“A valuable monument of mathematical genius”☆:
The Ladies’ Diary (1704–1840)

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Abstract

Our purpose is to view the mathematical contribution of The Ladies’ Diary as a whole. We shall range from the state of mathematics in England at the beginning of the 18th century to the transformations of the mathematics that was published in The Diary over 134 years, including the leading role The Ladies’ Diary played in the early development of British mathematics periodicals, to finally an account of how progress in mathematics and its journals began to overtake The Diary in Victorian Britain.

Résumé


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1. Introduction

Arithmetical Questions are as entertaining and delightful as any other Subject whatever, they are no other than Enigmas, to be solved by Numbers; . . . those who are pleased to send me any Arithmetical Questions, I desire they may be very pleasant, and not too hard; and likewise that they may be proposed in Verse. [Diary, 1709, 25, 29]

In giving these instructions to his readers, John Tipper (before 1680–1713), who founded The Ladies’ Diary (henceforth The Diary) in 1704, transformed it into a periodical whose lasting fame was its mathematics [Capp, 2004].


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1 Tipper and his successors are commonly called The Diary’s editors or compilers. They wrote a good deal of the material that appeared in The Diary each year and they often referred to themselves as “Author.”
Mathematical problems were not new with *The Diary*, of course. In the previous decade, the *Acta eruditorum* (founded in 1682 and published in Leipzig) had offered several more challenging mathematical problems, probably the most famous being the brachistochrone problem (1696). In the beginning of the 18th century, there were no mathematics journals *per se*. The *Philosophical Transactions of the Royal Society* and the *Journal des sçavans* (both founded in 1665) reported on the researches of their respective members and thus included articles on a wide range of science, mathematics, and technology topics (see Gascoigne, 1985, 4–5, for a list of similar periodicals from this time).

*The Diary* was published annually for 137 consecutive years, enjoying a very long span in the history of modern (post-Newtonian) mathematics. From the first decade of the 18th century and for many decades following, *The Diary* was a pioneer in more than one respect. With unfailing regularity, starting in 1708, it presented an array of mathematical problems and their solutions to a wide range of readers. From the very start women were encouraged to participate fully in *The Diary*’s mathematical program. In the second half of the 18th century *The Diary* inspired a number of similar English periodicals, and in this way occupied a certain leading-by-example position in British mathematics. *The Diary* was long associated with the Royal Military Academy, Woolwich, a leader in 18th and early 19th century technical education in England. However, in spite of the stewardship of Charles Hutton (1737–1823), one of England’s most important late Georgian mathematicians, *The Diary* was not able to keep pace with the reforms in British mathematics of the first half of the 19th century. By 1840 the fact that *The Diary* was no longer near the forefront of mathematics combined with economic and other conditions to spell the end of this long and honorable journey.

We have two foci in this work. First, we want to provide a close-up of the year-to-year performance of the mathematical part of *The Diary*. Obviously, over a range of more than 130 years, mathematics itself changed and there were a good number of editors, contributors, and others involved in the journal. We will, therefore, have to be selective with some of the details. Especially, we will discuss a representative sample of the mathematical problems that were published in *The Diary*. Second, we want to portray *The Diary* in a broad sense, to position it in each of the British mathematical and scientific environments as it, and they, moved through the years of its existence. As we progress through this article, we shall divide *The Diary*’s tenure into the following periods: 1704–1744, in which *The Diary*, and especially its mathematics, established its popularity; 1745–1773, a time of controversy, conflict, and rebuilding; 1774–1834, when a dynasty of only two editors ruled *The Diary*; and 1835–1840, when *The Diary* had an opportunity for some modernization.

Recent studies of *The Diary* have not encompassed its whole life. Perl [1979] considers *The Diary* and its mathematics up to about 1815, and Costa [2000] takes an even shorter time frame, from 1704 to the middle of the 18th century. Both of Costa’s later works describe *The Diary* during the same period. In the first she describes how *The Diary* led similar English publications in the formation of “an interactive and dynamic public sphere” of readers and contributors [Costa, 2002a, 211–212], and in the second she explains how *The Diary* fits into “a dualistic conception of civil society” [Costa, 2002b, 49]. Costa does not study the mathematics of *The Diary* for its own interest; rather, the mathematics is used for other goals.

We begin with a brief account of the confluence of some of the events, in mathematics and in society, that were present at the creation of *The Diary* and its scientific formation. The historical framework for Section 2 was established in Perl [1979] and considerably enhanced in Costa [2000]. We have been guided by these two works and have relied on some other secondary sources, especially Blagden [1977], Guicciardini [1989], Stewart [1992].

2 The foundation of *The Ladies’ Diary*

John Wallis (1616–1703), educated at Cambridge and the Savilian Professor of Geometry at Oxford from 1648 until his death, had a rather low opinion of nonacademic 17th century British mathematics as, “Mechanical... the business of Traders, Merchants, Seamen, Carpenters, Surveyors of Lands, or the like; and perhaps some Almanakers in London” [Scriba, 1970, 27]. By the beginning of the 18th century, the *Philosophical Transactions of the Royal Society* occasionally published some mathematical works. Newtonian natural philosophy began to reach an expanding audience of educated citizens through the popular public lectures and books of John Theophilus Desaguliers (1683–1744) and others. In London and some other urban areas, a class of philomaths was beginning to develop in some special associations such as the Spitalfields Mathematical Society (founded 1717), the Manchester Mathematical

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2 Desaguliers was renowned as “plus Newtonien que Newton” [Hall, 1970–1980]. The campaign to popularize Newtonian natural philosophy led from William Whiston (1667–1752) to John Keill (1671–1721) to Willem s’Gravesande (1688–1742) to Desaguliers and others. See Ball [1889].
Society (founded 1718), the Northampton Mathematical Society (founded 1721), and others [Cassels, 1979; Enros, 1983; Guicciardini, 1989; Pedersen, 1963; Stewart, 1992; Strong, 1957].

As Costa has pointed out [Costa, 2000, 66–76], when The Diary was founded in 1704, it was first and foremost an almanac, that is, “a calendar or table in which are set down and marked the days and feasts of the year, . . . the course and phases of moon, etc., for each month” [Hutton, 1795, v. 1, 99–100]. The Diary was published by the Company of Stationers in London. The Company was essentially a trade association that had long held a monopoly on printed matter in England. For 1692, the Company of Stationers published 26 almanacs, and through the 18th century, almanacs remained among its more profitable and popular productions. The Diary followed the Company’s usual annual publication schedule: the calculations and writing were done in the spring and early summer so that the printers could set the type in late summer and early fall. Sales and distribution were in November and December in order for readers to have their almanacs in hand for the start of the new year [Blagden, 1977, 22, 31–33, 189, 240].

Prior to the mid-17th century, almanacs were commonly simply broadsides that were compiled by astrologers who based their work on the Ptolemaic geocentric model of the universe. These almanacs, which were often posted on the walls in a home, were consulted. They were often relied upon as predictors, e.g., as astrology-based guides for medical practitioners. The second half of the 17th century witnessed a paradigm shift as more and more almanacs became based on the “new astronomy” of Copernicus and Tycho Brahe, and some even incorporated evidence gathered by Galileo and other astronomers using telescopes. These almanacs were, at least in part, semiscientific little books and they were most likely to be read. Almanacs became convenient vehicles for various forms of popular literature, and in this role, “an almanac served for a year’s reading and guidance, and ranked next to the Bible in value” [Collins, 1876, 430]. See also Bosanquet [1917], Neuburg [1977], Nicolson [1939]. The Diary, when it was founded in 1704, was one of England’s modern almanacs. For instance, Tipper never gave any meteorological predictions, and in a special Preface, Tipper’s successor left no doubt that “the Astrological-Cant of telling News and Fortunes, and Prognostication of the Weather” would be foreign to this publication [Costa, 2000, 73 and 319–320; Costa, 2002a, 214; Diary, 1730, 2].

In a 1708 essay, Tipper compared the Ptolemaic and the Copernican systems, advising that “the latter [is] the more rational” (Tipper’s emphases) [Diary, 1708, 4–7], and in the next year, he included a short essay on the nature of comets and their elliptical motion [Diary, 1709, 3–4; Capp, 1979, 246; Nicolson, 1939].

As Costa has suggested, Tipper, perhaps, had three incentives for starting The Diary [Costa, 2000, 45–54]. First, Tipper was the master of the Bablake School in Coventry, and he used The Diary as a platform to advertise his enterprise [Diary, 1706, 2]:

By the Author are Taught, Writing, Arithmetick, Geometry, Trigonometry; the Doctrine of the Sphere, Astronomy, Algebra, with their Dependents, viz. Surveying, Gauging, Dialling, Navigation, and all other Mathematical Sciences; Also the True Grounds and Reasons of Musick.

Second, Tipper sought to supplement the financial support of his family. The Company of Stationers accepted The Diary “at first sight,” and for his first issue, Tipper’s compensation was 100 free copies of The Diary [Ellis, 1843, 307–308]. Once The Diary’s success had been demonstrated, Tipper’s income from the Company of Stationers may not have been generous but reportedly it was steady [Blagden, 1977].

Tipper’s third intention in establishing The Diary was his recognition of a need for an almanac that catered for women. Tipper’s attitude toward women was often remarkably progressive, and in fact he claimed The Diary to be “the First ever published of the kind” [Ellis, 1843, 307]. Tipper made some efforts to promote The Diary to women.
of the higher classes [Costa, 2002b, 49, 50, 55, 56; Ellis, 1843, 309–311]. In his advice on some of the finer points of courtship and marriage, Tipper perceived [Diary, 1708, 32] that

I cannot but take notice of the Hardship the fair Virgin is reduced to, in that she may not court the Man she loves, but only accept in Marriage one of those who happen to court her, whereas the Men may address themselves to whom they please; this, I must confess is very unequal.

Unfortunately, occasional patronizing remarks did occur, as in the statement of Arithmetical Question 16. The anonymous writer drew a contrast between the difficulties he would encounter in the mathematics (trigonometry, to be specific) required vs his asserted ability “to find, Sir, a pretty plump Girl, or a good Glass of Wine, Sir” [Diary, 1710, 36; cf. Costa, 2002b, 64].

The cover of each one of the 137 issues of The Diary featured a picture of a prominent English woman (see Fig. 1), beginning with Queen Anne in 1704. Tipper took special care that the cover was printed from a copper plate [Costa, 2002b, note 2; Ellis, 1843, 307, 310]. He began each issue with a short signed epistle addressed to “Ladies” or “To the Charming FAIR” or with a similar appeal. Typical for its genre, The Diary was a small book, about 10 cm (3 1/2 in) wide and 16 cm (6 in) tall [Perl, 1979, 37], and until 1744 The Diary was 40 pages long. The first issues cost 3 pence each, 50% above the prevailing price of the Company’s almanacs, and this initially worried Tipper [Costa, 2000, 47; Ellis, 1843, 305]. In its second year, 1705, 4000 copies of The Diary were sold; in 1718, sales expanded to about 7000 copies; and in the middle of the 18th century, sales were around 30,000 copies a year [Costa, 2002b, 52, 66].

In his effort to address women’s issues, and in addition to the almanac [pp. 8–19], Tipper included the following features in the 1706 issue7 of The Diary8:

- “A Brief Chronology of [19] Famous Women” starting with Eve, who it was claimed lived 5710 years prior to 1706 [p. 3]
- “The History of Famous Women…” [pp. 25–31]
- “Of the Unfortunate Courtier, Or the Story of the Unfortunate Abbot continued” [pp. 35–36]
- Enigmas 9, 10, and 11 [pp. 36–38]9

Tipper opened the 1706 issue with his expository article, “Of the Nature of an Eclipse of the Sun,” containing six figures [pp. 4–7]: “… of all the Objects of our Thoughts, there is none more Noble, or gives a greater Satisfaction to the Mind, than Contemplation of the Heavenly Phaenomena…” This piece and the articles on the solar system and on comets, mentioned above, were part of a sequence of educational papers on planetary astronomy Tipper wrote for The Diary [see also The Diary, 1707, 1708, 1709, 1710, 1711]. Certainly Tipper showed considerable respect for the intelligence in mathematics and natural philosophy of his female readers [cf. Costa, 2000, 76–87].

