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XLVIII. Geometry and geometers

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I have this day received the following additional accounts of this meteor from Mr. Fasel, who with the Rev. J. B. Reade has revisited the spot from which he saw the meteor, and found by compass that the place occupied by the meteor when first seen was due magnetic north (about 7° west of true north). Just previously to this time Mr. Fasel was walking with his face towards the west, when the bursting of the meteor caused him to turn his head towards the north. He then went home, made a diagram in his journal (a copy of which he has forwarded to me), and described it as a very brilliant meteor of the size of a star of the first magnitude, and it left a long train of red light.

From Mr. Jones's account, the meteor was first seen

At an altitude of.....	13	and in azimuth.....	68	E. of N.
Its altitude at the next observation was	27	and its azimuth.....	89	E. of S.
...	...	49	...	63 E. of S.
...	...	56	...	45 E. of S.
Its altitude at explosion was	60	...	8	W. of S.

From Mr. Fasel's account, the meteor was first seen at an altitude of 30° , and in azimuth 7° W. of N., and its altitude at explosion was 38° , in azimuth 59° W. of N.

The path of the meteor seems to have been from E.N.E. to W.S.W., and was contrary to the order of planetary motion.

The intersections of the azimuths at explosion indicates that the meteor at this time was vertical over a spot at about fifteen miles from Montgomery, and north-east of it. Its distance from the earth at this time was about eighty miles.

Blackheath, April 22, 1850.

XLVIII. *Geometry and Geometers*.

Collected by T. S. DAVIES, Esq., F.R.S. and F.S.A.*

No. V.

THE mathematical collections of Pappus have an enduring interest to the geometer; but without question, the short notice respecting the Porisms of Euclid (in the preface to his seventh book) is the most interesting part of the whole work.

It is unknown what MSS. were used by Commandine in making his translation; and all that have been since discovered are of comparatively modern dates. From some remarkable coincidences, there is reason to believe that the MS. of Commandine was of the same period as some of these:—one of which coincidences is, the absence of a figure alike from all known codices and from Commandine's translation. They are all alike defective in not even verbally describing this

* Communicated by the Author.

figure*. Other and multiplied coincidences might be pointed out, all of which tend to show that the existing MSS. are only copies (with sometimes unaccountable variations, it is true) from some one of an earlier date,—and this, too, an imperfect transcript of the original.

The Savilian Library of Oxford contains two such MSS. (Nos. 3 and 9); and from these Halley attempted to form a text of that celebrated preface. This was prefixed to his Restoration of the Section of Ratio and Section of Space, printed in 1706; and is still the only text that is considered to make any probable approach towards the original. Yet he gives up in despair all attempts to elucidate what is said respecting the Porisms.

Under these circumstances it would have been advisable (at least as regards the section, *Περὶ τῶν πορισμάτων Εὐκλείδου*, pp. vi.—ix.) to give the readings of each of his MSS., and his reasons for any departure from them, however slight. The

* M. Breton, indeed, denies that this figure (or these figures) has ever existed, or was at all necessary (*Comptes Rendus*, Oct. 29, 1849, p. 482): but in this he stands alone, and offers a very unsatisfactory reason,—“*puisqu'il s'agissait de propriétés générales.*” As, however, M. Breton's paper is not published, and only a slight notice given of it in the place referred to, it would be obviously an inappropriate subject of comment here. Still his general views are indicated with precision; and I may be (especially as my thoughts are deeply occupied with the same subject) permitted to express my entire dissent from his conclusions, and my conviction that his interpretation is alike contradictory to all historical evidence, and incompatible with the state of geometrical science in Euclid's time.

I hope to be able to offer conclusive evidence that the porism of Euclid must have been what Simson divined it to be, and *could not possibly have been anything else*. I speak of it as a proposition: but I do not venture to affirm that any single actual porism that has been said to be “restored” is precisely one of those which Euclid gave, whether offered as such by Simson, Noble, or whoever else has made the attempt. They *may be* so: but so long as the same lemma may be subservient to many porisms, how are we to tell which of these many was really Euclid's individual porism? Probability would indeed rest upon the simplest, but certainly upon no one.

The fragmentary character of the description of the several porisms in the last three paragraphs of the text renders it impossible to affirm whether the words refer to the predicate of the proposition, or to successive mutations of the subject; or, in other words, whether they express the conclusion in which the reasoning is to terminate, or the several interchanges of one single condition. The former has been uniformly assumed: but, when closely examined, it seems to lead to difficulties from which the latter is free. One of these difficulties is, that it is impossible to see in an enunciation so constructed anything more than a local theorem. This assumption, indeed, may account for the almost universal tendency (especially amongst the continental geometers) to confound the porism with the local theorem. There is no question, however, that the propositions given by Simson, as porisms, are truly and essentially such, whether they coincide with any of Euclid's or not.

