Newton's Method

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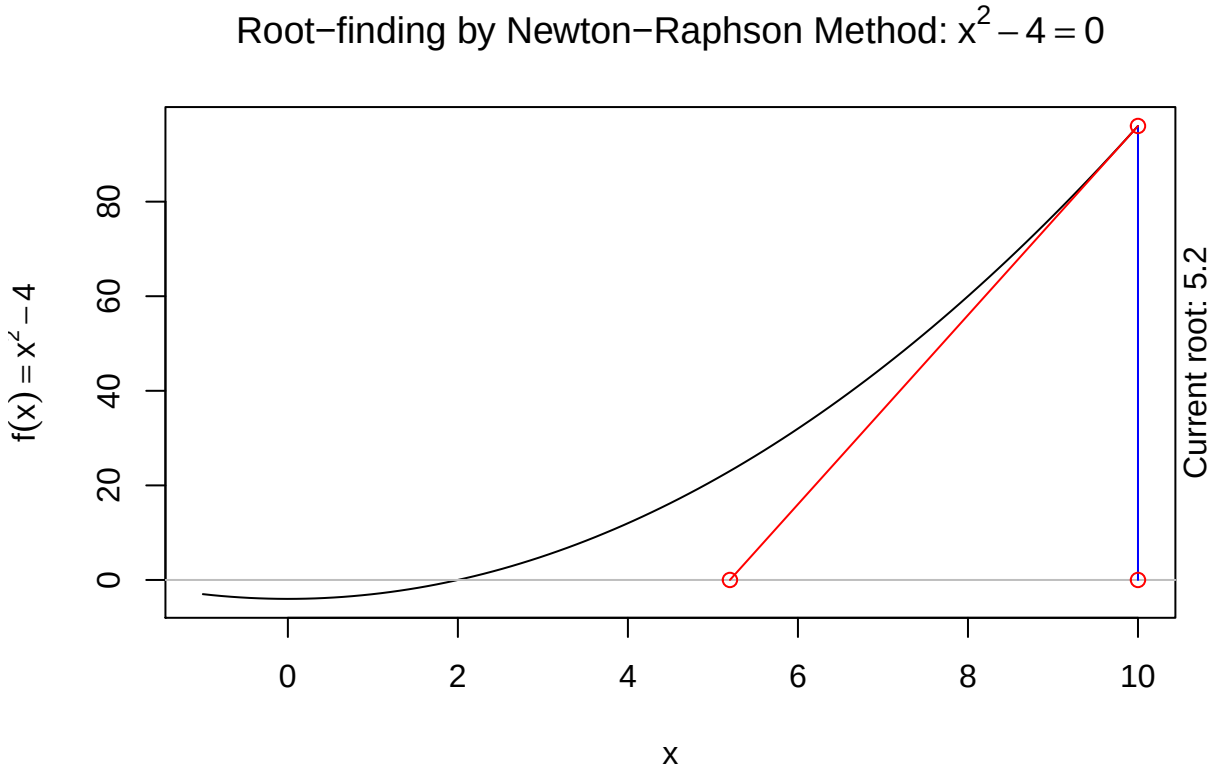
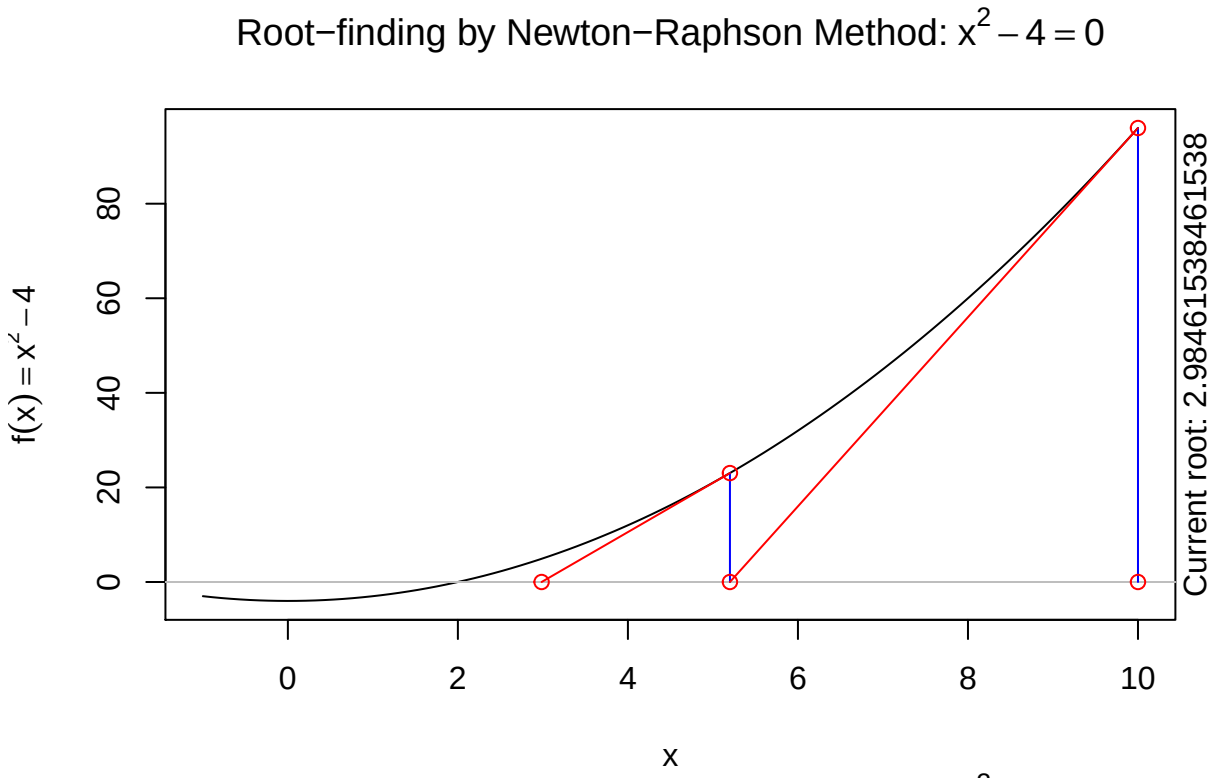
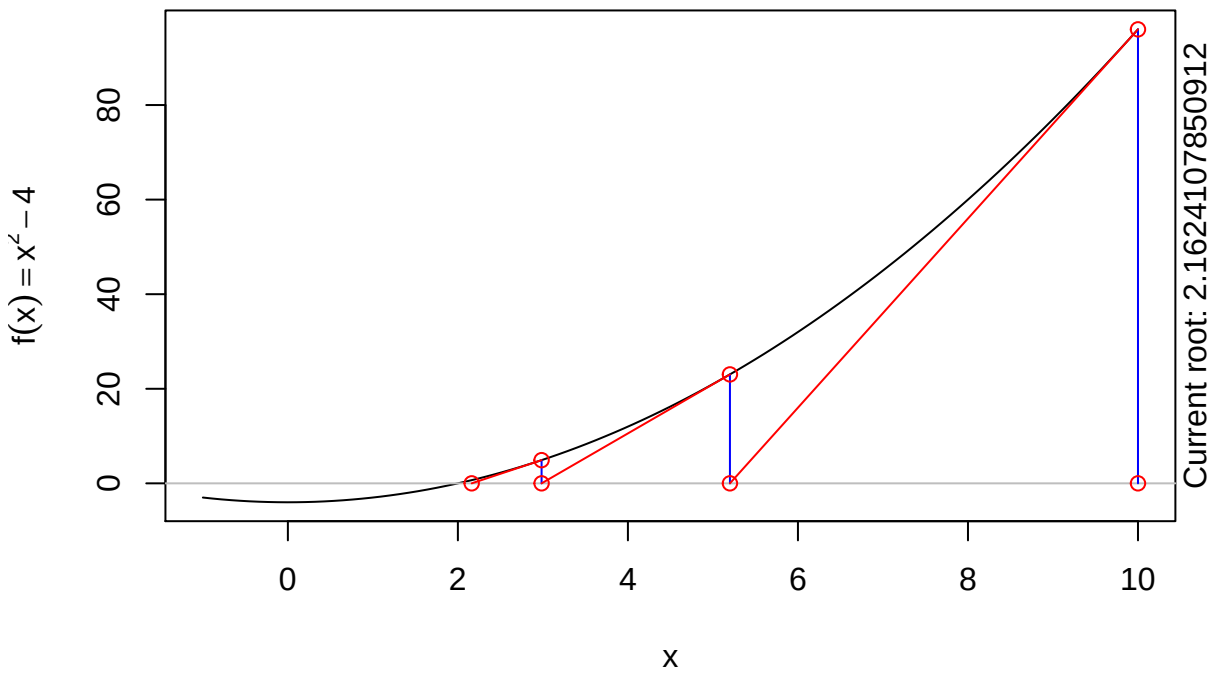
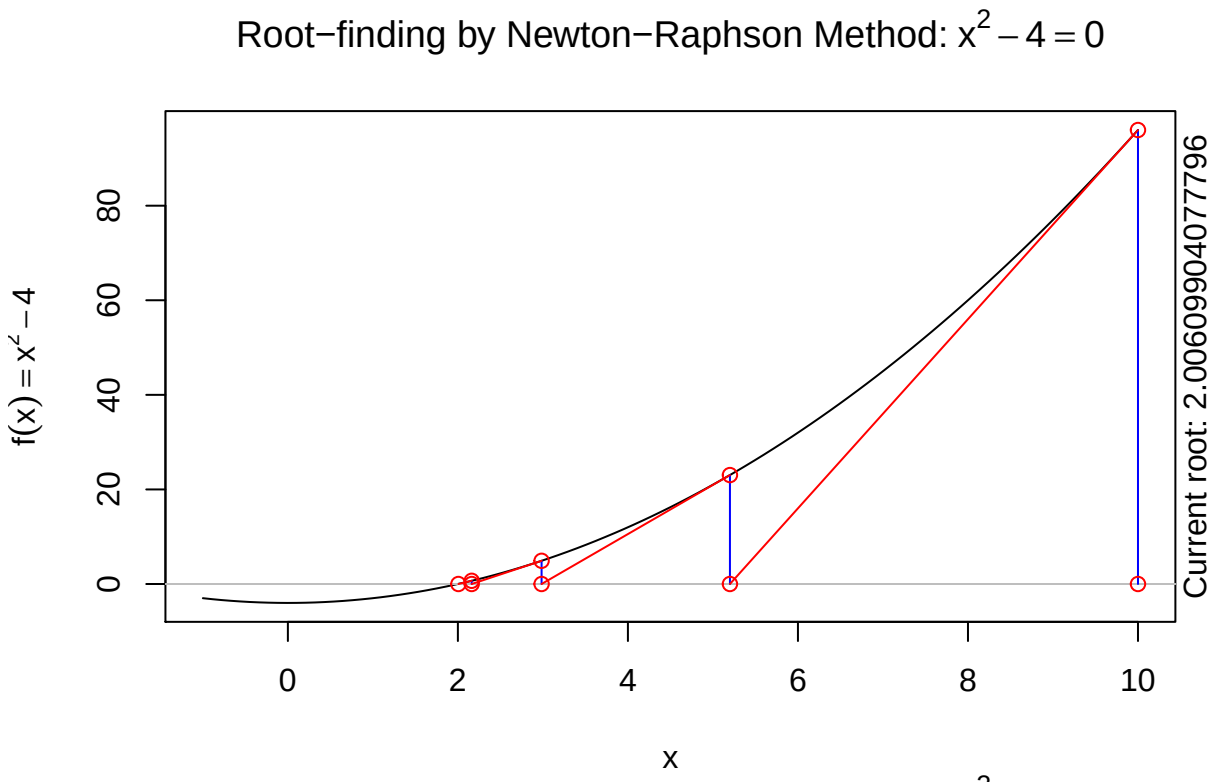
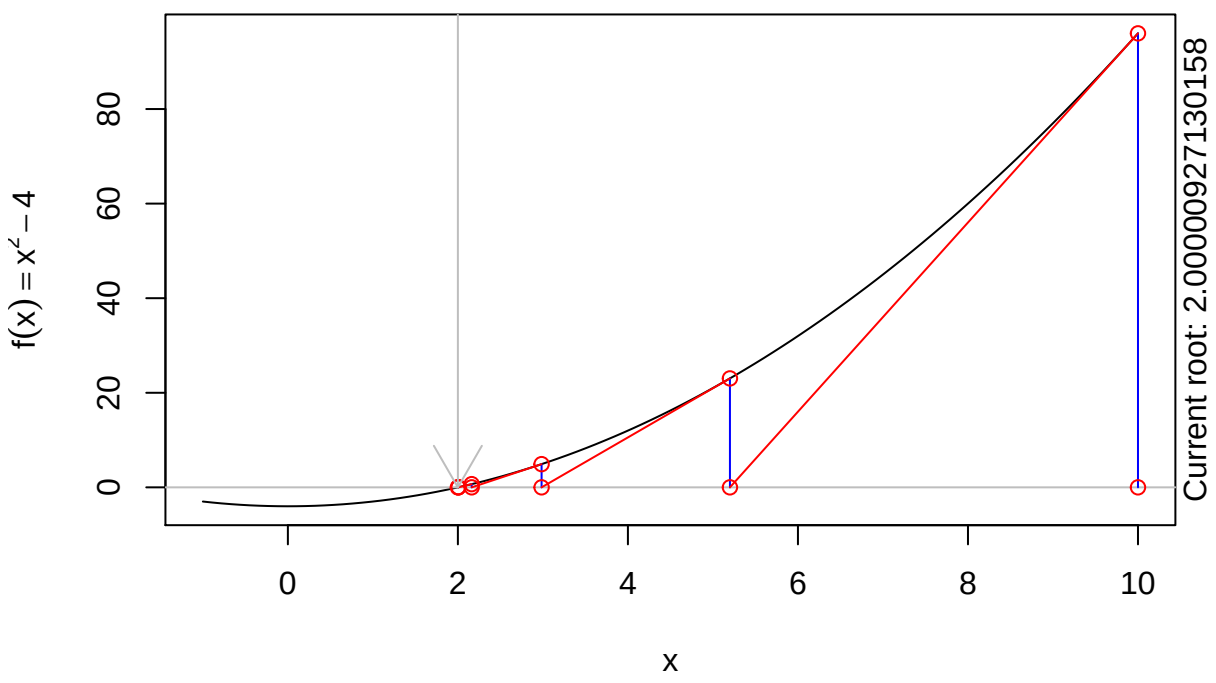
```
library(animation)
f = newton.method()
```




Root−finding by Newton−Raphson Method: $x^2 - 4 = 0$
$f(x) = x^2 - 4$
0
20
40
60
80
0
2
4
6
8
10
x
Current root: 2.98461538461538


Root−finding by Newton−Raphson Method: $x^2 - 4 = 0$
$f(x) = x^2 - 4$
0
20
40
60
80
0
2
4
6
8
10
x
Current root: 2.16241078509 12