From the first issue, one of the most popular features of The Diary each year was its several Enigmas. Costa has contextualised The Diary’s Enigmas with contemporary riddling practice [Costa, 2000, 84–86]. According to Tipper, “An Enigma… is an ingenious and beautiful obscuring of plainest things, which when discovered, strikes the soul with admiration…” [Hutton, 1775, IV, 12].10 At this time, riddling was in the mainstream of a literary tradition whose

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6 We do not have sales figures for competing almanacs produced by the Company of Stationers during the 18th century; we believe such statistics have been lost [Blagden, 1977; Myers, 1990].
7 Our source for The Diary is Vickery [n.d., reels 15, 16, and 17]. Although the 1704, 1705, 1713, 1714, 1715, 1719, 1721, 1735, 1743, 1745, 1746, 1772, 1773, 1775, 1791, 1795, 1802, 1806, 1807, and 1808 issues are missing from this collection (almost 15% of the total number of issues), we were able to compensate for the most important deficiencies caused by these omissions thanks to Hutton [1775], Leybourn [1817]; see footnote 10.
8 The pages of the first issues were unnumbered. In the issue for 1710 there were 21 unnumbered pages at the start, including the 12 pages of the almanac; in “The Second Part,” which followed, the pages were numbered 1, 2, …, 10; the final eight pages, containing the mathematics, the conclusion to “The Story of the Unfortunate Lover,” and an advertisement, were unnumbered. Irregular numbering of The Diary’s pages continued until 1743; the first issue in which all pages except for title page were numbered was 1744.
9 Enigma 11 is reproduced as the first item in Appendix A.
10 For those issues of The Diary which we have not examined in Vickery [n.d.], we have relied on Hutton [1775], Leybourn [1817]. Hutton transformed almost all of the mathematical questions and their answers that had been published originally in verse into prose and he added...
Fig. 1. Cover of the 1706 Diary. [From Gale, Eighteenth Century Collections Online. Copyright Gale, part of Cengage Learning, Inc. Reproduced by permission. http://www.cengage.com/permissions.]
practice stretched back at least to medieval Britain and expanded during the Renaissance, even exerting some influence on Shakespeare. Jonathan Swift (1667–1745) was probably the most important English enigmatographer of Tipper’s era. In European literary history, riddling reached its zenith in the 18th century, and in England this literary form remained popular until well into the 19th century [Bryant, 1983, 48–49, 62–69]. Enthusiastic responses from readers ensured that Enigmas, in various forms, were a feature of The Diary in every one of its 137 issues.

In 1707, Tipper reported that Enigmas 10 and 11 “were explain’d by several Ladies, and also by Mr. John White of Rutterly in Devon, who sent me the two following Arithmetical Enigmas” [Diary, 1707, 36].

1. IN how long a time would a Million of Millions of money be in telling, supposing one hundred Pounds to be counted every Month, (without any intermission Day or Night, Sunday or Work-Day) till all be told?

2. If to my Age there added be
   One Half, one Third, and three times Three;
   Six score and ten the Sum you’ll see,
   Pray find out what my Age may be?11

Next year, in the 1708 issue, Tipper repeated problem 1, above, and added four new mathematical problems, each stated in verse, to challenge his readers.12 Three of these new exercises involved at most elementary algebra and the apparent geometric problem could easily be solved arithmetically. Tipper called all five problems and their solutions “Arithmetic Questions” and “Answers” respectively [Diary, 1708, 37; 1709, 27–29]. For the rest of the life of The Diary, mathematical problems were called “Arithmetical Questions” or “Questions” or “Mathematical Questions” and their solutions referred to as “Answers.” When referring to these mathematical contributions in The Diary we will follow this terminology. Later in the 18th century and into the 19th century this practice gradually evolved so that some periodicals contained “Questions” and others “Problems,” some used the terms interchangeably, and some journals called their results “Answers” and others called them “Solutions,” again without intending any distinction. When discussing these journals we will also interchange the terminology appropriately.

The introduction of the Arithmetical Questions and their Answers marked a profound turning point in the life of The Diary. In 1709 the popularity of these Questions and of the Enigmas forced Tipper to “insist the Longer upon them, and for that Reason defer the Receipts of Cookery, &c. to a more favourable Opportunity” [Diary, 1709, 23]. Receipts of Cookery, pious stories, and other so-called women’s features never returned to The Diary [Costa, 2002b, 52].

3. A mathematics journal

Of the 29 Arithmetical Questions posed in The Diary from 1708 to 1712, eight were considered purely arithmetic and 13 required some elementary algebra.13 Of the eleven geometry questions from these years, one required calculating the areas of several circles, and there were eight planar mensurations, one three-dimensional mensuration, and one simple navigation exercise. An example of one of the geometry questions follows:

**Question 9 by unknown author [1709]**

Seven men bought a grinding stone, the diameter of which was 5 feet, and they agreed that each should use it till he had ground away his share. What part of the diameter must each grind away? [Leybourn, 1817, I, 5–8; Geometrical Problems resolved by pure Geometry or by Arithmetic]

**Question 16** was the first to require trigonometry [Diary, 1710, 36; 1711, 30–31] (I) and was also the first Prize Question that Tipper offered, and these Prize Questions became a regular feature for the remaining 130 years of

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11 Each of the remaining mathematical problems (called Questions) from The Diary that we mention but do not include in the body of this paper will be referenced by (n) and will be reproduced in Appendix A. Enigma 11 is referenced by (0).
12 All mathematical Questions in The Diary were stated in verse until 1729. Questions 140 and 142 were the first such problems to be stated in prose [Diary, 1729, 18]. By 1840 there had been more than 1650 Questions stated and answered in The Diary.
13 We are using the system of classifying The Diary’s problems established in Leybourn [1817, IV, 437–440]. See Appendix B.
The first to solve the second Prize Question (2) was Henry Beighton (1687–1743), whose reward was 12 free issues of the 1712 Diary containing his answer [Costa, 2000, 226]. When Tipper died unexpectedly in 1713, the Company of Stationers chose Beighton to take over as The Diary’s editor.

Beighton was a small landowner in Griff, a village near Coventry, who began his scientific career as a surveyor of some local distinction [Costa, 2002a, 218–219, 222–226]. In 1717, Beighton was introduced by his friend Desaguliers to the Royal Society. Beighton was elected F.R.S. in 1720 for his work improving Newcomen engines [Cook, 2004; Stewart, 1992, 247–248]. In his own words, Beighton was a Newtonian philosopher [Diary, 1721, 21]:

We generally see, those who pretend to be Engineers, have only guess’d, . . . But he who has skill enough in Geometry, to reduce the Physico-Mechanical Part to Numbers, when Quantity of Weight or Motion is given, and the Force designed to move it, can bring forth all the Proportions, in a Numerical Calculation, so as it may be almost impossible to Err.

As Costa has described, under Henry Beighton’s leadership, the mathematical sophistication of the questions increased significantly [Costa, 2002a, 212–213]. In the 35 questions posed from 1714 to 1718, there were only two in arithmetic, and half as many in elementary algebra as there had been among the first 29 questions. The number of geometry questions increased to 14 and included six requiring three-dimensional mensurations. Probably because of Beighton’s engineering interests, there were five questions requiring dynamics, hydrostatics, or statics. Question 36 was the first to use fluxions [Leybourn, 1817, I, 36–37] (3). The following is an example of a statics problem:

Question 44 by Mr. T. Hayward [1715]

Two men, one stronger than the other, have to remove a large stone, weighing 300 lbs. With a bearing barrow, whose length is 6 feet: the weakest cannot undertake to carry more than 100 lbs. How must the stone be placed upon the barrow, so as just to allow him that weight for his share? [Leybourn, 1817, I, 44; Statics]

Question 61 (not classified by Leybourn) asked for the construction of a 10 × 10 magic square [Diary, 1718, 36; Leybourn, 1817, I, 74–85]. The Prize Question of 1714 (4) showed that not only were the challenges generally greater under Beighton than they had been when Tipper started the program, but also a few questions were so multifaceted that the idea of squeezing all of the diary’s questions into neat categories organized by mathematical topics was then, and is now, a very subjective exercise.

The Diary actually employed two numbering systems for its questions and answers. Tipper initiated the total accounting with the first five Arithmetical Questions in 1708 and their Answers in 1709. This system ran continuously, with a few exceptions, all of the way until 1840 and included approximately 1670 questions and answers. By 1722, a yearly accounting, at first using Hindu–Arabic numerals and then gradually introducing Roman numerals, was also being used in The Diary. For example, in 1722 the first of the “New Arithmetical Questions” was headed “(1.) Question 92, by Mr. J. Andrew,” and in 1728 the first such was labeled “Q. Question 130. by Rich. Whitehead, Gent.” [Diary, 1722, 32; 1728, 43]. This yearly numbering system gained common use as seen, for instance, in “An Alphabetical Catalogue of Contributors to the Diary: Shewing by the Numbers i, ii, iii &c. what QUESTIONS, each answered” [Diary, 1742, 47]. By 1752 the yearly numbering system was also employed to designate answers, where the first question posed in 1751 was headed in 1752 as follows: “I. Question 337, answer’d by Mr. T. Cowper, the proposer” [Diary, 1752, 33]. For the sake of simplicity we will use only Tipper’s original total accounting system and will have no more to say about the yearly system.

Tipper exhorted his readers [Diary, 1711, 2]:

ALL such Ladies or Others, who are pleased to Honor me with any Enigmas, Arithmetical Questions, or other Subjects fit to be inserted in this DIARY, are desired always to send their Explications with them: And if they, or any others, who find out the solutions of any of the Enigma’s or Questions, have a desire to have their Names Printed, upon Notice given, it shall be done accordingly. BUT then all such must pay the Postage of their Letters; . . . Direct to me, to be Left with Mr. J. Collier, at Stationers-Hall, London.

Until this point Tipper had been inconsistent in publishing credit for the authors of enigmas, questions, and their answers. In 1711, he included an indeterminate list of 100 persons who supplied him with one or more of these contributions [Diary, 1711, 35–36]. In 1716, Henry Beighton supplied attributions for all of the answers to the questions
and enigmas posed in 1715 and for each of the new questions and enigmas; and he listed nine persons who solved the 1715 Prize Question. The Second Part of the 1716 Diary concluded with an “Alphabetical-Catalogue” in which all of those readers who had answered at least one of the enigmas or questions had their contributions noted [Diary, 1716, 21–39]. The format for giving credit for mathematical problems and their solutions was now essentially the one we use today: each proposer of a question and each contributor to a correct answer was appropriately recognized. Occasionally this practice was not followed, as can be seen, for example, in Diary [1731, 36; 1751, 27] where answers are credited to “others.”

From an inspection of the 1716 “Alphabetical-Catalogue,” it appears that the majority of the contributors to The Diary were men [Diary, 1716, 38–39]. We believe it is impossible to determine exactly how many of these contributors were men and how many were women.\(^{14}\) The best we can do today is to say that the women contributors formed a small but perhaps significant minority. We can, however, glean some insights from Costa’s recent gender analysis of contributors to The Diary that covered approximately the first 50 years of The Diary’s existence [Costa, 2000, 2002b]. It appears that in the first two decades of The Diary, the enigmas were more popular with the female contributors than the mathematical questions by a ratio of roughly four to one [Costa, 2000, 147, 150], and a cursory look at later years of The Diary confirms that this ratio was either maintained or increased. Costa convincingly argues that Mrs. Mary Nelson [Leybourn, 1817, I, 24] was probably the married name of Mary Wright and Anna Philomathes [Diary, 1719] was probably her sister Anna Wright [Diary, 1711, 31; Costa, 2000, 210]. Keeping track today of 18th century women contributors who changed their names after marriage is almost impossible.