I cannot, however, enter into further details here. What I have to offer on the subject will hence be reserved for another occasion and another place.

reasons can now, of course, only be conjectured from the alterations which he made: but it only requires careful collation to assign what those changes were. I am fortunately enabled to give these from a MS. of the late Mr. S. P. Rigaud, Savilian Professor of Geometry in the University of Oxford, drawn up in 1815, 1816, and undertaken at the request of the late Professor Leybourn of the Royal Military College, Sandhurst. I believe that all who had the privilege of Professor Rigaud's friendship will admit that he was, from his habitual care and accuracy, eminently likely to observe even the most minute variation:—they would trust his eye quite as much as their own, and feel even more confidence in his transcripts than if made by themselves. This collation, too, was made three times over; and by a scholar resident on the spot, who could examine the MSS. at his leisure, and who moreover thoroughly understood the subject to which they relate.

It was for the use of Mr. Mark Noble, one of the then Sandhurst staff of Professors, that Mr. Leybourn procured this collation. Mr. Noble had some years previously published two short papers on Porisms, into the analysis of which he conceived he had introduced material improvements. [See Leybourn's *Mathematical Repository*, vol. i. p. 35, N.S., and *Gentleman's Mathematical Companion*, vol. ii. p. 42.] That venerable mathematician placed the papers in my hands a short time ago, with the hope that they might be of use to Mr. Potts and myself in preparing our notes to the translation of Simson's *Porisms*; and, knowing the casualties to which loose papers are liable when they are vested in private families, I have thought it better to secure for the public a correct copy in print, whilst the MS. remains in my possession. It will save, too, a good deal of trouble, and remove in some degree the vagueness with which we all estimate the value of information which is not generally accessible. If, too, other MSS. (the Paris and Burney, for instance) were collated with the same care, and printed in the same manner, all the information that *literature* can supply on this subject would be open to all; instead of being, as now, confined to a few, and obtained even by them with much trouble and expense.

Any notes made by Simson in his copy of *Commandine* would also tend to utility. The *Adversaria*, too, might contribute something, were those valuable papers carefully examined. Glasgow, however, has her own resident geometers; and it is not too much to hope, that regard for her own honour, and veneration for her great men of past days, will operate as sufficient incentives to this illustration of a book so intimately connected with Simson's and with Scotland's fame.

A short summary of the contents of the mathematical col-

lections was given by Dr. Hutton in the first edition of his Dictionary (1796); and a somewhat more philosophical one by Dr. Trail in the third supplement to his Life of Simson (1812).

The letter itself is sufficiently explicit as to the signification of the references and construction of the list of readings. Those which were crossed out are here dotted beneath, to still guide the reader to the words which were originally noted; and the numbers referring to them are omitted from the margin. Those words where the variations are retained have a line beneath them in the original; but are here referred to by numbers and letters in the usual manner.

“MS. Sav. 3. The propositions are not numbered on from the beginning of the book, but have a separate numbering for each part of the 7th Book.—What is Prop. 127 of Commandine stands thus in the manuscript:—

Πορισμάτων α^{ν} β^{ν} γ^{ν} .

Του πρώτου εἰς τὸ πρῶτον πορίσμα ἔστω καταγραφὴ $\bar{\alpha}$
 ἢ $\alpha\beta\gamma\delta\epsilon\zeta$ καὶ ἔστω ὡς $\bar{\alpha}\zeta$ πρὸς τὴν $\zeta\eta$, οὕτως ἢ $\bar{\alpha}\delta$ πρὸς $\kappa\zeta$
 τὴν $\delta\gamma$, καὶ ἐπεξεύχθω ἢ $\theta\kappa$ ὅτι παράλληλός ἐστιν ἢ $\theta\kappa$,
 (N. the enunciation ends in this incomplete manner).

“What Commandine has in p. 355 (Ed. 1660), ‘Per compositam vero proportionem, &c.’ is marked β in the margin of MS., and Commandine’s Prop. 128 begins thus:

Εἰς τὸ δεύτερον πορίσμα καταγραφὴ ἢ $\alpha\beta$ $\gamma\delta$ $\epsilon\zeta$ $\eta\theta$ $\bar{\gamma}$
 ἔστω δε παράλληλος ἢ $\bar{\alpha}\zeta$ τῇ $\bar{\alpha}\beta$ ὡς δε ἢ $\bar{\alpha}\epsilon$ πρὸς τὴν $\epsilon\zeta$
 οὕτως ἢ $\bar{\gamma}\eta$ πρὸς τὴν $\kappa\zeta$. ὅτι εὐθεία ἐστὶν ἢ διὰ τῶν $\theta\kappa\zeta$.

“Commandine’s 164 begins thus:

Εἰς το πορίσμα $\bar{\alpha}$ β γ βιβλίου.

Θέσει ὄντος παραλληλογράμμου του $\bar{\alpha}\delta$ ἀπὸ δοθέντος $\bar{\alpha}$
 του $\bar{\epsilon}$ διαγραφειν τὴν $\epsilon\zeta$ καὶ ποιειν ἴσον τὸ $\zeta\eta$ τρίγωνον
 τῷ $\bar{\alpha}\delta$ παραλληλογράμμῳ.

“MS. 9.

Πορισμάτων $\bar{\alpha}$ β γ .

