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W. J. C. MILLER

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W. J. C. MILLER, B.A.,

REGISTRAR

OF THE

GENERAL MEDICAL COUNCIL.

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Page 60, line 26, *for* these *read* there.
Page 82, line 5 from bottom, *for* 2668 *read* 6268.

VOL. XXXII.

Page 72, *omit* from line 5 from bottom to line 8 from bottom of page 73; the paragraph to be left out belonging to the Solution of the closely related Question 5276, by the same author (Vol. XXXI., p. 27.)

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Solved Questions.

1433. (The Editor.)—Prove the following reciproca cases of involution:—

a. The three sides of every triangle, and every three concurrent lines through its three vertices, intersect every axis in six points in involution.

a'. The three vertices of every triangle, and every three collinear points on its three sides, subtend every vertex in six rays in involution.

b. The six perpendiculars on the six lines from any point in the former case determine at the point a pencil of six rays in involution.

b'. The six perpendiculars from the six points upon any line in the latter case determine on the line a system of six points in involution. 50

1588. (Professor Sylvester, F.R.S.)—Solve the equation
$ax^5 + 5bx^4 + 10cax^3 + 10cbx^2 + 5c^2ax + c^2b = 0$. 115

1628. (Professor Sylvester, F.R.S.)—Extending the meaning of the word Bicorn to signify the general curve defined by the equations

$$x = \frac{c^3}{\phi^4 + \phi^3}, \quad y = \frac{c^2(2\phi - 3)}{\phi^2 + \phi^3},$$

show that the limiting form of the curve, as c converges towards zero, is a semicubical parabola and its axis extended indefinitely in both directions, forming together a sort of Trident. Explain the mode in which the geometrical passage of the double-horned to the tridentine form takes place, and specify in the Trident the morphological equivalents of the respective four branches of the general curve.......... 79

2432. (Colonel Clarke, C.B., F.R.S.)—Two perfectly flexible and inextensible films, being equal circles in form, are fastened together along the perimeter; what is the greatest amount of air that this could be made to hold (as an *air-cushion*)?.......... 25

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2756. (J. Griffiths, M.A.)—Show that an infinite number of triangles can be described such that each has the same circumscribed, nine-point, and self-conjugate circles as a given triangle..... 45

2782. (Professor Crofton, F.R.S.)—(1) A given point is known to be within a certain circle of given radius, but unknown position; find the chance that another given point is also within the circle. Also (2) three given points are known to be within a certain circle, which is otherwise altogether unknown: determine the most probable position of its centre. Again, (3) two given points are known to be within a circle, and a third given point is known to be outside it: determine the most probable position of its centre. 18

2753. (W. H. H. Hudson, M.A.)—There are three towns A, B, C, forming a railway triangle; the population of each is proportional to the line joining the other two. Assuming that the number of trains in and out of each varies as its population, prove that the number of train-miles run between A and B varies as $\cos^2 \frac{1}{2}C$. Show also that, for a given aggregate population and length of line, the total number of train-miles is greatest when the towns are equidistant 26

3915. (J. J. Walker, M.A.)—From points on a diameter of a conic, tangents are drawn and perpendiculars let fall on the chords of contact; prove that the locus of the intersection of these last named lines is a hyperbola having as asymptotes the diameter conjugate to the given one and a perpendicular diameter. 76

3916. (S. Watson.)—If O, O_1, O_2, O_3 be the centres of the inscribed and escribed circles of a triangle ABC; show that the sum of the squares of the distances of the centroids of the triangles BOC, COA, AOB, BO_1C, CO_2A, AO_3B from the centroid of the triangle ABC, is $\frac{2}{9}(ab+bc+ca)+\frac{2}{3}D(D-r)$. 37

4031. (Professor Sylvester, F.R.S.)—Define *a tree* in its most general form regarded as a complex of relations between any given number of points or ideas..... 96