**Question 72 by Mrs. Mary Nelson [1719]**

A prize was divided by a captain among his crew in the following manner: the first took 1l. and one hundredth part of the remainder; the second 2l. and one hundredth part of the remainder; the third 3l. and one hundredth part of the remainder; and they proceeded in this manner to the last, who took all that was left, and it was then found that the prize had by this means been equally divided amongst the crew. Now if the number of men of which the crew consisted be added to the number of pounds in each share, the square of that sum will be four times the number of pounds in the chest:

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\text{How many men did the crew consist of, and what was each share? [Leybourn, 1817, I, 94–95; Algebra]}
\]

Pseudonyms, which in general were quite popular in the 18th century, make it even more difficult for us to produce accurate statistics of female contributors to The Diary [Ezell, 2003, 63; Room, 2004]. For example, Ann Nichols [Diary, 1760, 46] was an alias of Mr. W. Wales, who also contributed 13 questions under his own name [Leybourn, 1817, IV, 429]. Henry Beighton responded to Blowzabella as if she were a woman [Diary, 1726, 20], and she won a Prize for one of her mathematical answers [Diary, 1740, 40]. Today we have no idea who Blowzabella, Chrononomonpublicus, Birchoverensis, or many others were [Diary, 1752, 26; 1762, 33]. Thomas Simpson (1710–1761) used at least seven pseudonyms [Perl, 1979, 49] and John Landen (1719–1790) had at least five, including C. Bumpkin [Almkvist and Berndt, 1988, 589–592]. Occasionally, only initials were given in attribution for mathematical questions or answers,\(^{15}\) and of course the gender of such a person is usually unknown. This suggests the equally speculative task of determining how many women contributed anonymously to the mathematics in The Diary. According to Costa [2002b, 70–71], up to the mid-1720s, there may have been a good number of these women. From Perl’s list of women by name who contributed mathematics to The Diary from 1710 to 1814, most of these offerings were made in the earlier years and the pattern appears to be quite uneven. From 1710 to 1725, 42 questions and answers are attributed to women, and then there is a 23-year gap before the next woman is credited. Women made 17 such contributions from 1748 to 1768, and then there were only two attributed female contributors to The Diary’s mathematics in the next 27 years.

For The Diary, there are at least two implications to be drawn from the proposition that, in the 17th and much of the 18th centuries, “a woman going into print was a challenge to the theological and medical grounds that supported the inferiority of women—an inferiority that demanded silence” [Otten, 1992, 1]. First, we honor John Tipper, Henry

\(^{14}\) As Tipper had done before him, Beighton made encouraging remarks about the women who contributed to the mathematics of The Diary, and more generally, about the scientific abilities and general intelligence of women. For example, “... the fair sex may be encourag’d to attempt mathematicks and philosophical knowledge, they see here in The Diary] that their sex have as clear judgments, a sprightly quick wit, a penetrating genius, and as discerning and sagacious faculties as ours...” [Diary, 1718, 17–18; Costa, 2002b].

\(^{15}\) For example, see Question 1535 in Section 5.
Brighton, and those succeeding editors of *The Diary* who had the foresight to encourage the participation of women in the advance of mathematics. Second, in spite of *The Diary*’s enlightenment, British culture during these decades made it even more likely that some of the women who did contribute to *The Diary* would use pseudonyms to shield their identities and gender than would men [Costa, 2002b, 65–70; Ezell, 2003, 63–65, 77–78; Griffin, 2003; Wallis and Wallis, 1980].

By the early 1720s the format for *The Diary* was established, and it would last essentially unchanged until 1840. Always the first obligation was the almanac, the first 14 or 15 pages, where the occasional introductory letter and other astronomical information was included. The Enigmas and their near relatives, Rebuses, Paradoxes, etc. were next. Finally, the last 16 pages contained the Mathematical Questions and their Answers and occasional discussions.

4. A century of *The Diary*, 1743–1840

When Henry Brighton died unexpectedly in 1743, his wife Elizabeth and Anthony Thacker (d. 1744), who had contributed questions and answers to *The Diary* since 1737, stepped in and produced the 1744 issue. Table 1 gives a complete list of the editors of *The Diary*.

The most notable mathematical feature of the 1744 issue was Thacker’s answer to the following:

The Prize Question [1743], *by the late illustrious Sir. I. Newton*

Three staves being erected, or set up on end, in some certain place on earth, perpendicular to the plane of the horizon, in the points A, B, and C; whereof that which is at A, is 6 feet long; that in B, 18; that in C, 8; the line AB being 33 feet long: It happens on a certain day in the year, that the end of the shadow of the staff A passes through the points B and C; and of the staff B, through A and C; and of the staff C, through the point A. To find the sun’s declination, and the elevation of the pole or day, and the place where this shall happen. [Leybourn, 1817, I, 343–354; Astronomy; Geometrical Problems resolved by Algebra]

In spite of the attribution to Newton, this problem probably originated with René Descartes (1596–1650); it first appeared in print in *Den Onwissen Wis-Konstenaer* (1640, Dutch) by John Stampioen, edited by Jacob van Wassanaer. Reportedly, it was “revised, corrected, and improved” in one of Frans van Schooten’s commentaries to his *Geometria a Renato Descartes* [Leybourn, 1817, I, 347], and this is probably where Newton obtained it. The problem (containing the error $AB = 30$ feet) is number 55 in the second edition of Newton’s *Universal Arithmetic*, where it is the first of seven problems employing conic sections and capping his “Resolution of Geometrical Questions” section. Newton’s solution starts with the observation that “the shadow of each staff describes a conic section,” as the Sun passes overhead [Newton, 1728, 172–177]. In contrast, Anthony Thacker’s answer in *The Diary* is purely algebraic, except for the trigonometry required to determine the declination and elevation, and he published a generalization in Thacker [1743, 202–210]. A synthetic geometric solution by a Mr. Skene, which also outlined the history of the problem, was published in 1805 and reproduced in Leybourn [1817, I, 348–350].

The Company of Stationers chose one of *The Diary*’s frequent contributors and one of Brighton’s assistants, Robert Heath (d. 1779), to be the next editor [Wallis, 2004]. Apparently, by mid-18th century English standards, Heath was a competent if not outstanding mathematician, as might be seen by the following Question:

<table>
<thead>
<tr>
<th>Name and dates</th>
<th>Editorial term</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Tipper (1663–1713)</td>
<td>1704–1713</td>
</tr>
<tr>
<td>Henry Brighton (1687–1743)</td>
<td>1714–1743</td>
</tr>
<tr>
<td>Elizabeth Brighton (d. 1759) and Anthony Thacker (1715–1744)</td>
<td>1744</td>
</tr>
<tr>
<td>Robert Heath (1720–1779)</td>
<td>1745–1753</td>
</tr>
<tr>
<td>Thomas Simpson (1710–1761)</td>
<td>1754–1760</td>
</tr>
<tr>
<td>Edward Rollinson (d. 1773)</td>
<td>1761–1773</td>
</tr>
<tr>
<td>Charles Hutton (1737–1823)</td>
<td>1774–1818</td>
</tr>
<tr>
<td>Olinthus Gregory (1774–1841)</td>
<td>1819–1840</td>
</tr>
</tbody>
</table>
Three ships, A, B, and C, sailed from a certain port in north latitude, until they arrived at three different ports, all lying under the equinoctial; A sailed on a direct course, between the south and the west 175.62 leagues; C sailed 133 leagues between the south and east; and B sailed a course between A and C 102 leagues, making the angle or rhumb with A, equal the angle that C made with the equinoctial. Hence it is required to find the port sailed from, each ship’s course, and distance from each other, and their respective ports? And to solve it by an equation not higher than a quadratic? [Diary, 1737, 35; 1738, 24–25; Leybourn, 1817, I, 261; Geometrical Problems resolved by Algebra]

Heath was also a contentious person, and his choice as editor turned out to be unfortunate. Disputes, often polemical, over the first principles of fluxions provided the mathematical basis for many of the arguments between Heath and some of The Diary’s contributors. Heath was a strong advocate of infinitesimals, especially as espoused in the works of William Emerson (1701–1782).

Heath’s essays, “The NATURE and USE of the Algebraic Cypher, or Quantity, 0” and “Of the Cypher-Value and Office of the Algebraic Quantity 0…” were essentially editorials on behalf of infinitesimals [Diary, 1751, 43–45; 1752, 44–48]. Thomas Simpson (1710–1761), who believed that fluxions should be based on the continuity of a variable and on the flow of its magnitude, was a favorite target, and Heath attacked Simpson and his views in The Diary and in other venues. Heath even accused Simpson of plagiarizing parts of Roger Cotes’ (1682–1716) Aestimato errorum (1722) [Cajori, 1919, 207–224; Clarke, 1929, 25–30].

Heath was also critical of the Company of Stationers exercised over the publication of almanacs and he chafed under the low pay he received for editing The Diary [Capp, 1979, 312]. In 1749 he started The Palladium or Appendix to the Ladies Diary [Diary, 1749, 2; Heath, 1752], and he also began The Lady’s Philosopher (1752, 1753, and 1754) and The Ladies’ Chronologer (1754). Heath used the pages of these periodicals to support his battles with several of The Diary’s contributors, and he is alleged to have diverted some materials submitted to The Diary to his Palladium [Archibald, 1929, 381, 385–386; Wilkinson, 1849, 466–475]. In addition, apparently none of these new periodicals was published by the Company of Stationers, and Heath somehow avoided paying the Stamp tax required for such publications [Capp, 1979, 241]. Writing about a century later, Augustus De Morgan (1806–1871) summarized this sad state of affairs [De Morgan, 1847, 71–72; Taylor, 1966, 38]:

Robert Heath was a person who made noise in his day, and in so doing established a claim to be considered a worthless vagabond… the Stationers’ Company found it absolutely necessary to strike out some of his scrurrility, and dismiss him; appointing Thomas Simpson in his place.

Thomas Simpson’s is a rags-to-riches story. He was given a copy of Edward Cocker’s Arithmetic (first edition 1677) and he observed the May 11, 1724, solar eclipse; these were watershed events that set him on a journey of self-education in mathematics. He answered several questions in The Diary and he submitted the geometrical question (5). His first book was A New Treatise of Fluxions (1737) and he also wrote Doctrine and Applications of Fluxions (1750). In 1743 he was appointed second master (also called mathematical master) of the Royal Military Academy at Woolwich (henceforth RMA).

Beginning in 1721, the Royal Regiment of Artillery performed maintenance on its equipment and conducted training at Tower Place in Woolwich Warren, on the banks of the Thames downriver from London. Mr. Burnett Godfrey, who lived with other “masters” in the renovated Tudor mansion adjacent to the tower, was the first mathematical master. The RMA was formally chartered in 1741, Mr. Godfrey died in 1743, and Thomas Simpson succeeded him. Through the years, the RMA has been informally known as The Tower and as The Shop, the latter referring to the artillery repair facilities. Martin Folkes (1690–1754), President of the Royal Society, was the titular first chief master of the RMA, but he never functioned as such. John Muller (1699–1784) performed all the duties of first chief master and he and Simpson taught trigonometry, conic sections, mechanics and chemistry, artillery and fortification, bridge building, and mining. Like Simpson, Muller was a widely published author [Muller, 1757, 1756; Shepperd, 1980;
Rollinson answered.

