Day 1: Standard Deviation

Objective

In this challenge, we practice calculating *standard deviation*. Check out the *Tutorial* tab for learning materials and an instructional video!

Task

Given an array, arr, of n integers, calculate and print the standard deviation. Your answer should be in decimal form, rounded to a scale of 1 decimal place (i.e., 12.3 format). An error margin of ± 0.1 will be tolerated for the standard deviation.

Example
$arr = [2, 5, 2, 7, 4]$

The sum of the array values is 20 and there are 5 elements. The mean is 4.0.
Subtract the mean from each element, square each result, and take their sum.

$(2 - 4)^2 = 4$
$(5 - 4)^2 = 1$
$(2 - 4)^2 = 4$
$(7 - 4)^2 = 9$
$(4 - 4)^2 = 0$

Their sum is 18. Take the square root of $\frac{18}{5}$ to get 1.7, the standard deviation.

Function Description

Complete the *stdDev* function in the editor below.

stdDev has the following parameters:
- *int arr[n]:* an array of integers

Prints
- *float:* the standard deviation to 1 place after the decimal

Input Format

The first line contains an integer, n, denoting the size of arr.
The second line contains n space-separated integers that describe arr.

Constraints

- $5 \leq n \leq 100$

- $0 < arr[i] \leq 10^5$

Output Format

Print the *standard deviation* on a new line, rounded to a scale of 1 decimal place (i.e., 12.3 format).

Sample Input

```
STDIN            Function
-----            --------
5                arr[] size n = 5
10 40 30 50 20   arr =[10, 40, 30, 50, 20]
```

Sample Output

```
14.1
```

Explanation

First, find the *mean*:

$$\mu = \frac{\sum_{i=0}^{n-1} arr[i]}{n} = 30.0$$

Next, calculate the squared distance from the mean, $(arr[i] - \mu)^2$, for each $arr[i]$:

1. $(arr[0] - \mu)^2 = (10 - 30)^2 = 400$

2. $(arr[1] - \mu)^2 = (40 - 30)^2 = 100$

3. $(arr[2] - \mu)^2 = (30 - 30)^2 = 0$

4. $(arr[3] - \mu)^2 = (50 - 30)^2 = 400$

5. $(arr[4] - \mu)^2 = (20 - 30)^2 = 100$

Now compute $\sum_{i=0}^{n-1} (arr[i] - \mu)^2 = 400 + 100 + 0 + 400 + 100 = 1000$, so:

$$\sigma = \sqrt{\frac{\sum_{i=0}^{n-1} (arr[i] - \mu)^2}{n}} = \sqrt{\frac{1000}{5}} = \sqrt{200} = 14.1421356$$