Figure 1: timing-pattern

1

time (s)

30

25

20

15

10

5

0

0   2,000   4,000   6,000   8,000   10,000   12,000   14,000   16,000

0-univ-count

Legend:

○ abstract-real
— $9.94 \cdot 10^{-8} \cdot x^2 + 4.05 \cdot 10^{-4} \cdot x$
∗ abstract-user
— $9.94 \cdot 10^{-8} \cdot x^2 + 4.02 \cdot 10^{-4} \cdot x$
⋆ close-abstract-real
— $9.91 \cdot 10^{-8} \cdot x^2 + 3.27 \cdot 10^{-4} \cdot x$
⊕ close-abstract-user
— $9.91 \cdot 10^{-8} \cdot x^2 + 3.26 \cdot 10^{-4} \cdot x$
⊗ exact-real
— $8.14 \cdot 10^{-5} \cdot x - 5.53$
□ exact-user
— $8.05 \cdot 10^{-5} \cdot x - 6.13$
■ abstract-sys
△ close-abstract-sys
▲ exact-sys

Figure 2: timing-n-polymorphic-universes param-1-n 0

time (s)

100

80

60

40

20

0

0   50   100   150   200   250   300   350   400

n

repeat-seto

$2.21 \cdot 10^{-6} \cdot x^3 - 1.87 \cdot 10^{-}$

repeat-seto

$2.21 \cdot 10^{-6} \cdot x^3 - 1.88 \cdot 10^{-}$

abstract+se

$1.16 \cdot 10^{-6} \cdot x^3 - 8.62 \cdot 10^{-}$