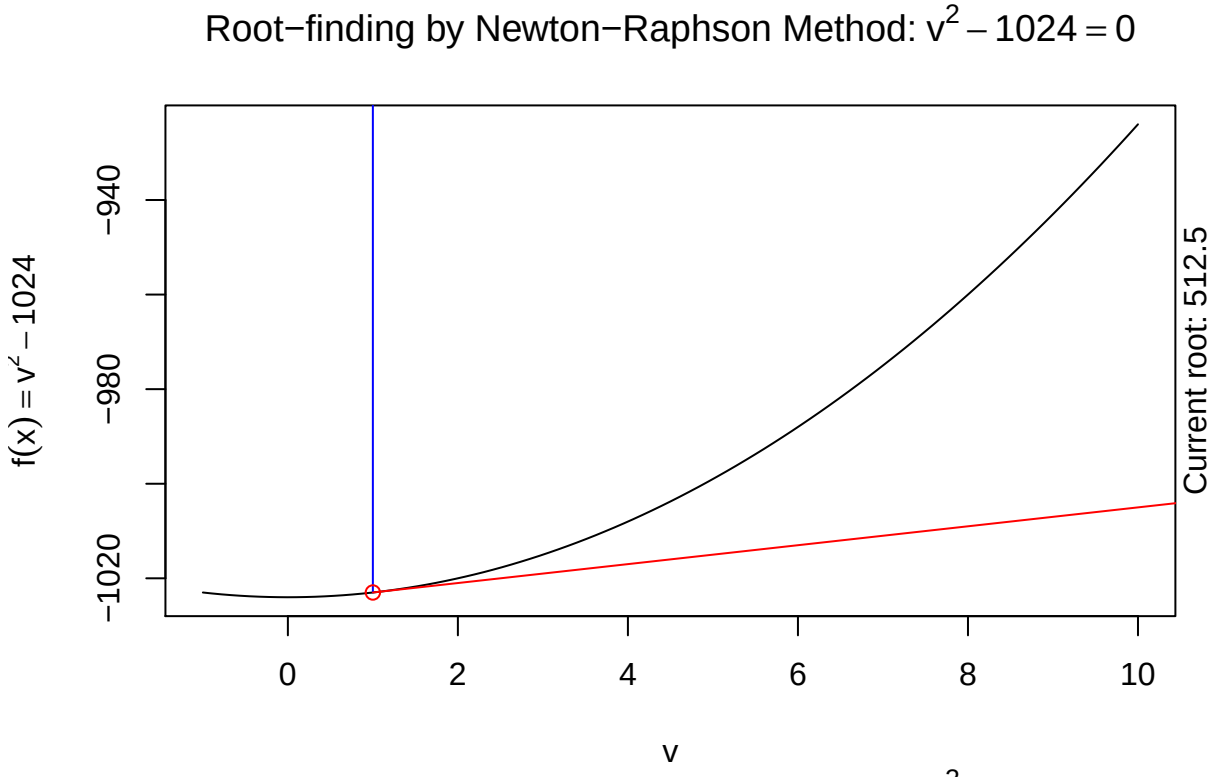


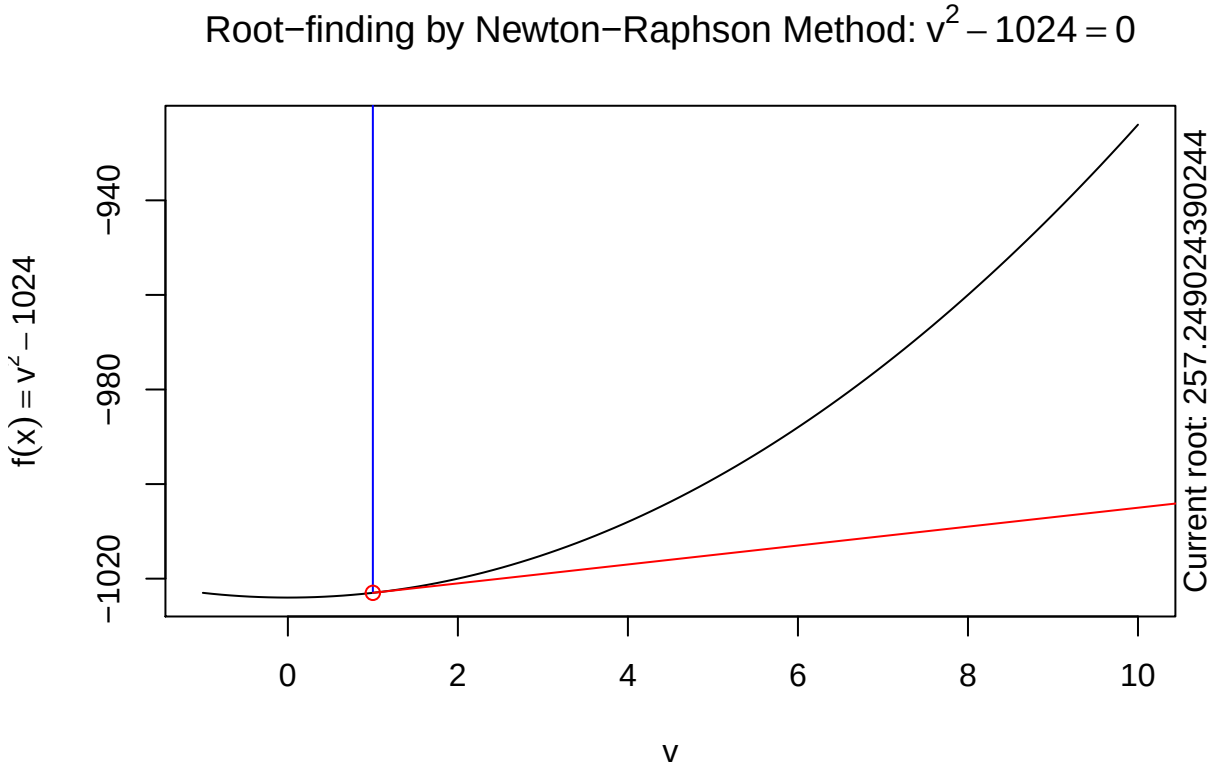


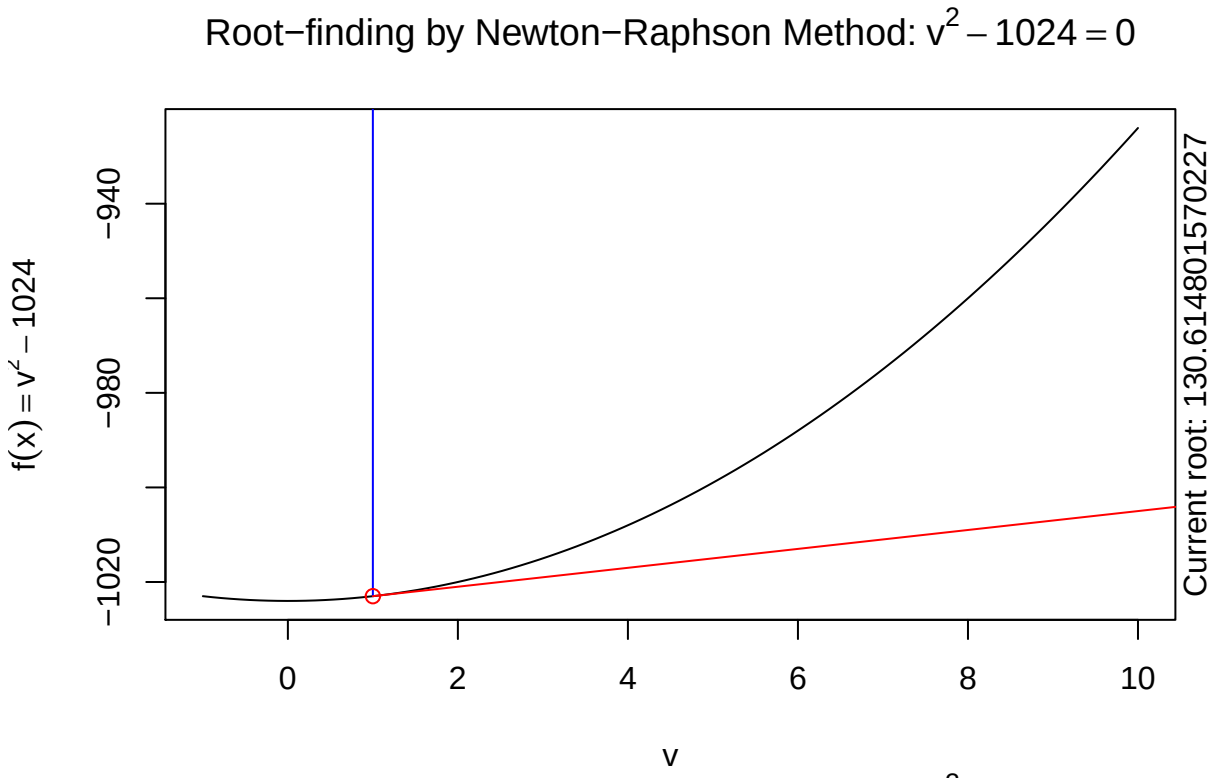

```
f$root
```

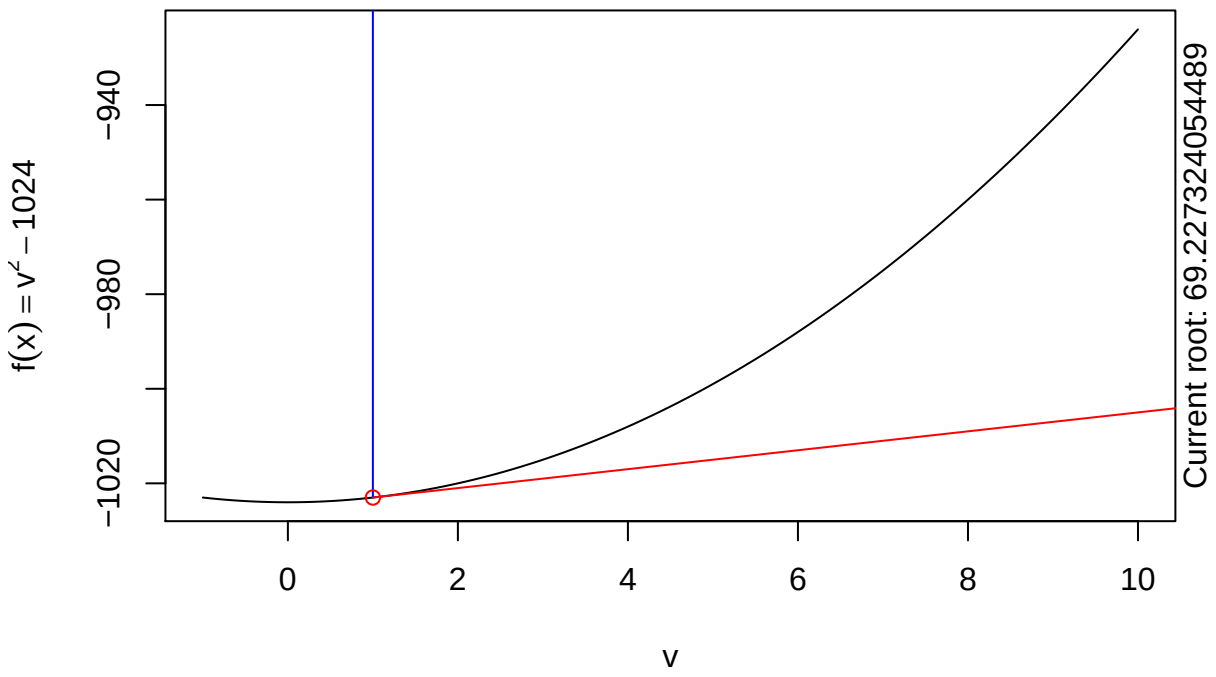
```
## [1] 2.000009
```

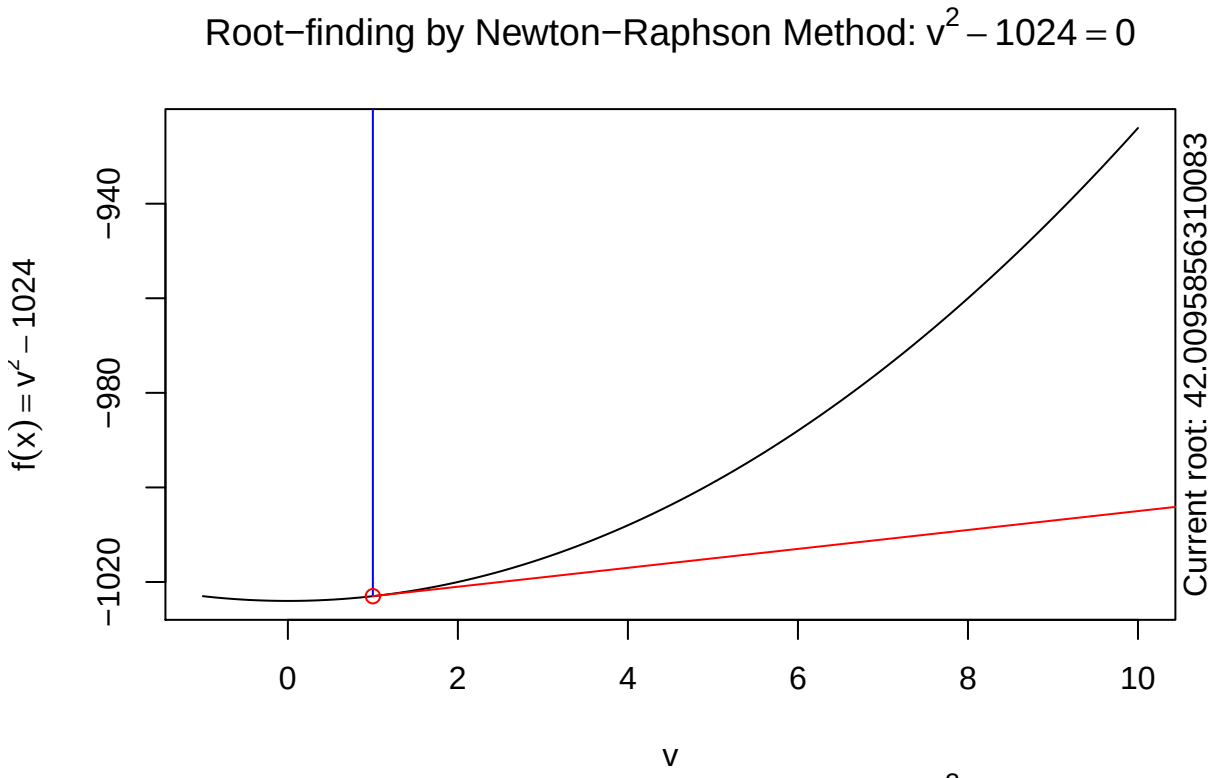
```
f1=newton.method(function(v) v^2-1024,init=1)
```

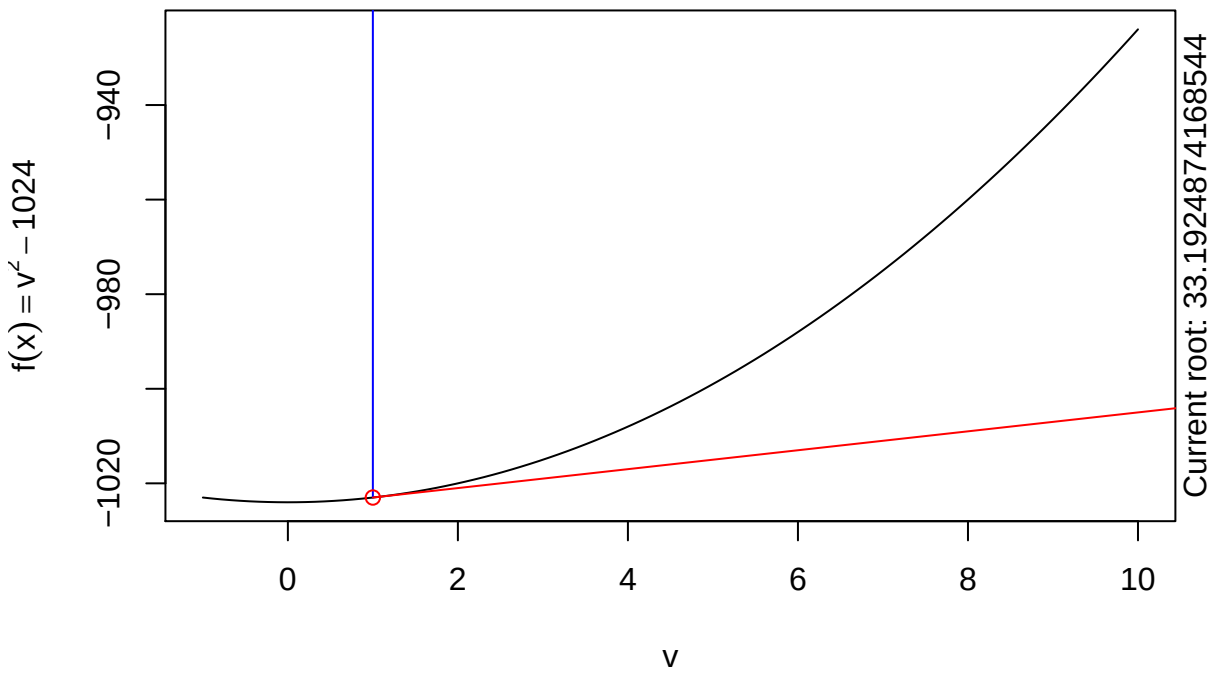


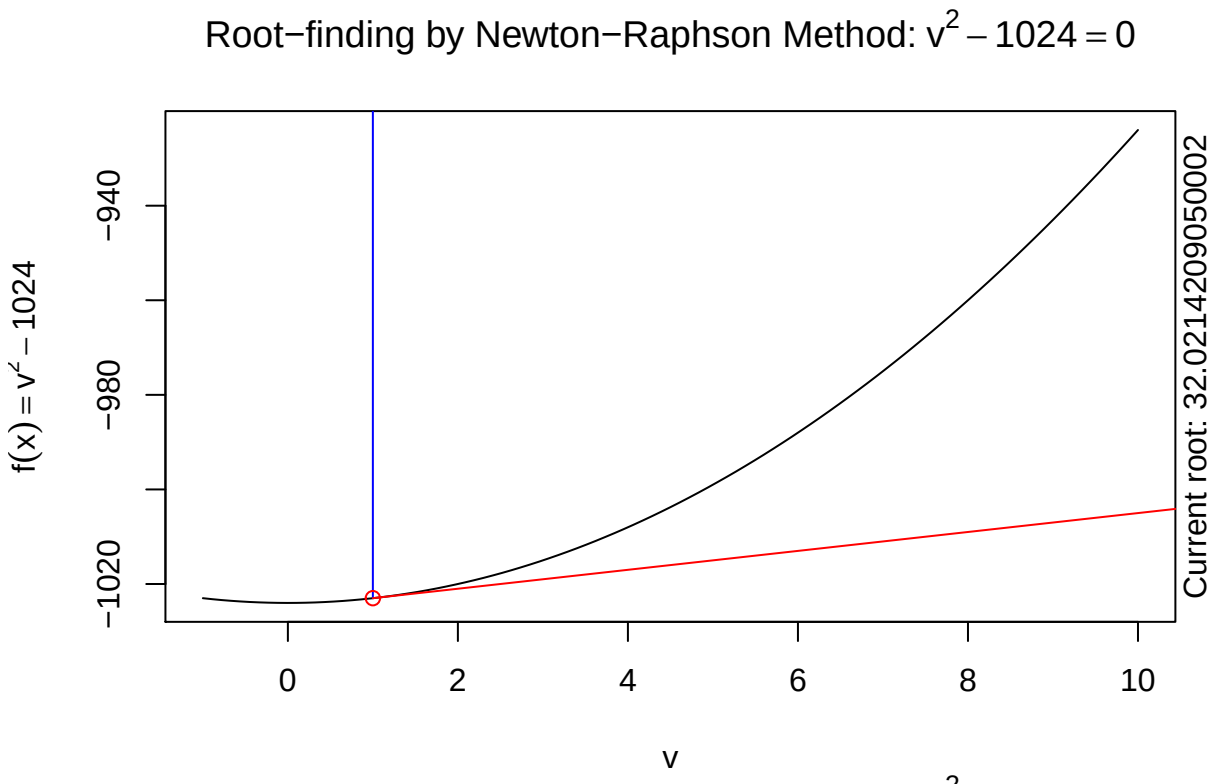


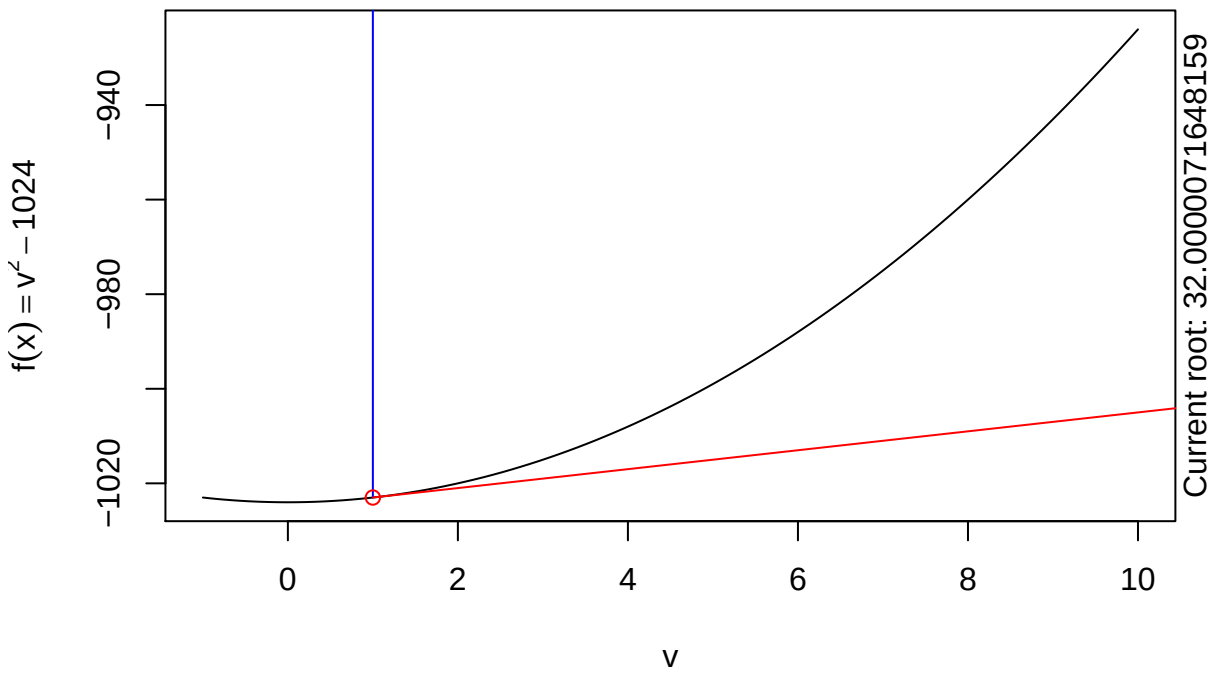

Root−finding by Newton−Raphson Method: $v^2 - 1024 = 0$
$f(x) = v^2 - 1024$
−940
−980
−1020
0
2
4
6
8
10
v
Current root: 130.614801570227


Root−finding by Newton−Raphson Method: $v^2 - 1024 = 0$
$f(x) = v^2 - 1024$
−940
−980
−1020
0
2
4
6
8
10
v
Current root: 69.2273240544489


Root−finding by Newton−Raphson Method: $v^2 - 1024 = 0$
$f(x) = v^2 - 1024$
−1020
−980
−940
0
2
4
6
8
10
v
Current root: 42.0095856310083


Root−finding by Newton−Raphson Method: $v^2 - 1024 = 0$
$f(x) = v^2 - 1024$
−1020
−980
−940
0
2
4
6
8
10
v
Current root: 33.1924874168544

