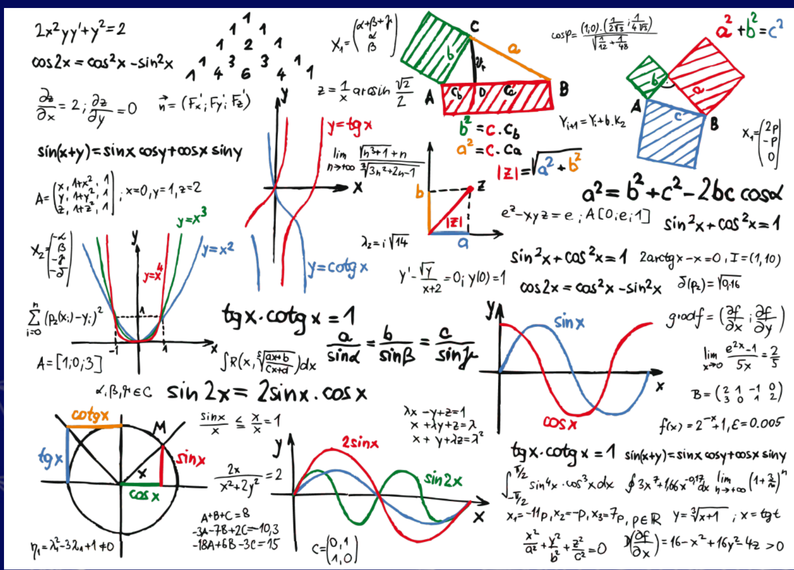
110BORWEIN

SAVING YEARS OF CALCULATIONS...



110BORWEIN

binary name: 110borwein
language: everything working on “the dump”
compilation: when necessary, via Makefile, including re, clean and fclean rules

- ✓ The totality of your source files, except all useless files (binary, temp files, objfiles,...), must be included in your delivery.
- ✓ All the bonus files (including a potential specific Makefile) should be in a directory named bonus.
- ✓ Error messages have to be written on the error output, and the program should then exit with the 84 error code (0 if there is no error).

In 2001, the Borwein brothers studied the following integrals, which now bear their name:

$$\forall n \in \mathbb{N}, I_n = \int_0^{+\infty} \prod_{k=0}^{n} \frac{\sin(\frac{x}{2k+1})}{\frac{x}{2k+1}} dx$$

These integrals are remarkable because the first ones are all equal to $\frac{\pi}{2}$. An obvious conjecture would be that this is true for every value of n.

Some decades ago, an old-school mathemacian would have had to hand-calculate the values of the first integrals (which would take several months, or even years), then assume all the integrals are equal to $\frac{\pi}{2}$, and finally try and demonstrate this conjecture.

Today, we can use numerical calculus to evaluate as many of these integrals as possible before getting into a demonstration; this is the goal of this project.

You have to compute Borwein integrals, using the midpoint rule, the trapezoidal rule and the Simpson’s rule, and print both the value of I_n and the absolute difference between I_n and $\frac{\pi}{2}$.

Since it is impossible to compute the integral between 0 and $+\infty$, the upper bound will be limited to 5000.

The integration interval must be divided into 10000 sub-intervals.

Usage

```
Terminal
~/B-MAT-200> ./110borwein -h
USAGE
    ./110borwein n

DESCRIPTION
    n    constant defining the integral to be computed
```

Examples

```
Terminal
~/B-MAT-200> ./110borwein 0
Midpoint:
I0 = 1.5707651076
diff = 0.0000312192

Trapezoidal:
I0 = 1.5707660806
diff = 0.0000302462

Simpson:
I0 = 1.5707654320
diff = 0.0000308948
```

v3

EPITECH

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