του πρωτου Εστω καταγραφη η $\alpha\beta\gamma\delta\epsilon\zeta$ και εστω ως η $\alpha\zeta$
 εις το α^{ν} προς την $\zeta\eta$ ουτως η $\alpha\delta$ προς την $\delta\gamma$ και επε-
 χεινχθω η $\theta\kappa$ ὅτι $=^{\circ s}$ ἐστιν η $\theta\kappa$ τη $\alpha\gamma$.

Εἰς το δευτερον πορίσμα καταγραφὴ η $\bar{\alpha}\beta$ $\bar{\gamma}\delta$
 $\epsilon\zeta$ εστω δε $=^{\circ s}$ η $\bar{\alpha}\zeta$ τη $\bar{\delta}\beta$. ως δε η $\bar{\alpha}\epsilon$ προς την
 $\epsilon\zeta$ ουτως $\bar{\gamma}\eta$ προς την $\eta\zeta$ ὅτι ευθεια ἐστιν η δια
 των $\theta\kappa\zeta$.

Εἰς το πορίσμα του $\bar{\alpha}$ βιβλίου.

Θεσει οντος $=\gamma\rho\upsilon\upsilon$ του $\bar{\alpha}\delta$ απο δοθεντος του $\bar{\epsilon}$
 διαγαγειν την $\epsilon\zeta$ και ποιειν ισον το $\zeta\eta$ $\Delta^{\circ\nu}$ τῷ
 $\bar{\alpha}\delta =\gamma\rho\omega$.

"SIR,

"Oxford, Feb. 24, 1816.

"The above are all the instances in which I can find anything like what you desired me to look for: but although they are only three in number, the last is new, as I see nothing like it in Commandine. I am much obliged to you for *Beja Ganita*, and regret that your efforts for the promotion of scientific literature should be so little profitable to you. I have had the pleasure of being able to complete the collation sooner than I expected, and I lose no time in forwarding it to you. I hope your friend will have no difficulty in understanding the references which I have made in the margins. You may explain to him that I have drawn lines under the words to which any various readings occurred, and I have put numbers in the margins referring to them. These will be found to have two interruptions: the first is from my having in a few instances discovered variations in a second collation which had previously escaped me, such as (18) No. 3. P. VII. (28) No. 9. P. VII. and (29) No. 9. P. IX.; the other interruption is from my having erased many references which I had made in my first collation. These erasures consisted almost entirely of what had been introduced by an excess of minuteness, which had induced me to copy out some of the contractions. Hence you will find very many of them in P. VIII., for in the MS. No. 9 the page which contains from *δαψιλεστερου* (line penult. P. VII.) to *δοθεντα* (line 4. P. IX.) is written in a different hand from the two pages which precede and follow it, and it contains several contractions which differ from the characters used in them; thus (29) it has *δεδομεν-σηων* for *δεδομενων σημειων* where the printed text has *δεδομενω σημειω*; but as I had no doubts about the meaning of any of these contractions, I thought it useless to leave the mention of them where no variation was offered in the readings. Wherever any erasure has been made, the line which was drawn under the word to which the reference was made is marked thus In some cases there are more words in the margin than that to which the various reading belongs; but this occurs only where I thought that there might otherwise be some mistake: if, however, in this or in any other particular I have failed in making myself clearly understood, I shall be happy in hearing from you or from your friend (although I possibly have not the pleasure of his acquaintance), and as I have Halley's book at hand, it will only be necessary to mark the page and line in which the difficulty may occur.

"I have carefully made the collation three several times, and the last time I repeated it I could discover no variation which I had not previously noted; I therefore feel confident of the accuracy of what I send you. I hope likewise that it

is sufficiently minute, as I have not omitted to mark even what are most obviously the blunders of transcription. I did not, however, think it necessary to set down where words were differently divided from what they are in the printed text, and which in many instances occurs in No. 9 without any reason, and I gave up any attention to accents in that MS.; indeed you may remember what Wallis says, ‘*accentuum spirituumque notæ et interstinctionum puncta desiderantur fere omnia.*’ He certainly studied these MSS. with great attention; but still I cannot feel perfectly satisfied with his conjecture of the one being only a copy of the other. Readings and omissions likewise will be found in each which do not occur in the other; and though there are very many instances of peculiar similarity in them, this may have been occasioned by their both being transcripts from the same original.

“Pray remember me to my old acquaintance Mr. Dalby, whom by some strange oversight I neglected to mention in my last letter. “Your most humble Servant,

“Oxford, Feb. 24, 1816.”

“S. P. RIGAUD.”

“P.S. You omitted to mention the bookseller who receives the subscription for the Diaries. I shall go to the publisher if I hear nothing from you to the contrary; and I should not have troubled you on the subject, if I had not been afraid of a mistake between your copies (for one of which I consider myself as subscribing) and those which remained as Mr. Mawman’s property.”

¹Περὶ τῶν πορισμάτων Εὐκλείδου^a.