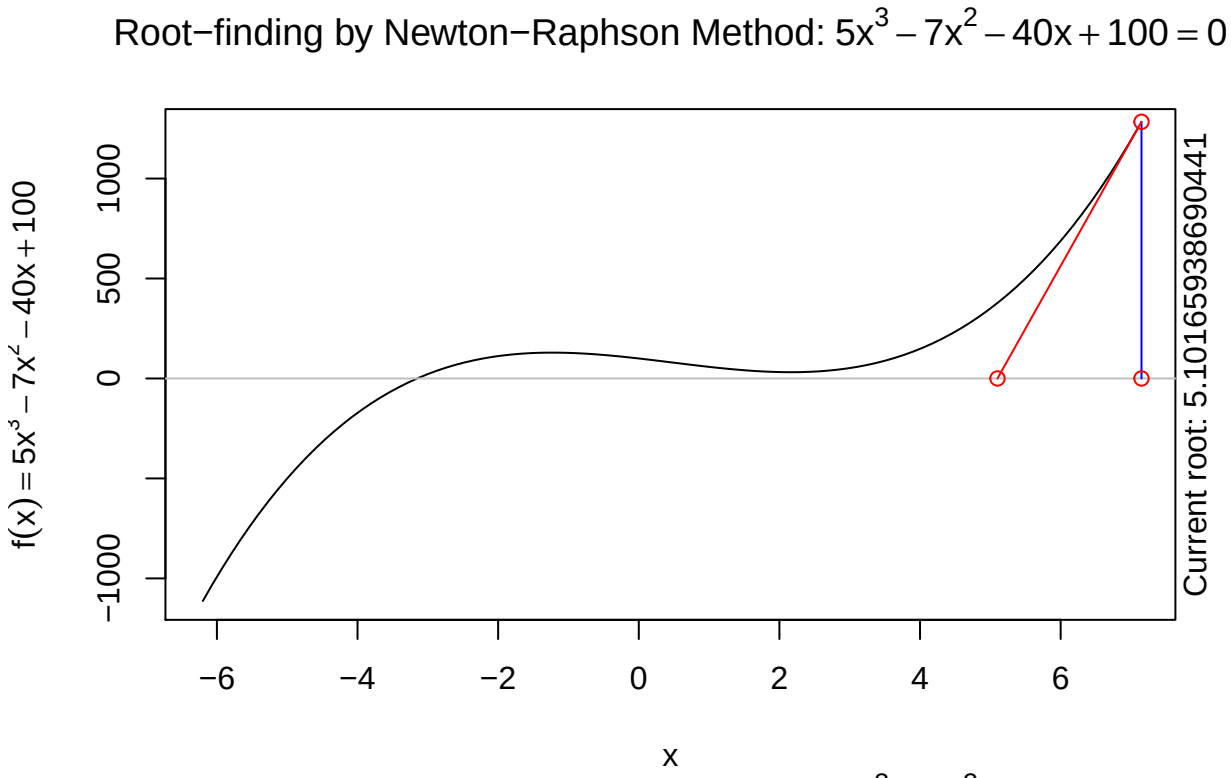


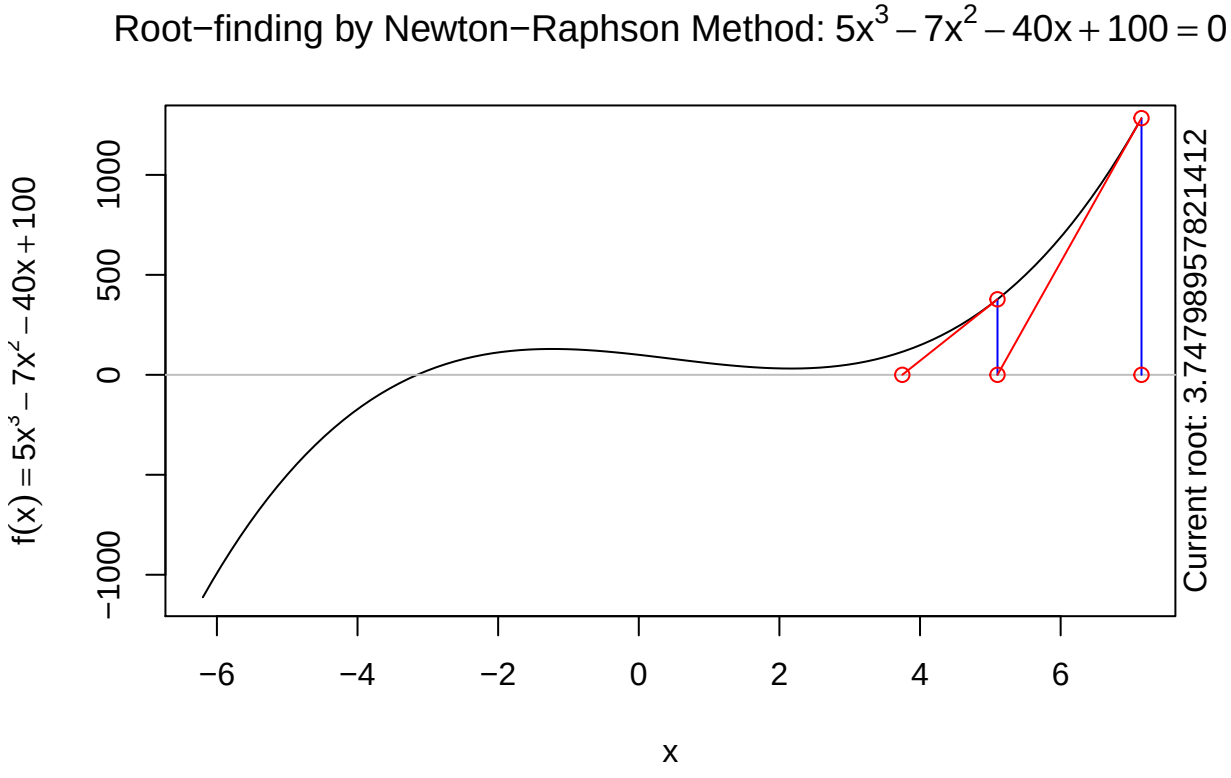


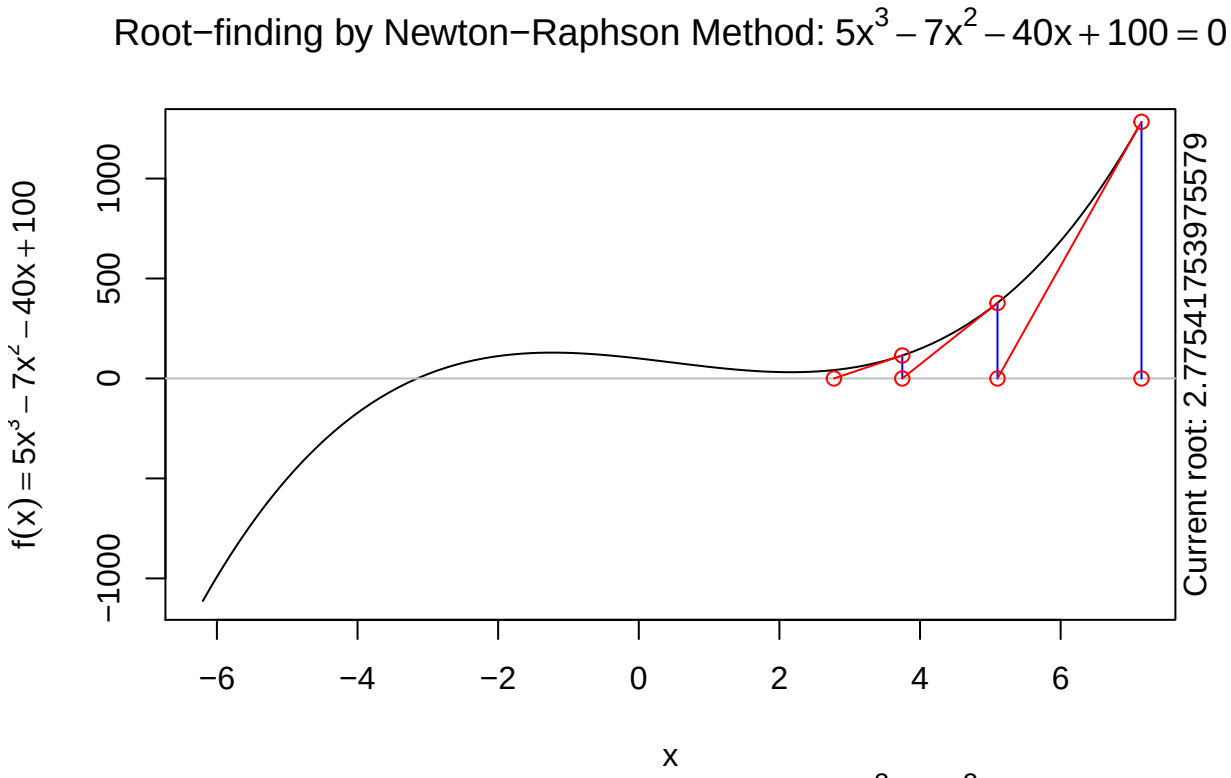

```
f1$root
```

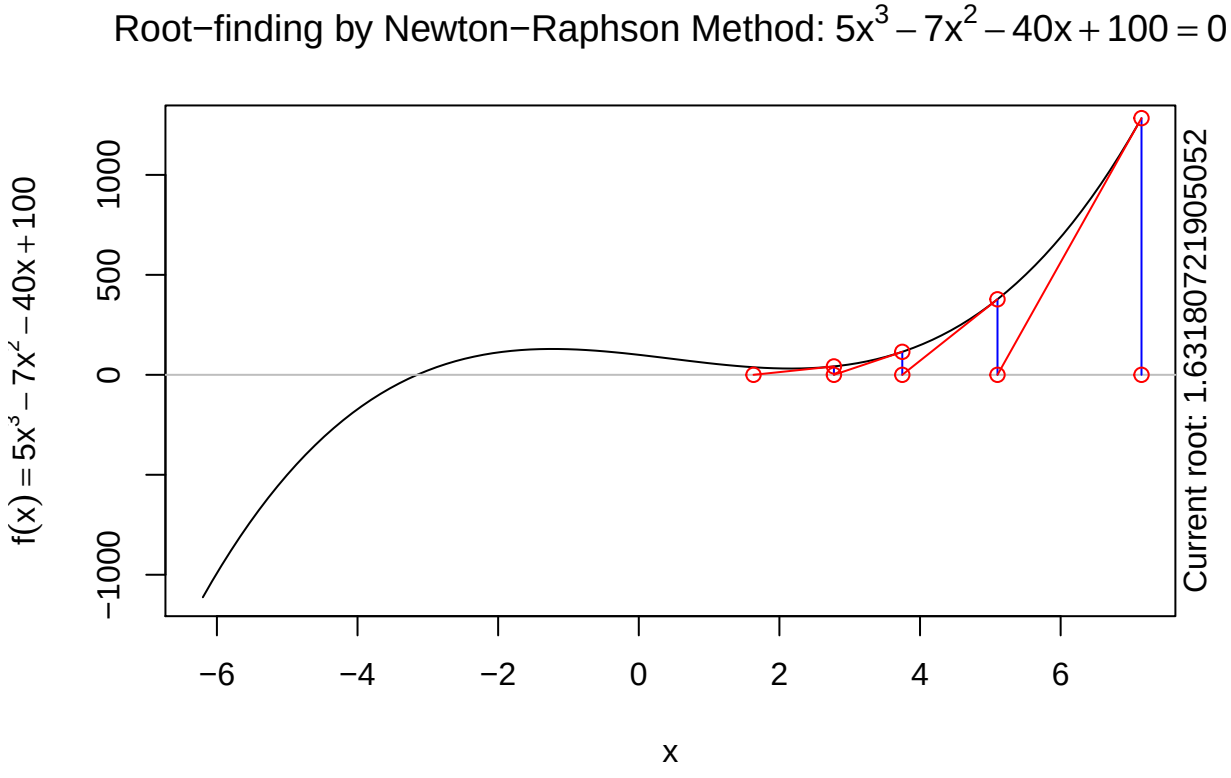
```
## [1] 32.00001
```

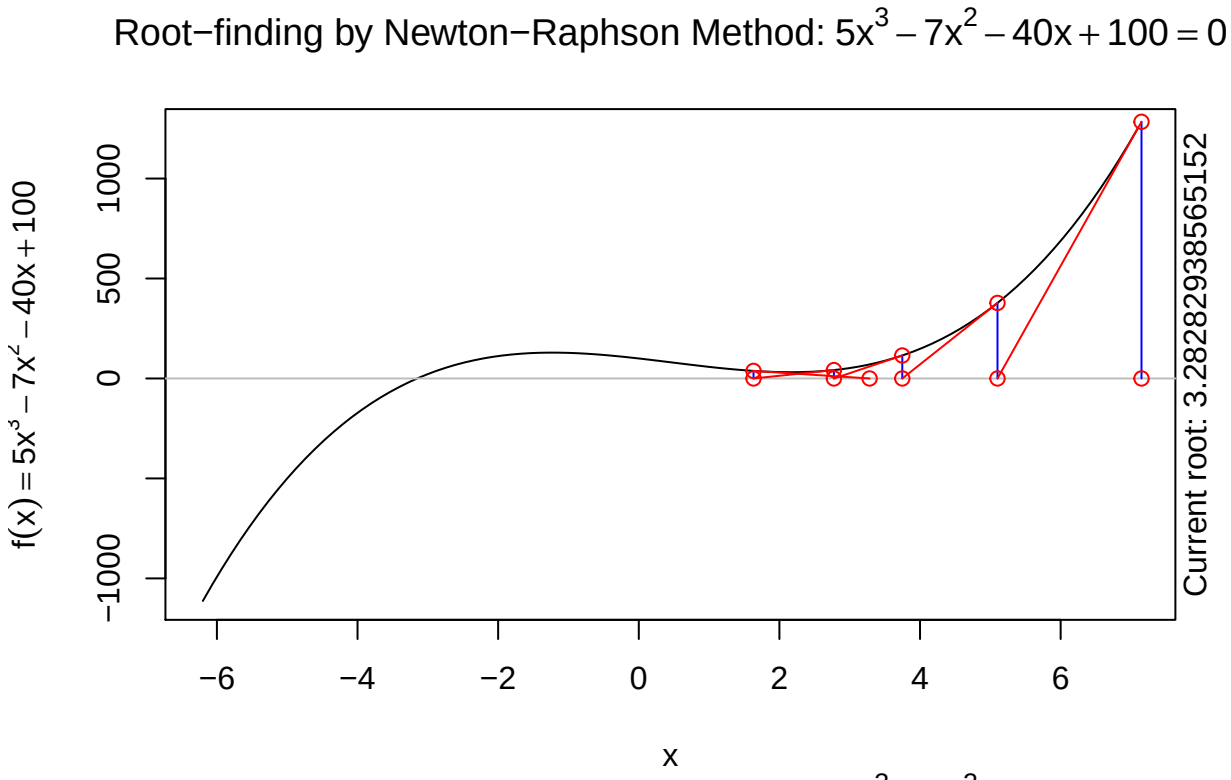
```
## take a long long journey
f2=newton.method(function(x) 5 * x^3 - 7 * x^2 - 40 * x + 100, 7.15, c(-6.2,7.1))
```