abstract+se

$1.15 \cdot 10^{-6} \cdot x^3 - 8.51 \cdot 10^{-}$

setoid-r

$1.15 \cdot 10^{-6} \cdot x^3 - 1.07 \cdot 10^{-}$

setoid-r

$1.15 \cdot 10^{-6} \cdot x^3 - 1.06 \cdot 10^{-}$

noop-try-set

$1.12 \cdot 10^{-6} \cdot x^3 - 9.62 \cdot 10^{-5} \cdot$

noop-try-set

$1.11 \cdot 10^{-6} \cdot x^3 - 9.61 \cdot 10$

noop-repeat-s

$1.07 \cdot 10^{-6} \cdot x^3 - 7.9 \cdot 10^{-5} \cdot$

noop-repeat-s

$1.07 \cdot 10^{-6} \cdot x^3 - 7.82 \cdot 10^{-5} \cdot$

close-abstract+

$2.23 \cdot 10^{-5} \cdot x^2 + 4.3$

close-abstract+

$2.23 \cdot 10^{-5} \cdot x^2 + 4.1$

repeat-seto

setoid-r

abstract+se

noop-try-set

noop-repeat-s

close-abstract+

Figure 3: timing-repeat-setoid-rewrite-under-binders

3
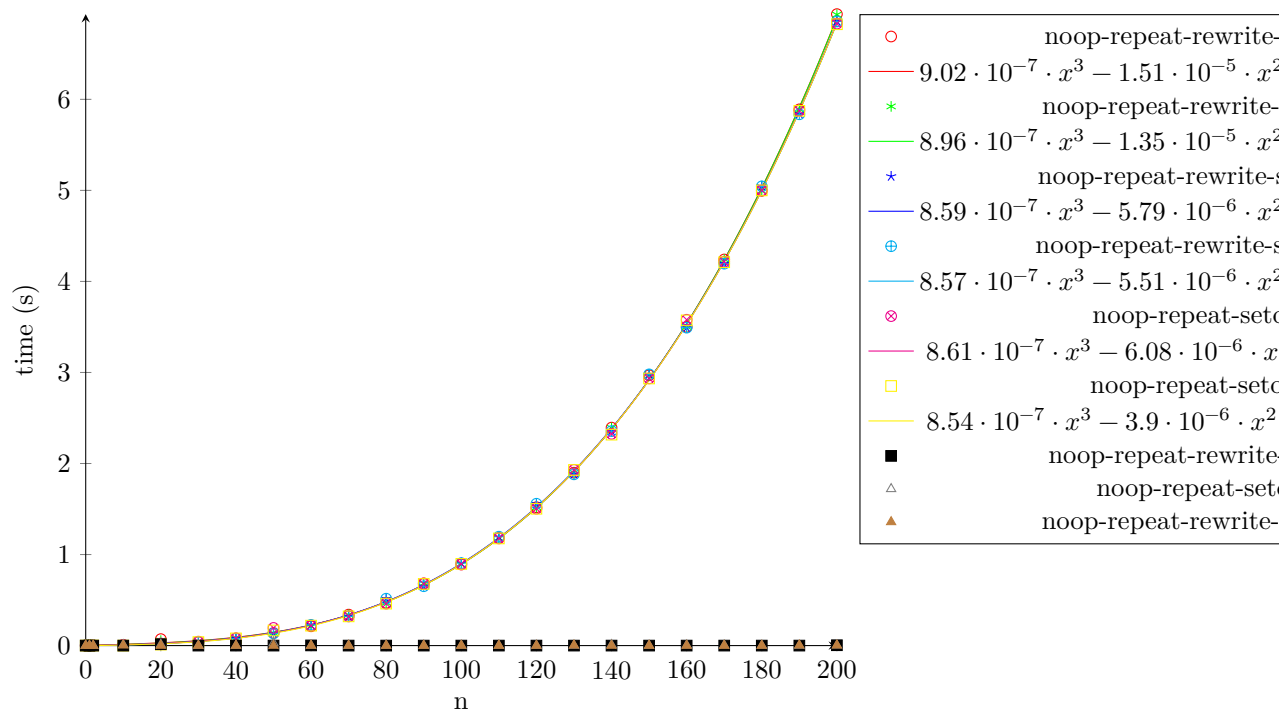
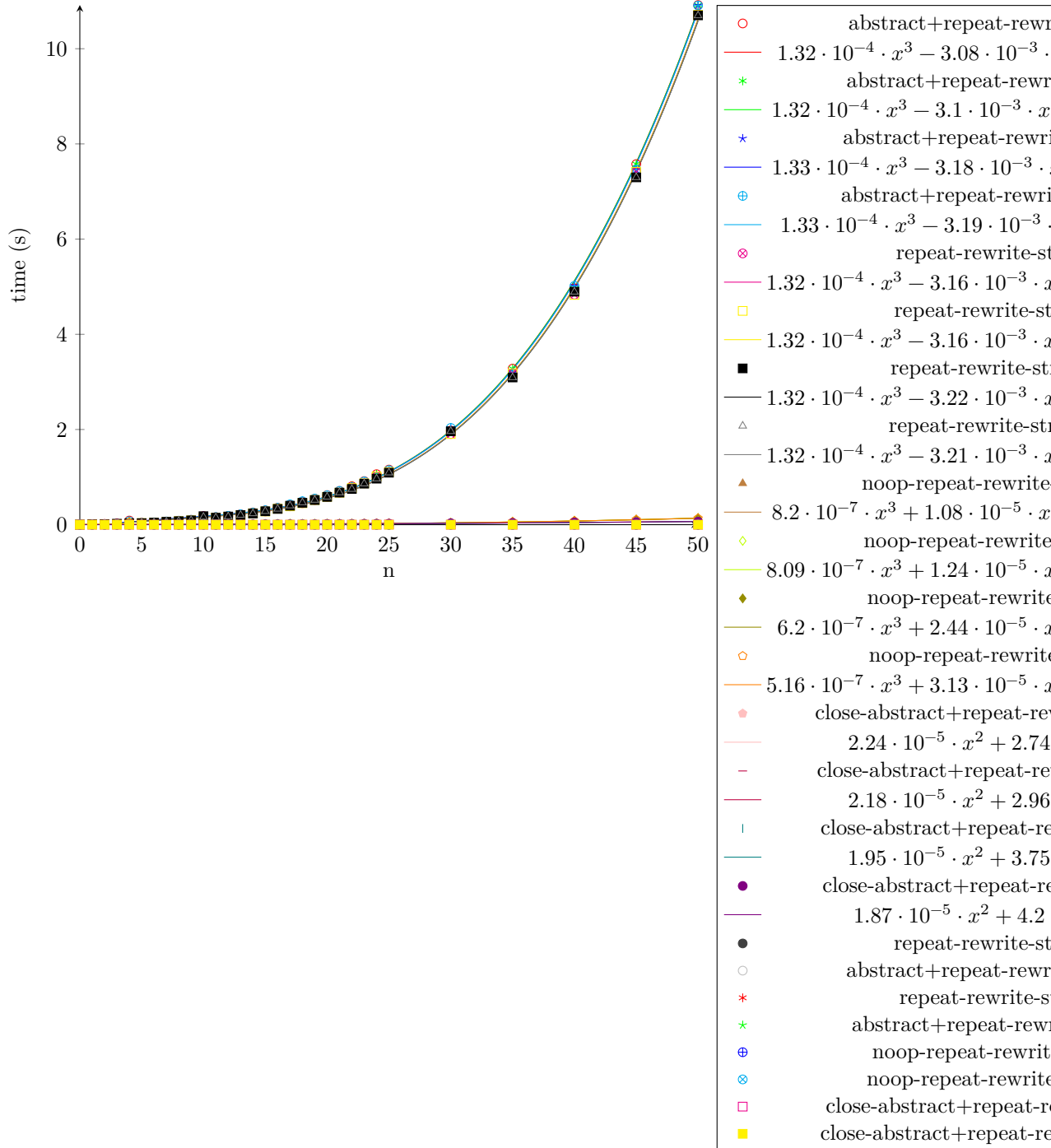Figure 4: timing-repeat-setoid-rewrite-under-binders-noop
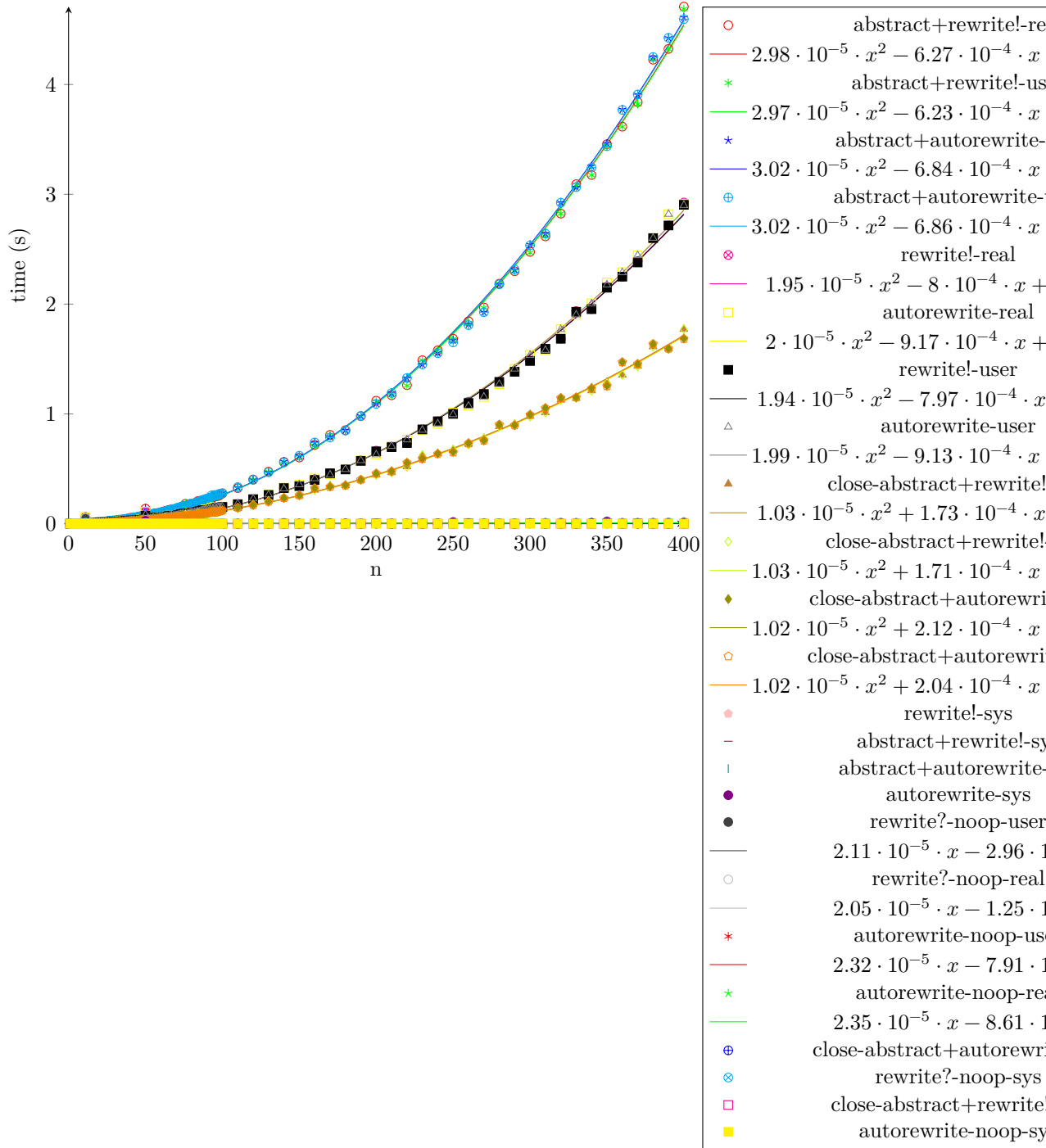
Figure 5: timing-rewrite-strat-under-binders

