

XXXV. *Some New Properties in Conic Sections, discovered by Edward Waring, M. A. Lucasian Professor of the Mathematics in the University of Cambridge, and F R. S. to Charles Morton, M. D. Sec. R. S.*

T H E O R. I.

Read June 21,  
1764.

SIT ellipsis APBQCRDSET, &c. describantur circa eam duo polygona [TAB. XIII. Fig. 1.] (*abcdef*, &c. *pqrstv*, &c.) eundem laterum numerum habentia, & quorum latera ad respectiva contactuum puncta (APBQCRDS, &c.) in duas æquales partes dividuntur, i. e.  $aA = Ab$ ,  $bB = Bc$ ,  $cC = Cd$ , &c.  $pP = Pq$ ,  $qQ = Qr$ ,  $rR = Rs$ , &c. & erit summa quadratorum ex singulis unius polygoni lateribus æqualis summæ quadratorum ex singulis alterius polygoni lateribus, i. e.

$$ab^2 + bc^2 + cd^2 + de^2 + ef^2 + \dots = pq^2 + qr^2 + rs^2 + st^2 + tv^2 + \dots, \&c.$$

Cor. Ducantur lineæ AB, BC, CD, DE, EF, &c. PQ, QR, RS, ST, TV, &c. & erit  $AB^2 + BC^2 + CD^2 + DE^2 + EF^2 + \dots = PQ^2 + QR^2 + RS^2 + ST^2 + TV^2 + \dots$ .

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T H E O R.

# THEOR. II.

Iisdem positis sit O centrum ellipseos, & ducantur lineæ OA, OP, OB, OQ, OC, OR, OD, OS, &c. erit

$$OA^2 + OB^2 + OC^2 + OD^2 + \&c. = OP^2 + OQ^2 + OR^2 + OS^2 + \&c.$$

Cor. Ducantur etiam lineæ Oa, Op, Ob, Oq, Oc, Or, Od, Os, &c. & erit

$$Oa^2 + Ob^2 + Oc^2 + Od^2 + \&c. = Op^2 + Oq^2 + Or^2 + Os^2 + \&c.$$

Hæc etiam vera sunt de polygonis inter conjugatas hyperbolas eodem modo descriptis.

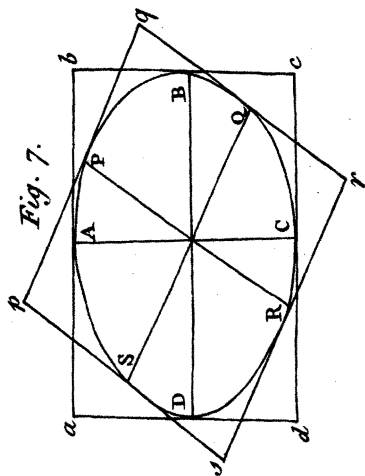
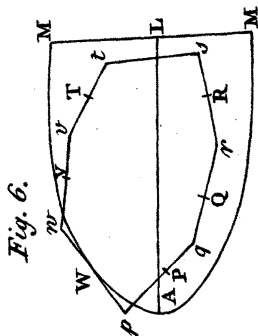
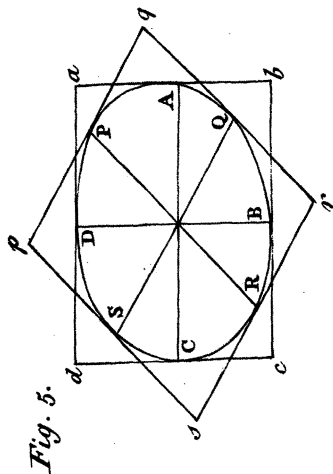
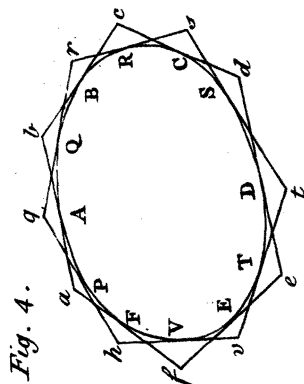
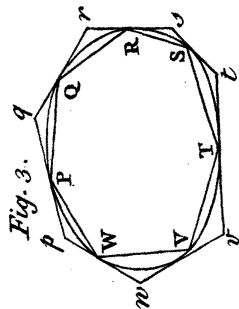
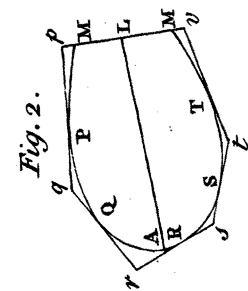
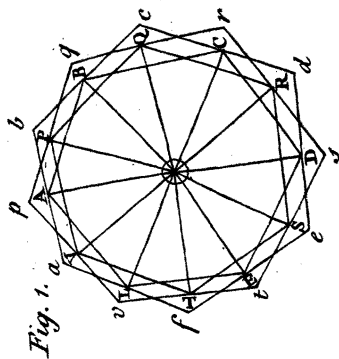
# THEOR. III.