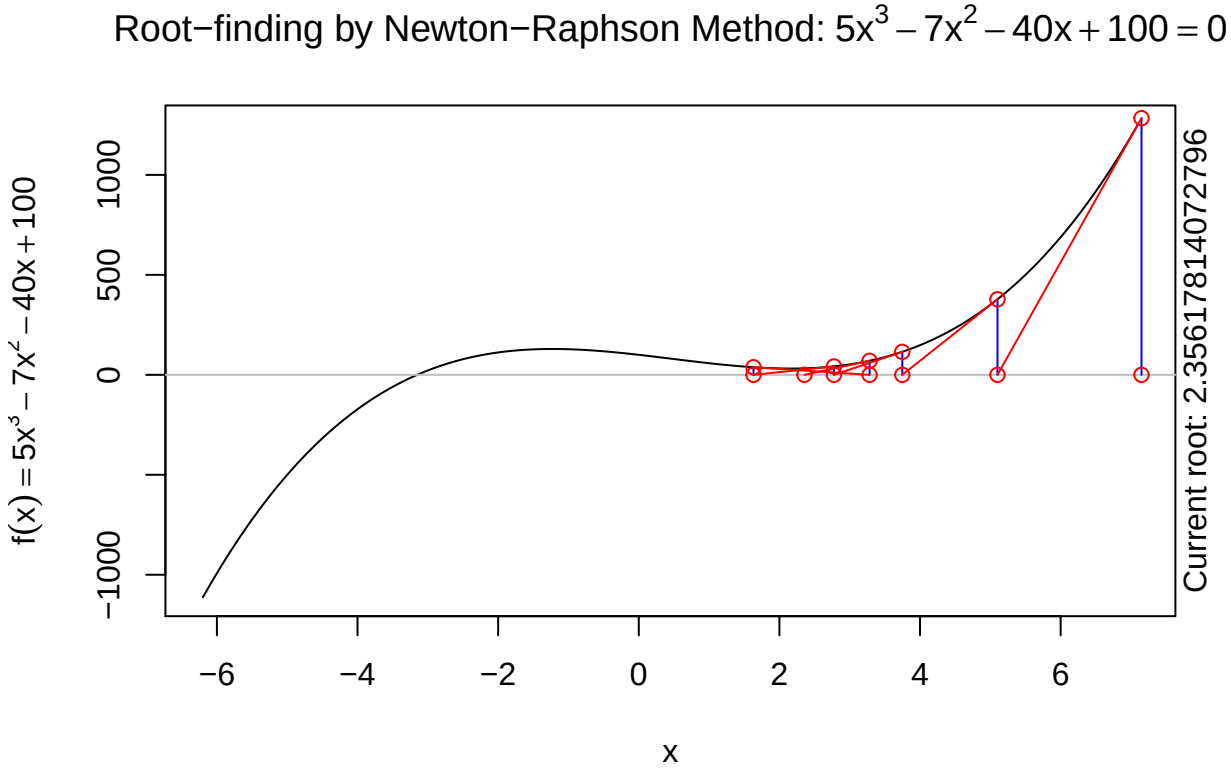

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 5.10165938690441

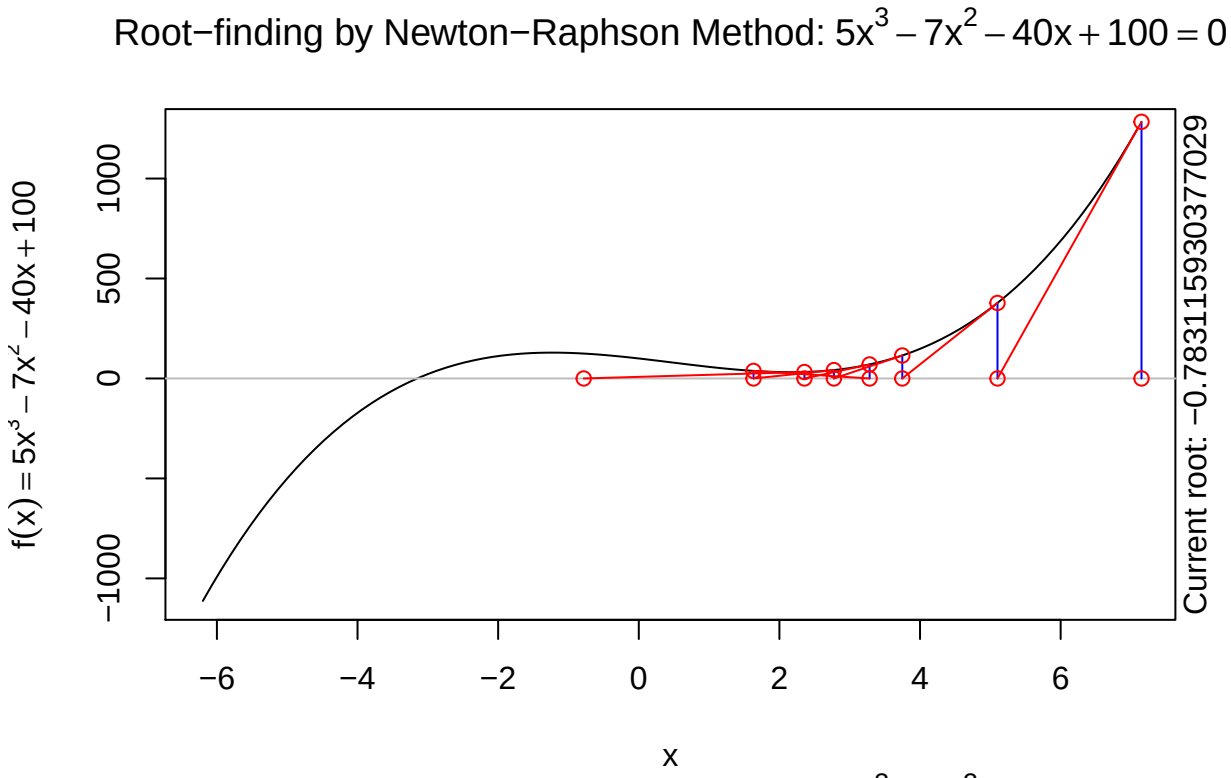

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 3.74798957821412

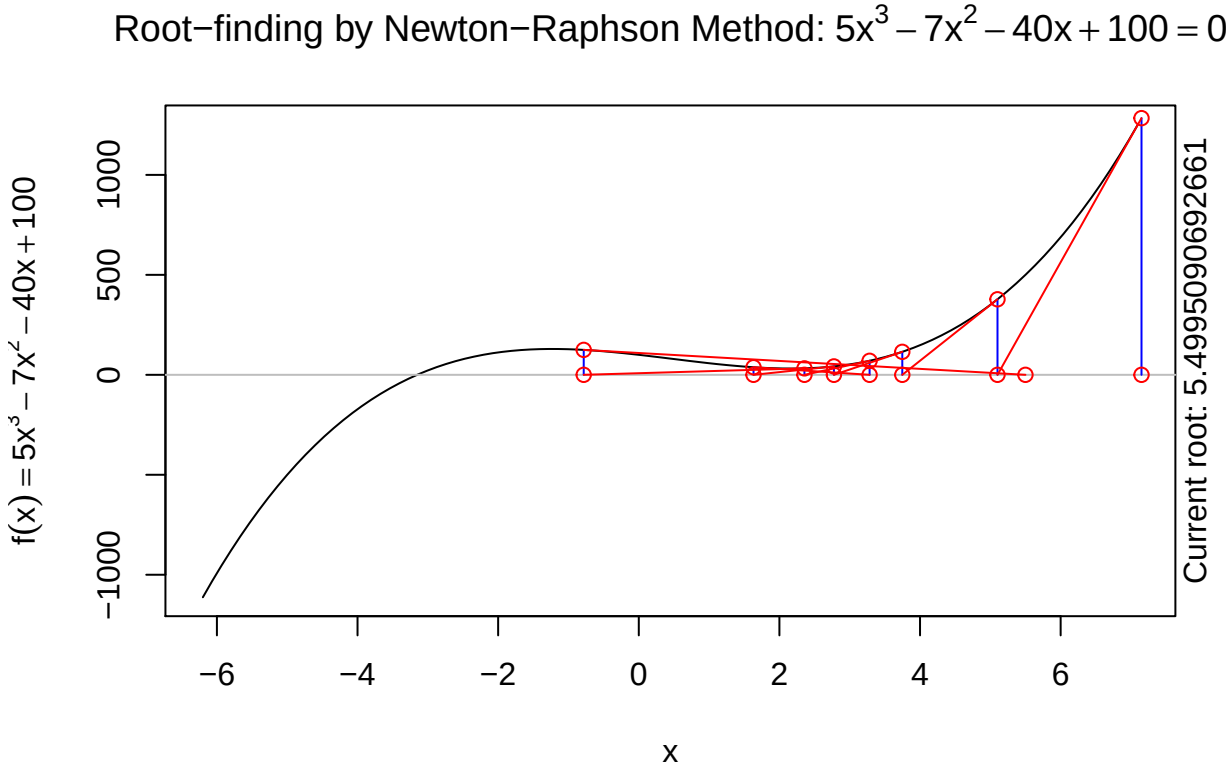

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 2.77541753975579

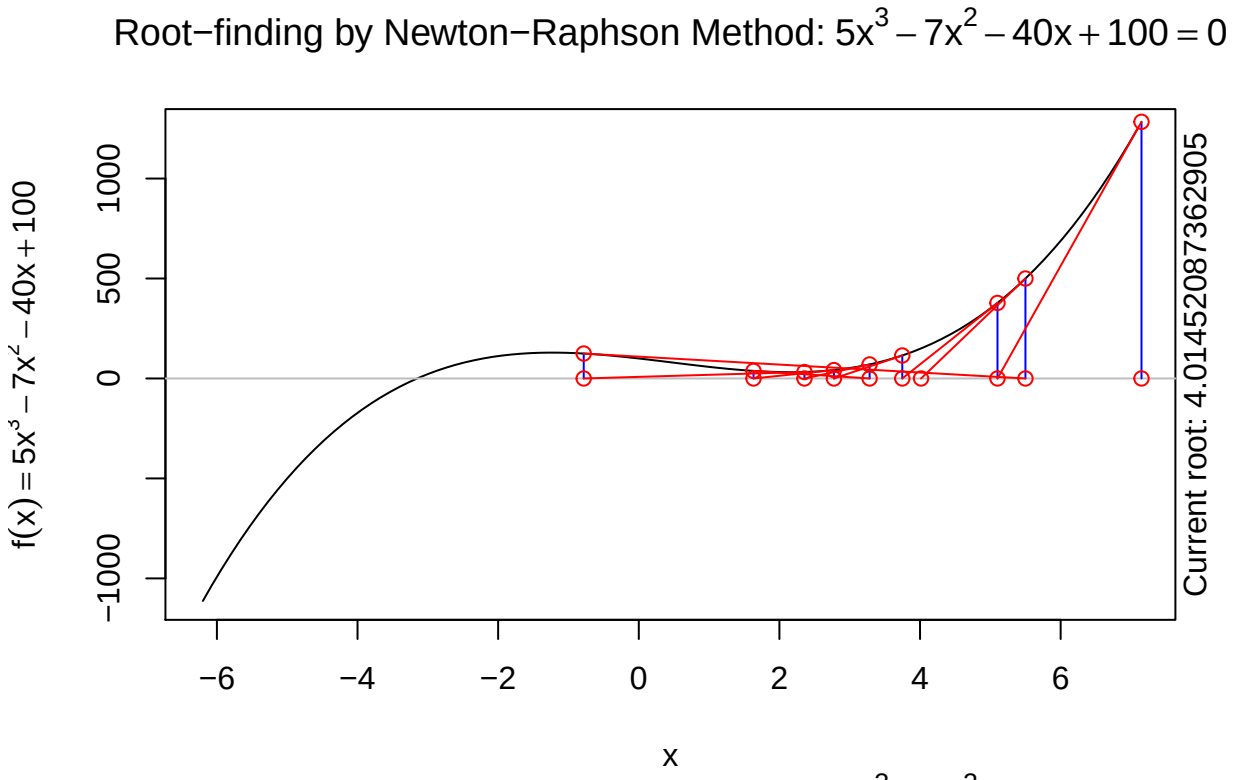

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 1.63180721905052

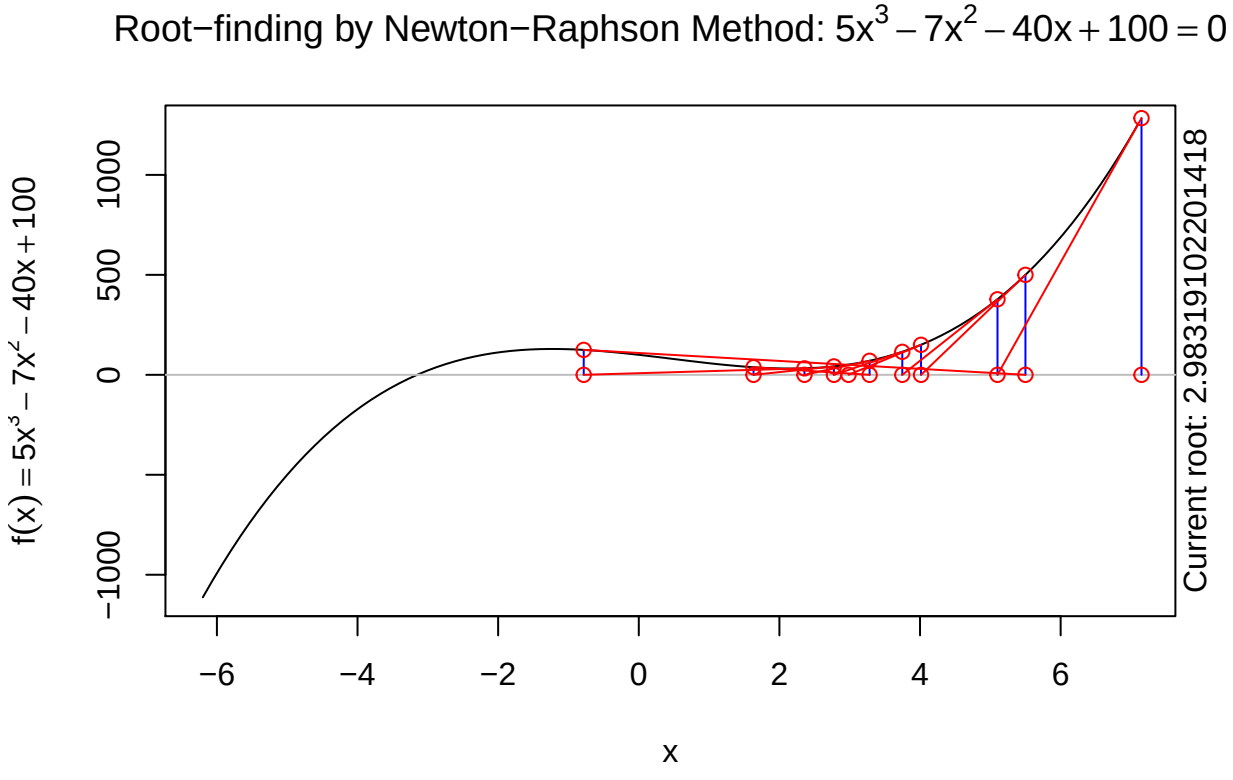

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 3.28282938565152

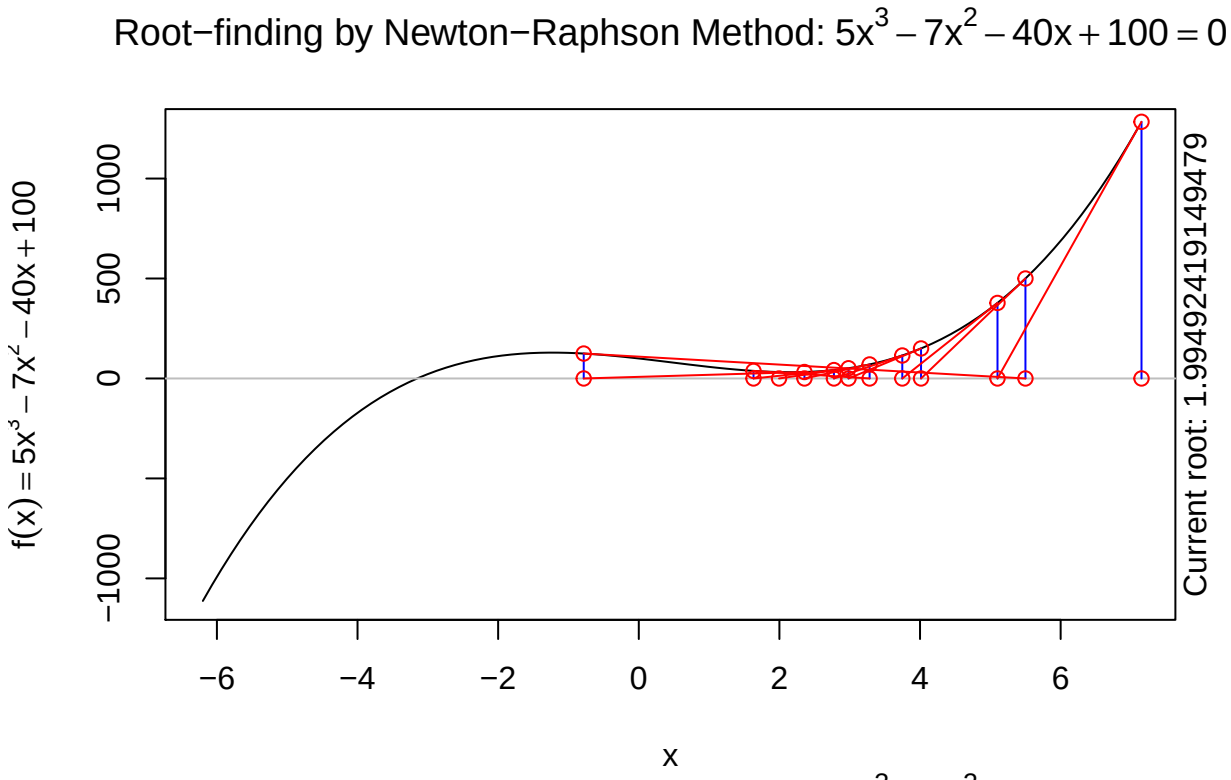

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 2.35617814072796

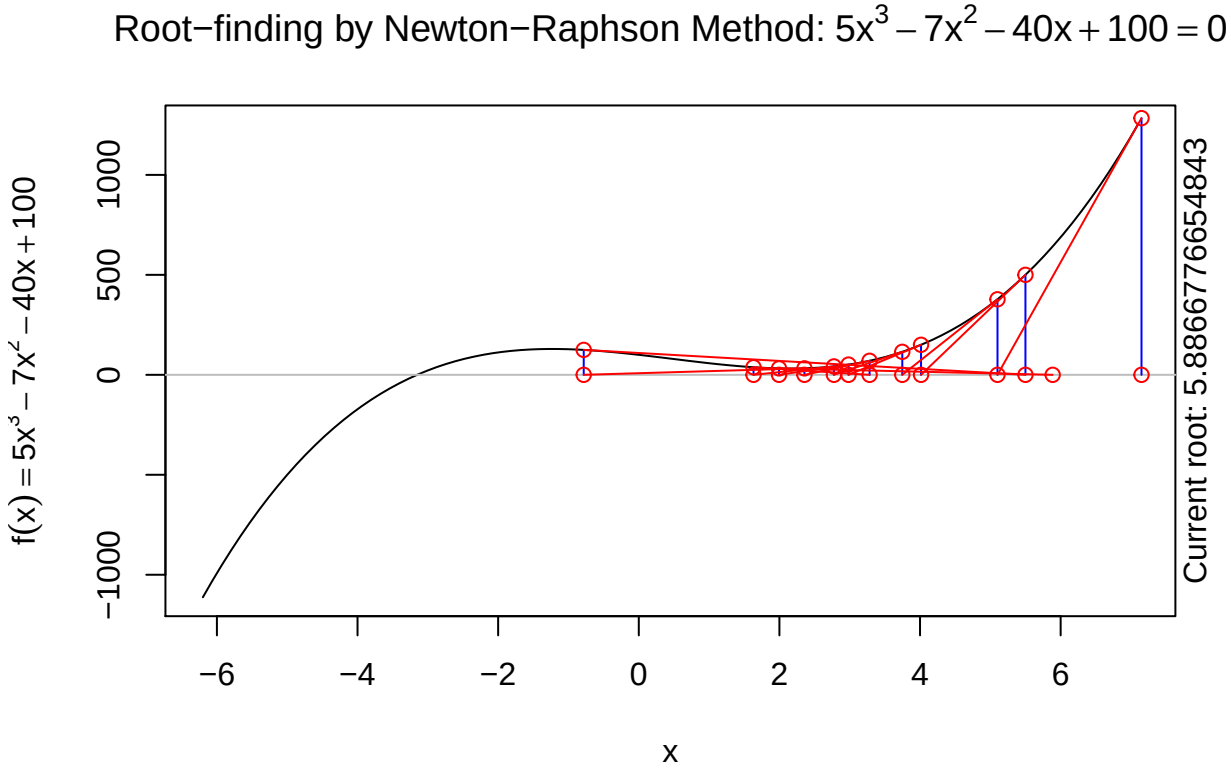

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: −0.783115930377029

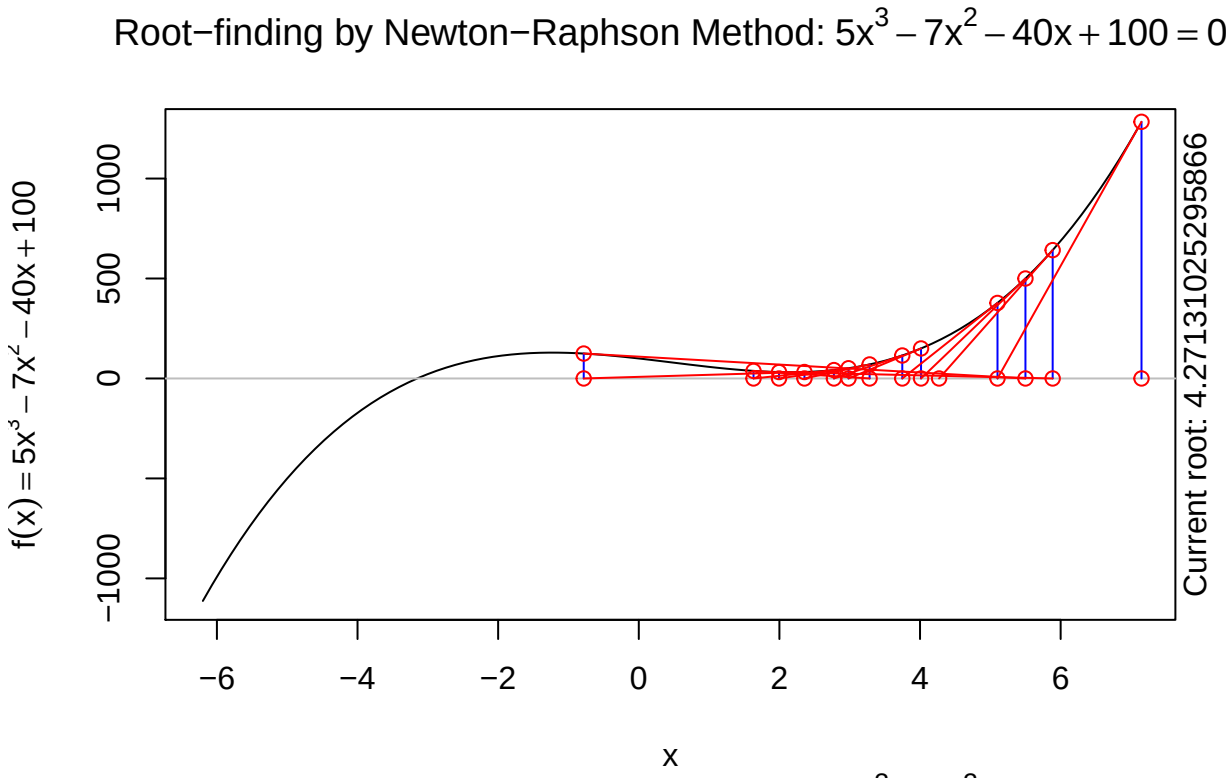

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 5.49950906926 61

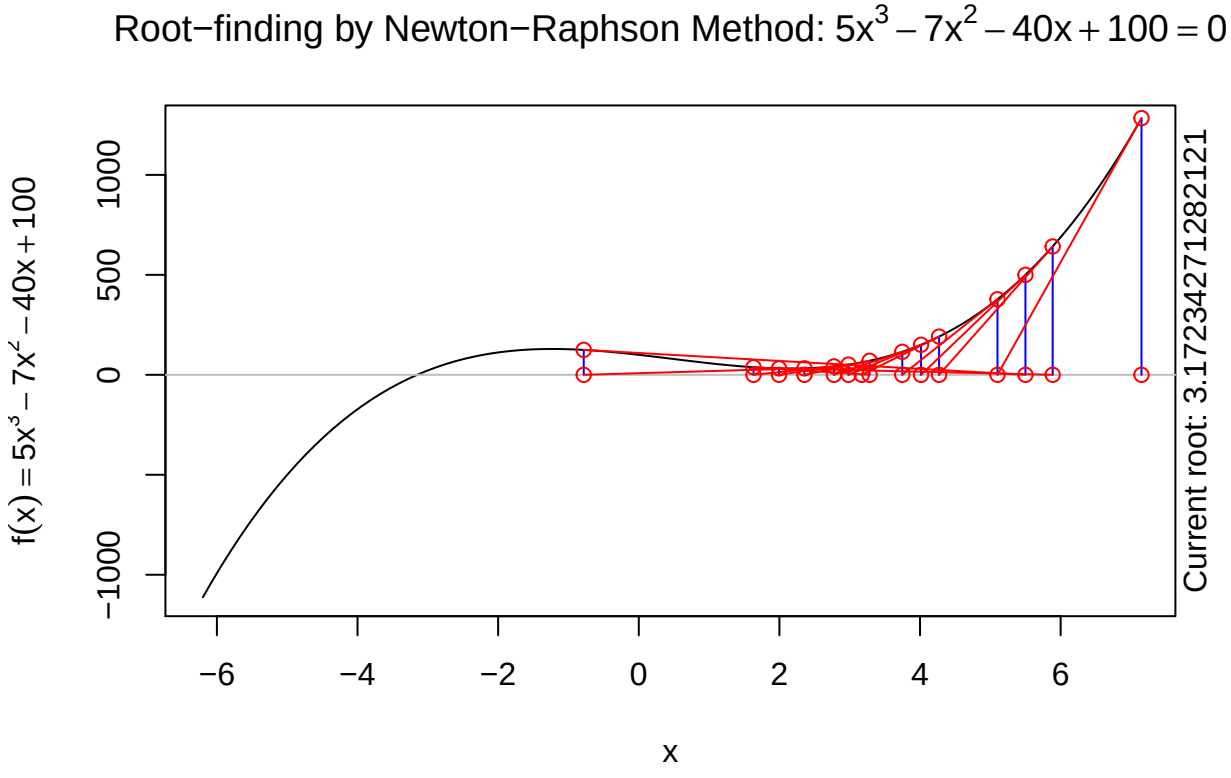

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
Current root: 4.014520873629 05
x