The figure legend entries:

- abstract+rewrite!-re...
- $2.98 \cdot 10^{-5} \cdot x^2 - 6.27 \cdot 10^{-4} \cdot x$
- abstract+rewrite!-us...
- $2.97 \cdot 10^{-5} \cdot x^2 - 6.23 \cdot 10^{-4} \cdot x$
- abstract+autorewrite-...
- $3.02 \cdot 10^{-5} \cdot x^2 - 6.84 \cdot 10^{-4} \cdot x$
- abstract+autorewrite-...
- $3.02 \cdot 10^{-5} \cdot x^2 - 6.86 \cdot 10^{-4} \cdot x$
- rewrite!-real
- $1.95 \cdot 10^{-5} \cdot x^2 - 8 \cdot 10^{-4} \cdot x +$
- autorewrite-real
- $2 \cdot 10^{-5} \cdot x^2 - 9.17 \cdot 10^{-4} \cdot x +$
- rewrite!-user
- $1.94 \cdot 10^{-5} \cdot x^2 - 7.97 \cdot 10^{-4} \cdot x$
- autorewrite-user
- $1.99 \cdot 10^{-5} \cdot x^2 - 9.13 \cdot 10^{-4} \cdot x$
- close-abstract+rewrite!...
- $1.03 \cdot 10^{-5} \cdot x^2 + 1.73 \cdot 10^{-4} \cdot x$
- close-abstract+rewrite!-...
- $1.03 \cdot 10^{-5} \cdot x^2 + 1.71 \cdot 10^{-4} \cdot x$
- close-abstract+autorewri...
- $1.02 \cdot 10^{-5} \cdot x^2 + 2.12 \cdot 10^{-4} \cdot x$
- close-abstract+autorewri...
- $1.02 \cdot 10^{-5} \cdot x^2 + 2.04 \cdot 10^{-4} \cdot x$
- rewrite!-sys
- abstract+rewrite!-sy...
- abstract+autorewrite-...
- autorewrite-sys
- rewrite?-noop-user
- $2.11 \cdot 10^{-5} \cdot x - 2.96 \cdot 1...$
- rewrite?-noop-real
- $2.05 \cdot 10^{-5} \cdot x - 1.25 \cdot 1...$
- autorewrite-noop-us...
- $2.32 \cdot 10^{-5} \cdot x - 7.91 \cdot 1...$
- autorewrite-noop-re...
- $2.35 \cdot 10^{-5} \cdot x - 8.61 \cdot 1...$
- close-abstract+autorewri...
- rewrite?-noop-sys
- close-abstract+rewrite!...
- autorewrite-noop-sy...