Edward Rollinson (d. 1773) [Archibald, 1929, 384–386]. Rollinson was apparently a philomath who contributed the Prize Question of 1743, discussed above [Thacker, 1743, 191–210]. Thacker may have been preparing a complete collection of collections appeared almost simultaneously.18

18 Some believe the editor was Samuel Clark—not to be confused with Samuel Clarke (1675–1729) [Archibald, 1929, 382].

The Diary of the RMA continued to appear, but its format and purpose were changing. Simpson's successor, John Lodge Cowley (fl. 1752–1773), who had followed Simpson as second master, thus became the RMA's first professor of mathematics. By the mid-1770s, Hutton had established a broad and popular reputation that created a certain paradox. On the one hand, as Elizabeth Beighton wrote in 1750, old almanacs “lose much of their value when stale,” [Costa, 2000, 122] but on the other, the mathematical and enigmatic material published each year in The Diary had attained sufficient interest that demands were made to produce a permanent collection [Costa, 2000, 122; Diary, 1741, 39; 1761, 32]. Two collections appeared almost simultaneously.18 The Diarian Repository by “a society of mathematicians”19 claimed to be a complete collection of all of The Diary’s mathematical questions and answers from 1704 [sic.] to 1760, “As an Easy and Familiar Praxis for Young Students in Mathematical and Philosophical Learning.” Those questions stated in verse in The Diary remained so in The Diarian Repository. But the Repository’s editors pointed out that a few of the answers published in The Diary were incomplete and needed “extending.” Further, they claimed some other answers were “defective,” and among editorial comments they supplied several “Repository Solutions” [Anon., 1774, iv, 57–64]. Second, in 1771 while he was still living in Newcastle upon Tyne, Charles Hutton began assembling “all the useful and entertaining parts, both mathematical and poetical” of The Diary since its foundation in 1704. Hutton started publishing this collection serially (there were 14 issues) as The Diarian Miscellany [Archibald, 1929, 381–382]. In 1775, Hutton put these issues together into the five volumes, with the same title [Hutton, 1775], of which the first three contained the mathematics and the last two the enigmas, rebus, etc. Hutton restated in prose almost all of The Diary’s questions that originally had appeared in verse. Answers, especially numerical results, to some of the earlier Diary questions were often published without explanation which Hutton then supplied in The Diarian Miscellany. Hutton also included occasional additional answers and miscellaneous remarks in his collection. Leybourn

Smyth, 1961]. Simpson enjoyed a prominent and productive career at the RMA [Clarke, 1929; Shepperd, 1980; Smyth, 1961]. With Elizabeth Beighton’s help at the start, Simpson was editor of The Diary for only seven issues, 1754 to 1760, inclusive, and in view of Robert Heath’s mismanagement, Simpson’s purpose was “to restore it to the character it had maintained under the guidance of Henry Beighton” and under Simpson’s guidance “its mathematical parts were decidedly superior to those of Beighton’s time” [Clarke, 1929, 171–175]. In 1761, Simpson was succeeded as editor of The Diary by one of his assistants, and a frequent Diary contributor, Edward Rollinson (d. 1773) [Archibald, 1929, 384–386]. Rollinson was apparently a philomath who contributed mathematical questions and answers to several mid-18th century British publications. The following is a question Rollinson answered.

Question 388, by Mr. Timothy Doodle [1754]

Supposing p, q, r, s, t, &c. to represent the tangents of any number of arcs P, Q, R, S, T, &c. equal, or unequal: To determine a general expression for the tangent of the sum (P + Q + R + S + T + &c.) of all these arcs; the common radius being unity? [Answered by Mr. E. Rollinson and by Mr. E. Bevil] [Diary, 1754, 27; 1755, 40–41; Leybourn, 1817, II, 99–101; not classified by Leybourn]
incorporated all of Hutton’s work, for those questions and answers up to 1773, noting each of Hutton’s additions with a small “H.” Leybourn added his own comments and a few essays, perhaps the most notable of the latter being his 12-page disquisition on magic squares [Leybourn, 1817, I, 74–85].

In addition to his Woolwich career and extensive publications, Hutton served The Diary as editor from 1774 to 1817, for 44 issues, much longer than any other Diary editor [Gregory, 1823a, cols. 208–227; Guicciardini, 2004]. Hutton expanded his service to the Diary audience by starting A Supplement to the Ladies’ Diary For the Year 1788 (32 pp.). The 1788 Supplement was entirely devoted to enigmas (it featured an alphabetical list of the answers to all the enigmas since 1704) and charades; it contained no mathematics. Several changes in its name led to The Diarian Companion, Being a Supplement to The Ladies’ Diary, which continued to be published annually from 1792 to 1800. (It actually ran to 1806, the year before Hutton retired from the RMA, but we have only been able to see the issues up to 1800.) Enigmas, charades, etc. dominated the pages of Hutton’s Supplement. In 1789 he offered some “easy Questions for the Exercises of Young Tyros,” and each year (1789–1800) he also included discussions and calculations of eclipses and comets, and news of “New Discoveries in the Heavens.” The Supplement appears to have been quite popular because by 1789 it had grown to a 48-page book. From 1788 to 1791 each issue cost 6 pence, but by 1798 the charge was 12 pence per issue [Archibald, 1929, 382; Hutton, 1788–1789].

4.1. Some followers of The Ladies’ Diary

Following Henry Beighton’s success with The Ladies’ Diary, a committee of eight men, headquartered in Nottingham and including Anthony Thacker, founded The Gentleman’s Diary, or the Mathematical Repository in 1741. Also published by the Company of Stationers, each 48-page issue of The Gentleman’s Diary featured an almanac, enigmas, and mathematical problems. Like The Ladies’ Diary, a typical issue of The Gentleman’s Diary contained solutions to the ten mathematical problems posed the previous year and ten new mathematical problems for the coming year. Comparing the Ladies’ and Gentleman’s Diaries, the emphases between the mathematics and the enigmas was typically reversed: 16 pages were budgeted in each issue of The Ladies’ Diary for mathematical problems and their solutions, while mathematical problems and solutions usually took up 24 pages in each issue of The Gentleman’s Diary; enigmas and their solutions (including rebuses, charades, queries) occupied 12–16 pages in The Ladies’ Diary whereas The Gentleman’s Diary usually devoted only about 7 pages to them. Mathematical problems in The Gentleman’s Diary were “generally of greater difficulty” than those in The Ladies’ Diary [Archibald, 1929, 382–383; The Gentleman’s Diary, 1741, 1742; Pedersen, 1963; Wilkinson, 1848, 57].

The fact that The Gentleman’s Diary was started by a committee and that it appeared annually for 100 issues, until 1840, made it an exceptional enterprise. Most late 18th century British mathematical periodicals were founded and produced by only one or two men and most were ephemeral.20 (See Table 2.) Problems and solutions were featured in all English mathematics periodicals of this era. The Mathematician, containing many Curious Dissertations on the Rise of Geometry (an annual, 1745 to 1750) is believed to have been published to compensate for Robert Heath’s mismanagement of The Diary, and it was succeeded, for the same purpose, by Mathematical Exercises (a semiannual, 1750 to 1753). Edward Rollinson was the nominal editor of The Mathematician, but Thomas Simpson is said also to have been heavily involved in editing and other work in its production. Mathematical Exercises ceased publication as soon as Simpson was appointed editor of The Diary [Anon., 1751; Archibald, 1929, 384–386; Wilkinson, 1849, 5–9].

Just before he assumed the editorship of The Diary, Charles Hutton started Miscellanea Mathematica, “to allow room for such little essays or dissertations as are too small to print and make a book of.” Among the 116 problems, solutions, and articles in Miscellanea Mathematica, a few were continuations and in some cases completions of problems and articles from The British Oracle (1769–1770), The Oracle reprinted and discussed a number of problems and solutions from The Diary [Archibald, 1929, 388–389; Wilkinson, 1848, 83]. In 1776 the Company of Stationers’ monopoly on the publication of English almanacs was successfully challenged by The Lady’s and Gentleman’s Diary, or Royal Almanac, whose editor, Reuben Burrow (1747–1792), was a minor contributor to The Ladies’ Diary (7) [Archibald, 1929, 389; Blagden, 1960; Blagden, 1977, 234–236; Stephen and Wallis, 2004]. Mathematical... Delights also offered a few expository articles on mathematics and natural philosophy, and the Mathematical Companion of

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20 Archibald [1929] discusses 52 minor mathematics journals from this period. If we remove The Ladies’ Diary and The Gentleman’s Diary from Archibald’s list, the average life-span of the remaining 50 journals is 6.8 years. See also Despeaux [2002, 109, 114].
Table 2
A selection of British mathematical periodicals, 1745–1837.

<table>
<thead>
<tr>
<th>Name(s)</th>
<th>Editor(s)</th>
<th>Years (numbers and/or issues)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Mathematician, containing many Curious Dissertations on the Rise Progress and Improvement of Geometry...</td>
<td>Edward Rollinson</td>
<td>1745–1750 (six annual numbers)</td>
</tr>
<tr>
<td>The Palladium or Appendix to the Ladies Diary (at least 12 different titles) [Archibald, 1929, 385]</td>
<td>Robert Heath</td>
<td>1749–1779 (irregular)</td>
</tr>
<tr>
<td>British Oracle: Consisting of Questions, Essays, and Dissertations in Natural Philosophy and Mathematics</td>
<td>(unknown)</td>
<td>1769–1770 (12 numbers)</td>
</tr>
<tr>
<td>Miscellanea Mathematica: consisting of a large collection of curious Mathematical Problems and their solutions...</td>
<td>Charles Hutton</td>
<td>1771–1775 (13 numbers)</td>
</tr>
<tr>
<td>The Lady's and Gentleman's Diary, or, Royal Almanac (also known as “Burrow’s Diary” and as “Carnan’s Diary”) [Archibald, 1929, 389]</td>
<td>Reuben Barrow</td>
<td>1776–1788 (annual; plus three supplements)</td>
</tr>
<tr>
<td>Mathematical, Geometrical, and Philosophical Delights: containing Essays, Problems, Solutions, Theorems, etc. selected from an Extensive Correspondence</td>
<td>Thomas Whiting</td>
<td>1792–1798 (11 “parts”)</td>
</tr>
<tr>
<td>The Mathematical Repository (also known as “Leybourn's Repository”)</td>
<td>Thomas Leybourn</td>
<td>first series 1795–1804 (14 numbers)</td>
</tr>
<tr>
<td>The Gentleman's Mathematical Companion (also known as “A Companion to the Gentleman’s Diary, or a Preparative to that Work”)</td>
<td>William Davis, and John Hampshire</td>
<td>second series 1804–1835 (24 numbers)</td>
</tr>
<tr>
<td>The Northumbrian Mirror; or Young's Student’s Literary Mathematical Companion, forming an introduction to the Ladies Diary.</td>
<td>Rev. W. Telfer, and Stephen Fenwick</td>
<td>1837–1841 (15 numbers)</td>
</tr>
</tbody>
</table>

William Davis (1771–1807)\(^{21}\) began with a few papers selected from back issues of the Philosophical Transactions of the Royal Society, and in all contained 42 papers “extracted from various sources along with 35 original articles” [Wilkinson, 1848, 154–155, 224–226, 254–255, 279–281, 514]. William Marrat (1772–1852) of The Enquirer also contributed several problems and solutions (11) to The Diary [Sutton and McConnell, 2004]. The 225 problems and 220 solutions in The Northumbrian Mirror were not just entertainments but were devised for the instruction of “the younger and less experienced Mathematician” [Archibald, 1929, 395; Wilkinson, 1853, 506–507, 528–530].

An anonymous judgment in The Philosophical Magazine\(^{22}\) in 1819 claimed that the three most important British mathematical journals of the time were The Ladies’ Diary, The Gentleman’s Diary, and The Mathematical Repository of Thomas Leybourn (ca. 1769–1841) [Despeaux, 2002, 113–114; Mathematicus, 1819]. Leybourn’s Repository (Second Series) was almost an annual, with 24 numbers having been published in 6 volumes from 1804 to 1835 [Leybourn, 1804–1835]. Like The Ladies’ Diary, the Repository contained mathematical problems and solutions, but the similarities ended there. Each volume of the Repository was divided, and paginated, into the following Parts:

I. Mathematical Questions, including solutions from the previous issue;
II. Original Essays;
III. Mathematical Memoirs Extracted from Works of Eminence.\(^{23}\)

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\(^{21}\) Today, William Davis is known for his 1803 revision of Andrew Motte’s English translation of Newton’s Principia [Gray and Wallis, 2004].