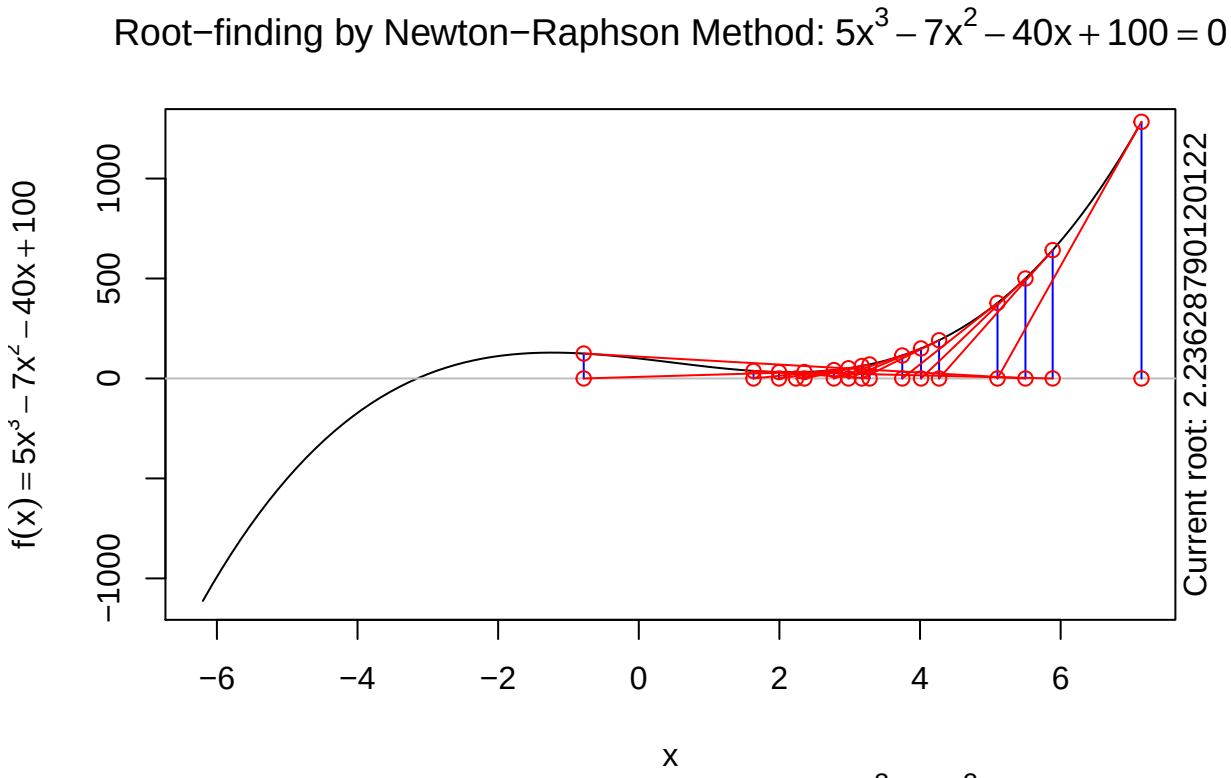

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
Current root: 2.983191022014 18
x