4143. (The late Professor Clifford, F.R.S.)—Three elastic strings without weight, whose natural lengths are OA, OB, OC, are joined together at O, the centre of the circumscribing circle of the horizontal triangle ABC; and a smooth sphere of given radius and weight is placed with its centre vertically above O, and allowed to descend until the centre rests at O. Find the moduli of elasticity in the three strings..... 18

4208. (Professor Monck, M.A.)—Three lines AD, BE, CF are drawn from the vertices of a triangle ABC through a point O to the opposite sides; prove that

$$2\Delta ABC : \Delta DEF = AO \cdot BO \cdot CO : DO \cdot EO \cdot FO$$..... 35

4549, 4566, 4578, 4579. (C. Leudesdorf, M.A., and E. B. Elliott, M.A.) A bag contains mn balls, each equally likely to be of any one of m different colours. All but m are drawn out at random, and found to be $n-1$ of each colour. Find the chance that the remaining m are (1) one of each colour, (2) all of one colour.... 68

4817. (Professor Sylvester, F.R.S.)—In a school of 15 girls, a rule has been laid down that they shall walk out every day in rows of threes, but that the same two girls shall never come together twice in the same row. The rule is supposed to have been carried out correctly during the six working days of the week,

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but when the time comes for their going to church together on Sunday it is found to be absolutely impossible to continue it any further. Investigate whether the rule *can* have been correctly carried out during the six previous days; and if so, show how. 53

5113. (The Editor.)—124, 154, 156, 163, 234, 132, 473, 456, 467, 367, and 124, 143, 126, 234, 167, 523, 173, 562, 567, 573 are two sets of ten triplets each made with seven elements, so that every duad employed occurs twice in either system. If we change them by any substitution, as 2135746—which means, put 2 for 1, 1 for 2, 3 for 3, 5 for 4, 7 for 5, 4 for 6, and 6 for 7—the first becomes 215, 275, 274, 243, 135, 231, 563, 574, 546, 346, which is similar to the first; but no substitution can make the first into the second, or the second into the first; so that these two are dissimilar sets. Find the entire number of dissimilar sets. 114

5138. (The Editor.)—Two persons make an appointment to meet on a certain day at the Medical Council Office, but without fixing the time further than that it is to be between 2 and 3 o'clock; and each agrees to wait ten minutes for the other. Now, supposing all times between the specified limits for coming to the Office to be equally probable, show, by a general solution, that the odds are 25 to 11 against the meeting taking place..... 78

5167. (Professor Seitz, M.A.)—A point is taken at random in the surface of a given circle, and from it a line equal in length to the radius is drawn, so as to lie wholly in the surface of the circle; find the chance that the line intersects a given diameter. 52

5264. (Rev. H. G. Day, M.A.)—Two similar polygons ABCDE..., $A_1B_1C_1D_1E_1$... are similarly situated on lines AB, A_1B_1 (not parallel); show that (1) if they are situated towards the same parts, a point O can be found at which AA_1, BB_1, CC_1, &c. all subtend the same angle: and (2) if towards opposite parts, a point O can be found at which the bisectors of the angles AOA_1, BOB_1, COC_1 coincide. 43

5272. (Professor Townsend, F.R.S.)—A solid of revolution of uniform density, turning without friction round a fixed point on its axis of figure, and rolling without sliding on a fixed plane inclined at any angle to the horizon, being supposed to have the velocity of rotation just sufficient to carry it with exhausted energy of motion to its position of unstable equilibrium against the action of gravity; determine, in finite terms, its time of passage from the opposite position of stable equilibrium to any other on its way..... 42

5329. (Professor Townsend, F.R.S.)—A rigid body, in unconstrained equilibrium in free space, being supposed set in motion by a single impulsive force applied at a definite point of its mass; if the initial motion be a pure rotation, show that—

(*a*) The several possible lines of impulsive action through the point generate a quadric cone, containing the three perpendiculars from the point on the three central principal planes, and the connector of the point with the centre of inertia of the body.

(*b*) The several corresponding axes of initial rotation in the body envelope a quadric cone, touching the three central principal planes, and the diametral plane conjugate to the direction of the point with respect to the central ellipsoid of the body.... 84