$=2x$. Curve bisects sub-tangent. Length of normal $=2d$. Analytical investigation into diameters and their properties (alternative with § 147.)

Geometrical proof of the equation to the parabola referred to diameter and tangent, together with a proof that the chords parallel to the tangent are bisected, &c., (as in the obligatory course.

To draw a parabola, given any diameter and the tangent at its vertex and one other point.

To draw a parabola touching two intersecting straight lines at given points; also, to construct the focus and directrix, the latter by at least six points.

To draw a parabola, given its vertex, axis and one point; thence to draw it, given the axis and two points at different distances from the axis.

Construction of tangents from any external point; their lengths are proportional to the cosecants of their inclinations.

Intersections of Conics, straight lines and other curves.

Contact. Circle of curvature; 2ρ as limit of $\frac{y^2}{x}$ or $\frac{y^2}{x \sin \theta}$,

$\therefore \rho = \frac{2a}{\sin^3 \theta} = \frac{N}{\sin^2 \theta} = \frac{N^3}{SL^2}$; thence construction of radius of curvature, and evolute.

Intersection of circle and conic, equal inclination of opposite chords; thence construction of radius of curvature, § 208.

Ellipse.—Chapter IX, X, omitting § 205.

Equation found from the definitions of an ellipse as the projection of a circle, as described by the trammel, and as $r + r' = 2a$, instead of that given in Todhunter. Geometric properties proved from the definition $r + r' = 2a$, as follows: Construction of a tangent; its equal inclinations to the focal distances; locus of the foot of the perpendicular from the focus. $pp' = b^2$; $\frac{p}{p'} = \frac{r}{r'}$; $p^2 = \frac{b^2 r}{r'}$.

Locus of intersection of tangent with the perpendicular at the focus to the radius vector; proof of Todhunter's definition of an ellipse; locus of intersection of tangent at the extremities of a focal chord; straight lines ae, $\frac{a}{e}$; $r = a \pm ex$.

Polar equation referred to both focus and centre. Equations to tangent and normal. Points where they cut the axes. The length e^2x' both analytically and geometrically.

Equation at the vertex becomes a parabola if $e = 1$ or $a = \infty$. Latus rectum $= 2\frac{b^2}{a} = 2e\left(\frac{a}{e} - ae\right)$, compared with