\(^{22}\) The Philosophical Magazine (founded in 1798) was, and remains, a commercial scholarly journal, broadly conceived to include all of the physical sciences. Between 1800 and 1836, mathematics occupied only about 6% of its pages [Despeaux, 2002, 71–93].

\(^{23}\) Irregularly within Part I there were also “Notices relating to Mathematics,” and we will say more about them below. Also within Part I, the pages in which the problems were enunciated were numbered separately, but this will be of no concern to us. In addition, certain volumes
Whereas *The Diary* was editorially centered at the RMA for almost 75 years, *Leybourn’s Repository* was closely associated with the Royal Military College, first at Marlow and then at Sandhurst. After wars with France in the 1790s exposed the lack of education and professionalism among many nonartillery officers of the Royal Army, efforts began in 1799 and culminated in 1801 to establish a Royal Military College at Great Marlow (henceforth RMC) [Smyth, 1961, 41–47]. The RMC was very much an outgrowth of the RMA [Shepperd, 1980, 27–28, 32–36]. The prominence of mathematics in the curricula of both institutions had practical purposes beyond the “training of the mind” [Smyth, 1961, 50–58]. Even though the mathematical instruction at the RMC was at a lower level than that at the RMA, William Wallace (1768–1843) and James Ivory (1765–1842), two of the leading British mathematicians of the time, joined Leybourn on the RMC faculty in 1803 and 1804, respectively [Guicciardini, 1989, 114]. In the winter of 1812–1813, the cadets and faculty of the RMC moved from Marlow to new facilities constructed for the College at Sandhurst [Smyth, 1961].

Thomas Leybourn answered three questions in *The Diary*; for example,

**Question 900 by Mr. William Hardy, of Cottingham** [1789]

There is a geometrical square, whose side is 12 inches, required the radius of a circle, whose centre shall be in the middle of one of its sides, that shall cut the said square into equal parts. [*Diary*, 1789, 47; 1790, 37–38; Leybourn, 1817, III, 203–204; Geometrical Problems resolved by pure Geometry or by Arithmetic]

Leybourn launched *The Mathematical and Philosophical Repository* in 1795, dedicating the first volume to Charles Hutton, and he was appointed mathematical master at the Royal Military College in 1802, the year the first cadets entered the College. In 1804 Leybourn revived *The Mathematical Repository* (Second Series) which then flourished until 1835 [Archibald, 1929, 390–391; Bendall, 2004].

William Marrat was among those who solved the first question in the *Repository’s* Second Series, and there were other question posers and solvers from *The Diary* who contributed similarly to the *Leybourn’s Repository*. Question 14 was attributed to Hypatia, and from our observations, we believe that more pseudonyms appeared among the *Repository’s* questions and solutions than in *The Diary*. The first recognized female contributor was Miss Maria Parker, who solved Question 53 [*Repository*, 1806, I, 1, 32, 115–116]. It is generally accepted that the mathematical questions in *Leybourn’s Repository* were, on average, more difficult than those in *The Diary*.

There were 89 Original Essays in volumes 1–5 of *Leybourn’s Repository*. Most were brief (an average length of about 4 1/2 pages each in 1806) and they tended to be longer in later years (on average about 9 1/2 pages each in 1830). Some were elementary, such as Mr. Noble’s “Solution to the Problem of making a Magic Square of nine cells” [*Repository*, 1814, II, 37–38]. A few were short but important, such as James Ivory’s “Demonstration of a Theorem Respecting Prime Numbers,” which simplified Euler’s 1736 proof of Fermat’s Theorem to the effect that if \( p \) is prime and \( p \) and \( n \) are relatively prime, then \( p \) divides \( n^{p-1} - 1 \) [*Repository*, 1806, II, 6–8]. Perhaps the most important of these essays was Thomas Knight’s “Four papers on the Summation of Series etc.” [*Repository*, 1819, II, 78–116; Guicciardini, 1989, 116]. Of the eight extractions from works of eminence, the most notable was William Wallace’s translation of Legendre’s “A Memoir on Elliptic Transcendentals” [*Repository*, 1809, III, 1–52; 1814, III, 1–45; Guicciardini, 1989, 117; Legendre, 1794]. Reviewing all three Parts of the *Repository* suggests that a good number of Leybourn’s colleagues at Marlow and Sandhurst contributed significantly to all aspects of the writing in Parts I and II; we do not know if this was a part of Leybourn’s design or not. On the other hand, colleagues and even occasional cadets of the RMA participated in the problems and solutions of *The Diary*, but not nearly in as great a proportion as the in-house support that Leybourn enjoyed [Guicciardini, 1989, 116].

Earlier, we briefly indicated that the sales of *The Diary* rose steadily from its start, reaching about 30,000 copies per year by the mid-18th century. In 1761, reported sales were down to about half this figure, perhaps in part as *The Diary* struggled to overcome the legacy of Robert Heath’s editorial term. There was a gradual decline in *The Diary’s* circulation over the second half of the 18th century, in spite of Charles Hutton’s stewardship at the helm [Blagden, 1977, 240; Capp, 1979, 247]. We can gain an appreciation of the scope of the almanac business of the Company of Stationers near
the turn of the 19th century from Fig. 2 and Table 3. Even though the opinion seems broadly accepted that The Ladies’ Diary and The Gentleman’s Diary were “the most successful” and “most respectable” 18th century British almanacs, detailed print and sales figures are beyond reach for at least two reasons. First, the long-standing Stamp Tax made pirated copies of many British almanacs very plentiful in the 17th, 18th, and well into the 19th centuries. Second, the Company of Stationers’ business records are not complete [Blagden, 1977, 266; Capp, 1979, 245; Myers, 1990, 26, 43; Perkins, 1996, 14].

4.2. The 19th century and The Ladies’ Diary

As noted above, at the turn of the 19th century, The Diary was supposed to be at the zenith of British mathematical periodicals. However, the practice of British science, technology and mathematics, in research, in education, and in the literature of the emerging disciplines, was less structured and less accomplished than for comparable French institutions. Following the Revolution in France, progress in mathematical analysis was institutionalized within the larger framework of the development of state-organized professional science [Guicciardini, 1989, 139–141]. After the fall of the ancien régime, the Académie Royale des Sciences was reformulated as the First Class of the Institute, which in turn was divided into Sections. The purpose of the French Institute was “to follow scientific and literary work which has as its object the general utility and glory of the Republic” [Crosland, 1976, 148, 153]. Mathematicians and scientists in general in the French Institute were essentially civil servants. The second French contribution to the professionalization of science was the École Polytechnique, founded in 1794. As the foundation of the French reorganization of the nation’s engineering profession, it had a number of practical goals. In mathematics, as in other fields, specialization became a hallmark of professionalism in French science. Specialized journals were one manifestation of this character, the first of these being the Annales de chimie founded in 1789. The Journal de polytechnique, which was founded in 1794 and changed its name in 1795 to Journal de l’École polytechnique, contained a great deal of mathematics. In Nîmes, J.D. Gergonne (1771–1859) founded the Annales de mathématiques pures et appliquées in 1819 [Gascoigne, 1985, 10, 30, 43]. Most of the readers of these journals were men of science, as opposed to the readers to whom The Diary appealed, i.e., general intellectuals, some of whom were women.

Perhaps the greatest inhibition to general progress in British mathematics in the early 19th century was the lengthy reign (42 years, from 1778 to 1820) of Sir Joseph Banks (1743–1820) as President of the Royal Society [Craik, 2007, 291]. The controversy over Charles Hutton’s service as Foreign Secretary of the Royal Society (1779 to 1783), combined with a debate between the “mathematicians” and the “disciples of Linneus,” led to Hutton’s estrangement from the Society and from Banks. A notable botanist in his younger years, Banks came to be “the embodiment of a scientific old regime,” in which he opposed efforts of several sciences beyond mathematics (especially astronomy and geology) to progress beyond the conservative confines of his Royal Society [Gascoigne, 1994, 252–260; 2004; Grattan-Guinness, 1990, 264–265].

Charles Hutton’s association with the Royal Society was insignificant in comparison to his extraordinary tenure (44 years) as editor of The Diary and his 31 years (1773 to 1804) as the RMA Professor of Mathematics. He produced a “massive amount” of work during these years, including the composition (with Richard Pearson) of The Abridgement of the Philosophical Transactions of the Royal Society, 1665–1800, in 18 volumes (1809), and works on infinite series, ballistics, and the density of the earth [Guicciardini, 1989; Hutton, 1812; Johnson, 1899a]. It is important for us to recognize Hutton’s support for Margaret Bryan (fl. 1795–1816), who ran a succession of schools for girls in which mathematics and science were taught. Hutton endorsed Bryan’s first book, A Compendious System of Astronomy (1797, 2nd ed. 1799) and encouraged publication of her second, Lectures on Natural Philosophy (1806) [Ogilvie, 2004; Wallis and Wallis, 1980, 62]. Charles Hutton’s magnificent Mathematical and Philosophical Dictionary [Hutton, 1795] showed, among its many features, his considerable knowledge of current leading mathematical developments in France and the rest of continental Europe; for one example see Hutton [1795, I, 60–63]. In his Dictionary and in his teaching, Hutton openly admired the continental methods of differential and in-

25 In 1820, Olinthus Gregory (1774–1841), Hutton’s successor as editor of The Diary, delineated many of Banks’s deficiencies as the leader of the Royal Society over this long period, specifically emphasizing Banks’s relationships with mathematics: “Of mathematics, either pure or mixed, he knew nothing. The sublime investigations of Landen, Euler, Lagrange and Laplace, had no more charms for Sir Joseph, than for the rudest peasant that laboured on his Lincolnshire estates. He had a dislike to them; and for many years indicated this dislike by some waspish and petulant expressions from the chair whenever a mathematical paper was read” [Gregory, 1820, 166].
Fig. 2. A broadside advertising national and local English “Almanacks” for 1794 [Blagden, 1977, 240].
Table 3
Circulation figures for “Almanacks” published nationally by the company of stationers for 1801.

<table>
<thead>
<tr>
<th>Title</th>
<th>Print run</th>
<th>Number sold</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Ladies Diary</td>
<td>11,000</td>
<td>8671</td>
<td>£54.19s.0d.</td>
</tr>
<tr>
<td>The Gentleman’s Diary</td>
<td>4000</td>
<td>2648</td>
<td>£0.1s.0d.</td>
</tr>
<tr>
<td>Francis Moore’s Almanack</td>
<td>380,000</td>
<td>362,449</td>
<td>£2,595.12s.2d.</td>
</tr>
<tr>
<td>John Partridge’s Almanack</td>
<td>4000</td>
<td>2968</td>
<td>£8.6s.0d.</td>
</tr>
<tr>
<td>Poor Robin’s Almanack</td>
<td>6500</td>
<td>4215</td>
<td>£8.15s.4d.</td>
</tr>
<tr>
<td>Season on the Seasons</td>
<td>2750</td>
<td>1968</td>
<td>£3.6s.10d.</td>
</tr>
<tr>
<td>Tycho Wing’s Almanack</td>
<td>1000</td>
<td>443</td>
<td>−£7.10s.8d.</td>
</tr>
<tr>
<td>White’s New Ephemeris</td>
<td>4500</td>
<td>3868</td>
<td>£42.19s.0d.</td>
</tr>
<tr>
<td>Rider’s British Merlin</td>
<td>14,000</td>
<td>12,328</td>
<td>£128.10s.7d.</td>
</tr>
<tr>
<td>The Free Mason’s Calendar</td>
<td>1500</td>
<td>1300</td>
<td>−£0.14s.4d.</td>
</tr>
<tr>
<td>Wing’s Sheet Almanack</td>
<td>54,000</td>
<td>38,345</td>
<td>£130.6s.0d.</td>
</tr>
<tr>
<td>Cambridge Sheet Almanack</td>
<td>7000</td>
<td>3052</td>
<td>£0.1s.5d.</td>
</tr>
<tr>
<td>Goldsmith’s Almanack</td>
<td>30,000</td>
<td>27,829</td>
<td>£250.16s.0d.</td>
</tr>
<tr>
<td>A New London Sheet Almanack</td>
<td>1250</td>
<td>750</td>
<td>£1.7s.6d.</td>
</tr>
</tbody>
</table>

Source: Perkins [1996, 238].

