

## Stiff ODEs

Input file:	standard input
Output file:	standard output
Time limit:	10 seconds
Memory limit:	512 megabytes

The simplest example of oscillating chemical system is the Oregonator<sup>1</sup>, which consists of the following reactions:

$$\frac{dX}{dt} = k_1AY - k_2XY + k_3AX - 2k_4X^2$$

$$\frac{dY}{dt} = -k_1AY - k_2XY + k_5BZ$$

$$\frac{dZ}{dt} = 2k_3AX - k_5BZ$$

$$\frac{dP}{dt} = k_1AY + 2k_2XY + k_4X^2$$

$$\frac{dA}{dt} = -k_1AY - k_3AX + k_4X^2$$

$$\frac{dB}{dt} = -k_5BZ$$

Classically,  $X$  is  $HBrO_2$ ,  $Y$  is  $Br^-$ ,  $Z$  is  $Ce(IV)$ ,  $A$  is  $BrO_3^-$ ,  $B$  is  $CH_2(COOH)_2$ , and  $P$  is either  $HOBr$  or  $BrCH(COOH)_2$ . But that does not matter to you.

The reaction rates will always be within order of magnitude from their respective values in the example input file.

### Input

The first line contains a single integer number  $T = 1 \dots 1000$  – how long we will run our virtual reactor.

The second line contains six floating-point values – the initial concentrations of  $X$ ,  $Y$ ,  $Z$ ,  $A$ ,  $B$ , and  $P$ .

The third line contains five floating-point values – the reaction rate constants  $k_1, \dots, k_5$ .

### Output

The output should contains six floating-point values – the final concentrations of  $X$ ,  $Y$ ,  $Z$ ,  $A$ ,  $B$ , and  $P$ .  
Required precision is  $10^{-6}$

<sup>1</sup><http://www.scholarpedia.org/article/Oregonator>