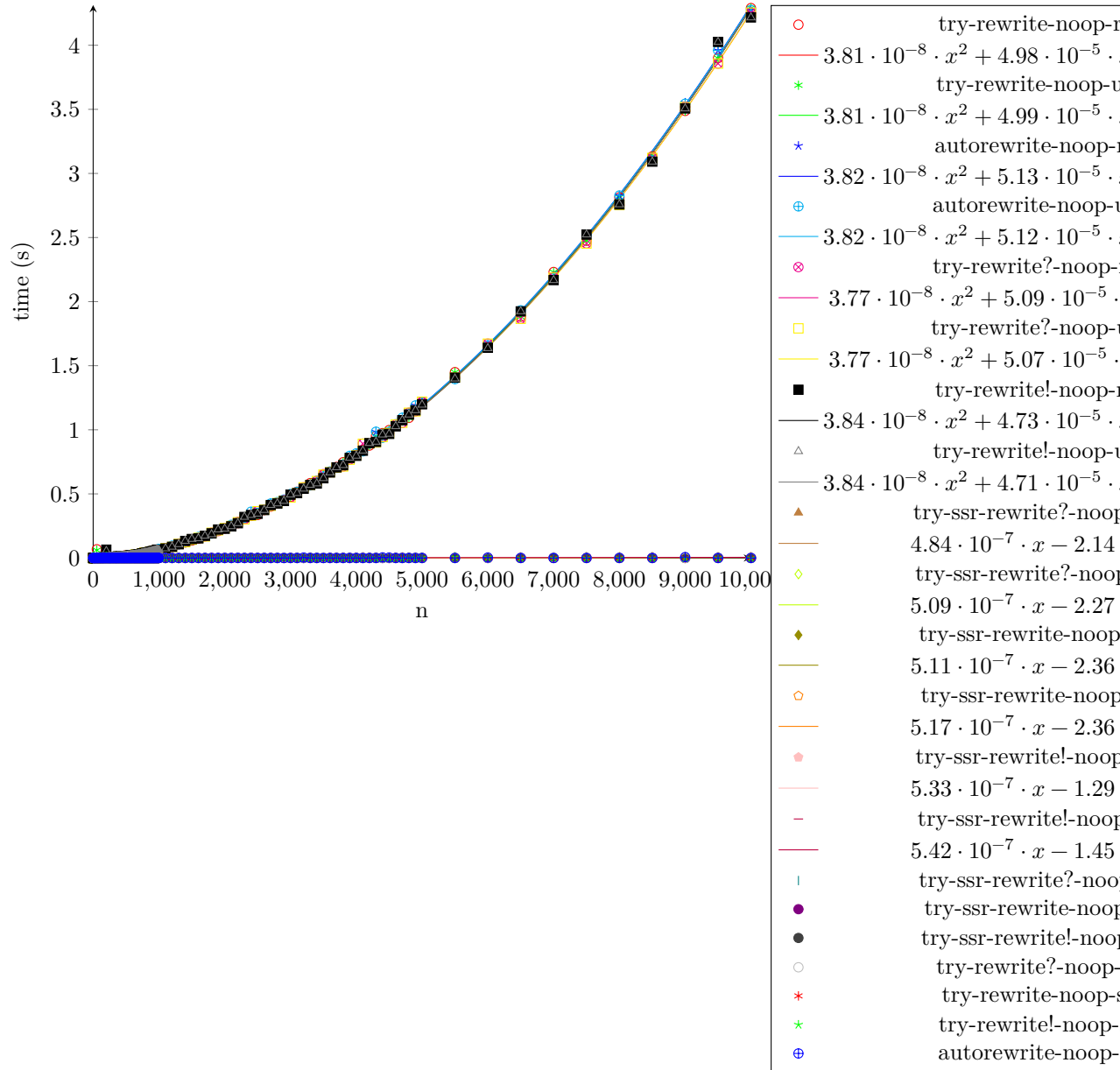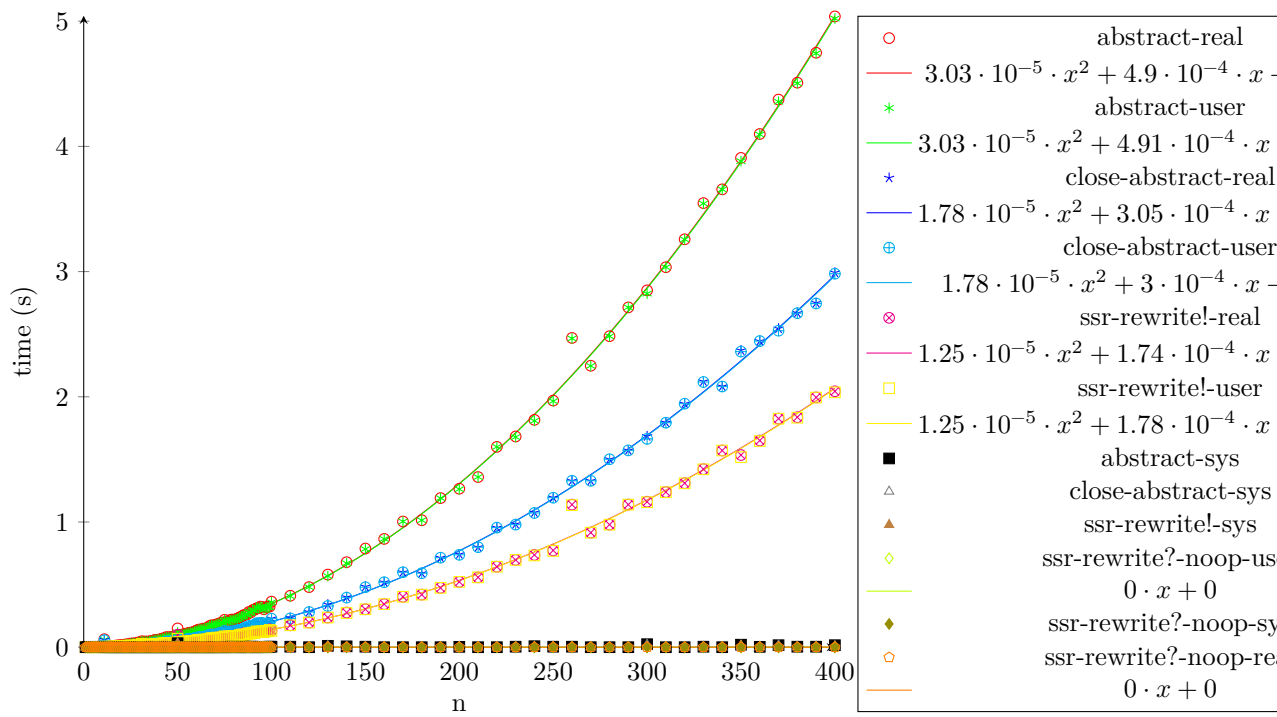Figure 6: timing-rewrite-repeated-app-autorewrite

