UNIVERSITY WORK.

MATHEMATICS.

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CAMBRIDGE EXAMINATION PAPERS.

MATHEMATICAL TRIPOS.

1. Triangles on equal bases, and between the same parallels, are equal to one another.

Find the condition that must exist in order that it may be possible to fold the four corners of a quadrilateral piece of paper flat down on the paper so that the four angular points meet in a point, and the paper is everywhere doubled.

2. If a straight line drawn through the centre of a circle bisect a straight line in it which does not pass through the centre, it cuts it at right angles.

Draw from a given point P two straight lines PQ, PR at a given inclination to one another to meet two given straight lines in Q and R, so that PQ, PR may be equal.

3. The angles in the same segment of a circle are equal to one another.

If A, B be two fixed points on a circle, and C, D the extremities of a chord of constant length, then the intersections of AD, BC and of AC, BD lie on fixed circles.

4. If a chord of a circle and a diameter intersect at right angles, the rectangle contained by the segments of one of them is equal to the rectangle contained by the segments of the other.

If P be a point in a diameter AB of a circle, and PT be the perpendicular on the tangent at a point Q, then

rect. $PT, AB =$ rect. $AP, PB +$ sq. on PQ.

5. In a right-angled triangle, if a perpendicular be drawn from the right angle to the base, the triangles on each side of it are similar to the whole triangle.

Show that the middle points of the four common tangents to two circles which lie outside each other lie on a straight line.

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1. An article made of sterling silver weighs as much as 5*s.* 6*d.* in silver; the same article and a fourpenny-piece together weigh $1\frac{1}{4}$ oz. avoirdupois. The cost of the article is 11*s.* $5\frac{1}{2}$*d.*; what is this per oz. Troy?

2. Find two independent relations between the roots and the coefficients in a quadratic equation.

If the result of eliminating x between the equations

$$x^2+px+q=0 \text{ and } xy+a(x+y)+b=0$$

be an equation in y, whose roots are the reciprocals of those of the given equation in x, then either $a(1-q)=0$ and $ap=1+b$, or $b=1$ and $p=a(1+q)$.

3. Eliminate x, y, z from

$$\frac{x^2-xy-xz}{a}=\frac{y^2-yz-yx}{b}=\frac{z^2-zx-zy}{c},$$

and $$ax+by+cz=0.$$

Solve (i.) $$\sqrt{(\alpha x+\beta)}+\sqrt{(\alpha' x+\beta')} =\sqrt{(ax+b)}+(\sqrt{a'x+b'})$$

where $\alpha+\alpha'=a+a'$ and $\beta+\beta'=b+b'$;

(ii.) $$\frac{\sqrt[3]{(3a+a^2-3x-x^2)}}{a-x}=\frac{3}{a^2}+1.$$

4. Find the sum of n terms of a geometrical progression when the r^{th} and s^{th} terms are known.

B holds an estate from A on a lease with two years unexpired. He has made permanent improvements on it and sublet it for £510 per annum. Reckoning yearly interest at 4 per cent., the present value of the estate to A is 24 times B's interest in it. What rent is B paying to A?

5. Assuming the binomial theorem for a positive integral index, prove it for a fractional one.