2013.06.24 No.9. $\int_0^1 \frac{\log(x)}{\sqrt{x}} dx = -4$.

```
110 DEF f(x)=LOG(x)/SQR(x)
120 INPUT PROMPT "N?": N
130 LET A=0.0001
140 LET B=1
150 LET H=(B-A)/N
160 LET S=0
170 FOR K=1 TO N
180    LET S=S+(f(A+K*H-H)+f(A+K*H))*H/2
190 NEXT K
200 print S
210 END
```

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```c
/*
 gcc int-ex1b.c -lgsl -lblas
 From GSL 17.14 Examples.
 \int_0^1 x^{-1/2} log(x) dx = -4
   Gauss-Legendre formula (not installed in the gsl in orange).
 http://www.math.kobe-u.ac.jp/HOME/taka/2013/c1
*/

#include <stdio.h>
#include <math.h>
#include <gsl/gsl_integration.h>

double f (double x, void *params) {
  double f = log(x) / sqrt(x);
  return f;
}

main()
{
  double result, error;
  double expected = -4.0;
  gsl_integration_glfixed_table * w
    = gsl_integration_glfixed_table_alloc(100);
  gsl_function F;

  F.function = &f;

  result = gsl_integration_glfixed (&F, 0, 1, w);

  printf ("result            = %.18f\n", result);
  printf ("exact result     = %.18f\n", expected);

  gsl_integration_glfixed_table_free (w);

  return 0;
}
```

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```c
/*
 gcc int-ex1.c -lgsl -lblas
 From GSL 17.14 Examples.
 \int_0^1 x^{-1/2} log(x) dx = -4
The program below computes this integral
 to a relative accuracy bound of 1e-7.
 0, 1, 0, 1e-7,                      1000
 a  b  abs error, rel error,     max sub intervals.
 21 points Gauss-Kronrod integration
http://www.gnu.org/software/gsl/manual/html_node/
```

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```
 QAGS−adaptive−integration−with−singularities.html
*/

#include <stdio.h>
#include <math.h>
#include <gsl/gsl_integration.h>

double f (double x, void *params) {
  double f = log(x) / sqrt(x);
  return f;
}

main()
{
  double result, error;
  double expected = −4.0;
  gsl_integration_workspace * w
    = gsl_integration_workspace_alloc (1000);
  gsl_function F;

  F.function = &f;

  gsl_integration_qags (&F, 0, 1, 0, 1e−7, 1000,
                        w, &result, &error);

  printf ("result            = %.18f\n", result);
  printf ("exact_result    = %.18f\n", expected);

  gsl_integration_workspace_free (w);

  return 0;
}
```

,   .

```
/* Bug in a memory allocation.*/
#include <stdio.h>
#include <math.h>
#include <gsl/gsl_integration.h>
double f (double x, void *params) {
  double f = log(x) / sqrt(x);
  return f;
}
main()
{
  double *result;    /* <=== */
  double *error;     /* <=== */
  double expected = −4.0;
  gsl_integration_workspace * w
    = gsl_integration_workspace_alloc (1000);
  gsl_function F;
  F.function = &f;
  gsl_integration_qags (&F, 0, 1, 0, 1e−7, 1000,
                        w, result, error);
  printf ("result            = %.18f\n", *result);
  printf ("exact_result    = %.18f\n", expected);
  gsl_integration_workspace_free (w);
  return 0;
}
```