# 24 Synthetic division

*10 points*

## Introduction

What a name! The synthetic division refers to the method to divide a polynomial by the binomial $(x - c)$ where c is a constant. Consider the case of dividing

$$(-3x^3 + 5x - 2)/(x - 5)$$

Do not be afraid since Ruffini's rule will help you to do so. Let's see how it works with the previous example. First, it begins by drawing a couple of crossed lines and put the $c$ value at left.

```
     |
   5 |
-------------------------
     |
```

Next step is to write the coefficients of the polynomial ordered from highest to lowest degree at the top. If some degree is missing, put it as a zero in its corresponding place. In this case the coefficients are -3, for $x^3$, 5 for $x$ and -2 as an independent term.

```
     |   -3    0    5   -2
   5 |
-------------------------
     |
```

Now copy the coefficient of highest degree, which is -3, at the top just under horizontal line.

```
     |   -3    0    5   -2
   5 |
-------------------------
     |   -3
```

Multiply this number by the value of $c$, which is 5, and the result is put next above the horizontal line.

```
     |   -3    0    5   -2
   5 |       -15
-------------------------
     |   -3
```

Then add the values in the second column, write the result under the horizontal line and repeat the multiplication with the value of $c$.

```
     |   -3    0    5   -2
   5 |       -15  -75
-------------------------
     |   -3  -15
```

Again, it is time to add the numbers in the column and put the result down the horizontal line.

```
     |   -3    0    5   -2
   5|        -15  -75
-------------------------
     |   -3  -15  -70
```

Repeat these steps until reaching the last column.

```
     |   -3    0    5   -2
   5|        -15  -75 -350
-------------------------
     |   -3  -15  -70 -352
```

Last number at the right, that is -352, is the remainder of the division. And the polynomial quotient of the division is built from the coefficient numbers that are previous to the remainder from left to right providing as a result $-3x^2 - 15x - 70$

Now that you have refreshed how the Ruffini's rule work, can you write a program to perform a synthetic division?

**Important note:** The expected length of the horizontal line is 5 dashed characters per each number plus an extra dash aligned with the vertical line.

## Input

Two lines form the input. First line contains the coefficients of the dividend where a zero represents any missing terms. Second line have a single number representing the c constant of the binomial divisor.

## Output

The final table after applying Ruffini's rule. Please note that per each number a fixed size of 5 positions is defined in order to have the number properly printed in columns.

## Example

### Input

```
-3 0 5 -2
5
```

### Output

```
     |   -3    0    5   -2
   5|        -15  -75 -350
-------------------------
     |   -3  -15  -70 -352
```