 3
48 3
49 4
50 2
51 2
52 2
53 4
54 4
55 2
56 3
57 3
58 3
59 4
60 3
61 2
62 3
63 3
64 4
65 3
66 3
67 4
68 2
69 3
70 3
71 3
72 3
73 3
```

```
74 4
75 3
76 3
77 3
78 3
79 5
80 3
```

```
# so smallest are: 0,1,2,4,16,79.
```