Integrating calculus, especially the French applications to natural philosophy. But, when he wrote his influential Course of Mathematics (2 volumes, 1798), fluxions and fluents were employed, not derivatives or integrals [Baron, 1970–1980; Gregory, 1823a; Howson, 1982; Johnson, 1989a; Repository, Part I, 187–196].

Hutton remained scientifically active for a number of years after he retired from the RMA in 1804. He was followed as Professor of Mathematics by John Bonnycastle (ca. 1760–1821), who had proposed five and answered three Diary questions (e.g., ⟨9⟩) and who had come to Woolwich as a mathematics master in 1782. Bonnycastle was known as the author of many popular elementary mathematics textbooks. For example, his An Introduction to Algebra was first published in 1782 and ran to at least 13 editions (1824) in England and numerous editions and revisions in the United States from 1806 to at least 1847 [Bonnycastle, 1806; Whittaker and Rice, 2004]. Other than Charles Hutton himself, the most notable mathematician at the RMA during this period was Peter Barlow (1776–1862). Barlow contributed five questions to The Diary and answered thirteen ⟨12⟩, and he served as an RMA mathematics master for over 40 years (1801 or 1803 until 1847), but was never a professor. Even though Barlow also contributed eight articles and numerous questions and solutions to Leybourn’s Repository and was famous for his New Mathematical Tables, his major scientific accomplishments lay in magnetism and optics [Clerke and Morus, 2004; Johnson, 1989b; Repository, 1809, 1814, 1819].

In 1821, Hutton’s protégé Olinthus Gregory (1774–1841) succeeded Bonnycastle as Professor of Mathematics at the RMA. (See Fig. 3 for portraits of both.) Gregory rose from humble origins, he made his Diary debut in 1794 ⟨10⟩, and in total, he proposed eight Diary questions and answered 19. Like Hutton, Gregory was an advocate for reforming British mathematics and physics along the lines of French advances. He translated papers for Hutton’s Abridgement of the Philosophical Transactions and kept up to date with the works of Gaspard Monge (1746–1818), Jean Nicolas Pierre Hachette (1769–1834), and C.L.M.H. Navier (1785–1836). He combined his Treatise of Mechanics, 3 volumes (1806), with his 1807 translation of Traité élémentaire de physique, 2 vols., by Abbé René Just Haüy (1743–1822) to produce a complete account of natural philosophy [Grattan-Guinness, 1990, 437–438]. The Company of Stationers hired Olinthus Gregory to edit The Gentleman’s Diary in 1802 and at the same time Gregory succeeded Hutton as the “general superintendent” of all the Stationers’ almanacs. Gregory became editor of The Ladies’ Diary when Hutton finally relinquished that position in 1818 [Archibald, 1929, 383; Dorn, 1970–1980; Gregory, 1823b, cols. 777–791; Perkins, 1996, 30].

Comparing the questions that Gregory published, especially during the last decade of The Diary, with those with which John Tipper started, we observe an expected decline in the number of Arithmetic and Algebraic Questions. Even though many questions during the last decades of The Diary were based on knowledge of calculus and other parts of higher mathematical analysis there were still occasional straightforward questions intended for the clever reader without much formal education. The number of acknowledged women contributors remained very small. We know of only three women who contributed mathematical questions from 1817 to 1836, and none thereafter. Pseudonyms ⟨17⟩ appeared to be just as popular during these years as they were in the 18th century, leaving us with no reliable statistics.
on the issue of the exact number of women contributors. The following is an exception for which the identity of the person behind the pseudonym is known:

Question 1611, by Pen-and-Ink [1836]

Prove that if the equation

$$\frac{m \, dx}{\sqrt{m + nx + rx^2 + sx^3 + tx^4}} = \frac{dy}{\sqrt{m + ny + ry^2 + sy^3 + ty^4}}$$

admits of an algebraic integral, the quantity \( m \) must be rational when \( m, n, r, s, t \) are supposed real. [Diary, 1836, 48; 1837, 42; Calculus]

Gregory’s term as editor, 1818–1840, coincides almost exactly with the period covered by the Extended Index given in Appendix B. From this Index we immediately see that certain kinds of questions (Geodesic Problems and Theorems, Gnomonics, Harmonics, Navigation, Pneumatics) do not appear to have been published in The Diary when Gregory was editor, probably due to a certain narrowing of the realm of mathematics in the 19th century. During the industrial revolution, some of these were among the topics that migrated from mathematics to engineering [Armytage, 1961, 122–124; Heilbron, 1990, 3; Rae and Volti, 1993, 209–210]. On the other hand, Astronomy questions continued to be popular (21). The decrease in Algebra questions can probably be accounted for by the gains in the formal education of many of The Diary’s readers [Howson, 1982]. Perhaps these gains also contributed to the decline in the number of questions on “Chances, Combinations, Permutations, &c” (12) as well as in the decline in the number of questions on “Interest, Annuities, &c,” although these numbers were always small. The transition from fluxions and fluents to derivatives and integrals unfolded in The Diary much as it did in British mathematics generally. In the 1820s there were even Diary questions for which the answers employed both systems (16). Considering Question 1611 above, (23), and a number of other questions that appeared during The Diary’s last two decades, it is evident that The Diary published several new classes of questions and their solutions, e.g., Calculus Questions, and Differential Equations

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26 Pen-and-Ink was a pseudonym for T.S. Davies, a regular contributor to The Diary [Wilkinson, 1851].
Questions, during this period (see Appendix B). The significant number of questions involving Series (e.g., \([15]\) and \([20]\)) attests to an increased interest in calculus by readers of The Diary. We also note a generous number of questions concerning what we classify as Curves, or Calculus of Variations, such as \([13]\), but which Leybourn [1817] probably would have called Isoperimetric Problems. For instance,

**Question 1637 by Mr. John Cam, Torpenham, Cumberland [1838]**

Required the curve in which the integral \(\int \frac{dx}{y}\) between given limits, is a maximum. [Diary 1838, 47; 1839, 40–41; Calculus of Variations]

It is interesting to note that, during Gregory’s term as editor, The Diary attracted a few questions from major European authors. For example, the French mathematician C.J. Brianchon (1783–1864) contributed the following:

**Question 1523, or Prize Question, by M. Brianchon [1830]**

The six edges of any irregular tetrahedron are opposed two by two, and the nearest distance of the two opposite sides is called breadth; so that the tetrahedron has three breadths and four heights. It is required to demonstrate that, in every tetrahedron, the sum of the reciprocals of the squares of the breadths is equal to the sum of the reciprocals of the squares of the heights. [Diary, 1830, 48; 1831, 45–46; Geometry Problems resolved by Algebra]

Gregory also selected a problem submitted by Hachette \([14]\), which elicited four different but straightforward synthetic geometric demonstrations [Diary, 1823, 45–47].

In these latter years of The Diary, we encounter at least a dozen questions, which we believe border on contemporary research issues and practices, some more successfully than others. There were actually two problems in Question 1567:

**Question 1567, by Investigator [1833]**

When is \((a \pm b\sqrt{-1})a' \pm b'\sqrt{-1}\) a real quantity? Determine whether all functions of \(a \pm b\sqrt{-1}\) can be reduced to \(A \pm B\sqrt{-1}\), or not. [This is questioned, if not denied, by Gergonne.] [Diary, 1833, 48; 1834, 44–45; Algebra]

By writing the complex number \(a + b\sqrt{-1} = k(\cos \theta + \sqrt{-1}\sin \theta)\) in polar form and then raising it to a complex number power, an expression was obtained that could be split into real and imaginary terms. The published answer to the general question, however, was not satisfactory by the standards of the 1830s, much less those of today [Diary, 1834, 44–45]. Even though in the 18th century it was not uncommon to separate a function of a complex variable into real and imaginary parts, the study of general conditions under which this was possible began with Augustin-Louis Cauchy (1789–1857), whose first significant paper on the topic was published in 1827 [Kline, 1972, 628–635].

There were a few other open-ended questions. For instance,

**Question 1397, by Investigator [1822]**

Required a better method than has yet been published of finding \(x\) in the equation \(x^x = a\). [Diary, 1822, 47; 1823, 40–41; Algebra]

was well within the scope of many Diary contributors. On the other hand, the following was more challenging.

**Prize Question 1538, by Investigator [1831]**

Required a simple demonstration, upon received principles, of Prof. Gauss’s new principle of Mechanics; which is this, viz. The motion of a system of material points connected together in any manner whatsoever, whose motions are modified by any external restraints whatever, proceeds in every instance in the greatest possible accordance with free motion, or under the least restraint. Thus let \(m, m', m'', \&c\). be the masses of the points; \(a, a', a'', \&c\). their places at the time \(t\); \(b, b', b'', \&c\). the places which they would occupy, if entirely free in their motion, after the indefinitely small portion of time \(dt\),

\[27\] The Diary published one answer and gave credit for correct answers to seven other readers, one of whom was “Miss. L.L.”
in consequence of the forces acting upon them during that time, and of the velocities and directions acquired by them at the time \( t \). Their real places \( c, c', c'', &c \) will then be those which, of all places compatible with the conditions of the system, the quantity \( m(\dot{bc})^2 + m'(b'c')^2 + m''(b''c'')^2 &c \) is a minimum. The equilibrium, being only a particular case of the general law, its condition is that \( m(ab)^2 + m'(a'b')^2 + m''(a''b'')^2 &c \) is a minimum. [Diary, 1831, 48; 1832, 44–46; Dynamics]

In the 1820s and 1830s, Olinthus Gregory and the contributors to The Diary made increasing use of outside sources. As might be expected, several editions of Hutton’s Course of Mathematics and of Gregory’s Mechanics were cited [Gregory, 1815; Hutton, 1798], as well as other works by RMA authors. Other British books noted in The Diary were the classic Maclaurin [1742] and the out-of-date Landen [1755]. The contemporary Herschel [1820] was related to the answer to (20). Diary authors made reference to articles and questions in Leybourn’s Repository 11 times between 1829 and 1840. The differential equation in the 1824 Prize Question, (16), arose in one of Henry Cavendish’s (1731–1810) most important works [Cavendish, 1789]. In the answer to

Question 1628, by Investigator [1837]

Required a demonstration of the well-known general property of the parallelogram of forces, upon elementary principles, consistent with sound logic and pure science. [Diary, 1837, 48; 1838, 44–46; Statics] reference was made to Laplace [1799, 1802, 1805, 1823] and to Whewell [1823]. Gregory instructed his readers to consult Fourier [1831] in answering (22), although all of the published answers referred to the more up to date Sturm [1835a, 1835b]. Following the answer to (17), Gregory referred his readers to a posthumous paper of Leonard Euler’s (1707–1783) that appeared in volume 9 of the Mémoires de l’académie impériale des sciences de St. Pétersborg. From 1822 to 1840, we found 87 references to English published works and 25 references to non-English (almost all French) books and papers. Although none of the references given in The Diary would be considered complete by modern bibliographical standards, the standard of referencing did improve somewhat as the years advanced.

