

A Geometry Scavenger Hunt

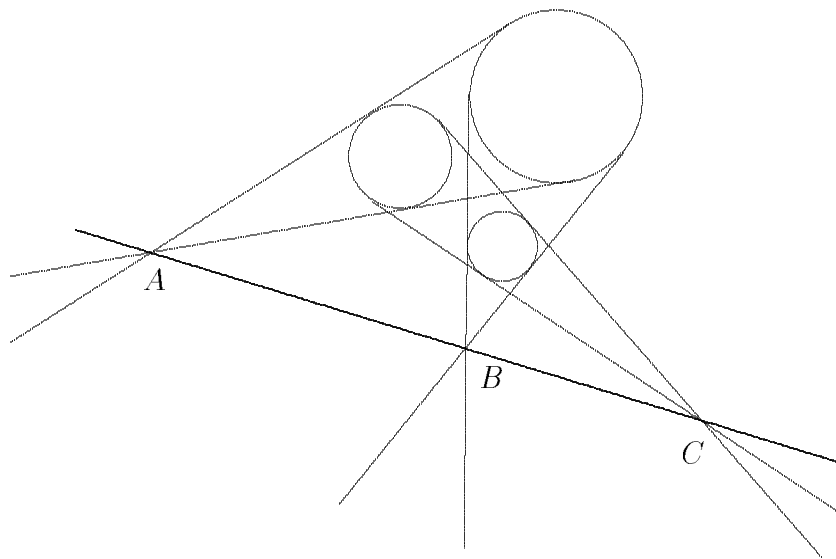
Carl W. Lee

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Your goal is to identify the following items. Sometimes a sketch or photograph will suffice. In most cases a few sentences describing the significance of the item will be necessary. You are free to ask anyone and everyone that you wish, but you should acknowledge your sources in writing. Results should be typed or computer-printed and handed in on $8\frac{1}{2} \times 11$ inch unlined paper,

Example:

Monge's Theorem. Draw three disjoint circles with different radii. For each pair of circles, draw the pair of external tangent lines and mark their intersection point. In this way you will obtain three points, A , B and C . Monge's Theorem states that these three points will always lie on a common line.



This result was proposed by d'Alembert and proved by Monge using the idea of viewing the problem in three dimensions. Think of the three circles as three balls in space bisected by a plane P in space. Each pair of balls determines a cone. The cone intersects the plane in the original pair of tangent lines. So the points A , B and C all lie in this plane. Now consider the special case when we can rest another plane Q on top of the three spheres. This plane is tangent to each of the three spheres and to each of the three cones, so the points A , B and C also lie in Q . Therefore the three points lie in the intersection of the planes P and Q , which is a straight line.

Reference: I.A. Graham, *Ingenious Problems and Methods*, Dover, New York, 1959.

Here is the list. Good luck!

1. A quasi-crystal.
2. A virus for the “common cold.”
3. The Witch of Agnesi.
4. A dissection of a square into four pieces that can be reassembled into an equilateral triangle.
5. The text of “The Kiss Precise.”
6. A painting by Dali that contains a dodecahedron.
7. A painting by Dali that contains an unfolded hypercube.
8. The mathematical name of a soccer ball.
9. An improperly drawn soccer ball from the popular media.
10. The number of configurations of Rubik’s cube.
11. A Chinese Rings puzzle.
12. A hexaflexagon.
13. A set of Soma Cubes.
14. Three works by Escher depicting impossible geometric figures.
15. A flower with 3-fold symmetry. Similarly with 4-, 5-, 6-, 7-, 8-, 9-, and 10-fold symmetry.
16. A set of pentominoes.
17. A Borromean rings configuration and the name of the beer company with which it is associated.
18. The formula for the number of ways of triangulating a convex polygon.
19. A two-foot piece of string and a can containing three tennis balls.

