Air Hockey

Computer Science Society
Programming Contest
Winter 2006

An air hockey table is a level rectangular table whereon a circular puck levitates on a cushion of air. If propelled forward, the puck slides with little friction, rebounding off vertical walls that meet the table's edges. In this problem, we assume there is no friction—puck speed is constant once moving—and rebounds are perfect—happening instantaneously and having equal angles of incidence and exit. Given a table's length and width, and a puck's radius, initial position and initial velocity, compute the position of the puck at given times.

Input Format

The first line contains two positive integers—the length l (along the x-axis) and width w (along the y-axis) of the table (in mm)—separated by a blank. The second line contains a positive integer—the radius r of the puck (in mm). The third line contains two positive integers—the initial velocity (v_x, v_y) of the puck (in mm/sec), as a vector. The fourth line contains two positive integers—the initial position (x_0, y_0) of the center of the puck. The fifth line contains a positive integer—the duration d of the observation period (in seconds). You can assume the puck fits on the table; i.e. $r \leqslant x_0 \leqslant l - r$ and $r \leqslant y_0 \leqslant w - r$.

Output Format

The first three lines echo the length l, width w, radius r and initial velocity (v_x, v_y), formatted as shown in the output sample below. The remaining $d+1$ lines report the position (x_t, y_t) of the puck after $t = 0, 1, 2, \ldots, d$ seconds, formatted as shown in the output sample below.

Input Sample

```
650 490
40
50 70
100 100
15
```

Output Sample

```
   table: 650 mm long by 490 mm wide
    puck: 40 mm radius
velocity: (50 mm/sec, 70 mm/sec)
t=0 secs: (100, 100)
t=1 secs: (150, 170)
t=2 secs: (200, 240)
t=3 secs: (250, 310)
t=4 secs: (300, 380)
t=5 secs: (350, 450)
t=6 secs: (400, 380)
t=7 secs: (450, 310)
t=8 secs: (500, 240)
t=9 secs: (550, 170)
t=10 secs: (600, 100)
t=11 secs: (570, 50)
t=12 secs: (520, 120)
t=13 secs: (470, 190)
t=14 secs: (420, 260)
t=15 secs: (370, 330)
```