Problem 4: Coding 90s in Loot Lists
7 Points

Problem ID: `fortnite`
Rank: `2`

Introduction

Falling out of the battle bus, Fortnite Jonesy drops into the warzone known as Tilted Towers. After cranking 90s and default dancing on the bodies of Ninja and Nick Eh 30, he realizes the storm is setting onto him. Remembering that he has to never back down, never give up, Jonesy decides to rush towards the reboot van outside the storm in order to get a #1 Victory Royale.

Problem Statement

You start with $\mathbf{N}$ health and you need to travel a distance of $\mathbf{D}$ meters to exit the storm, which continuously damages you at a rate of $\mathbf{P}$ health per second.

While inside the storm, you can perform any one of following two actions:

1. Run continuously at a rate of $\mathbf{S}$ meters per second towards the storm's exit.
2. Heal continuously to gain $\mathbf{H}$ health per second. While healing, you **can't move** and you **still take damage** from the storm.

Find the minimum time needed to exit the storm while keeping your health at or above 0. It's **not guaranteed** that the minimum time will be an integer.

If there is no way to exit while keeping your health at or above 0, output `-1.0`.

Input Format

The first line of the input contains an integer $\mathbf{T}$ denoting the number of test cases that follow. Each test case is described in a single line containing five space separated integers denoting:

- $\mathbf{N}$: starting health
- $\mathbf{H}$: healing per second
- $\mathbf{D}$: distance to exit storm (in meters)
- $\mathbf{S}$: running speed (in meters per second)
- $\mathbf{P}$: storm damage per second

Output Format

For each test case, output a single number denoting the minimum time needed to get out of the storm alive. This number can be an integer or a decimal.

Your answer must be within an absolute error of 0.1 to be considered correct.

Constraints

Time limit: **1 second**
Memory limit: **256 MB**

$1 \le \mathbf{T} \le 100$
$1 \le \mathbf{N} \le 100$
$1 \le \mathbf{H} \le 100$
$1 \le \mathbf{D} \le 100$
$1 \le \mathbf{S} \le 100$
$1 \le \mathbf{P} \le 100$

Sample Test Cases

Sample Input Download

```
5
100 15 50 10 10
20 15 50 10 10
20 15 50 10 30
100 15 50 10 20
42 17 73 9 14
```

Sample Output Download

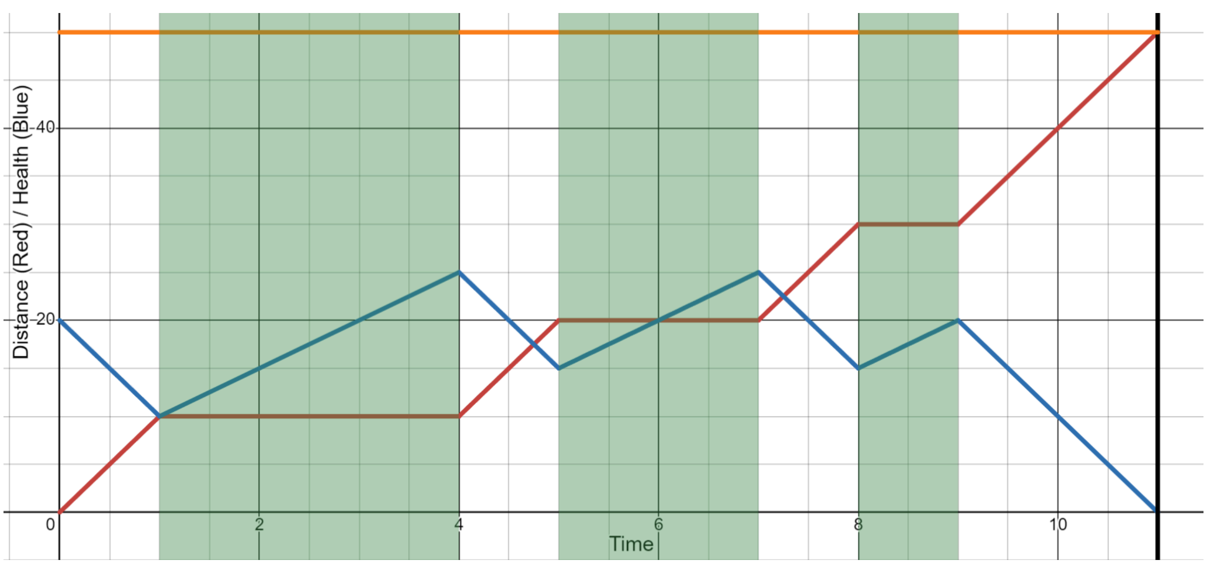
```
5
11.0
-1
5.000
31.96296296296296
```

Note that due to rounding, this is one of many possible correct outputs. If there are multiple solutions, you may output any of them.

Sample Explanations

Test Case #1:
The minimum time to exit the storm is achieved by running directly out of the storm. Since you run at a speed of $\mathbf{S}$ = 10 meters per second and you need to run $\mathbf{D}$ = 50 meters, it takes 5 seconds to escape the storm. This solution works because the health remaining is at or above 0 as you have $\mathbf{N}$ = 100 health and the total damage taken would be 50 ($\mathbf{P}$ = 10 damage from storm per second * 5 seconds). Thus the minimum time needed is 5 seconds.

Test Case #2:
One possible strategy to exit is to run for 1 second, heal for 3 seconds, run for 1 second, heal for 2 seconds, run for 1 second, heal for 1 second, run for 2 seconds, then exit. The minimum time needed is 11 seconds. Here's a Desmos plot that illustrates this strategy in action:



Test Case #3

It is impossible to exit the storm given these values so we print `-1`.

Test Case #4

This is the same as Test Case #1, but now the damage from the storm $\mathbf{P}$ is higher. However, the minimum time to exit the storm is still a straight line out. We still run for 5 seconds, but this time we take 100 damage. However, since we exit the storm as we take 100 damage, this is still the minimum time. Therefore, we return `5.000`.