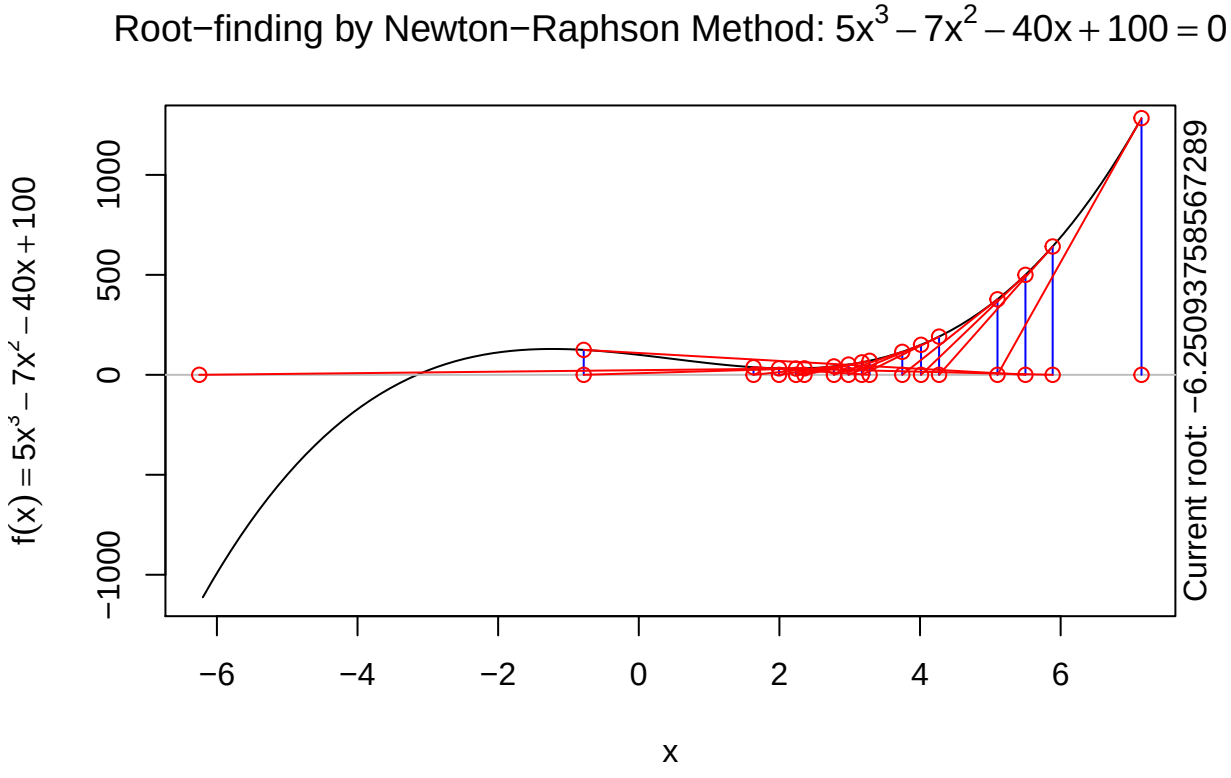

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 1.99492419149479

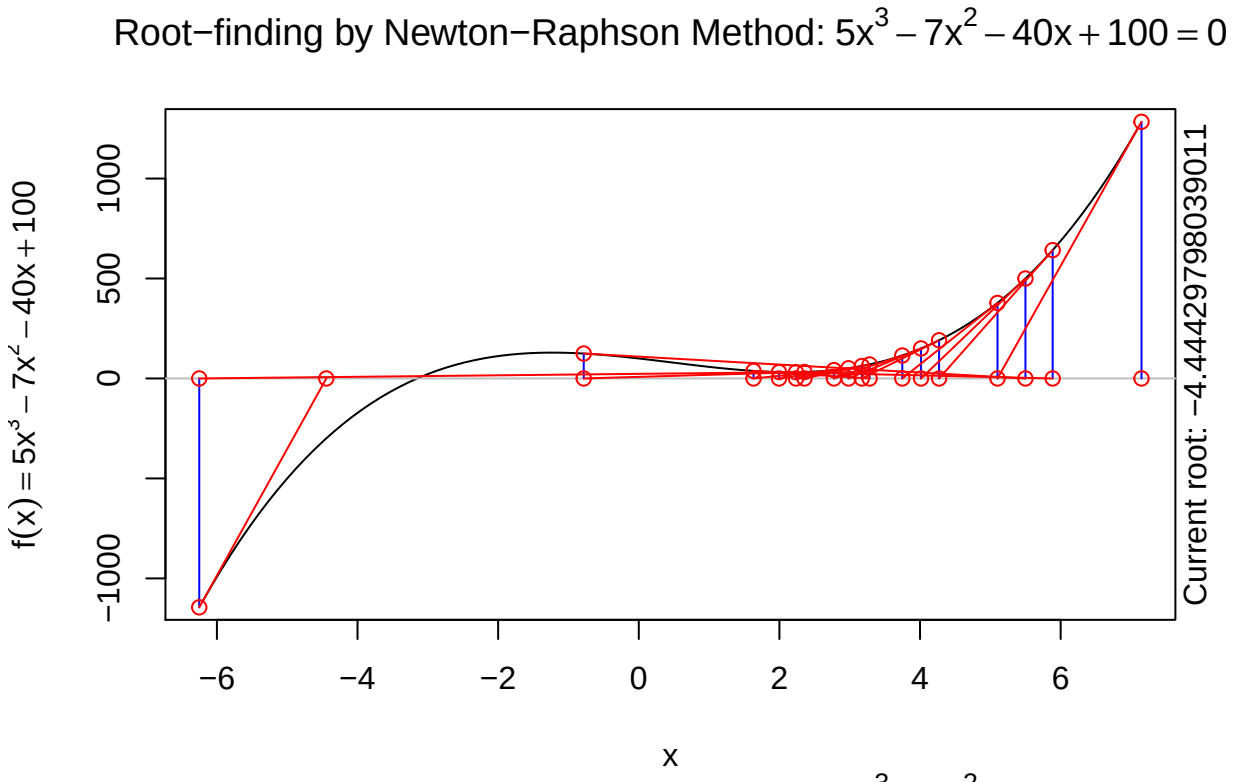

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 5.88667766654843

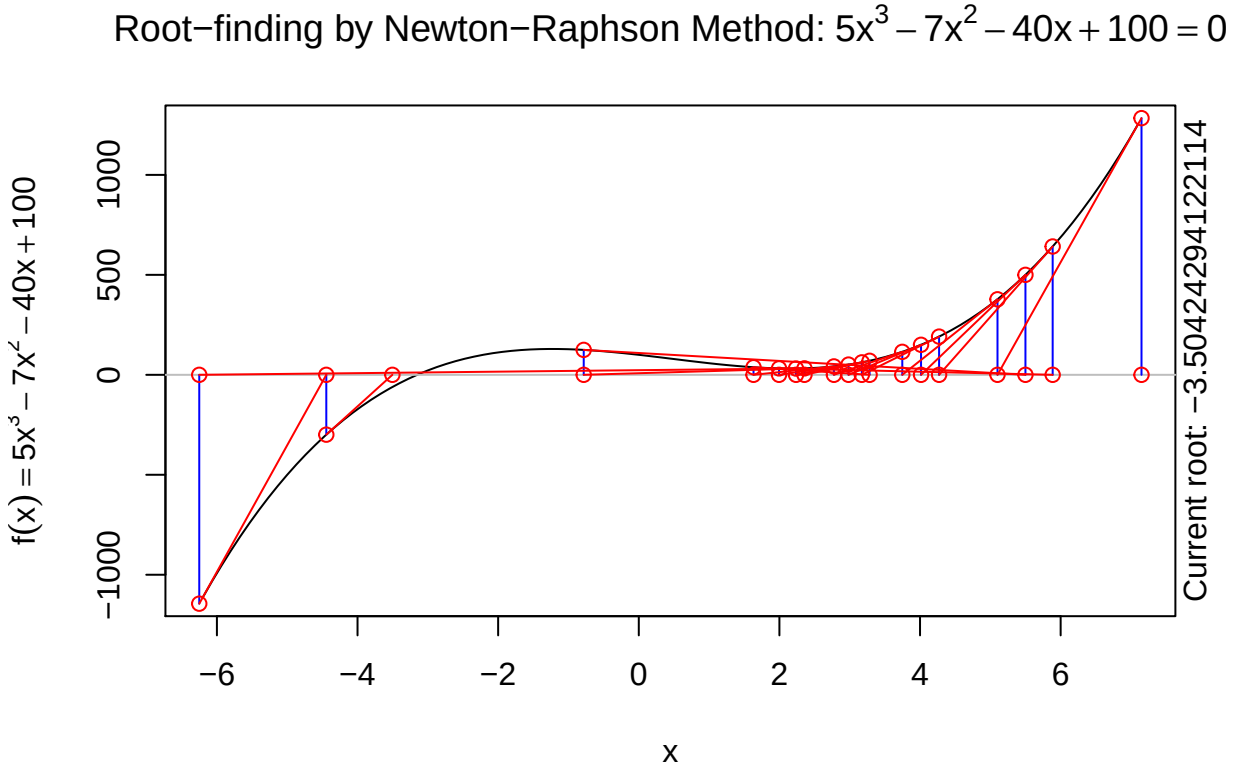

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 4.271310252958 66

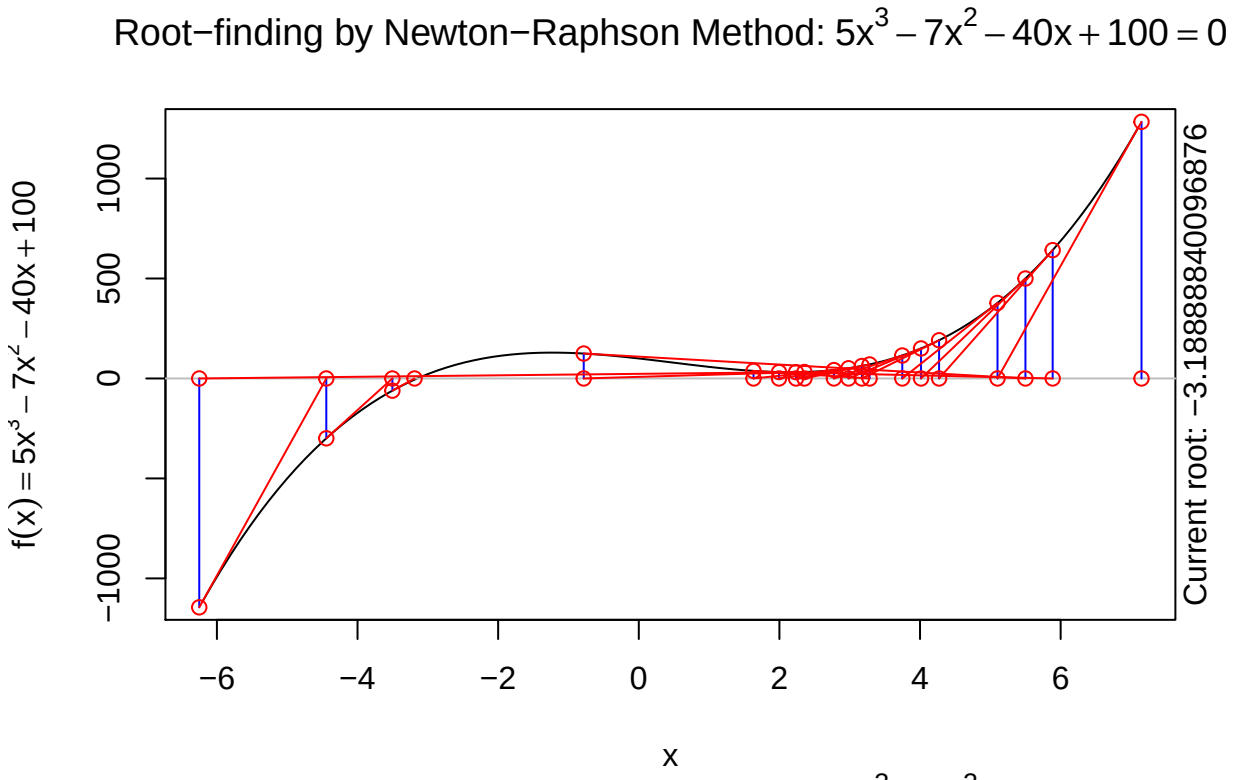

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 3.172342712821 21

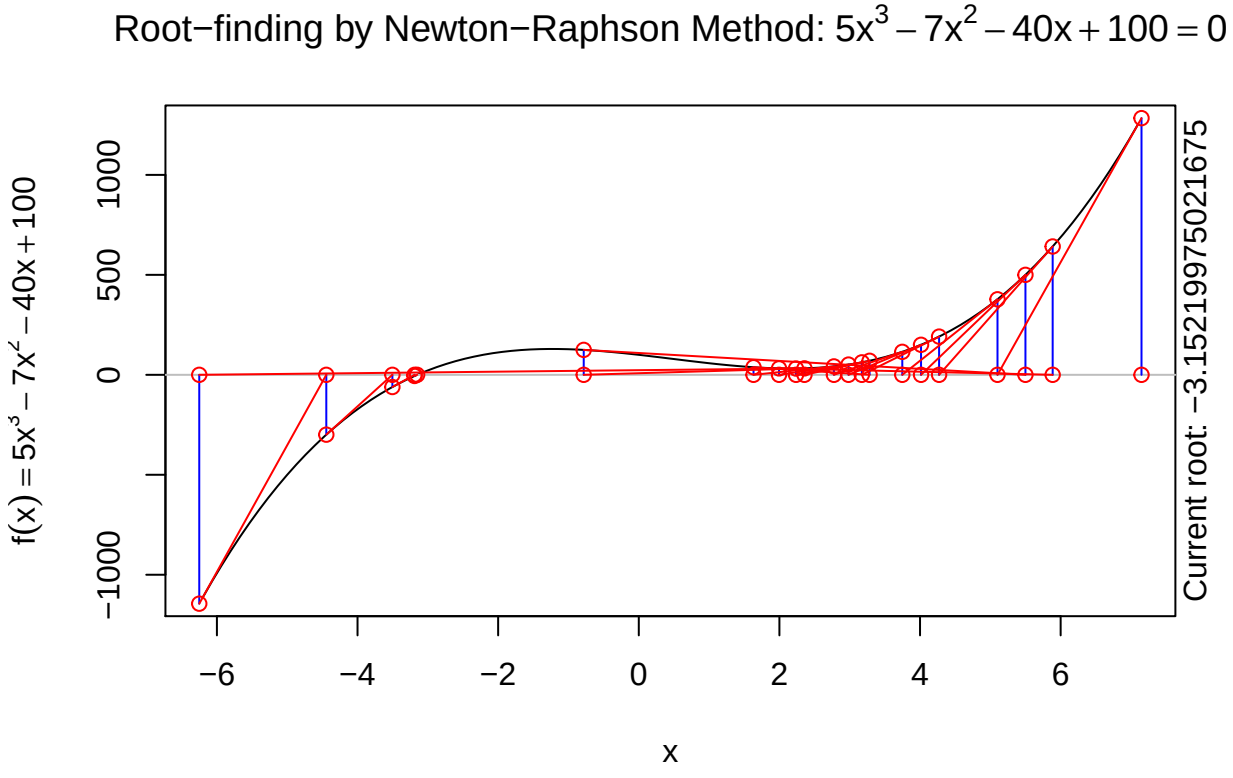

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: 2.23628790120122

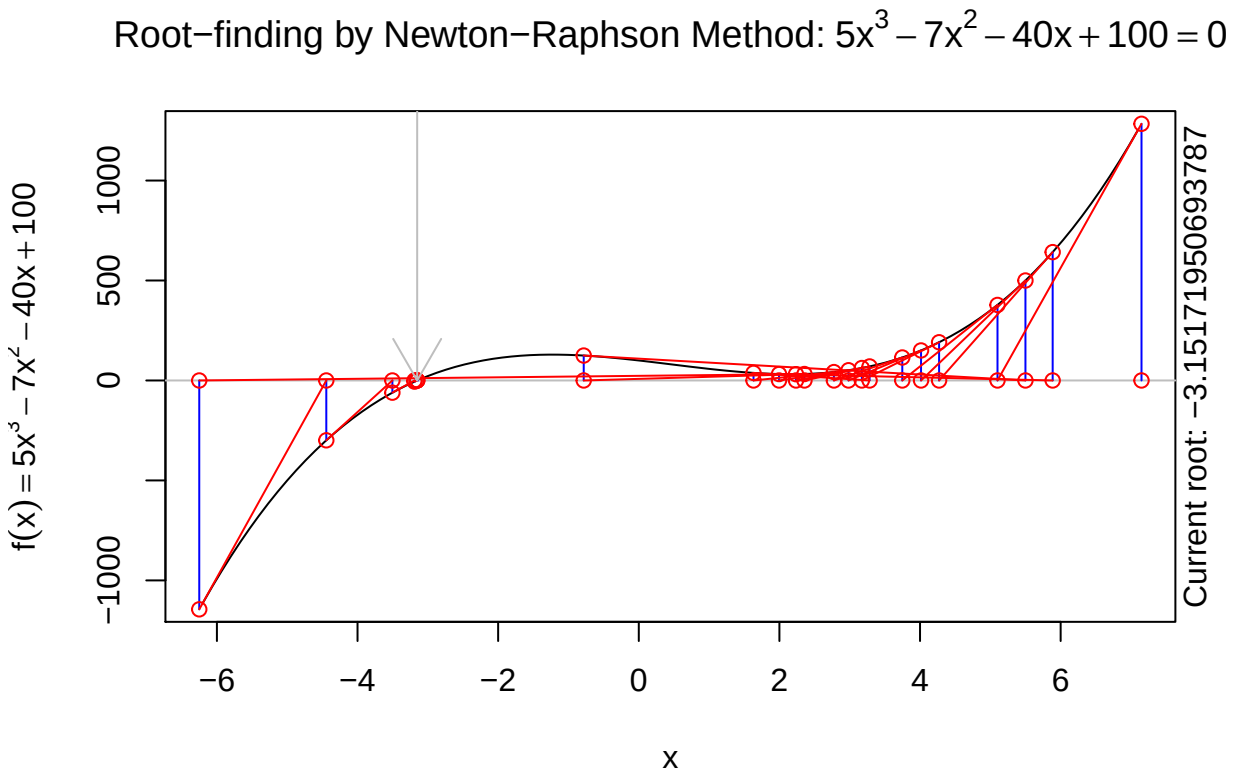

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: −6.25093758567289


Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: −4.44429798039011


Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: −3.50424294122114


Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: −3.18888840096876

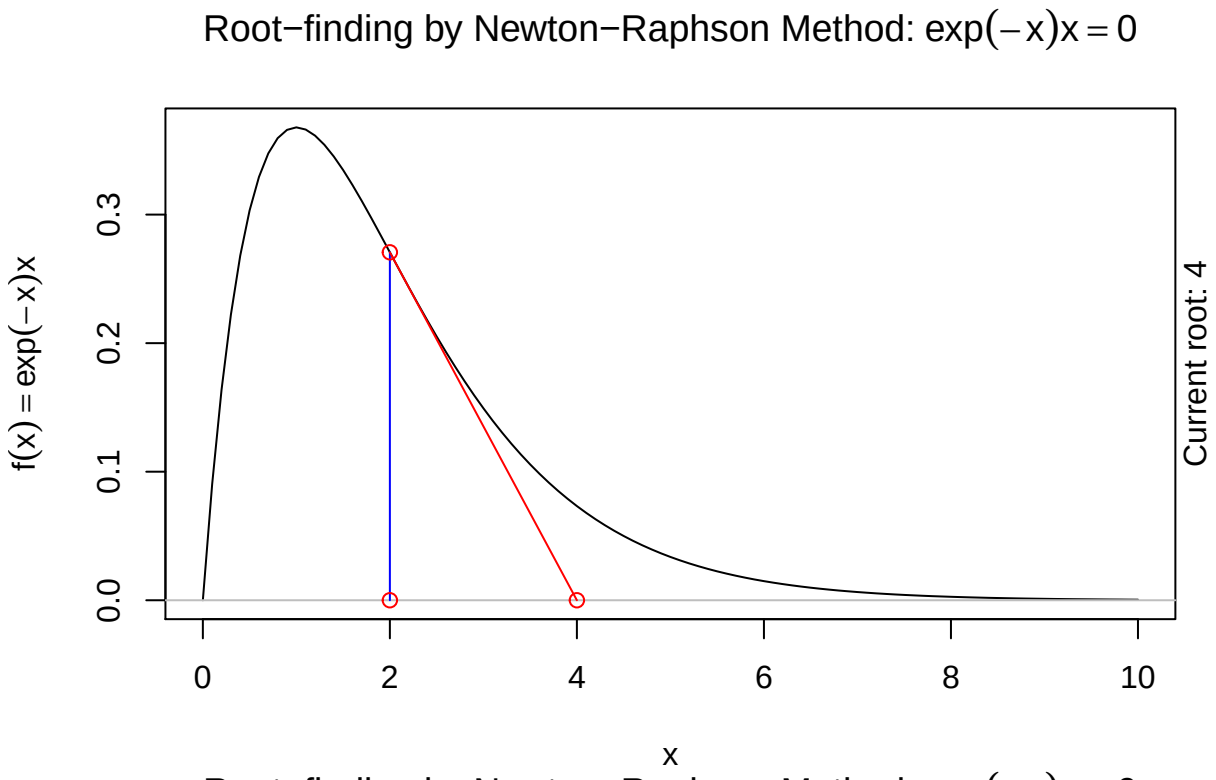

Root−finding by Newton−Raphson Method: $5x^3 - 7x^2 - 40x + 100 = 0$
$f(x) = 5x^3 - 7x^2 - 40x + 100$
1000
500
0
−1000
−6
−4
−2
0
2
4
6
x
Current root: −3.15219975021675

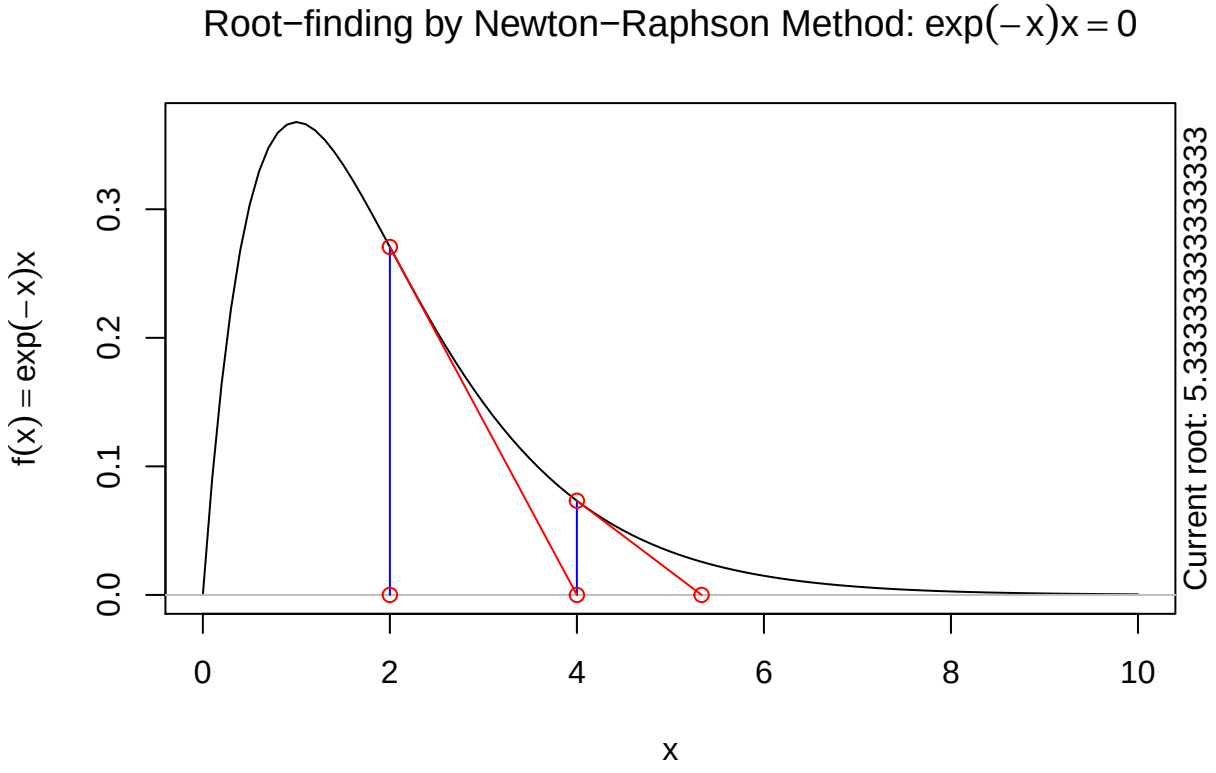


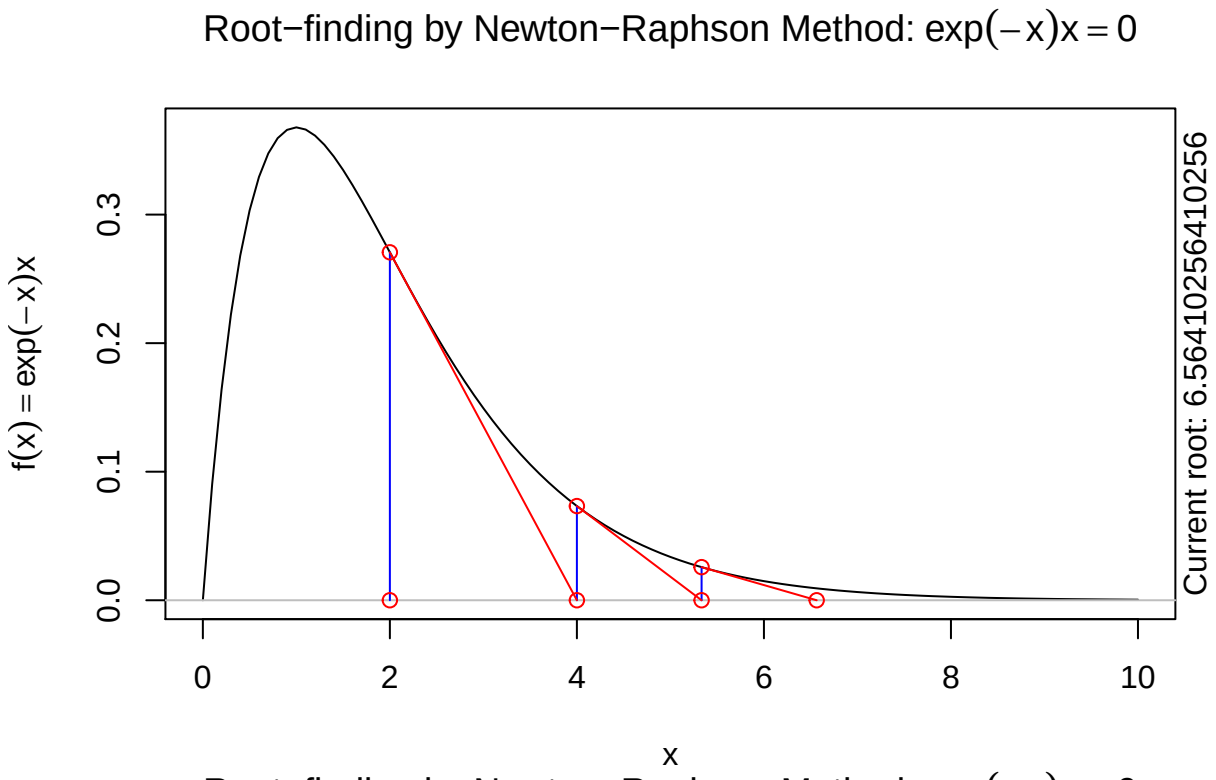

```
f2$root
```

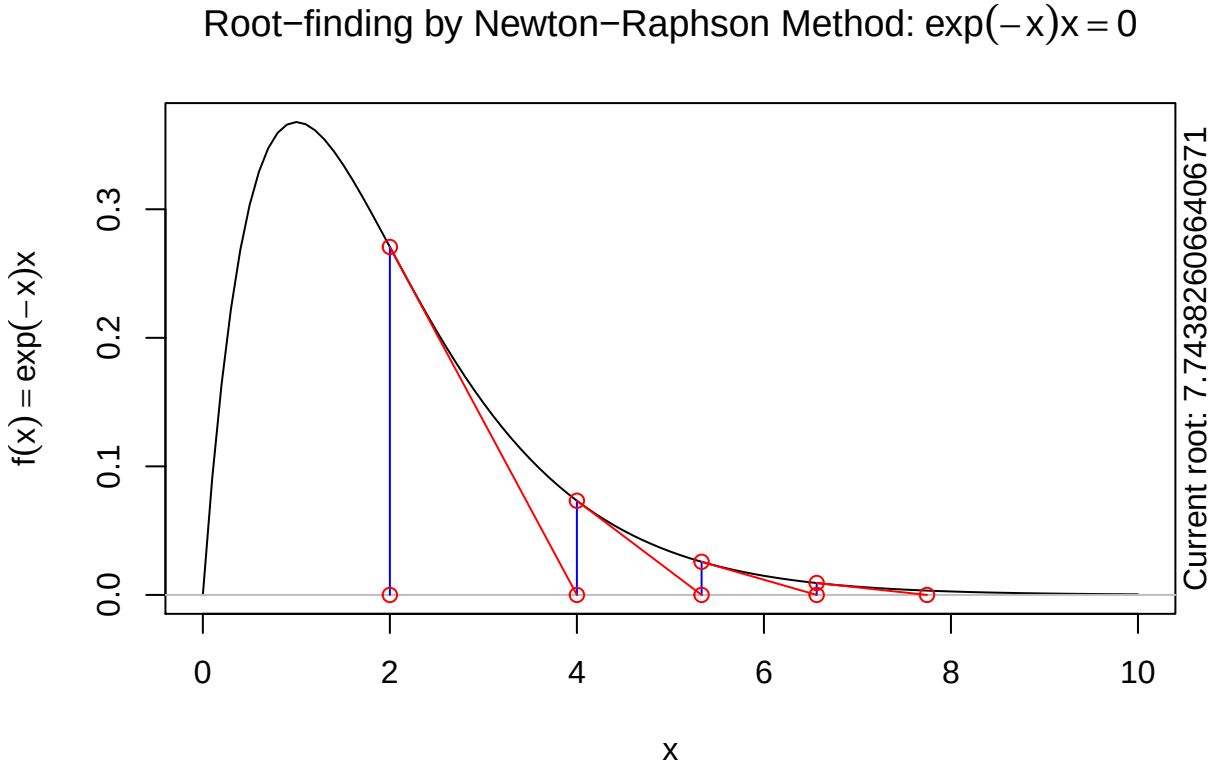
```
## [1] -3.15172
```

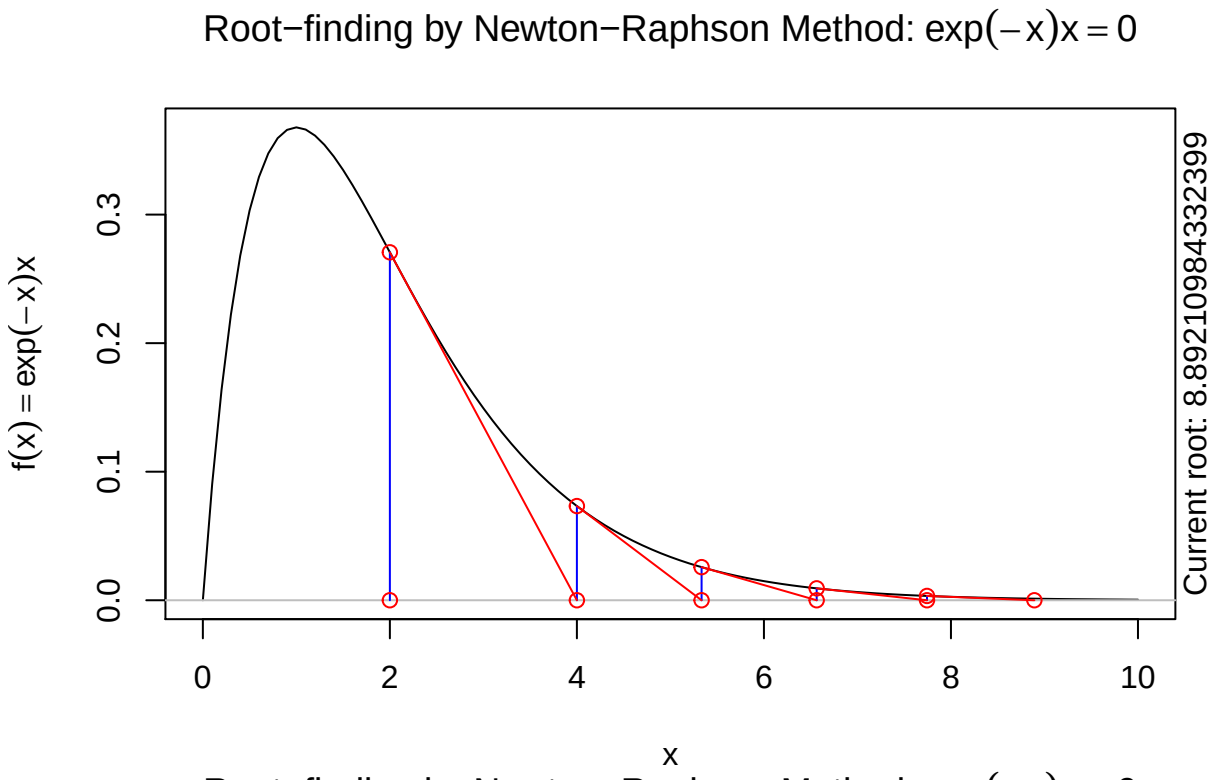
```
## another function
ani.options(interval = 0.5)
xx = newton.method(function(x) exp(-x) * x, rg = c(0, 10), init = 2)
```