Problems and their solutions, in the form of the Senate House Examination, also known as the Mathematical Tripos, were the driving force of a Cambridge education throughout the Georgian and early Victorian periods [Shaffer, 2003, 253–255]. Whatever its scientific merits, however, the Tripos received no formal recognition in The Diary. According to Sir Frederick Pollock, senior wrangler of 1806, “A Cambridge education has for its object to make good members of society—not to extend science and make profound mathematicians” [Ball, 1889, 112–113; Gascoigne, 1994]. John Brinkley (1763–1835), senior wrangler of 1788, was an exception. Beginning even before he came to Cambridge, Brinkley contributed three questions and six answers to The Diary, and after he left Cambridge, he had two professional careers, one as professor of astronomy in Dublin and the second as a clergyman, including being Bishop of Cloyne [Ball, 1889, 102] (8). The Reverend John Toplis (1774–1857), a Cambridge graduate although not a senior wrangler, attacked the low estate of British mathematics in Toplis [1805]. In his effort to make the greatest work of “the second Newton” available to English mathematicians, Toplis translated the first volume of Pierre Simon Laplace’s (1749–1827) Mécanique céleste, but Toplis cautioned his readers that the calculus of Silvestre Lacroix (1765–1848) would be required [Laplace, 1814].29

Meanwhile, at Oxford, following the tenure of Edmund Halley (1656–1742) as Savilian Professor of geometry and astronomy, mathematics had “sunk in a decadent slumber” [Fauvel et al., 2000, 156]. In England at the turn of the 19th century, there was “no single institution which offered points of comparison with the École polytechnique” in every particular. If we consider the latter as a school of engineers, and especially military engineers, we can only find the Academy at Woolwich with which to compare it” [Grattan-Guinness, 1985, 89]. Points of comparison, yes, but in mathematics, even more significantly, points of difference [Knox, 2003]. The “spirit of research,” in particular as manifested in research papers and articles, permeated French institutions of higher education in the last years of the

28 The Mathematical Tripos was taken by candidates for the Bachelor of Arts degree. The examination emphasized a rather static curriculum based on algebraic manipulations, Euclidean geometry, and Newtonian natural philosophy. The students were ranked in order of merit: those in the first class became wranglers and those in the second and third classes became senior and junior optimes respectively [Ball, 1889, Chapter X; Enros, 1981, 138–140]. Success in the Tripos in the 19th century often led to a prominent career in the church or in the law and/or government.
29 There were other efforts at reform of British mathematics during these decades. We have already briefly mentioned the work of William Wallace and James Ivory. One should also add Robert Woodhouse (1773–1827) and John Playfair to this short list; neither of them contributed to The Diary.
18th century and the first half of the 19th century [Gillispie, 1997, 166–167]. Mathematics at the École polytechnique was led by Joseph Louis Lagrange (1736–1813), Gaspard Monge (1746–1818), Pierre Simon Laplace, Jean-Baptiste Fourier, Siméon Denis Poisson (1781–1840), Augustin Louis Cauchy, and many others, as the 19th century progressed [Grattan-Guinness, 1988; Grattan-Guinness, 1990, 1353–1362; Howson, 1982, 65]. In spite of their service to The Diary and their other mathematical accomplishments, the RMA mathematical leaders of this time, Charles Hutton, Olinthus Gregory, John Bonnycastle, and Peter Barlow, did not attain the scientific stature of their French contemporaries.

Until 1835, The Diary was never a hospitable venue for mathematical articles and papers. We have already mentioned John Tipper’s didactic articles on the “new astronomy” and Robert Heath’s short essays on infinitesimals. Henry Beighton published a short review of early 18th century astronomy, and he was probably the author of the brief articles discussing the nature of mathematics [Diary, 1716, 18–20]. The meager explanation (less than one page) of the conversion of the English calendar to the Gregorian standard in 1752 was contained in the unsigned note, “Of the Alteration of Style” [Diary, 1752, 13]. Similarly, for the Transit of Venus of June 6, 1761, the one-page explanation assumed the reader had a basic knowledge of the phenomenon and its importance to astronomy [Diary, 1761, 16]. Transits of both Venus and Mercury occurred in 1769, but the latter was not visible in Europe and The Diary’s note for the former was even briefer than its account had been in 1761 [Diary, 1769, 16]. No further mathematical articles or essays appeared in The Diary until 1835; The Diary’s mathematical horizon was confined to the publication of questions and answers.

Foreshadowing the formation of mathematics as a profession in England, Leybourn’s Repository included a miscellany of “Notices relating to Mathematics.” There were lists of recently published British and French mathematical works and listings of the mathematical papers published in the Philosophical Transactions of the Royal Society, 1803–1818 [Repository, 1809, I, 193–196; 1814, I, 97–98; 1819, I, 76–77; 1819, I, 117–118]. Personal notes and obituaries of varying length of British and of Continental mathematicians also appeared. There were none of these features in The Diary.

In the first two decades of the 19th century, attempts at reform of the Cambridge mathematics curriculum coalesced in the formation of the well-known Analytical Society (1812–1813), which “saw itself as a mathematical organization participating in the revival of English mathematics by the creation of analytical mathematics” [Enros, 1981, 141; 1983]. Over the next decade, the Analytical Society stimulated several useful changes. Three of its leaders, Charles Babbage (1792–1871), John Herschel (1792–1871), and George Peacock (1791–1858), produced an English translation of Lacroix’s popular Traité élémentaire de calcul (1816). Peacock became a Moderator of the Senate House Examination, and with some assistance in 1819, replaced some of the fluxions problems with calculus problems. In 1820, Peacock published A Collection of Examples of The Applications of the Differential and Integral Calculus to encourage these reforms [Peacock, 1820]. Leybourn’s Repository published all of the mathematical problems, but none of the solutions, from the Tripos for the years 1811 through 1829 [Repository, 1814, 1819, 1830]. No notice of these developments appeared in The Diary. In the 1830s, at least five well-regarded calculus books were published in England; none received notice of any sort in The Diary [Craik, 2007, 338–339]. Similarly, Peacock [1834] was not recognized in The Diary.

“The foundation of the Cambridge Philosophical Society in 1819 was the first positive step taken in modern times towards the emergence of Cambridge University as a great center for teaching and research in science” [Hall, 1969, 1]. To preserve the papers presented at the Society’s meetings, the Transactions of the Cambridge Philosophical Society was inaugurated in 1821. Several mathematicians were prominent among the founders of the Society, and Babbage, Herschel, and other mathematicians contributed significantly to the Transactions in its early years [Hall, 1969, 9–11, 32, 36; Transactions, 1821]. “To supply a means for publication for original papers in mathematics,” Duncan Gregory (1813–1844), Archibald Smith (1813–1872), and Samuel S. Greathed (1813–1887) started the Cambridge Mathematical Journal as soon as they had completed the Tripos in January 1837. Due to Gregory’s precarious health, to inconsistent institutional support, and to difficult relations on occasion with the publishers, the Cambridge Mathematical Journal and its successors, the Cambridge and Dublin Mathematical Journal and the Quarterly Journal of Pure and Applied Mathematics, struggled through some insecure times in the mid-19th century [Crilly, 2004, 461–463, 465]
490–492]. But the enterprise survived and this was “England’s first exclusively mathematical periodical of a research character” [Archibald, 1929, 396]. There was no place in either the Transactions of the Cambridge Philosophical Society or the Cambridge Mathematical Journal for any program of mathematical questions and answers [Anon., 1821, 1839; Despeaux, 2007; Meadows, 1980].

Olinthus Gregory reflected on the state of The Diary in 1835 [Diary, 1835, 48]:

The Editor congratulated several of his correspondences upon their great improvement in science… It is his desire to encourage the young and aspiring, to do justice to the profound men [our emphasis] of science whose contributions adorn his pages… and to render the “Ladies’ Diary” still, what it has been for much more than a century, the arena of honorable struggle and enterprise,—the storehouse of entertaining and useful knowledge.

In this same issue, Gregory added an Appendix of 24 pages of “a series of papers, either original or cautiously selected, on curious or interesting subjects in various departments of mathematics” [Diary, 1835, 49]. The repeal of the English Stamp Duty on almanacs saved the Company of Stationers enough money on postage so that it could allow Gregory the opportunity to try to keep up with other leading British mathematics journals by adding these articles and essays [Blagden, 1977, 266].

The first articles in The Diary in the 19th century, “Horae Geometricae” and “Synopsis of Spherical Geometry,” were commissioned by Gregory to fill a gap he perceived in the literature [Diary, 1835, 49–64]. Their author, Thomas S. Davies (1795–1851), may be considered a protégé of Gregory’s. Davies began his mathematical career contributing problems and solutions to several periodicals, including at least 4 questions and 10 answers to The Diary.31 He joined the Woolwich faculty in 1834, and he produced later editions of Charles Hutton’s famous Course of Mathematics [Boase and Rice, 2004; Hutton, 1798; Wilkinson, 1851]. There was wisdom in Gregory’s promotion of Davies’ two articles because they were cited in two answers to Diary questions [Diary, 1837, 34; 1840, 46]. Among the oldest papers Gregory selected for The Diary’s Appendices was Pierre de Fermat’s (1606–1665) “Spherical Triangles” [Diary, 1840, 62–72].32 On the other hand, the original works “General 5th Degree Equations” by Charles Gill and “Remarks on Sturm’s Theorem” by W.S.B. Woolhouse were up to date with some current research in algebra in England [Diary, 1839, 53–58].33 In the six Appendices, from 1835 to 1840, The Diary published 21 articles, of average length 6.9 pages, by different authors in the following subjects34:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Number of Articles</th>
</tr>
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<tbody>
<tr>
<td>Geometry</td>
<td>6</td>
</tr>
<tr>
<td>Algebra</td>
<td>6</td>
</tr>
<tr>
<td>Infinite series</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>3</td>
</tr>
<tr>
<td>Geology</td>
<td>2</td>
</tr>
<tr>
<td>Differential equations</td>
<td>1</td>
</tr>
</tbody>
</table>

We could find no evidence of editorial help for Olinthus Gregory in the publication of these 21 articles in the six appendices of The Diary. By contrast, the Cambridge Mathematical Journal, as noted above, began with three editors. Furthermore, through the several editorial changes during its first decade, some of the Cambridge Mathematical Journal’s supporters, who included several contributors as well as the editors, were consulted on the Journal’s scope, its policies, and the fates of a few submitted works. Although there was no formally declared Editorial Board or roster of referees, the Cambridge Mathematical Journal was nevertheless produced by a mathematical community in the

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31 Exact tallies for Davies are difficult to determine because he also used pseudonyms, two of which, “Pen-and-Ink,” as noted above, and “Knickerbocker,” appear in The Diary. But the Knickerbocker whose address is given as New York might have been Charles Gill, a frequent contributor to The Diary who is known to have moved to the United States in the 1830s [Smith and Ginsburg, 1934, 89].

32 One of the least known of Fermat’s works, “De contactibus sphaericis” may have been composed in 1643, or perhaps much earlier [Mahoney, 1973, 407–408]. The translator is unknown.

33 Charles-François Sturm (1803–1855) included his famous theorem in his paper “Mémoire sur le résolution des équations numériques,” which was presented to the Paris Academy on May 13, 1829, and first published in Sturm [1835a]. The English translation was also published in 1835 [Speziali, 1970–1980; Sturm, 1835b].

34 These categories are not easy to define; e.g., both geology papers involved a good deal of geometry, and an algebra article on expanding binomials made liberal use of infinite series. See the text of Appendix B for difficulties of categorizing the questions.

With a profile of Queen Victoria on its cover (Fig. 4), The Diary of 1840 featured answers to the 15 Mathematical Questions (#1644–1658) from the 1839 Diary and 15 new Questions (#1659–1673). Even though approximately 20% of the contributors to the Enigmas in this issue were women, there were no women identified among the contributors to the mathematical questions or their answers. Despite Gregory’s best efforts, sales of The Ladies’ Diary slipped. Since sales of The Gentleman’s Diary were also in decline, the Company of Stationers combined the two journals [Collins, 1876, 415; Perkins, 1996, 26–27]. In their place, in 1841, the Company of Stationers published The Lady’s and Gentleman’s Diary, “Designed Principally for the Amusement and Instruction of Students in Mathematics,” and edited by Gregory’s protégé W.S.B. Woolhouse. The transition was so smooth that the greatest change was probably the name and the cover (see Fig. 4). The new Diary opened with an almanac, the Enigmas continued directly from The Ladies’ Diary, and the solutions to the Questions (#1659–1673) from The Ladies’ Diary were followed by the solutions from the 1840 Gentleman’s Diary (#1410–1424). The new mathematical questions followed the numbering of The Ladies’ Diary (#1674–1688). The topics of these new problems were essentially the same as those of 1840 and the proposers and solvers also featured the same correspondents. The Lady’s and Gentleman’s Diary was published annually until 1871.