Μετὰ δὲ τὰς ἐπαφὰς ἐν τρισὶ βιβλίοις πορίσματα ἔστιν Εὐκλείδου, πολλοῖς ἄθροισμα φιλοτεχνότατον εἰς τὴν ἀνά-
λυσιν τῶν ἐμβριθεστέρων προβλημάτων καὶ τῶν γενῶν, ²ἀπε-
ρίληπτον^b τῆς φύσεως παρεχομένης πλήθος. Οὐδὲν προσ-
τεθείκασιν τοῖς ὑπ’^c Εὐκλείδου γραφέεσι πρώτου, χωρὶς
εἰ μὴ τινες τῶν πρὸ ἡμῶν ἀπειρόκαλοι δευτέρας γραφὰς
ὀλίγοις αὐτῶν παρατεθείκασιν^d ἐκάστου μὲν πλήθος

References to MS. No. 3.

¹ There is no such title in the MS., it is written thus :

πτῶσιν :

ἔχει δὲ τὸ πρῶτον τῶν ἐπαφῶν προ-
βλήματα ζ’.

τὸ δὲ δεύτερον προβλήματα δ’

Λήμματα δὲ ἔχει τὰ β’ βιβλία, κδ’.

αὐτὰ δὲ θεωρημάτα ἔστιν ξ’ μετὰ δὲ
τὰς ἐπαφὰς. κ.τ.λ.

ἔχει δὲ, &c. to Δ inclusive is written
in red ink, the rest is in black.

In the margin is “Euclidis Porism.
Lib. 3.”

² ὑπο.

References to MS. No. 9.

^a There is no title in the text, but
in the margin there is πορίσματα
3 Lib.—There is no distinction of
red and black in it, but there is a
break in the line thus : κατα πτῶσιν,
ἔχει δὲ τὸ πρῶτον τῶν επαφῶν
προβλήματα επτα, το δε δευτερον προ-
βληματα τεσσαρα. λημματα δε ἔχει
τὰ δύο βιβλια κα’. αὐτὰ δε θεωρημα-
των εστιν ξ’ μετὰ δε τας επαφὰς κ.τ.λ.

^b ἀπερίληπτον.

^c ὑπο.

^d παρατεθείκασιν.

¹ὠρισμένον^a ἔχοντος ἀποδείξων, * ὡς ἐδείξαμεν, ²τοῦ δὲ
 Εὐκλείδου^b μίαν ἐκάστου θέντος τὴν μάλιστα ³ὑπεμφαίνου-
 σαν^c. Ταῦτα^d δὲ λεπτήν καὶ φυσικὴν ἔχει θεωρίαν καὶ
 ἀναγκαίαν καὶ καθολικωτέραν, καὶ τοῖς δυναμένοις^e ὄρᾱν
 καὶ πορίζειν ἐπιτερπῆ. ἅπαντα δὲ αὐτῶν τὰ εἶδη οὔτε Θεω-
 ρημάτων ⁴ἐστὶ οὔτε προβλημάτων, ἀλλὰ μέσην πως^f τούτων
 ἐχούσης ἰδέας· ὥστε τὰς προτάσεις αὐτῶν δύνασθαι σχηματί-
 ζεσθαι ⁵ἢ ὡς^g θεωρημάτων ἢ ὡς προβλημάτων· παρ' ὃ καὶ
 συμβέβηκεν,^h τῶν πολλῶν γεωμετρῶν τοὺς μὲν ὑπολαμ-
 βάνειν αὐτὰ εἶναι τῷ γένειⁱ θεωρήματα, τοὺς δὲ προβλή-
 ματα, ἀποβλέποντας τῷ σχήματι μόνον τῆς προτάσεως. ⁶τὰς^j
 δὲ διαφορὰς τῶν τριῶν τούτων ὅτι βέλτιον ⁷ᾗδειςαν^k οἱ ἀρ-
 χαῖοι, δῆλον ἐκ τῶν ὅρων. ἔφασαν γὰρ θεώρημα μὲν εἶναι τὸ
 προτεινόμενον^l εἰς ⁸ἀπόδειξιν αὐτοῦ τοῦ προτεινομένου·
 πρόβλημα δὲ τὸ προβαλλόμενον εἰς κατασκευὴν αὐτοῦ τοῦ
 προτεινομένου· πόρισμα δὲ τὸ προτεινόμενον εἰς πορισμὸν^m
 αὐτοῦ τοῦ προτεινομένου. μετεγράφηⁿ δὲ οὗτος ὁ τοῦ πο-
 ρίσματος ὅρος ὑπὸ τῶν νεωτέρων, μὴ δυναμένων ἅπαντα πορί-
 ζειν, ἀλλὰ συγχρωμένων τοῖς στοιχείοις τούτοις, καὶ δεικνύντων
 αὐτὸ μόνον τοῦτ' ὅτι ἐστὶ τὸ ζητούμενον, μὴ πορίζοντων δὲ
 τοῦτο· καὶ ⁹ἐλεγχόμενοι^o ὑπὸ τοῦ ὅρου καὶ τῶν διδασκο-
 μένων^p, ¹⁰ἐγράψαν^q ἀπὸ συμβεβηκότος οὕτως^r. πόρισμά
 ἐστὶ τὸ λείπον ὑποθέσει ¹¹τοπικοῦ θεωρήματος. τούτου δὲ τοῦ
 γένους τῶν πορισμάτων εἰδὸς ἐστὶν οἱ τόποι, καὶ ¹²πλεονάζουσι
 ἐν τῷ ἀναλυμένῳ· κεχωρισμένων δὲ τῶν πορισμάτων ἡθροισται
 καὶ ἐπιγράφεται καὶ παραδίδεται διὰ τὸ πολύχυτον εἶναι μάλ-
 λον τῶν ἄλλων εἰδῶν. τῶν γοῦν τόπων ¹³ἐστίν^s ἃ μὲν ἐπι-
 πέδων, ἃ δὲ στερεῶν, ἃ δὲ γραμμικῶν, καὶ ¹⁴ἐτι^t τῶν πρὸς
 μεσότητας. Συμβέβηκεν^u δὲ καὶ τοῦτο τοῖς πορίσμασι, τὰς
 προτάσεις ἔχειν ἐπιτετμημένας διὰ τὴν σκολιότητα πολλῶν
 συνήθως συνυπακουμένων, ὥστε πολλοὺς τῶν γεωμετρῶν ἐπὶ
 μέρους^v ¹⁵ἐκδέχεσθαι^w, τὰ δὲ ἀναγκαιότερα ἀγνοεῖν τῶν
 σημαينوμένων. περιλαβεῖν δὲ πολλὰ μὴ προτάσει ¹⁶ἡκιστα^x
 δυνατὸν ἐν τούτοις, διὰ τὸ καὶ αὐτὸν Εὐκλείδην οὐ πολλὰ ἐξ
 ἐκάστου εἰδους τεθεικέναι, ἀλλὰ δείγματος ἕνεκα τῆς ¹⁷πολυ-
 πληθίας^y * ἐνῇ ὀλίγα πρὸς ἀρχήν. δεδομένον * τοῦ πρώτου^z
 βιβλίου τέθεικεν ὁμοειδῆ πᾶν ἐκείνου τοῦ δαψιλεστέρου εἰδους
 τῶν τόπων, ὡς δέκα * τὸ πλήθος. Διὸ καὶ περιλαβεῖν ταύτας
 ἐν^{1a} μὴ προτάσει ἐνδεχόμενον εὐρόντες^{1b} οὕτως ἐγράψαμεν.