Figure 7: timing-rewrite-repeated-app-autorewrite-noop
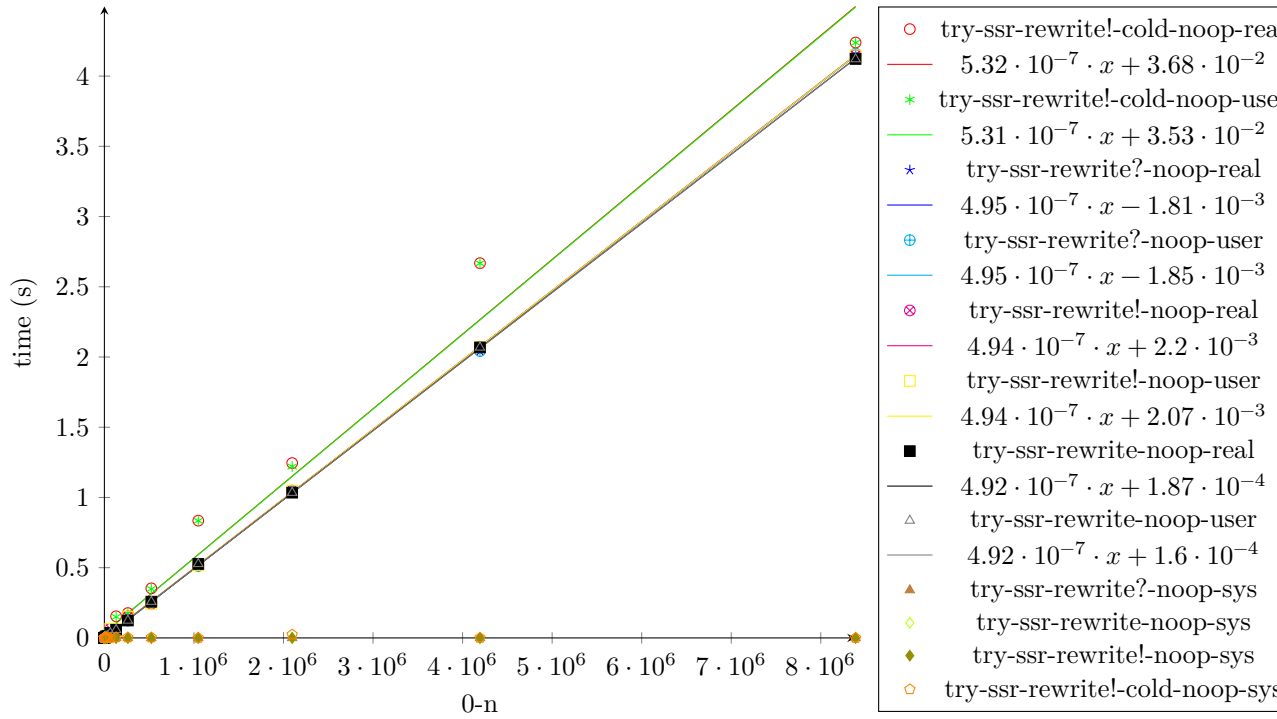
Figure 8: timing-rewrite-repeated-app-ssrrewrite

