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.

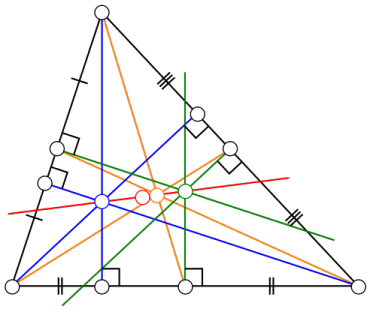

Figure 1: Euler's line (red) is a straight line through the centroid (orange), orthocenter (blue), circumcenter (green) and even the center of the nine-point circle, which is not considered in this problem (red). Source: wikipedia.org

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

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

Sample Input 1	Sample Output 1
2 0.0 0.0 1.0 0.0 0.0 1.0 1.0 1.0 99.123 -12.5 58.54 -32.643	Case #1: 0.3333333333333333 0.3333333333333333 -0.0 0.0 0.5 0.5 Case #2: 52.88766666666666 -14.714333333333332 49.676013785025596 -97.06973476829143 54.49349310748721 26.463367384145705

Sample Input 2	Sample Output 2
11 88.522485 -13.515400 96.557602 -91.472879 84.454638 -4.411959 -3.279037 -78.645062 -52.052942 -29.057519 -15.253739 30.182695 36.046769 -47.450735 26.944309 -66.084199 -61.253595 -93.322007 42.578721 -4.376319 -40.074226 -27.429373 7.812475 -2.407942 -30.804920 -37.877214 43.840443 -47.983403 -62.024012 -46.533710 -48.139515 -63.515330 -64.147930 -97.615190 73.356022 84.524712 -17.834603 84.752420 26.233284 -71.114394 -76.968554 78.692437 -4.323212 68.841193 35.389655 96.911932 43.156818 12.697935 -19.194674 -15.108690 64.847219 -98.297499 -56.392759 -73.380304 93.866003 -83.332342 24.188865 -54.178823 17.522348 -24.369514 -78.935011 31.004570 50.508662 -8.021209 61.379419 24.470746	Case #1: 89.8449083333333 -36.466746000000036 353.4347674713959 23.311959714429097 -41.9500212356979 -66.35609885721455 Case #2: -23.52857266666667 -25.839962 -78.4333391662827 -31.96024715884536 3.9238105831413415 -22.77981942057733 Case #3: 0.5791609999999942 -68.95231366666665 70.01667024246443 -157.4476219988495 -34.13959362123222 -24.704659500575225 Case #4: 3.4389899999999995 -11.404544666666663 -30.816231489606167 136.08895434024086 20.566600744803086 -85.15129417012045 Case #5: -16.32949633333335 -44.131442333333325 -27.423852930701237 209.0266633104088 -10.78231803464937 -170.7104951552044 Case #6: -12.977140999999964 -25.535269333333275 -766.5004672455115 478.8011465743702 363.7845221227557 -277.7034772871851 Case #7: -22.85662433333333 30.77682099999999 8.407585224917984 102.83064807461625 -38.48872911245898 -5.250092537308133 Case #8: 24.741086999999997 59.483686666666664 2.9952682334270673 69.51618564861288 35.61399638328648 54.46743717569357 Case #9: -3.580071333333327 -62.262164333333324 -24.561625646796877 -41.222748969507535 6.910705823398435 -72.78187201524624 Case #10: 45.192405333333326 -53.96022633333334 -17.57611725297092 -108.25511995444622 76.57666662648545 -26.812779522776914 Case #11: 10.984356666666663 15.818035666666663 50.312332131187105 -12.237409747748446 -8.679631065593552 29.84575837387423