References to MS. No. 3.

- ¹ ὠρισμένον.
- ² τὴν δ' εὐκλείδου.
- ³ ἀπεμφαίνουσιν.
- ⁴ ἐστίν.
- ⁵ τεῶς.
- ⁶ τῆς.
- ⁷ ἤδεσαν.
- ⁸ ἀπόδουσιν.
- ⁹ ἐλεγχόμενων.
- ¹⁰ ἔγραψαν δὲ ἀπὸ.
- ¹¹ τυπικου.
- ¹² πλεονάζουσιν.
- ¹³ ἐστὶ ἰ ἂ.
- ¹⁴ ἐπι for ἐτι.
- ¹⁵ ἐκδεχεται.
- ¹⁶ ἤδιστα.
- ¹⁷ πολυπλάθιάς.

References to MS. No. 9.

- ^a ὀρισμενον.
- ^b τὴν δε ευκλειδου.
- ^c απεμφαίνουσιν.
- ^d ταυτην.
- ^e δυνομενοις.
- ^f επι.
- ^g τεως.
- ^h συμβεβηκε.
- ⁱ τω γενει αυτα ειναι.
- ^j την.
- ^k ηδεσαν.
- ^l προβαλλομενον and τειν in margin.
- ^m πορισμα.
- ⁿ μεταγραφη.
- ^o ελεγχομενων.
- ^p τωνιδιδασκομενων.
- ^q εγραψαν δε απο.
- ^r ουτω.
- ^s εστι δεκα α.
- ^t επι.
- ^u συμβεβηκε.
- ^v μερου.
- ^w εδεχεται.
- ^x ηδιστε.
- ^y πολυπληθι and the two last letters of the word are blotted.
- ^z προυτου.
- ^{1a} εν not in MS.
- ^{1b} ορωντες.

