

# 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.

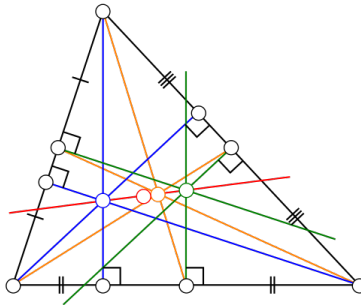


Figure 1: Euler's line (red) is a straight line through the centroid (orange), orthocenter (blue), circumcenter (green) and even the center of the nine-point circle, which is not considered in this problem (red). Source: wikipedia.org

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 separate 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

```
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
```

### Sample Output 1

```
Case #1:
0.3333333333333333 0.3333333333333333
-0.0 0.0
0.5 0.5
Case #2:
52.887666666666666 -14.714333333333332
49.676013785025596 -97.06973476829143
54.49349310748721 26.463367384145705
```

**Sample Input 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
```

**Sample Output 2**

```
Case #1:
89.84490833333333 -36.4667460000000036
353.4347674713959 23.311959714429097
-41.9500212356979 -66.35609885721455
Case #2:
-23.528572666666667 -25.839962
-78.4333391662827 -31.96024715884536
3.9238105831413415 -22.77981942057733
Case #3:
0.57916099999999942 -68.952313666666665
70.01667024246443 -157.4476219988495
-34.13959362123222 -24.704659500575225
Case #4:
3.4389899999999995 -11.404544666666663
-30.816231489606167 136.08895434024086
20.566600744803086 -85.15129417012045
Case #5:
-16.329496333333335 -44.131442333333325
-27.423852930701237 209.0266633104088
-10.78231803464937 -170.7104951552044
Case #6:
-12.9771409999999964 -25.535269333333275
-766.5004672455115 478.8011465743702
363.7845221227557 -277.7034772871851
Case #7:
-22.856624333333333 30.776820999999999
8.407585224917984 102.83064807461625
-38.48872911245898 -5.250092537308133
Case #8:
24.741086999999997 59.483686666666664
2.9952682334270673 69.51618564861288
35.61399638328648 54.46743717569357
Case #9:
-3.5800713333333327 -62.262164333333324
-24.561625646796877 -41.222748969507535
6.910705823398435 -72.78187201524624
Case #10:
45.192405333333326 -53.960226333333334
-17.57611725297092 -108.25511995444622
76.57666662648545 -26.812779522776914
Case #11:
10.984356666666663 15.818035666666663
50.312332131187105 -12.237409747748446
-8.679631065593552 29.84575837387423
```