

## 3500 Model Rocket Height

One method used to determine the height achieved by a model rocket is the *geodesic* method. Two observers  $A$  and  $B$  are spaced 100 feet apart along a base line along one edge of the flat test field. The launch platform is equidistant from observers  $A$  and  $B$  and 50 feet from the base line. Each observer has a theodolite or some other device for measuring angle above the horizontal (elevation angle) of a distant object and the azimuth angle (the angle the vertical plane of the sight line makes with the line from  $A$  through  $B$  measured counter-clockwise). Each measuring device is on a stand.  $A$ 's device is  $HA$  feet above the launch platform and  $B$ 's device is  $HB$  feet above the launch platform. When a rocket is fired, near the top of its flight, it deploys a parachute and emits a puff of smoke. Each observer measures the elevation angle and azimuth angle of the puff of smoke from their location. If the peak location is on the wrong side of the baseline or outside the lines determined by  $A$  and  $B$  perpendicular to the base line, it is out of bounds and disqualified. From this information, the height of the rocket may be determined as follows:

On each sight line, find the point on that sight line closest to the other sight line. The point halfway between these two points is assumed to be the location of the rocket at the top of its flight. The height achieved by the rocket is the vertical distance of this point above the launch platform.

This problem is to write a program which, given the parameters  $HA$  (the distance of the measuring device  $A$  above the launch platform in feet),  $HB$  (the distance of the measuring device  $B$  above the launch platform in feet),  $\alpha$  (the elevation angle of the rocket in degrees measured by the left observer  $A$ ),  $\beta$  (the elevation angle of the rocket in degrees observed by the right observer  $B$ ),  $\gamma$  (the azimuth angle in degrees measured by the left observer  $A$ ) and  $\delta$  (the azimuth angle in degrees measured by the right observer  $B$ ), computes the height of the rocket above the launch platform in feet to the nearest foot.

### Input

The first line of input contains the number of shots that follow  $N$  ( $1 \leq N \leq 100$ ) and the parameters  $HA$  and  $HB$  in that order as decimal values (the values are separated by one or more spaces). These values would be measured once at the beginning of the day and remain fixed through all  $N$  rocket shots. Each succeeding line of input will contain the angles  $\alpha, \beta, \gamma$  and  $\delta$  in that order (measured in degrees) as decimal values. The angles  $\alpha, \beta$  and  $\gamma$  will be strictly between 0 and 90 degrees and  $\delta$  will be strictly between 90 degrees and 180 degrees.

### Output

For each set of four angles (other than the end indicator), the output contains a line with the shot number, ( $1 \dots N$ ), a colon, a space and finally the height above the field in feet to the nearest foot with no leading spaces.

### Sample Input

```
4 5.25 2.92
39.6 36.0 35.4 151.2
65.1 71.2 16.5 160.6
59.4 59.5 43.8 139.0
45.0 41.2 32.9 152.6
```

**Sample Output**

1: 50  
2: 135  
3: 119  
4: 58