Εὰν ὑπτίου ἢ παραπτίου ¹ ἢ παραλλήλου * ἑτέρα τρία τὰ ἐπὶ μιᾷ σημείᾳ^a δεδομένα ἦ, τὰ δὲ λοιπὰ πλὴν ἐνὸς ἄπτηται θέσει δεδομένης εὐθείας, καὶ τοῦθ' ἄψεται θέσει δεδομένης εὐθείας. τοῦτ' ² ἐπὶ^b τεσσάρων μὲν εὐθειῶν εἴρηται μόνων, ὧν οὐ πλείονες ἢ δύο διὰ τοῦ αὐτοῦ σημείου εἰσὶν· ἀγνοεῖται δὲ ἐπὶ παντὸς τοῦ προτεινομένου πλήθους ἀληθὲς ὑπάρχον οὕτω λεγόμενον. εἰν ὅποσαι οὖν εὐθεῖαι τέμνωσιν ἀλλήλας ³ μὴ^c πλείονες ἢ δύο διὰ τοῦ αὐτοῦ σημείου, πάντα δὲ ἐπὶ μιᾷ αὐτῶν δεδομένα ἦ, καὶ τῶν ἐπὶ ἑτέρας ἕκαστον ἄπτηται θέσει δεδομένης εὐθείας· ἢ καθολικώτερον^d οὕτως, εἰν ὅποσαι οὖν εὐθεῖαι τέμνωσιν ἀλλήλας μὴ πλείονες ἢ δύο διὰ τοῦ αὐτοῦ σημείου, πάντα δὲ τὰ ἐπὶ μιᾷ αὐτῶν ⁴ σημείᾳ^e δεδομένα ἦ, τῶν δὲ λοιπῶν τὸ πλῆθος ἐχόντων τρίγωνον ἀριθμὸν, ἢ πλευρὰ τοῦτου ἕκαστον ἔχει σημεῖον ἀπτόμενον εὐθείας θέσει δεδομένης, ⁵ ὧν τριῶν μὴ πρὸς γωνίαν ὑπάρχον τρίγωνον χωρίου ἕκαστον λοιπὸν σημεῖον ἄψεται θέσει δεδομένης εὐθείας. τὸν δὲ στοιχειωτήν^f οὐκ εἰκὸς ἀγνοῆσαι τοῦτο, τὴν δ' ⁶ ἀρχὴν μόνην τάξει. καὶ ἐπὶ πάντων δὲ τῶν^h πορισμάτων φαίνεται ἀρχὰς καὶ σπέρματα μόνᾳⁱ πληθῶν πολλῶν καὶ μεγάλων ⁶ καταβεβληκέναι, ὧν ⁷ ἕκαστον οὐ κατὰ τὰς τῶν ὑποθέσεων^j διαφορὰς διαστέλλειν δεῖ, ἀλλὰ κατὰ τὰς τῶν συμβεβηκότων καὶ ζητουμένων· αἱ μὲν ὑποθέσεις ἅπασαι ⁸ διαφέρουσιν^k ἀλλήλων εἰδικώταται οἶσαι, τῶν δὲ συμβαινόντων καὶ ζητουμένων ⁹ ἕκαστον ἐν καὶ τὸ αὐτὸ ὃν πολλαῖς ¹⁰ ὑποθέσεσιν^l διάφοροις ¹¹ συμβέβηκε^m.

Ποιητέον οὖν ἐν μὲν τῷ πρώτῳ βιβλίῳ ταῦτα τὰ γένη τῶν ἐν ταῖς προτάσεσι ζητουμένων. (ἐν ἀρχῇ μὲν ¹² τοῦ ζ' διάγραμμα τοῦτο). Εἰν ἀπὸ δύο δεδομένων σημείων πρὸς θέσει δεδομένην εὐθείαν ¹³ κλασθῶσινⁿ, ἀποτέμνη δὲ ¹⁴ μία^o ἀπὸ θέσει δεδομένης εὐθείας^p πρὸς τῷ ἐπ' αὐτῆς δεδομένῳ σημείῳ^q, ἀποτεμεῖ καὶ ἡ ἑτέρα ἀπὸ ἑτέρας λόγον ¹⁵ ἔχουσιν^r δοθέντα. ἐν δὲ τοῖς ἐξῆς, ὅτι τόδε τὸ σημεῖον ἄπτεται θέσει δεδομένης εὐθείας· ὅτι λόγος τῆςδε πρὸς τήνδε δοθείς· ὅτι λόγος τῆςδε πρὸς ἀποτομήν· ὅτι ἥδε θέσει δεδομένη ἐστίν· ὅτι ἥδε ἐπὶ δοθὲν νεύει· ¹⁶ ὅτι λόγος τῆςδε πρὸς τινα ἀπὸ τοῦδε ¹⁷ ἕως^s δοθέντος· ὅτι λόγος τῆςδε πρὸς τινα ἀπὸ τοῦδε ¹⁸ κατηγμένην^t ὅτι λόγος τοῦδε τοῦ * χωρίου ¹⁹ πρὸς τὸ ὑπὸ δοθεί-

References to MS. No. 3.

- ¹ τρία τὰ ἐπὶ μιᾷ σημειον ἢ
παράλληλον ἕτερα τα.
² εστι.
³ μη is not in MS.
⁴ σημειων.
⁵ ῶ.
⁶ καταβεβλημενας.
⁷ ἐν^α ἢ for εκαστον.
⁸ διαφουρουσιν.
⁹ εκαστην.
¹⁰ υποθεσεσι.
¹¹ συμβέβηκε τῶ ταῦτα γένη.
¹² τό ξ̄.
¹³ κλαθωσιν.
¹⁴ μιαν.
¹⁵ εχουσα.
¹⁶ ὁ λόγος.
¹⁷ ὡς.
¹⁸ κατηγμενης.
¹⁹ πρὸς τὸ ὑπὸ δοθείσης καὶ
τῇσδε· ὅτι τοῦδε τοῦ χω-
ρίου not in MS.

References to MS. No. 9.

