

Marking Scheme – IGO2017
Advanced level

Problem 1:

Calculating $\angle XIY$: 2 points

Calculating $\angle IZB$: 2 points

Congruence of triangles BIZ, BIA and conclusion: 4 points

Problem 2:

Complete proof (official solution): 8 points

Proving that it is sufficient to prove the statement for six unit circles: 3 points

Proving only the case of six unit circles: 5 points

Problem 3:

Similarity of triangles XOM, XPA : 4 points

Conclusion: 4 points

Problem 4:

ZT is the radical axis of ω_1, ω_3 : 2 points

The midpoint of AC lies on the radical axis of ω_1, ω_3 : 1 point

ZB equals to the length of tangent from Z to ω_1, ω_3 : 2 points

Calculating AC and conclusion: 3 points

Problem 5:

Definition of P_{ab} s and W_a s: 2 points

Inversion with center P : 2 points

Considering Michel's point: 2 points

Conclusion: 2 points

Marking Scheme – IGO2017
Elementary level

Problem 1:

X = number of correct answers

Y = number of incorrect answers

If $X = 0$: 0 point

If $X > 0$: $Z = \text{Max}\{0, X - Y + 1\}$ points

Problem 2:

Considering the rhombus and concluding the parallel lines: 2 points

Calculating the angles (even in the figure): 3 points

Calculating the angles of ABC : 3 points

Problem 3:

$AP = AF$: 3 points

$CE = EF$: 2 points

$BE = CE$: 1 point

Conclusion: 2 points

Problem 4:

Initial case: 1 point

The number of clockwise triangles changes one by one when the points move: 4 points

Final case: 1 point

Conclusion (there exists a moment with 2017 clockwise triangles): 2 points

Problem 5:

Solution 1:

Considering the midpoints of AB, AC and their images in l : 2 points

Mentioning the inequalities for ME, NF : 2 points

Final calculation and conclusion: 4 points

Solution 2:

Considering the reflections of P, E (perhaps D), and presenting $AP + AQ$ as length of a segment ($P'Q$ in the solution): 3 points

$P'Q \leq E'F$: 2 points

$E'F \leq AC$: 3 points

Marking Scheme – IGO2017
Intermediate level

Problem 1:

The side opposite to the 30-angle in a right triangle is half the length of the hypotenuse: 1 point

Calculating CE : 1 point

Calculating BF : 1 point

Final calculation and conclusion: 5 points

Problem 2:

$\angle BFD = \angle CEP$: 2 points

$\angle BEP = \angle BFQ$: 2 points

Conclusion: 4 points

Problem 3:

Complete example for $n > 4$: 3 points

(Correct example without mentioning the details worth 2 points)

$n = 4$ and convex quadrilateral: 3 points

$n = 4$ and concave quadrilateral: 2 points

The case $n = 3$ worth no point but if he/she forgot this case: -1 point

Problem 4:

Solution 1:

Considering the midpoints of AB, AC and their images in l : 2 points

Mentioning the inequalities for ME, NF : 2 points

Final calculation and conclusion: 4 points

Solution 2:

Considering the reflections of P, E (perhaps D), and presenting $AP + AQ$ as length of a segment ($P'Q$ in the solution): 3 points

$P'Q \leq E'F$: 2 points

$E'F \leq AC$: 3 points

Problem 5:

Mentioning equivalent statement ($AMOA'N$ cyclic): 1 point

Similarity of triangles $A'KX, XM'X$: 2 points

Similarity of triangles $A'KY, YN'N$: 2 points

Similarity of triangles $A'NY, A'MX$ and conclusion: 3 points