Sit conica sectio MPQRSTM' &c. [Fig. 2.] cujus diameter sit AL, et ejus ordinata ML'; sit Mp = Mv, & consequenter Lp = Lv.

Ducantur lineæ pq, qr, rs, st, tv, &c. quæ respective tangant conicam sectionem in punctis P, Q, R, S, T, &c. & erit contentum

$$pP \times qQ \times rR \times sS \times \&c. = Pq \times Qr \times Rs \times St \times Tv \times \&c. \text{ vel, quod idem est, summa omnium hujus generis rationum } (Pp : Pq, Qq : Qr, Rr : Rs, Ss : St, \&c.) \text{ erit nihilo æqualis.}$$

Cor. 1. Sit ellipsis PQRSTV &c. circa eam describatur quodcunque polygonum (pqrstuvw, &c.), [Fig.



[ Fig. 3. ] cujus latera respective tangant ellipſim in punctis P, Q, R, S, T, V, &c. & erit contentum

$$pP \times qQ \times rR \times sS \times tT \times vV \&c. = Pq \times Qr \times Rs \times St \times Tv \times Vw \times \&c.$$

Cor. Ducantur lineæ PQ, QR, RS, ST, &c. & pro finibus angulorum WP  $p$ , QP  $q$ , RQ  $r$ , QR  $s$ , SR  $s$ , TS  $t$ , &c. ſcribantur respective  $a, p, b, q, c, r, d, s$ , &c. & erit

$$abcd \&c. = pqrst \&c.$$

Et fic de polygonis inter conjugatis hyperbolas inſcriptis.

Idem verum eſt de polygono, cujus laterum ſumma vel area minima ſit, circa quamcunque ovalem in ſeſe ſemper concavam deſcripto, ut conſtat e noſtra Miſcell. Anal.

#### THEOR. IV.

Sit ellipſis PAQBRCSDTEVF, &c. [Fig. 4.] circa eam deſcribantur duo polygona  $abcdef$ , &c.  $pqrstv$ , &c. eundem laterum numerum habentia; eorum latera  $ab, bc, cd, de, ef$ , &c.  $pq, qr, rs, st, tv$ , &c. respective tangant ellipſim in punctis A, B, C, D, E, F, &c. & P, Q, R, S, T, U, &c. & ſit  $aA : Ab :: pP : Pq$ , &  $bB : Bc :: qQ : Qr$  &  $cC : Cd :: rR : Rs$  &  $dD : De :: sS : St$ , & fic deinceps. Et area polygona  $abcdef$ , &c. æqualis erit areæ polygona  $pqrstv$ , &c.

Cor. Duo parallelogramma ( $abcd$  &  $pqrst$ ) circa datæ ellipſeos conjugatas diametros (AC & BD; PR, QS) [Fig. 5.] deſcripta, erunt inter ſe æqualia.

In hoc casu enim  $aA = Ab$ ,  $bB = Bc$ ,  $cC = Cd$ ,  
 $dD = Da$ , &  $pP = Pq$ ,  $qQ = Qr$ ,  $rR = Rs$ ,  
 $sS = Sp$ ; & consequenter  $aA : Ab :: pP : Pq$  &  
 $bB : Bc :: qQ : Qr$ , & sic deinceps: ergo per the-  
 orema hæc duo parallelogramma erunt inter se æqualia,  
 quæ est notissima ellipseos proprietas.

Idem dici potest de polygonis inter conjugatas hy-  
 perbolas eodem modo descriptis.

## T H E O R. V.

Rotetur conica sectio circa diametrum ejus (AL),

& sit MAM', &c. solidum exinde generatum; sint  
 $pq$ ,  $qr$ ,  $rs$ ,  $st$ ,  $tv$ ,  $vw$ ,  $wp$ , &c. [Fig. 6.] lineæ,  
 quæ tangant solidum in respectivis punctis P, Q, R, S,  
 T, V, W, &c. & erit contentum

$$pP \times qQ \times rR \times sS \times tT \times vV \times wW \times \&c. = \\ Pq \times Qr \times Rs \times St \times Tv \times Vw \times \&c.$$

## T H E O R. VI.

Sit ellipsis APBQCR, &c. rotetur circa diame-  
 trum ejus BD; & circa conjugatas diametros (AC  
 & BD, PR & QS) describantur elliptici cylindri  
 ( $pqrs$  &  $acbd$ ) [Fig. 7.] solidum generatum cir-  
 cumscribentes, & erunt hi duo cylindri inter se æ-  
 quales.

Sint duo solida e truncatis conis composita, solidum  
 generatum circumscribentibus, & quorum latera con-  
 tinuo

tinuo eâdem ratione ad puncta contactuum dividuntur ; erunt hæc duo solida inter se æqualia.

Et sic de solidis inter conjugatas hyperboloides eodem modo descriptis.

Facile constant plures consimiles conicarum sectionum proprietates.

Hujus generis proprietates affirmari possunt de infinitis aliis curvis, ut facile deduci potest e nostrâ Miscell. Anal.