Figure 9: timing-rewrite-repeated-app-ssrrewrite-noop param-1-lgn 1
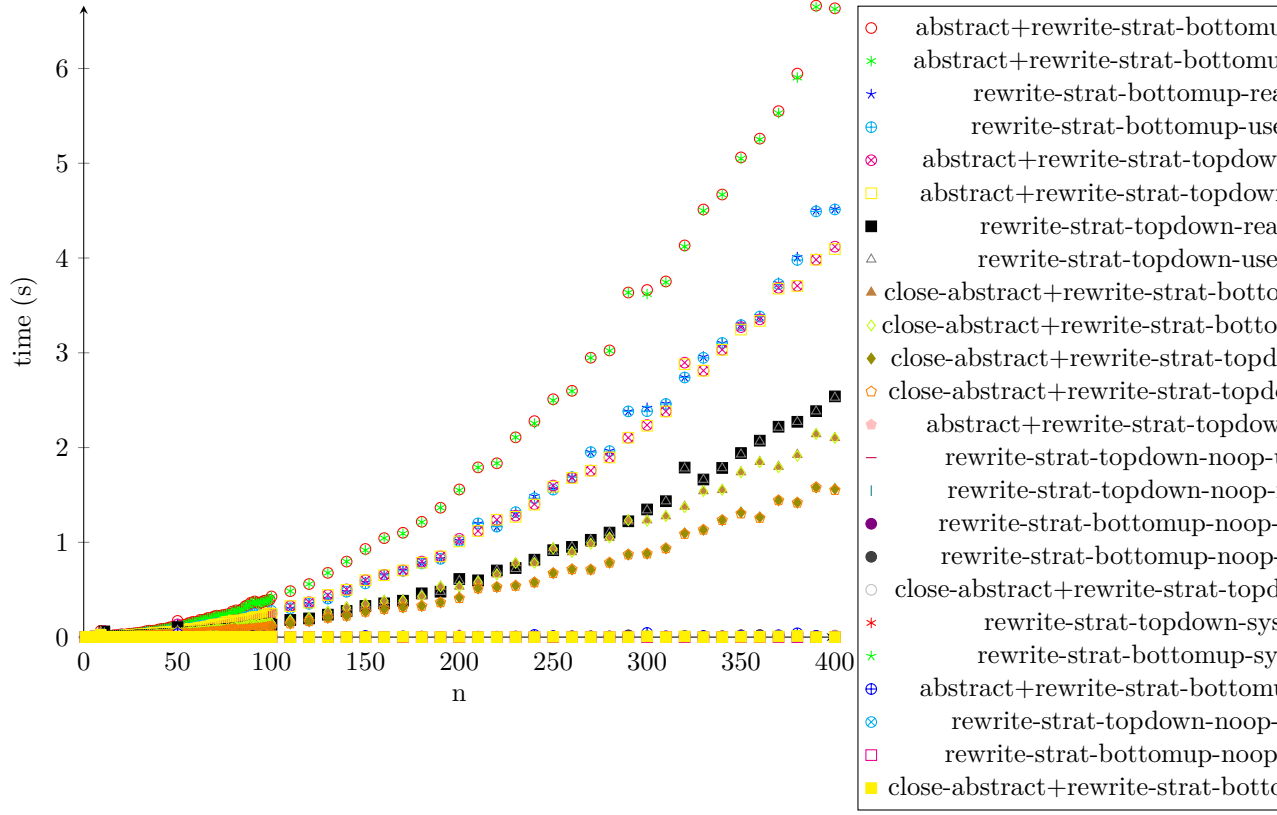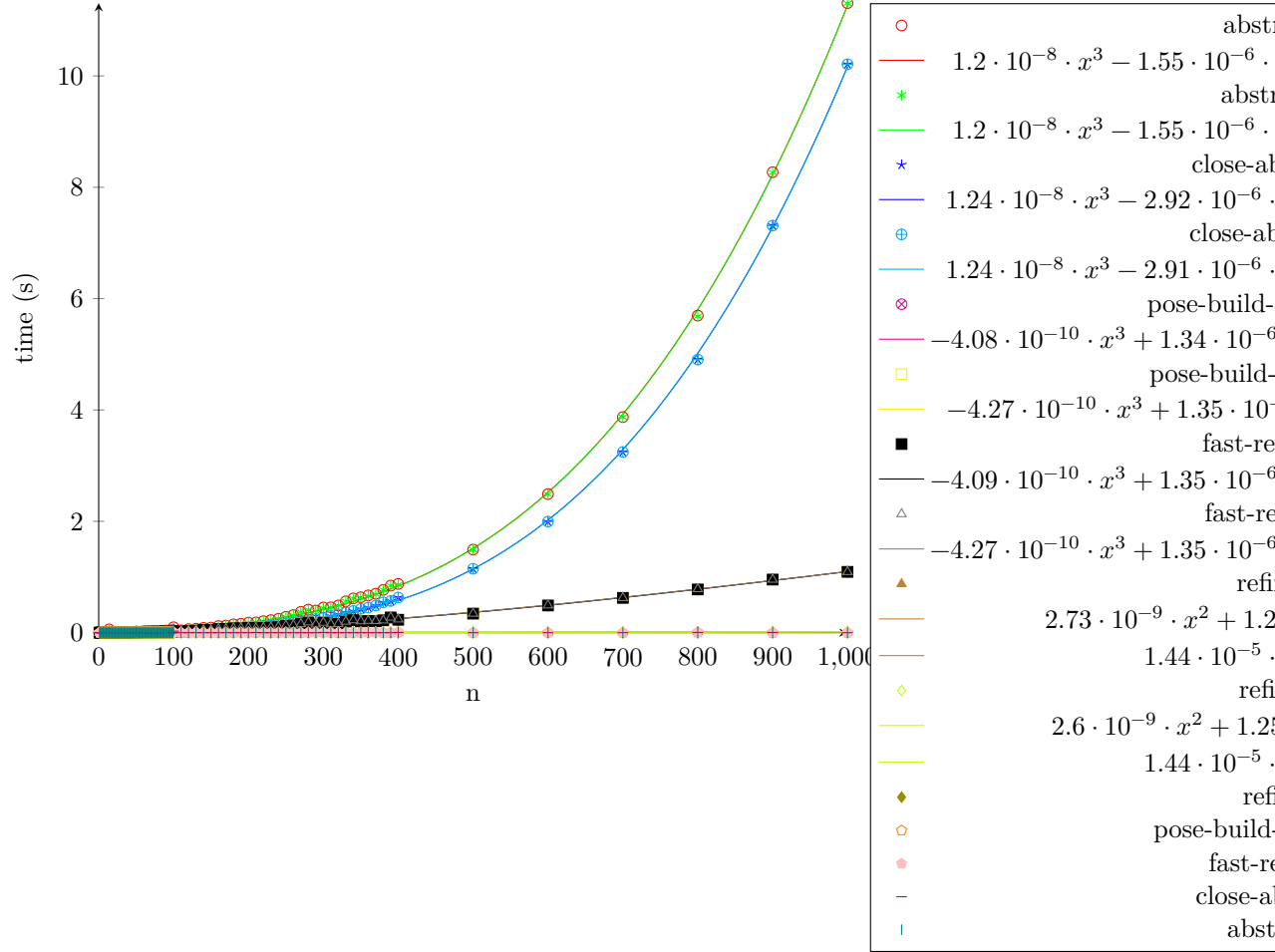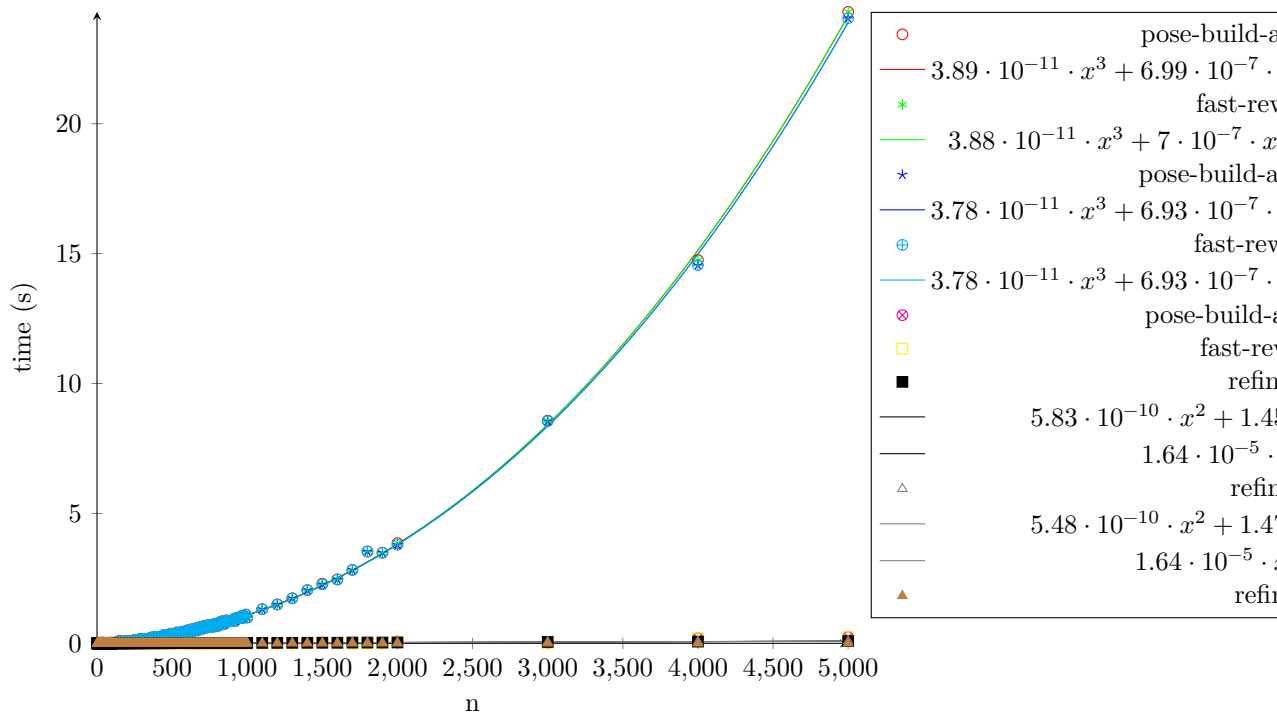
The legend for the figure reads:

- ○ try-ssr-rewrite!-cold-noop-real
- $5.32 \cdot 10^{-7} \cdot x + 3.68 \cdot 10^{-2}$
- ∗ try-ssr-rewrite!-cold-noop-user
- $5.31 \cdot 10^{-7} \cdot x + 3.53 \cdot 10^{-2}$
- ∗ try-ssr-rewrite?-noop-real
- $4.95 \cdot 10^{-7} \cdot x - 1.81 \cdot 10^{-3}$
- ⊕ try-ssr-rewrite?-noop-user
- $4.95 \cdot 10^{-7} \cdot x - 1.85 \cdot 10^{-3}$
- ⊗ try-ssr-rewrite!-noop-real
- $4.94 \cdot 10^{-7} \cdot x + 2.2 \cdot 10^{-3}$
- □ try-ssr-rewrite!-noop-user
- $4.94 \cdot 10^{-7} \cdot x + 2.07 \cdot 10^{-3}$
- ■ try-ssr-rewrite-noop-real
- $4.92 \cdot 10^{-7} \cdot x + 1.87 \cdot 10^{-4}$
- △ try-ssr-rewrite-noop-user
- $4.92 \cdot 10^{-7} \cdot x + 1.6 \cdot 10^{-4}$
- ▲ try-ssr-rewrite?-noop-sys
- ◇ try-ssr-rewrite-noop-sys
- ◆ try-ssr-rewrite!-noop-sys
- ⬠ try-ssr-rewrite!-cold-noop-sys

Figure 10: timing-rewrite-repeated-app-rewrite-strat

Legend (partially cut off):
- abstract+rewrite-strat-bottomu...
- abstract+rewrite-strat-bottomu...
- rewrite-strat-bottomup-rea...
- rewrite-strat-bottomup-use...
- abstract+rewrite-strat-topdow...
- abstract+rewrite-strat-topdow...
- rewrite-strat-topdown-rea...
- rewrite-strat-topdown-use...
- close-abstract+rewrite-strat-botto...
- close-abstract+rewrite-strat-botto...
- close-abstract+rewrite-strat-topd...
- close-abstract+rewrite-strat-topd...
- abstract+rewrite-strat-topdow...
- rewrite-strat-topdown-noop-...
- rewrite-strat-topdown-noop-...
- rewrite-strat-bottomup-noop-...
- rewrite-strat-bottomup-noop-...
- close-abstract+rewrite-strat-topd...
- rewrite-strat-topdown-sys...
- rewrite-strat-bottomup-sy...
- abstract+rewrite-strat-bottomu...
- rewrite-strat-topdown-noop-...
- rewrite-strat-bottomup-noop...
- close-abstract+rewrite-strat-botto...

