UNIVERSITY WORK.

MATHEMATICS.

ARCHIBALD MACMURCHY, M.A., TORONTO, EDITOR.

SELECTED PROBLEMS.

MATHEMATICAL TRIPOS, CAMBRIDGE, JUNE, 1882.

1. From P, Q, the extremities of any diameter of a circle, perpendiculars PL, PM, QL', QM', are drawn to two chords AB, AC; prove that LM, $L'M'$ are at right angles.

ii. One of the angles B of a right-angled isosceles triangle ABC is trisected by lines which meet the straight line AMN drawn from A the right angle perpendicular to the base BC in M and N, and CN produced cuts AB and E. Show geometrically that EM is parallel to BN.

3. $ABCD$ is a convex quadrilateral and circles are drawn lying outside it and touching every three successive sides, produced if necessary. Prove that their centres lie on a circle. Show also that, if $ABCD$ can be described about one circle and inscribed in another, the radius of the inscribed circle will be a mean proportional to the radii of either pair of opposite escribed circles.

iv. Two equal ellipses, centres C and C', touch one another in a point P on the line joining their centres and CD is the semi-diameter conjugate to CP. Show that, if the four tangents drawn from any point in the straight line PD cut CC' in H, K, L, M, then the rectangle HK, LM will be equal to the rectangle KL, HM.

5. If a tangent to a conic, whose centre is C, cut the auxiliary circle in Y, Y', the diameters conjugate to CY, CY' will meet the same tangent on the directrices.

vi. Show that if d be any constant and x, y, z be determined by the equations

$$\left.\begin{aligned}(a-\alpha)^2x+(a-\beta)^2y+(a-\gamma)^2z&=(a-\delta)^2\\(b-\alpha)^2x+(b-\beta)^2y+(b-\gamma)^2z&=(b-\delta)^2\\(c-\alpha)^2x+(c-\beta)^2y+(c-\gamma)^2z&=(c-\delta)^2\end{aligned}\right\},$$

then $(d-\alpha)^2x+(d-\beta)^2y+(d-\gamma)^2z$ will be independent of a, b, c, α, β and γ.

LONDON UNIVERSITY.

MATRICULATION EXAMINATION, JULY, 1882.

1. Add together and simplify

$1^{s}_{T}\left\{\frac{3}{20}+\frac{3}{4}\left(\frac{4}{5}-\frac{2}{5}\right)\right\}$ of a pound, and

$\frac{1}{7}$ of $1\frac{3}{8}$ of 14_{T}^{1} of a penny.

$=23_{2}^{9}1_{5}^{1}7_{8}$ pence.

2. Express $\sqrt{\frac{0.0864\times753}{0.00391}}$ correctly to the nearest integer.

$=128.9+=129$ nearly.

3. Express $\frac{1.\dot{5}47\dot{6}\times10.618}{2.\dot{6}547}$ in its simplest form.

$=6.19$.

4. A reduction of 20 per cent. in the price of apples would enable a purchaser to obtain 120 more for a sovereign. What may the price be before reduction?

240 pence at $\frac{4}{5}$ of the first price would buy just as many as $(\frac{5}{4}\times240)=300$ pence at the whole of the first price; $\therefore$ difference between 300 pence and 240 pence will buy 120 apples; $\therefore$ 60 pence buys 120 apples $=\frac{1}{2}d.$ each.

5. A merchant lays out £1000 in buying cloth in England at 3 shillings a yard. He takes the cloth to France at an expense of 3 pence a yard for carriage, packing, etc., and paying a duty of 42 centimes a metre. He sells half the cloth at 8 francs a metre, the rest at 6 francs a metre. What profit does he make?