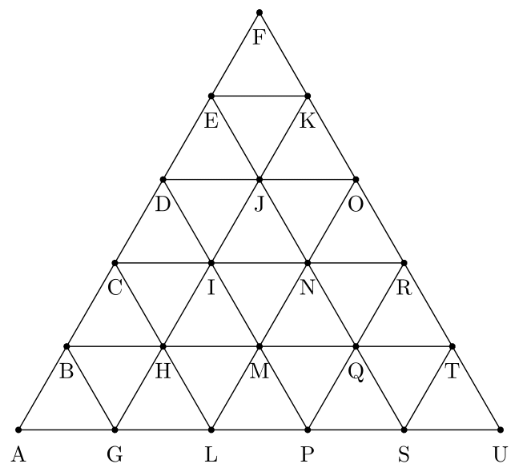
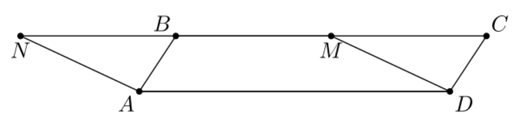
Time limit: 60 minutes.
Instructions: This test contains 10 short answer questions. All answers must be expressed in simplest form unless specified otherwise. Only answers written inside the boxes on the answer sheet will be considered for grading.
No calculators.

1. Consider the figure below, where every small triangle is equilateral with side length 1. Compute the area of the polygon $AEKS$.



2. A set of points in the plane is called full if every triple of points in the set are the vertices of a non-obtuse triangle. What is the largest size of a full set?

3. Let $ABCD$ be a parallelogram with $BC = 17$. Let M be the midpoint of BC and let N be the point such that $DANM$ is a parallelogram. What is the length of segment NC?



4. The area of right triangle ABC is 4, and hypotenuse AB is 12. Compute the perimeter of ABC.

5. Find the area of the set of all points z in the complex plane that satisfy

$$|z - 3i| + |z - 4| \leq 5\sqrt{2}.$$

6. Let ABE be a triangle with $AB/3 = BE/4 = EA/5$. Let $D \neq A$ be on line AE such that $AE = ED$ and D is closer to E than to A. Moreover, let C be a point such that $BCDE$ is a parallelogram. Furthermore, let M be on line CD such that AM bisects $\angle BAE$, and let P be the intersection of AM and BE. Compute the ratio of PM to the perimeter of ABE.

7. Points $ABCD$ are vertices of an isosceles trapezoid, with AB parallel to CD, $AB = 1$,$CD = 2$, and $BC = 1$. Point E is chosen uniformly and at random on CD, and let point F be the point on CD such that $EC = FD$. Let G denote the intersection of AE and BF, not necessarily in the trapezoid. What is the probability that $\angle AGB > 30°$?

8. Let ABC be a triangle with $AB = 13, BC = 14$, and $CA = 15$. Let G denote the centroid of ABC, and let G_A denote the image of G under a reflection across BC, with G_B the image of G under a reflection across AC, and G_C the image of G under a reflection across AB. Let O_G be the circumcenter of $G_A G_B G_C$ and let X be the intersection of AO_G with BC and Y denote the intersections of AG with BC. Compute XY.

9. Let $ABCD$ be a tetrahedron with $\angle ABC = \angle ABD = \angle CBD = 90^\circ$ and $AB = BC$. Let E, F, G be points on AD, BD, and CD, respectively, such that each of the quadrilaterals $AEFB, BFGC$, and $CGEA$ have an inscribed circle. Let r be the smallest real number such that area(EFG)/area$(ABC) \leq r$ for all such configurations A, B, C, D, E, F, G. If r can be expressed as $\frac{\sqrt{a-b\sqrt{c}}}{d}$ where a, b, c, d are positive integers with $gcd(a, b)$ squarefree and c squarefree, find $a + b + c + d$.

10. A $3-4-5$ point of a triangle ABC is a point P such that the ratio $AP : BP : CP$ is equivalent to the ratio $3 : 4 : 5$. If ABC is isosceles with base $BC = 12$ and ABC has exactly one $3-4-5$ point, compute the area of ABC.