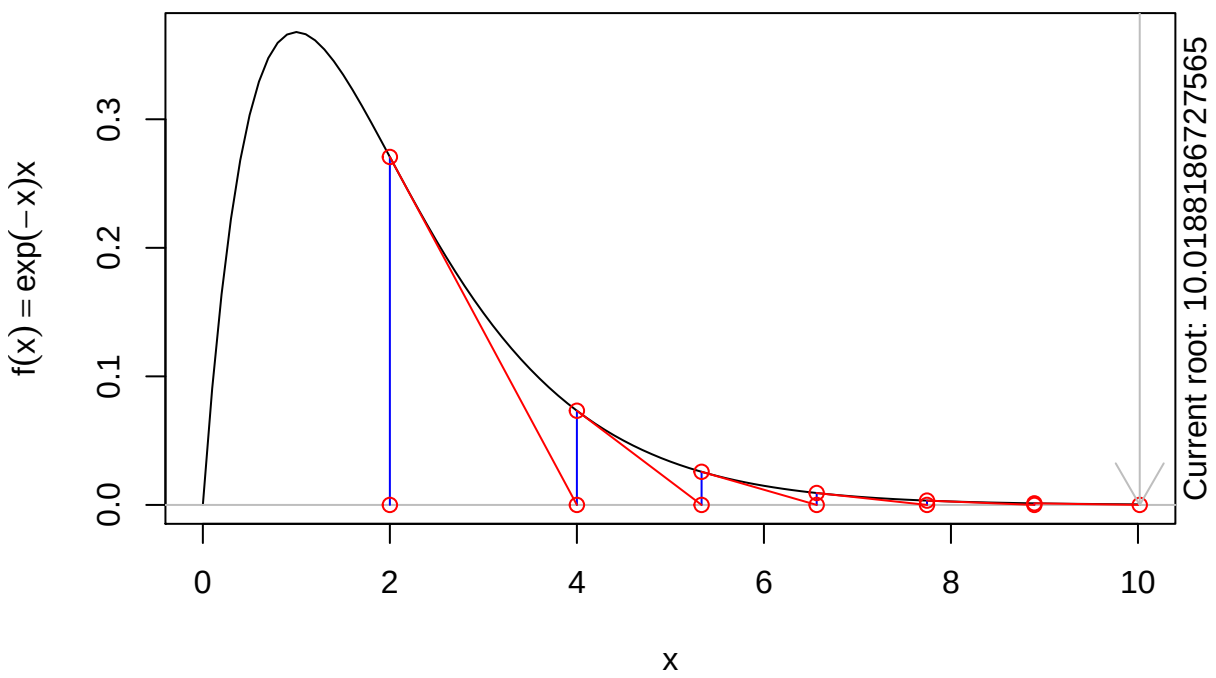

Root−finding by Newton−Raphson Method: exp(−x)x = 0
f(x) = exp(−x)x
0.0
0.1
0.2
0.3
0
2
4
6
8
10
x
Current root: 4


Root−finding by Newton−Raphson Method: exp(−x)x = 0
f(x) = exp(−x)x
0.0
0.1
0.2
0.3
0
2
4
6
8
10
x
Current root: 5.33333333333333

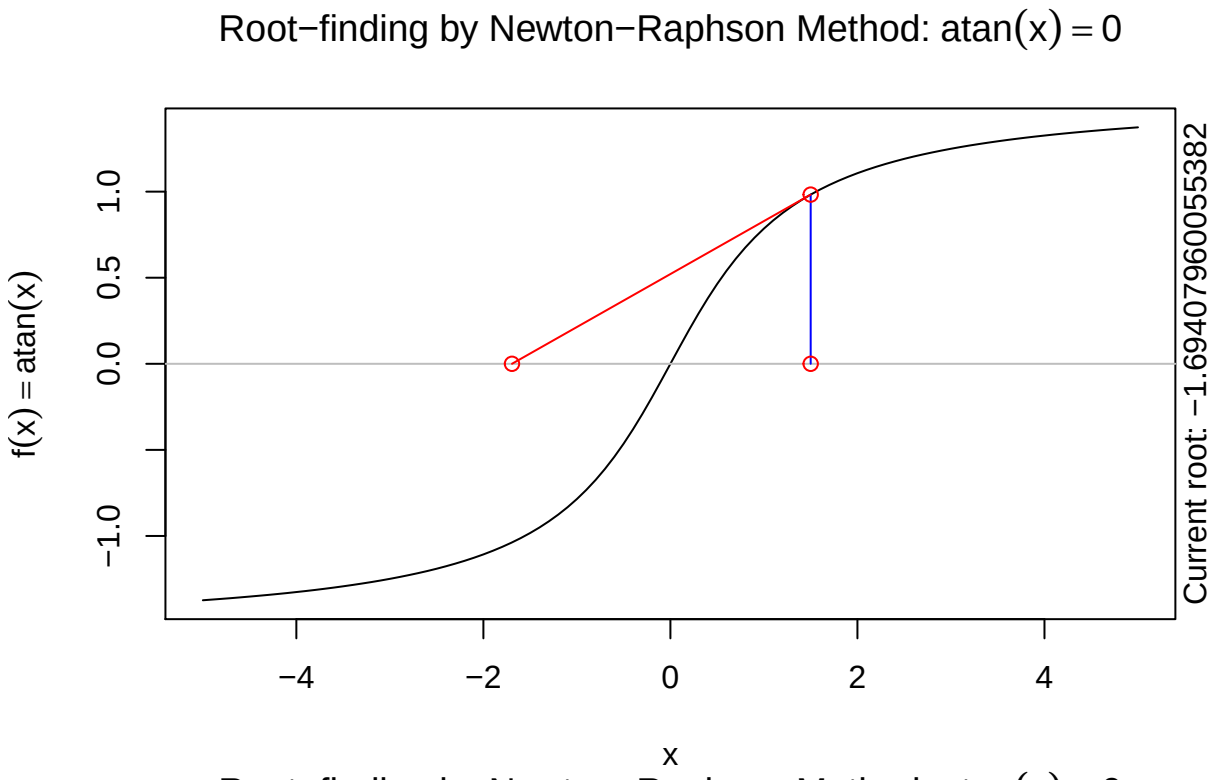

Root−finding by Newton−Raphson Method: exp(−x)x = 0
f(x) = exp(−x)x
0.0
0.1
0.2
0.3
0
2
4
6
8
10
x
Current root: 6.56410256410256

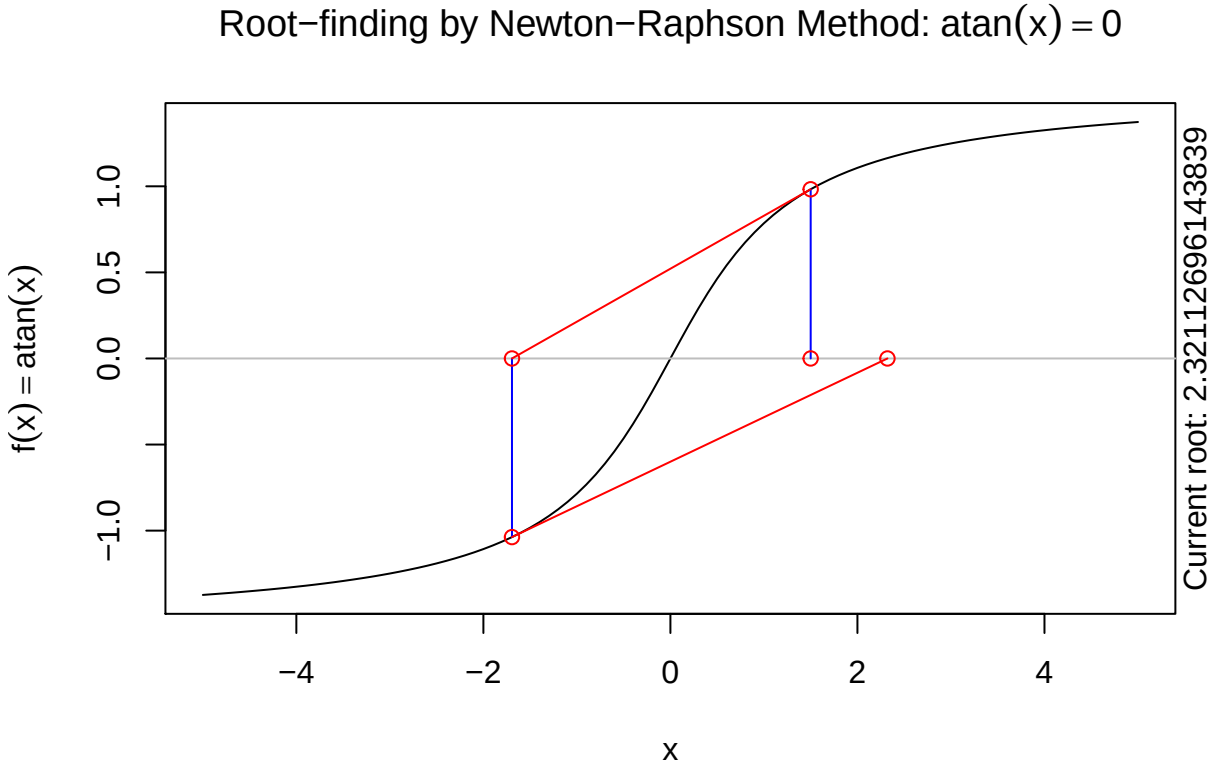

Root−finding by Newton−Raphson Method: exp(−x)x = 0
f(x) = exp(−x)x
0.0
0.1
0.2
0.3
0
2
4
6
8
10
x
Current root: 7.74382606640671

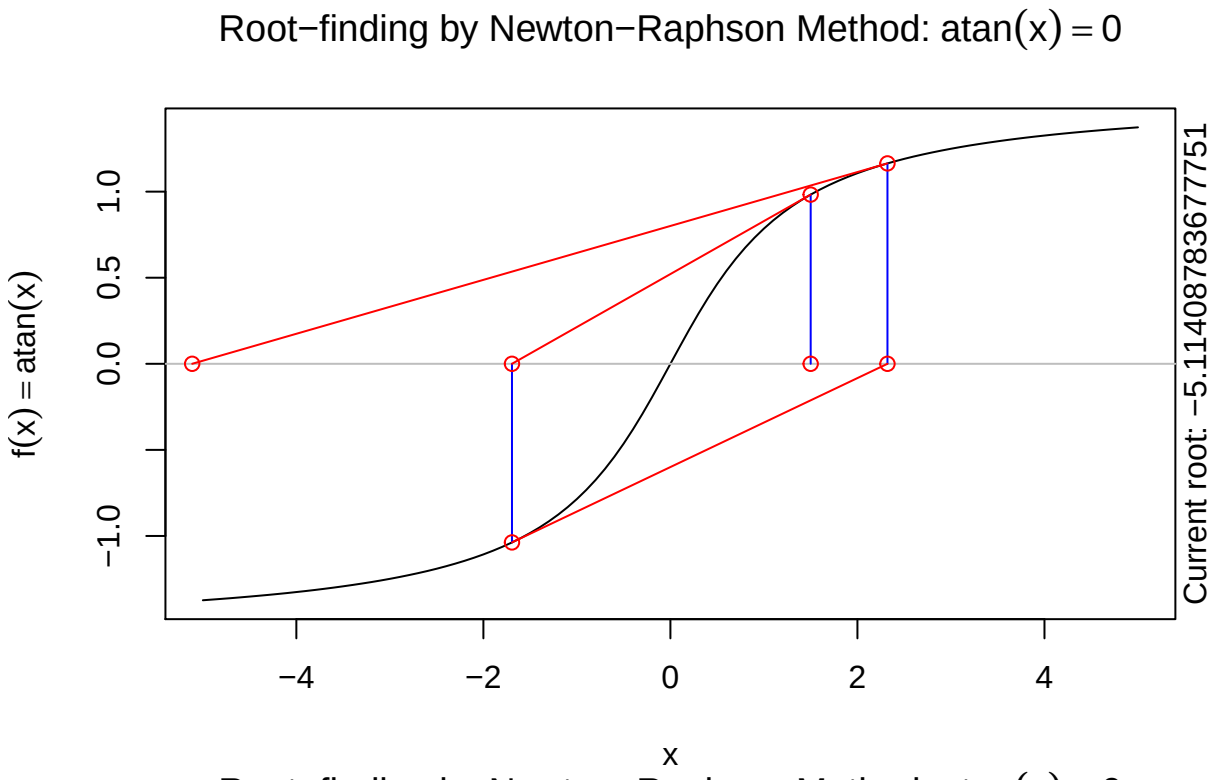


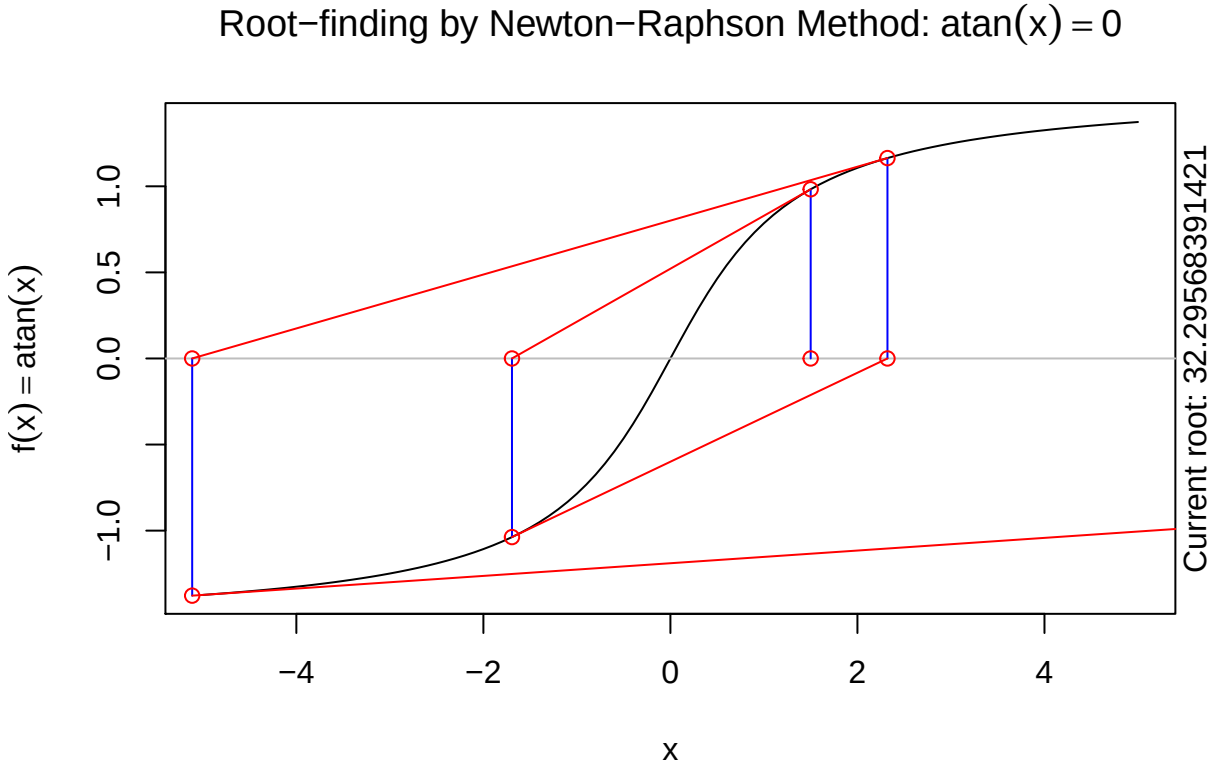


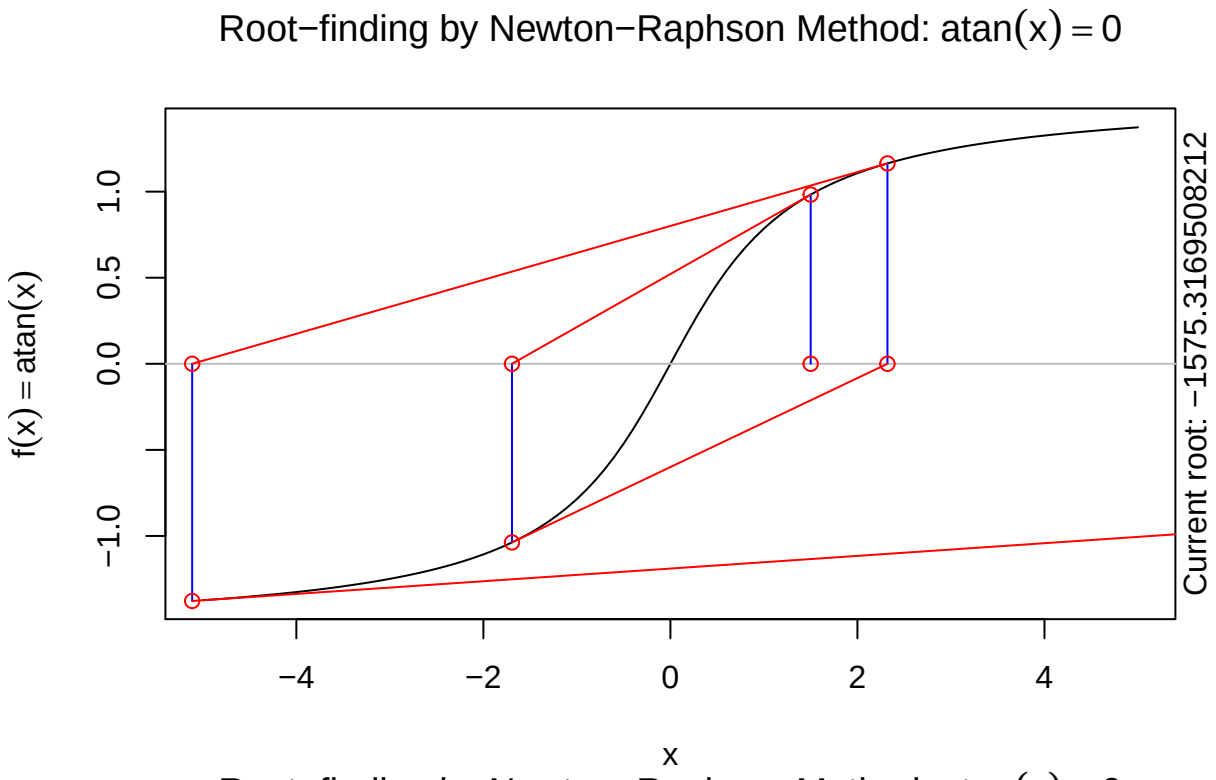

```
## does not converge!
xx = newton.method(function(x) atan(x), rg = c(-5, 5), init = 1.5)
```