10

Figure 11: timing-rewrite-repeated-app-fast-rewrite

Figure 12: timing-rewrite-repeated-app-fast-rewrite-no-abstract
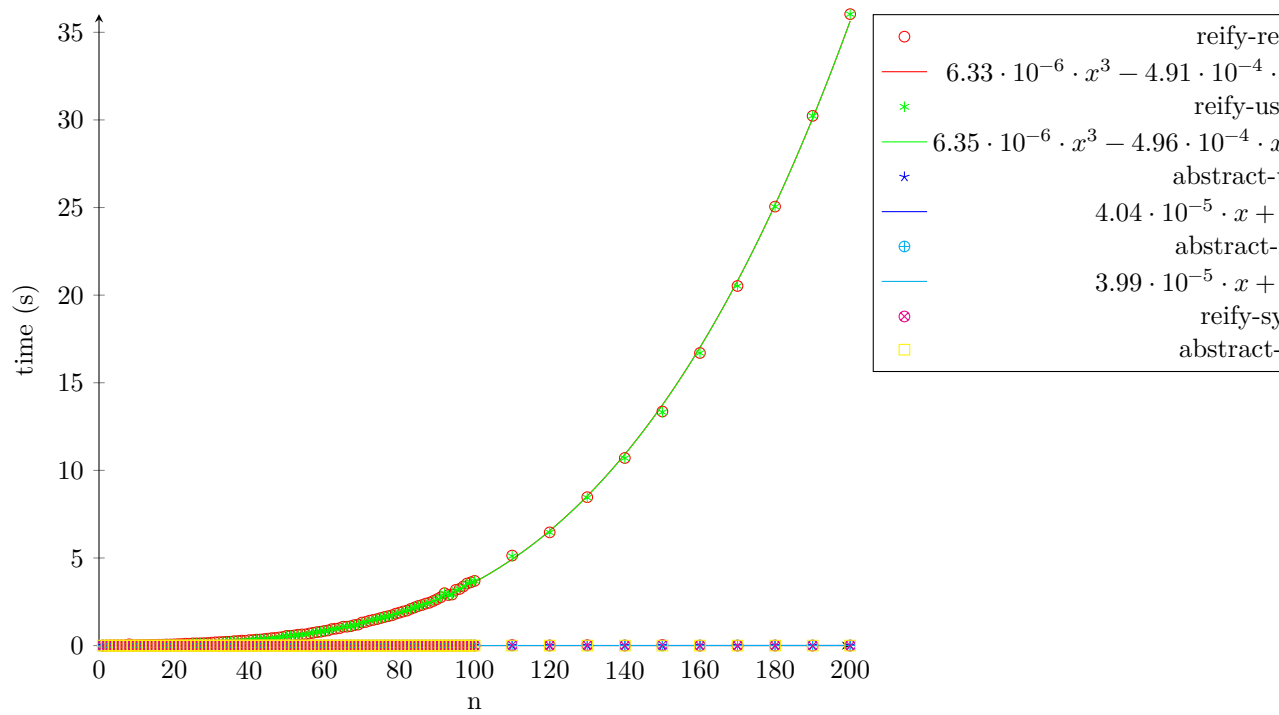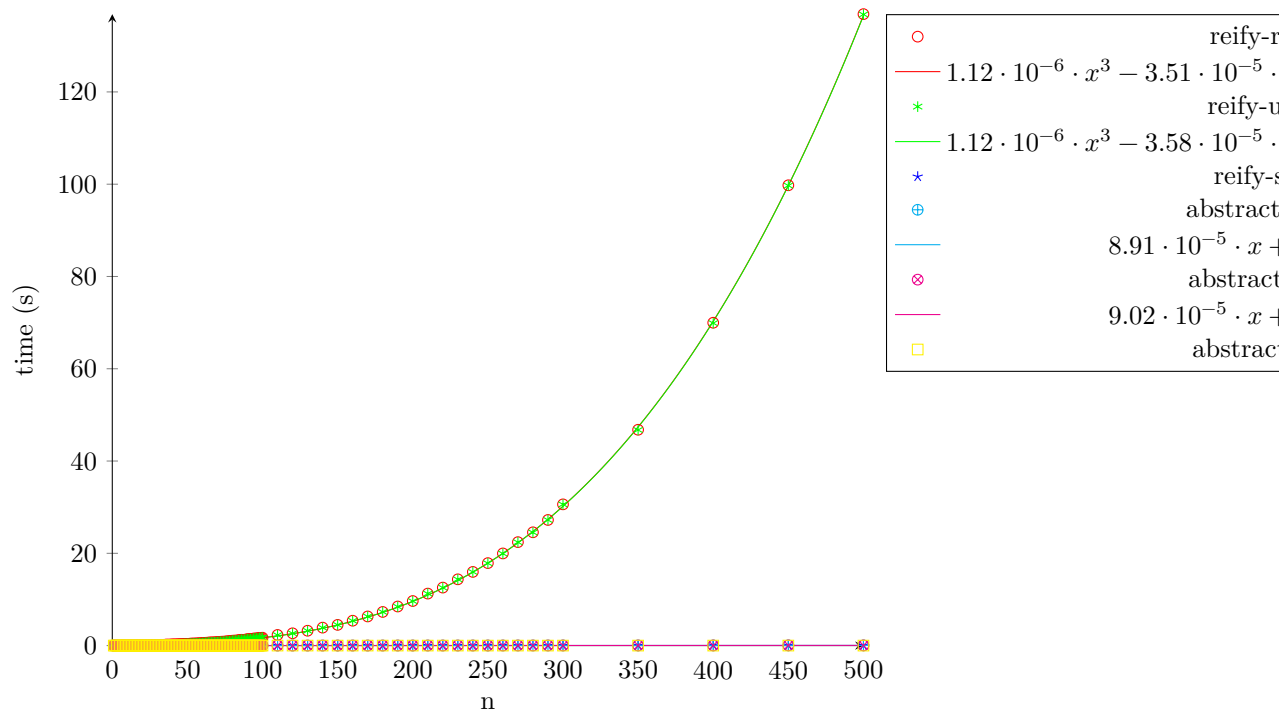
Figure 13: timing-typeclass-reification-let-in-HOAS

13

Figure 14: timing-typeclass-reification-let-in-PHOAS

14