20. A cube cut in half with a single slice yielding a regular hexagonal cross-section.
21. A regular tetrahedron cut in half with a single slice yielding a regular square cross-section.
22. A work by Escher containing glide-reflectional symmetry.
23. A pantograph.
24. The name of the shape of the St. Louis arch.
25. Pictures of buildings with 3-, 4-, 5-, 6-, 7-, 8-, 9-, and 10-fold symmetry.
26. A Penrose tiling.
27. The quadratrix of Hippias.
28. A curve whose dimension lies strictly between 1 and 2.
29. A work by Escher depicting a tiling of the hyperbolic plane.
30. A tensegrity structure.
31. A map of the earth drawn before 1000 AD.
32. Morley's theorem.
33. The inscription on Archimedes' tomb.
34. Kepler's conjecture regarding Platonic solids and planets.
35. A non-round manhole cover.
36. An important geometric problem that has been solved recently.
37. A method of constructing a regular pentagon with compass and straight-edge.
38. A theorem sometimes attributed to Napoleon.
39. A table of chords from the *Almagast*.
40. The Banach-Tarski paradox.
41. The shape of a cell in a honey-bee comb, including the back end.

42. A dragon design.
43. A picture of Alexander's horned sphere.
44. Where to place eight moonbases on the moon in order to keep them mutually as far apart as possible.
45. The location of an exhibit which demonstrates the focusing property of an ellipsoid.
46. The maximum number of regions into which space can be cut with seven planes.
47. Five geometric figures with religious significance.
48. A picture made with a Spirograph.
49. A ruled surface.
50. The name of the individual who spent ten years on the construction of the regular polygon with 65537 sides, and where his manuscript is to be found.
51. A Voronoi diagram.
52. Seven regions on a torus, each pair being somewhere adjacent.
53. A planimeter.
54. A nine-point circle.
55. The tractrix.
56. The four-dimensional regular solids.
57. The shape of a sliding board giving the fastest slide.
58. A dissection of a cube into three congruent square-base pyramids.
59. A dissection of a cube into five tetrahedra, one of which is regular.
60. A dissection of a cube into six tetrahedra.
61. The smallest torus you can make using only equilateral triangles.
62. A description of suitable shapes for swords and their scabbards.

63. Verses in the Bible suggesting that π equals 3.
64. States in which the government has tried to legislate the value of π .
65. The curve described by a point on the rim of a wheel of a moving train.
66. A Towers of Hanoi puzzle.
67. The Argand plane.
68. Seven strip patterns (e.g., used as border patterns around the top of a room) with different kinds of symmetry.
69. Peaucellier's inversor linkage.
70. A loxodrome.
71. A drill that makes a square hole.
72. The formulas for the four-dimensional volume and the three-dimensional surface area of a four-dimensional ball.
73. The volume of the region common to two pipes of equal radius intersecting at right angles.
74. The number of vertices, edges, squares, and cubes in a hypercube.
75. The curve describing the motion of the earth about the sun.
76. The reason we have seasons.
77. A glissette.
78. A space-filling Archimedean solid.
79. A space-filling Archimedean dual.
80. A pair of enantiomorphic objects.
81. A Mascheroni construction.
82. The U.S. patent numbers for the Möbius strip.

83. A model of a flexible sphere.
84. An art gallery theorem.
85. A golden rectangle appearing in architecture.
86. A plant that displays two terms in the Fibonacci sequence.
87. A pentagon that tiles the plane.
88. The statement of the Delian problem.
89. How to trisect an angle with a T-square or “tomahawk.”
90. A published false “proof” of the four-color theorem.
91. Five significant problems in geometry that have not yet been solved.
92. Archimedes’ method of trisecting an angle.
93. A game based on a dodecahedron invented by Hamilton.
94. An infinitely long spiral which is inside the unit circle.
95. The isoperimetric problem.
96. A dissection of a squares into unequal squares.
97. The ham sandwich theorem.
98. A three-and-a-half story Easter egg in Canada.
99. How to obtain a parabola by curve-stitching.
100. The Mandelbrot set.