- ^a τρια τα επι μιας ση^{ον} ἢ^{ον}
ετερα τα.
^b εστι.
^c μη not in MS.
^d καθωλικωτερον.
^e ση^{ων}.
^f του δε στοιχειωτου.
^g δε.
^h των not in MS.
ⁱ μον^{ον} both in same hand
and ink.
^j καταβεβλημενας ὧν ἐν ἡ οὐ
κατα τῶν υποθεσεων.
^k διαφορουσιν.
^l υποθεσεσι.
^m συμβεβηκε τω, ταυτα γένη
ποιητέον οὖν ἐν μεν.
ⁿ κλαθωσιν.
^o μιαν.
^p ευθειας not in MS.
^q δεδομεν^{ον} ση^{ων}.
^r εχουσα.
^s ως.
^t κατηγμενης.

σης καὶ τῆσδε· ὅτι τοῦδε τοῦ χωρίου ὁ ¹ μὲν τὸ δοθέν ἐστίν, ὁ δὲ λόγον ἔχει πρὸς ἀποτομήν· ὅτι τόδε τὸ χωρίον, ἡ τόδε μετὰ τίνος χωρίου δοθέντος ἐστίν, * ἐκείνο δὲ λόγον ἔχει πρὸς ἀποτομήν· ὅτι ἥδε μεθ' ἧς πρὸς ἣν ἥδε λόγον ἔχει δοθέντα, λόγον ἔχει πρὸς τινὰ ἀπὸ τοῦδε ² ἕως^a δοθέντος· ὅτι τὸ ὑπὸ ³ τοῦ δοθέντος καὶ ⁴ τῆσδε, ἴσον^b ἐστὶ τῷ ὑπὸ ⁵ δοθέντος^c καὶ ⁶ τῆς^d ἀπὸ τοῦδε ἕως δοθέντος· ὅτι λόγος τῆσδε καὶ τῆσδε πρὸς τινὰ ἀπὸ τοῦδε ⁷ ἕως^e δοθέντος· ὅτι ἥδε ἀποτεμένει ἀπὸ θέσει δεδομένων δοθὲν περιεχούσας.

Ἐν δὲ τῷ δευτέρῳ βιβλίῳ ὑποθέσεις μὲν ἕτεραι, τῶνδε ζητουμένων τὰ μὲν πλείονα τὰ αὐτὰ τοῖς ἐν τῷ πρώτῳ βιβλίῳ, περισσὰ δὲ ταῦτα· ὅτι τόδε τὸ χωρίον ἦτοι λόγον ἔχει πρὸς ἀποτομήν, ⁸ ἡ^f μετὰ δοθέντος λόγον ἔχει πρὸς ἀποτομήν· ὅτι ⁹ λόγος^g τοῦ ὑπὸ τῶνδε πρὸς ἀποτομήν· ὅτι λόγος τοῦ^h ὑπὸ συναμφοτέρου τῶνδε καὶ * ¹⁰ συναμφοτέρουⁱ τῶνδε πρὸς ἀποτομήν· ὅτι τὸ ὑπὸ τῆσδε καὶ ¹¹ συναμφοτέρου τῆσδε^j τε καὶ τῆς πρὸς ἣν ἥδε λόγον ἔχει δοθέντα· καὶ τὸ ὑπὸ τῆσδε καὶ τῆς πρὸς ἣν ἥδε λόγον ἔχει δοθέντα, λόγον ἔχει πρὸς ἀποτομήν· ὅτι ¹² λόγος^j συναμφοτέρου πρὸς τινὰ ¹³ ἀπὸ^k τοῦδε ἕως δοθέντος· ὅτι δοθὲν τὸ ὑπὸ τῶνδε.

Ἐν δὲ τῷ τρίτῳ βιβλίῳ αἱ μὲν πλείονες ὑποθέσεις ἐπὶ ἡμικυκλίων εἰσὶν, ὀλίγαι^l δὲ ἐπὶ κύκλου καὶ τμημάτων· τῶν δὲ ζητουμένων τὰ μὲν πολλὰ παραπλησίως τοῖς ἔμπροσθεν, περισσὰ δὲ ταῦτα· ὅτι λόγος τοῦ ὑπὸ τῶνδε πρὸς ¹⁴ τὸ ὑπὸ τῶνδε^m ὅτι λόγος τοῦ ἀπὸ τῆσδε πρὸς ἀποτομήνⁿ ὅτι τ' ὑπὸ τῶνδε τῷ ὑπὸ δοθείσης^o καὶ ¹⁵ τῆς^p ἀπὸ τοῦδε ἕως δοθέντος· ὅτι τὸ ἀπὸ τῆσδε τῷ ὑπὸ δοθέντος καὶ ἀπολαμβανομένης ὑπὸ καθέτου ἕως δοθέντος· ὅτι συναμφοτέρος καὶ πρὸς ἣν ἥδε λόγον ἔχει δοθέντα λόγον ἔχει πρὸς ἀποτομήν· ὅτι ἐστὶ τὸ δοθὲν σημεῖον ἀφ' οὗ αἱ ἐπιζευγνύμεναι ἐπὶ ¹⁶ τόδε^q δοθὲν περιέξουσιν τῷ εἶδει τρίγωνον· ὅτι ἐστὶ ¹⁷ τὸ δοθὲν σημεῖον ἀφ' οὗ ¹⁸ αἱ ἐπιζευγνύμεναι ἐπὶ τόδε ἴσας ἀπολαμβάνουσι περιφέρειας· ὅτι ¹⁹ ἥδε ἦτοι ἐν^r παραθέσει ἔσται, ἡ μετὰ τίνος εὐθείας ἐπὶ τὸ^s δοθὲν νευούσης δοθείσαν περιέχει γωνίαν· ἔχει δὲ τὰ τρία βιβλία τῶν πορισμάτων λήμματα λ η, αὐτὰ δὲ θεωρημάτων ἐστὶν ρ ο α.

