Euler Line

Sometimes, Lea likes to read math books that are written for people without mathematical background and is always fascinated how everything fits together. She recently read a chapter of such a book which was dealing with the so-called Euler line. The Euler line is part of the following theorem shown by Leonhard Euler in 1765: Given any triangle, its orthocenter (the intersection of its altitudes), circumcenter (the intersection of its perpendicular bisectors) and centroid (the intersection of its medians) are colinear, which means they are on one line, the Euler line.

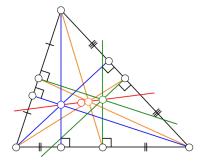


Figure 1: Euler's line (red) is a straight line through the centroid (orange), orthocenter (blue), circumcenter (green) and even the center of the nine-point circle, which is not considered in this problem (red). Source: wikipedia.org

Lea cannot believe this and thinks this is just a coincidence. The authors of the picture may just have chosen an example where it works. She wants to try this for some other examples and needs you to compute the coordinates of the points in question.

Input

The first line of the input contains an integer t. t test cases follow, each of them separated by a blank line.

Each test case consists of three lines, each of them containing two space-separated doubles: The x- and y-coordinates of the triangle's vertices.

Output

For each test case, output one line containing "Case #i:" where i is its number, starting at 1. Afterwards, print the x- and y-coordinates (separated by a space) of the triangle's centroid, orthocenter and circumcenter (in this order), each of them in a seperate line. Each line of the output should end with a line break.

Your solution is considered correct if all coordinates are accurate to six decimal places.

Constraints

- $1 \le t \le 20$
- $-100 \le x, y \le 100$

Sample Input 1

Sample Output 1

2 0.0 0.0 1.0 0.0 0.0 1.0	Case #1: 0.333333333333333333333333333333333333
1.0 1.0	Case #2: 52.88766666666666666666666666666666666666
99.123 -12.5 58.54 -32.643	49.676013785025596 -97.06973476829143 54.49349310748721 26.463367384145705

Sample Input 2

Sample Input 2	Sample Output 2
11	Case #1:
88.522485 -13.515400	89.8449083333333 -36.466746000000036
96.557602 -91.472879	353.4347674713959 23.311959714429097
84.454638 -4.411959	-41.9500212356979 -66.35609885721455
	Case #2:
-3.279037 -78.645062	-23.52857266666667 -25.839962
-52.052942 -29.057519	-78.4333391662827 -31.96024715884536
-15.253739 30.182695	3.9238105831413415 -22.77981942057733
	Case #3:
36.046769 -47.450735	0.5791609999999942 -68.95231366666665
26.944309 -66.084199	70.01667024246443 -157.4476219988495
-61.253595 -93.322007	-34.13959362123222 -24.704659500575225
	Case #4:
42.578721 -4.376319	3.43898999999999999999999999999999999999
-40.074226 -27.429373	-30.816231489606167 136.08895434024086
7.812475 -2.407942	20.566600744803086 -85.15129417012045
	Case #5:
-30.804920 -37.877214	-16.32949633333335 -44.1314423333333325
43.840443 -47.983403	-27.423852930701237 209.0266633104088
-62.024012 -46.533710	-10.78231803464937 -170.7104951552044
02.021012 10.003710	Case #6:
-48.139515 -63.515330	-12.977140999999964 -25.535269333333275
-64.147930 -97.615190	-766.5004672455115 478.8011465743702
73.356022 84.524712	363.7845221227557 -277.7034772871851
	Case #7:
-17.834603 84.752420	-22.85662433333333 30.77682099999999
26.233284 -71.114394	8.407585224917984 102.83064807461625
-76.968554 78.692437	-38.48872911245898 -5.250092537308133
	Case #8:
-4.323212 68.841193	24.741086999999997 59.48368666666664
35.389655 96.911932	2.9952682334270673 69.51618564861288
43.156818 12.697935	35.61399638328648 54.46743717569357
	Case #9:
-19.194674 -15.108690	-3.580071333333327 -62.262164333333324
64.847219 -98.297499	-24.561625646796877 -41.222748969507535
-56.392759 -73.380304	6.910705823398435 -72.78187201524624
	Case #10:
93.866003 -83.332342	45.192405333333326 -53.96022633333334
24.188865 -54.178823	-17.57611725297092 -108.25511995444622
17.522348 -24.369514	76.57666662648545 -26.812779522776914
	Case #11:
-78.935011 31.004570	10.984356666666663 15.81803566666663
50.508662 -8.021209	50.312332131187105 -12.237409747748446
61.379419 24.470746	-8.679631065593552 29.84575837387423