Problem 168: Power to Persevere

Difficulty: Easy

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Problem Background

When we look at building an automated machine to travel and explore beyond the current reach of human exploration - whether that be under the sea, into the caldera of a volcano, or somewhere beyond our atmosphere - understanding the limits and capabilities of our device is paramount to the successful execution of the mission. If the machine breaks down in such an extreme environment, you can't simply send a mechanic to repair it. It must be ready to take on any challenge it may face; and its operators need to understand what challenges are beyond its abilities.

NASA is working with Lockheed Martin to design a new lunar rover for future unmanned missions to the Moon. Your team is working on the design of the rover's propulsion systems and is evaluating several possible designs. Before you begin building a prototype, you'd like to evaluate the specifications to see if the designs could possibly work.

Problem Description

The rover's wheels will be powered by a series of servo motors. Each motor is able to spin at a certain speed (measured in revolutions per minute, RPM); each revolution requires a certain amount of power from the rover's batteries. It will take several revolutions of the motor to complete one rotation of the rover's wheels. Your team's task is to analyze data regarding this entire process and determine if the rover's power and propulsion systems are able to get the rover to its destination, and if so, how long it will take to get there.

There are a few formulas which will help you make these determinations:

- Circumference of a circle: $C = \pi d$
  - d = diameter of the circle
- Power (measured in watts): $P = IV$
  - I = Current (measured in amperes)
  - V = Voltage (measured in volts)

For example, let's examine a motor that runs at 12 volts, uses 6 watts of power to complete one revolution, and has a speed of 10 RPM. It takes the motor 6 revolutions to turn a 15 cm-diameter wheel. The rover needs to travel a distance of 5 meters. Each rotation of the wheel allows the rover to move a distance of 47.12 cm; so, over a distance of five meters (500 cm), this requires about 10.61 rotations of the wheel. This in turn requires 63.66 revolutions of the motor, which will take 6.367

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minutes. Each revolution of the motor draws 6 watts of power, so the motor will draw a total of 381.96 watts over the course of the mission. Dividing this by the voltage (12 V) shows us that we need a total of 31.83 amps of current to provide that amount of power. Multiplying this by the time of the mission gives us the total energy that must be provided by the power systems, 202.6616 ampere minutes, or 3.3777 ampere hours. As long as the power systems are able to supply this much current in that amount of time, the mission should be a success.

Sample Input

The first line of your program's input, received from the standard input channel, will contain a positive integer representing the number of test cases. Each test case will include a single line containing seven positive numbers, separated by spaces and representing (in order):

- The diameter of the rover's wheel, in centimeters (cm)
- The number of motor revolutions required to complete a full rotation of the wheel
- The amount of power required to complete one revolution of the motor, in watts
- The speed of the motor, in revolutions per minute
- The available capacity of the power system, in ampere hours
- The voltage requirement of the motor
- The required distance the rover must travel, in meters

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2
15 6 6 10 4 12 5
12 8 12 10 24 12 8
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Sample Output

For each test case, your program must print a single line with the following information:

- If the mission is possible with the given parameters:
  - The word "Success"
  - A space
  - The time required for the rover to travel the given distance, in minutes rounded to four decimal places. Include any trailing zeroes.
- If the mission is not possible with the given parameters, the word "Fail"

```
Success 6.3662
Fail
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