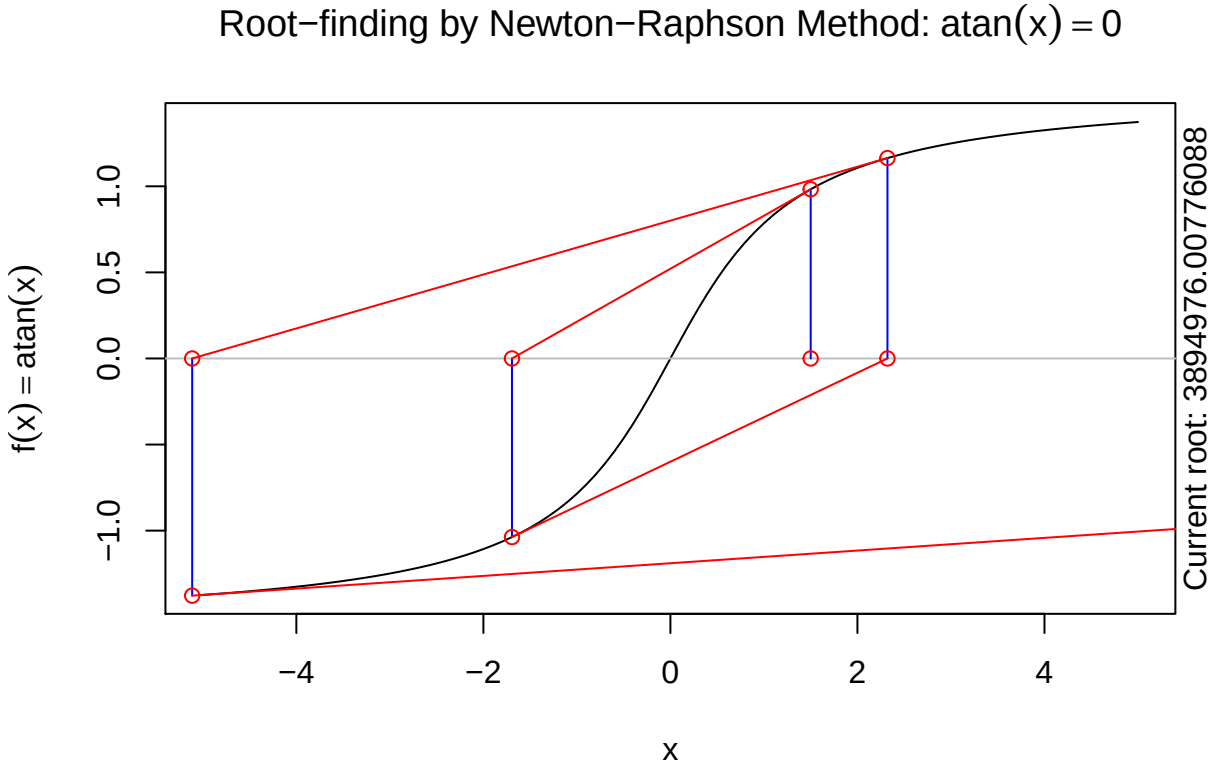

Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: −1.69407960055382

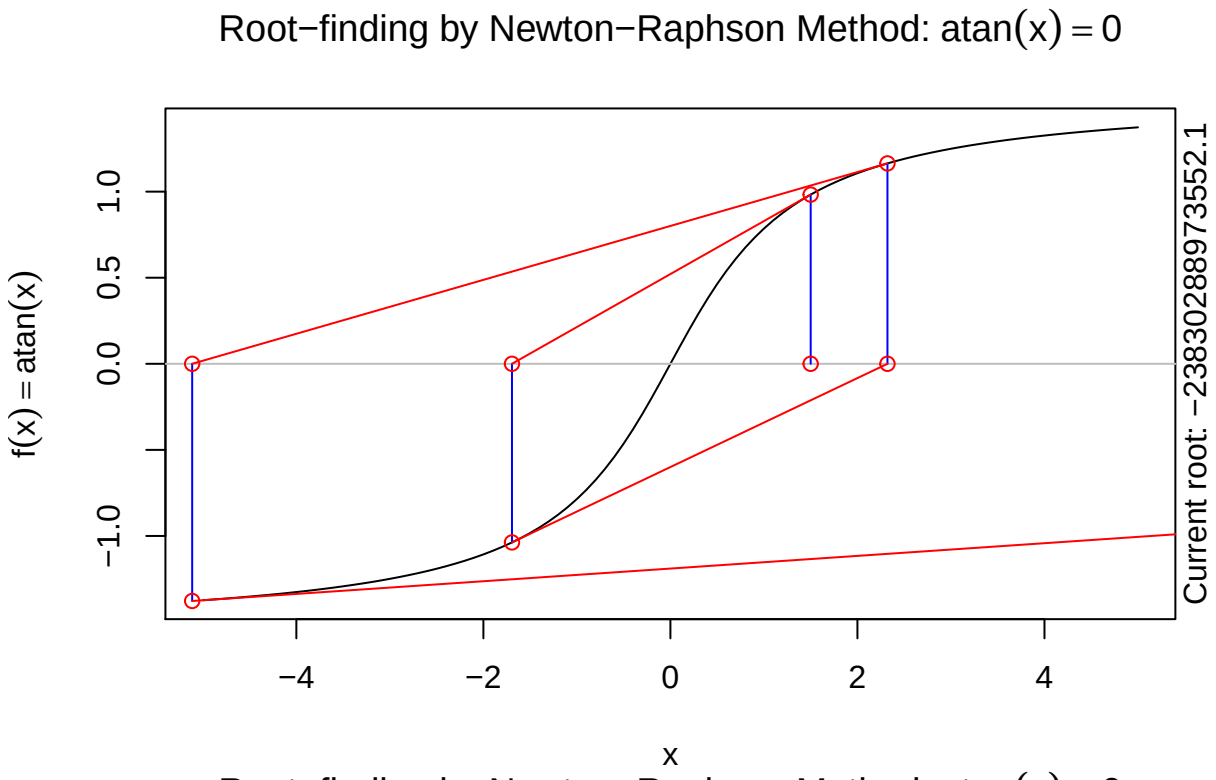

Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: 2.32112696143839

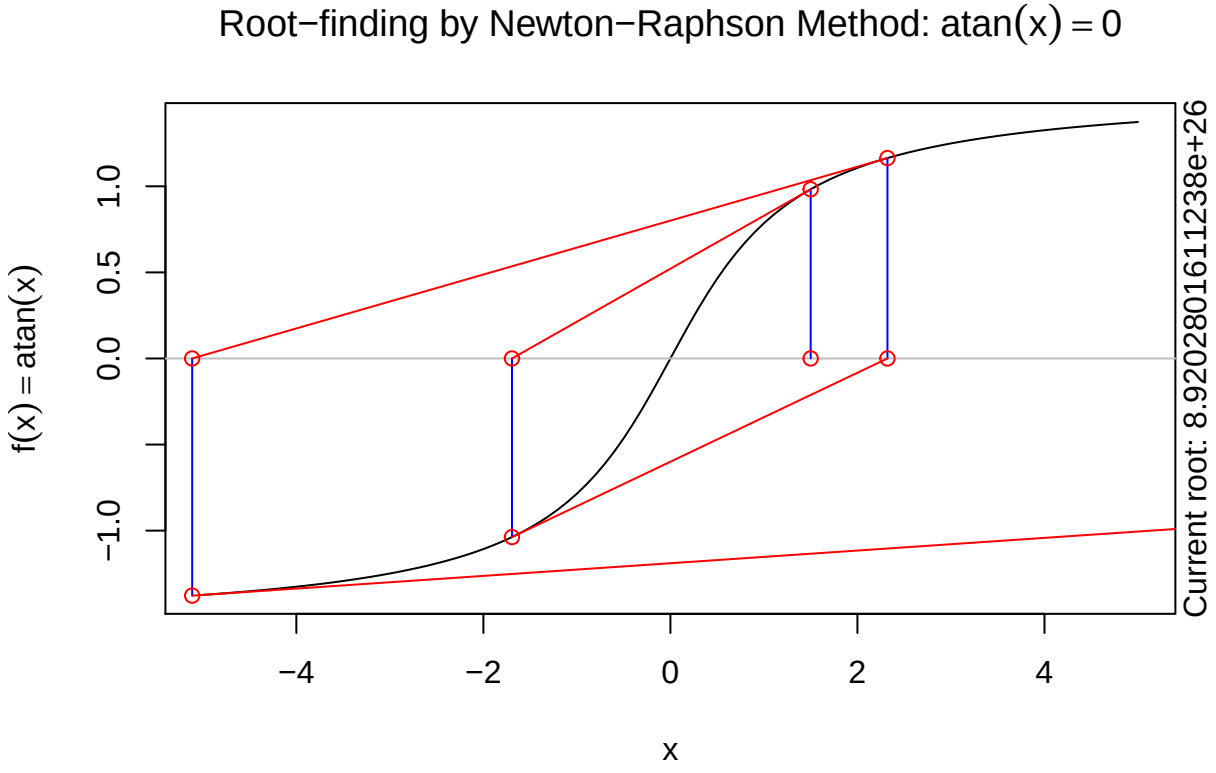

Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: −5.11408783677751

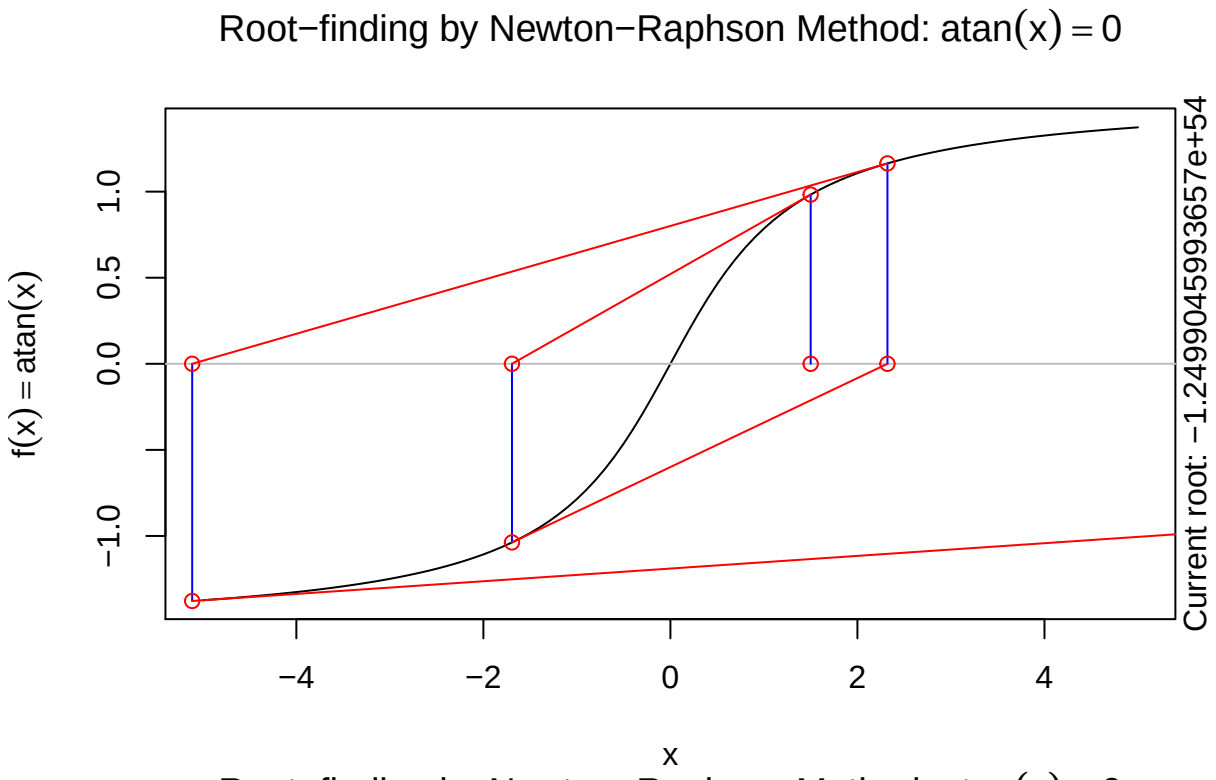

Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: 32.29568391421

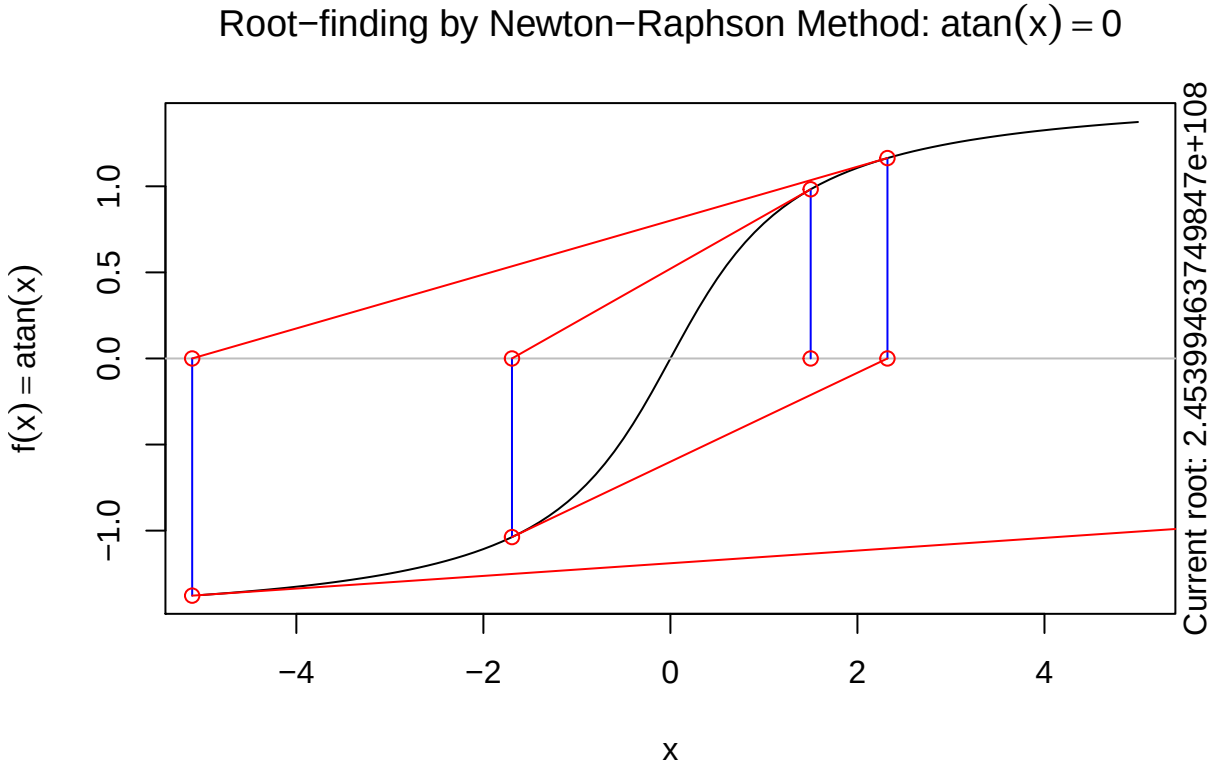

Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: −1575.3169508212

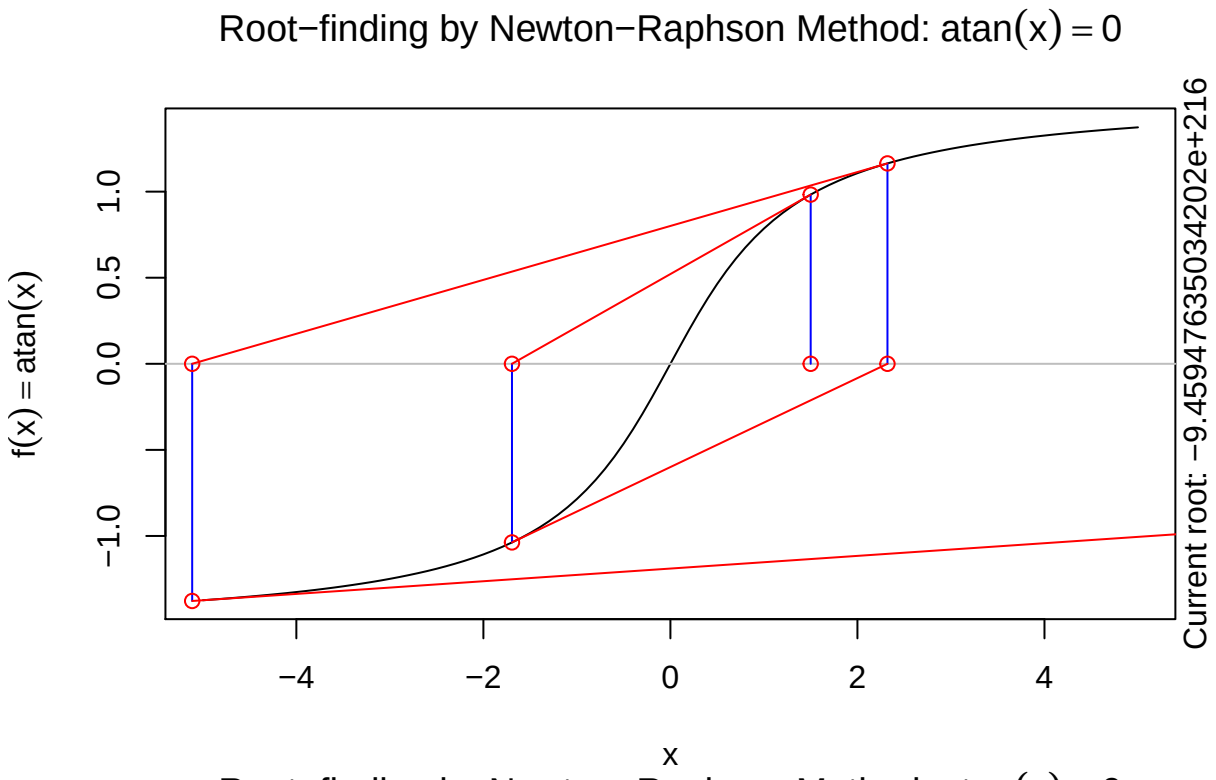

Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: 3894976.00776088

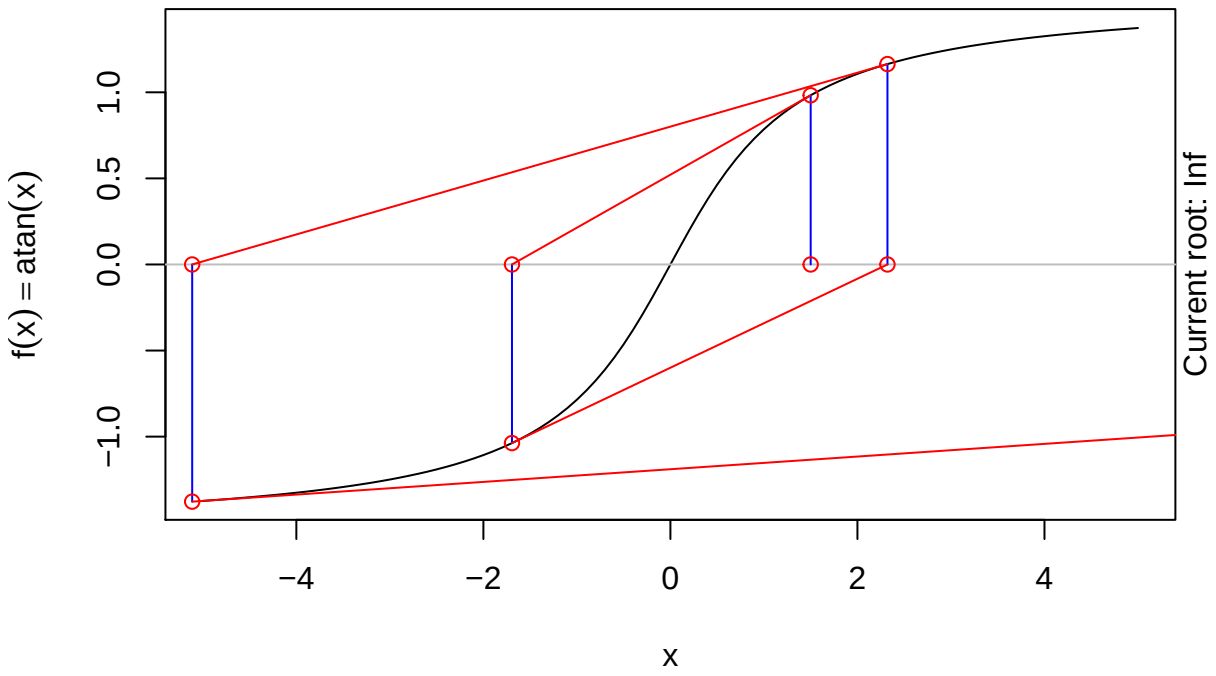

Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: −23830288973552.1


Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: 8.92028016111238e+26


Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: −1.24990459936 57e+54


Root−finding by Newton−Raphson Method: atan(x) = 0
f(x) = atan(x)
1.0
0.5
0.0
−1.0
−4
−2
0
2
4
x
Current root: 2.45399463749847e+108






```
xx$root # Inf
```

```
## [1] Inf
```