References to MS. No. 3.

- ¹ μέτι.
- ² ὡς.
- ³ του not in MS.
- ⁴ τῆσδε καὶ τὸ ὑπο δοθέντος
καὶ τῆς δε ἴσόν.
- ⁵ δοθέν τι.
- ⁶ τῆς not in MS.
- ⁷ ὡς.
- ⁸ ἡ not in MS.
- ⁹ λόγον.
- ¹⁰ συναμφοτέρων.
- ¹¹ (συναμφοτέρου τῆσδέ τε καὶ)
not in MS.
- ¹² λογου.
- ¹³ ἀπο not in MS.
- ¹⁴ υπο τωνδε οτι λογος του
απο τησδε προς not in
MS.
- ¹⁵ τῆς not in MS.
- ¹⁶ τὸ for τοδε.
- ¹⁷ τι not in MS.
- ¹⁸ αι not in MS.
- ¹⁹ ἡδέντοι, but in the margin
and in the same hand and
ink with the MS. "ἴσως
ἦτοι."

References to MS. No. 9.

- ^a ὡς.
- ^b τησδε και το υπο δοθεντος
και τησδε ισον.
- ^c δοθεντι.
- ^d τῆς not in MS.
- ^e ὡς.
- ^f ἡ not in MS.
- ^g λογον.
- ^h αποτομην μετα δοθεντος λο-
γον εχει προς αποτομην
οτι λογον του υπο τωνδε
προς αποτομην οτι λογος
του.
- ⁱ συναμφοτερων.
- ^j λογου.
- ^k απο not in MS.
- ^l ολιγοι.
- ^m τον ὑπὸ τῶνδε.
- ⁿ λογον του απο τησδε προς
το αποτομην.
N.B. There is against
this line την in the mar-
gin written in the same
hand and with the same
ink as the text.
- ^o δοθειση.
- ^p τῆς not in MS.
- ^q τότε δοθὲν περιέξουσιν τῶ
εἶδει τρίγωνον ὅτι ἐστὶ
τὴν δοθὲν σημείον ἀφ' ου
αὶ ἐπιζευγνύμεναι ἐπὶ.
not in MS.
- ^r ηδεντοι.
- ^s το not in MS.

I had intended to add (have, indeed, actually written them) a few remarks which are suggested by the letter of Professor Rigaud; but as they relate neither to Pappus, to Halley, nor to the Porisms, I shall reserve them till the occurrence in this series of a more miscellaneous set of notices. I may add, in conclusion, that the next of this series will complete the Nourse papers furnished me by Mr. Maynard. I only now interpose this paper on Pappus, as I wish to read the proof-sheets with the original before I return it to Mr. Noble.

Shooter's Hill,
March 8, 1850.

XLIX. *Notices respecting New Books.*

Hurricane Guide. By WILLIAM RADCLIFF BIRT. Murray.

THIS little work is devoted to the phenomena of revolving storms, and some few directions are given to seamen to avoid their centres. There are also some remarks upon atmospheric waves, and directions for taking meteorological observations.

The work is divided into five chapters. The first and fifth are devoted to revolving storms, and have been principally deduced from Colonel Reid's Theory of Storms. The second chapter is devoted to an explanation of Professor Dove's atmospheric waves, concluding with an urgent request to captains and masters of ships to make regular observations of the barometer, and the direction of the wind, both during the day and night. As the science of meteorology to seamen is of paramount importance, it is to be hoped that Mr. Birt's wishes will be complied with.

Chapter 3 is divided into five sections. The first treats of instruments, of observations, and of their reduction. The second, of the times of observation; but no mention is here made of the necessity of almost continuous observations during storms and gales of wind. (See Colonel Reid's book *On Storms*, 2nd edit. p. 418.) This section concludes with a repetition of the wish for the continuance of hourly meteorological observations on the days of the equinoxes and solstices.

These observations were first begun to be taken in the year 1833, and for a time they were sent to Professor Quetelet at Brussels; after this they were sent to Lamont at Munich; but at present it does not seem that there is any place for their reception. We know that observations of this kind have been sent to Munich; and neither has their receipt been acknowledged, nor has any use been made of them. If the numerous sets of these observations which have been made were collected, reduced and discussed, their results would be instructive, and possibly would suggest a different investigation. Till this is done we can scarcely join in the wish for their continuance. Nothing is more injurious to researches of this kind, than to urge observers to make observations, and then not to use them. In