In [15]:
```
# Problem 1
reset()
def problem1(a):
    print('program1('+ str(a) + '), where n = '+ str(a))
    var('x')
    h=0
    for i in range(a):
        h = h + ZZ.random_element(-100,101)*x^i

    result = (h, len(h.roots(ring=RR)))
    show(result)

problem1(4)
problem1(10)
```

program1(4), where n = 4

$$\left(60\,x^{3} + 16\,x^{2} + x + 26, 1\right)$$

program1(10), where n = 10

$$\left(78\,x^{9} + 46\,x^{8} + 98\,x^{7} - 31\,x^{6} + 60\,x^{5} + 49\,x^{4} - 20\,x^{3} + 34\,x^{2} - 19\,x + 30, 1\right)$$

In [16]:
```
# Problem 2
def problem2(f, l):
    result_list = []
    for e in l:
        # print(e, e[0], e[1])
        if e[1] == f.subs(x=e[0]):
            result_list.append(e)
    show(result_list)

# problem2(2*x^2-2*x+3, [[0, 3], [1, 4], [2, 7], [3, 17], [4, 33], [5, 43],
 [6, 63], [7, 87], [8, 116], [9, 147]])
problem2(x^3-x^2-1,  [[0, -1], [1, -2], [2, 4], [3, 17], [4, 48], [5, 99], [6,
189], [7, 332]])
```

$$\left[\left[0, -1\right], \left[3, 17\right], \left[5, 99\right]\right]$$

In [17]:
```
# Problem 3
def problem3(f):
    c = f.list()
    s = f.coefficients()
    counter = 0
    prev = c[0]/abs(c[0]) #first coefficient sign
    for e in c:
        if e/abs(e) != prev:
            prev = e/abs(e)
            counter+=1
    print(counter)

problem3(-27*x^7 + 3*x^6 - 28*x^5 + 44*x^4 - 11*x^3 - 71*x^2 + 6*x - 14)
```

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In [18]:
```
# Problem 4
def problem4(s1, s2, h, m):
    # convert hour to minute,then convert to second
    minutes = h*60 + m
    sec = 60*minutes
    # distance
    d1 = s1*sec
    d2 = s2*sec
    # distance between 2 cars
    d3 = sqrt(d1^2 + d2^2)/5280
    show(numerical_approx(d3))

# problem4(65, 65, 1, 12)
problem4(25, 45, 1, 30)
```

52.6481086755017