5. Conclusions

The mathematics that appeared in The Diary was as inclusive as the scientific talents and imaginations of its contributors and editors, but there is also a sense in which this mathematics had its limitations. The nature of almost all the mathematical questions and answers published throughout the life of The Diary was that each stood alone. As challenging as many of these questions were and as ingenious as some of their answers were, by their intent, they played no part in any research program or extended theory. George Boole’s (1815–1864) very brief relationship with The Diary portrayed this ambivalence.

Credit for an answer to the Prize Question of 1834 was the only contribution that George Boole ever made to The Diary [Diary, 1835, 46]. Born and raised in Yorkshire, Boole received most of his mathematical education from his father, who was a talented craftsman, but Boole received no formal higher education. On his own, about 1835, he began a study of Laplace’s Mécanique céleste and Lagrange’s Mécanique analytique [Macfarlane, 1916; MacHale, 1985]. In 1840, Boole published the first of his eight papers in the Cambridge Mathematical Journal, “On the integration of linear differential equations with constant coefficients.” Here, he exploited what was then called the “method of separation of symbols” to use abstractly stated algebraic properties of the derivative operator to derive general solutions to such homogeneous differential equations [Boole, 1840]. Boole’s paper was a generalization of an earlier Cambridge Mathematical Journal work of Duncan Gregory’s and it was a contribution to a line of research that began with two papers published in 1814 by François Servois (1767–1847) in Gergonne’s Annales. This development, whose story has been well told recently in Allaire and Bradley [2002], Bradley [2001, 10–13], was a part of the larger program known now as “British symbolical algebra” [Becher, 1980; Koppelman, 1971].

In The Diary, the closest question to the subject of Boole [1840] was

Question 1535, by H.K.C. [1831]

One solution of the equation \( \frac{d^2 y}{dx^2} + p \frac{dy}{dx} + Qy = 0 \), being given, req. a complete solution of the equation \( \frac{d^2 y}{dx^2} + p \frac{dy}{dx} + Qy + R = 0 \). [Diary, 1831, 47; 1832, 40; Differential equations]

The published answer, also attributed to H.K.C., showed by straightforward computation that \( v = Au + B \), where \( u \) was the assumed solution of the homogeneous equation and subject to two conditions on \( A \) and \( B \), would be the desired complete solution. (H.K.C. did not specify any other conditions on \( P, Q, R, A, \) or \( B \)) Olinthus Gregory revealed The Diary’s standing with regard to the leading edge of British mathematics of this time with his response to the following closely related question from the previous year:

Question 1513, by Mr. Tho. Hogan, London [1830]

Integrate the differential equation \( x^{4/3} \frac{dy}{dx} + y^2 x^{4/3} \frac{dx}{dy} = a^2 \frac{dx}{dy} \). [Diary, 1830, 47; 1831, 35–36; Differential equations]
Fig. 4. Cover of *The Ladies’ Diary*, 1840 (left); cover of *The Ladies’ and Gentleman’s Diary*, 1841 (right) [Vickery, n.d.].
The answer, “by Nehoc” and that of several other contributors, recognized this as an example of Riccati’s equation and referred to a problem in the contemporary text [Lardner, 1825]. Olinthus Gregory added this perceptive editorial observation [Diary, 1831, 36]:

We beg to refer our readers to Mr. Murphy’s elegant paper on “Definite Integrals,” in the last volume of the Cambridge Transactions: it contains a solution of Riccati’s equations, accomplished in the most general manner. We regret that it cannot be brought within the limits of a Diary solution.

Murphy [1830, 440–443] was one of Robert Murphy’s (1806–1843) several important contributions to the early development of differential operators, a subject to which Boole also contributed. As Olinthus Gregory acknowledged, the mathematical subjects and techniques of The Diary’s questions and answers did not approach the generality and modernity of the contemporary work of Boole, Murphy, Duncan Gregory, and the other scientists who, in the 1820s and 1830s, were forming the vanguard of British mathematics. Many of these men would be among the leaders of the prominent roles British mathematics played generally, later in the 19th century.

The first half of the 19th century witnessed an awakening as British mathematicians gained greater awareness of the scientific techniques and achievements of their French colleagues. Reforms at Cambridge University paved the way for crucial developments that left The Diary behind. Many of the “first generation” of scientists who provided the leadership for mid-century English achievements in mathematics and mathematical physics—achievements many of which were internationally acclaimed—received their start with their university education, not by contributing questions and/or answers to The Diary [Grattan-Guinness, 1985, 107]. All of the following leading contributors to 19th century British mathematics were Cambridge educated: Robert Woodhouse, John Toplis, George Peacock, Charles Babbage, John Herschel, George Green (1793–1841), William Whewell (1794–1866), Augustus De Morgan, Duncan Gregory, Archibald Smith, Samuel S. Greathed, James Joseph Sylvester (1814–1897), George G. Stokes (1819–1903), Isaac Todhunter (1820–1884), and Arthur Cayley (1821–1895). To this list of leaders, one could add the following non-Cambridge-educated men: William Rowan Hamilton (1805–1865), Thomas P. Kirkman (1806–1895), and George Boole. But, among all of these men, only Boole contributed to any questions and/or answers in The Diary. The Diary apparently did not serve as any kind of an incubator for any of the notable 19th century British mathematicians.

At the start of this work, we separated the long life of The Diary into four time periods. Taking the broader perspective of the evolution of mathematical journalism (at least up to the latter part of the 19th century), it has been proposed that the history of mathematical periodicals as a general form of scientific communication has passed through four stages [Glaisher, 1880, 73–75].

i. serials that contained a few puzzles and elementary problems but whose main contents were nonmathematical subjects;
ii. periodicals that supplemented their puzzles and problems with occasional short expository articles;
iii. journals whose total content was mathematics (including mechanics, astronomy, etc.), which was partitioned into original papers, on the one hand, and a limited number of problems and solutions, on the other hand; and
iv. “the strictly scientific journal,” the mathematics journal that consisted entirely of original research papers.

Clearly, the earliest mathematical questions in The Diary were puzzles, enigmas solved by numbers, and such contrived problems continued to appear through the whole life of The Diary. However, very quickly, the level of difficulty and the seriousness of many of the questions in The Diary increased, and The Diary became one of the participants in the popularization of mathematics and the Newtonian sciences in the 18th century [Pedersen, 1963, 245; Smith, 1951, 1, 446–447]. The practice of featuring expository articles in the mathematical sciences, begun by the founder John Tipper even before the Arithmetical Questions were introduced, was not continued with any regularity in the 18th century or indeed in the 19th century up until 1835. Even though The Diary offered some more advanced questions and solutions as the years went by and in its last six years published some papers (both expository and original), the most one can say is that The Diary passed through only the first and a portion of the second development stages listed above. Recall that whatever The Diary’s mathematical achievements were over 137 years, it was always an almanac first.

Viewed from the perspective of the overall growth of mathematical journals and in spite of the opinions expressed in Mathematicus [1819], by fulfilling stage iii, Leybourn’s Repository certainly attained a more advanced status than
The Diary. Furthermore, despite The Diary’s improvements in the 1820s and 1830s, as Cambridge began to assert a leading role in the professionalization of British higher mathematics and science generally, the Transactions of the Cambridge Philosophical Society and the Cambridge Mathematical Journal were modern stage iv journals.

When The Diary began, in the first decade of the 18th century, the Gresham, Lucasian, and Savilian professorships had established a certain class of academic mathematics in England. Into the territory between these professors and those members of the Royal Society who regarded mathematics and philosophy as all of one part, on the one hand, and John Wallis’ traders, merchants, seamen, carpenters, etc., on the other, The Diary created a new space for mathematical discourse [Stewart, 1999, 138]. Isaac Newton had given the physical universe a certain mathematical structure and, in the 18th century, mathematics gained a symbolic position as the driving force for progress in the sciences [Costa, 2002a, 214]. The Diary played a major role in the development of its region of the British mathematical world. In some ways, The Diary even functioned as a “mathematical club” [Taylor, 1966, 17, 38, 76], perhaps a precursor to the modern mathematical society. Thanks to John Tipper’s vision and to the enlightened efforts of most of the editors who followed him, some women were welcomed into this circle. Development brought change, however. Following the lead of Continental, especially French, mathematics at the end of the 18th century and in the first two or three decades of the 19th century, the landscape of British mathematics underwent tectonic shifts, one of whose consequences was to narrow The Diary’s former ground. In spite of some efforts at adaptation to this new and evolving environment, the era for The Ladies’ Diary had passed.

Acknowledgments

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Appendix A. An enigma and a small selection of questions from The Diary

We favor, whenever possible, the statements of the questions from Leybourn [1817] because they tend to be more accessible to the modern reader and also because answers, and in some cases discussions, are conveniently placed with the problems. When we can add the classification from Appendix B, we do so. For the questions too new to have been included in Leybourn [1817], we provide the references to their answers.

(0) Enigma 11

Tho’ always I travel, I’m always at home,
And am robb’d by my Neighbors where ever I come;
My Birth there’s none could ever remember,
And yet I’m as Young as this present November.
My Shape is but crooked, yet pleasant to View;
Calm and Cold is my Temter, and Pale is my Hue:
Yet when I’m enraged, I swell and grow red,
And none can against me presume to make Head,
Weak Women and Children I often affright,
But Men to my Company often invite:
Whene’re I vouchsafe to take to a Side,
I Victory bring, and Battle decide;
No Quarter I give, but Merciless Roar,
Batallions and Squadrons at once I devour. [Diary, 1706, 38]35

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35 The solution: a river.
(1) Prize Question 16 [1710]

Walking through Cheapside, London, on the first day of May, 1709, the sun shining brightly, I was desirous to know the height of Bow steeple. I accordingly measured its shadow just as the clock was striking twelve, and found its length to be 253 $\frac{1}{8}$ feet: it is required from thence to find the steeple’s height. [Answered by Mrs Mary Wright] [Diary, 1710, 36; Leybourn, 1817, I, 12–13; Astronomy, Geography, &c.]

(2) Prize Question [1711]

In a level garden there are two lofty firs having their tops ornamented with gilt balls, one is 100 feet high, the other is 80, and they are 120 feet distant at the bottom: now the owner wants to place a fountain in a right line between the trees, to be equally distant from the top of each; and to make a walk or path, from the fountain, in every point of which he shall be equally distant from each of the balls: also at the end of the walk he would fix a pleasure house, so that a couch placed therein should be at the same distance from each ball, as the two balls are from each other. How must this be done? [Answered by Mr Henry Beighton, Mrs Anna Wright, and others] [Diary, 1711, 35–36; Leybourn, 1817, I, 19–20; Geometry]

(3) Question 36 by Mrs Barbara Sidway [1714]

From a given cone to cut the greatest cylinder possible. [Leybourn, 1817, I, 36–37; Geometrical Problems relating to Maxima and Minima]

(4) Prize Question [1714]

In gauging a spheroidal ale cask, I found the diameter of one head to measure 18.1 inches, that of the other 16, the bung diameter 20, and the distance between the two heads 20.6 inches, also, by the cask lying a little obliquely, I observed that the liquor just rose to, or touched the upper extremities of the two heads. Having noticed these dimensions, I was informed that there were in the cask a ball of iron weighing 60 lb. Another ball of lead weighing 90 lb. And a cube of box, a foot square. Pray what quantity of liquor was in the cask? [Leybourn, 1817, I, 40–42; Geometrical Problems resolved by Algebra]

(5) Question 187, by Mr Tho. Simpson [1736]

By reading your di’ry a crowd of strange notions
Crept into my head, of your rules, laws, and motions;
Your extravagant fancies my senses confound;
Can the unwieldly earth at the sun caper round?
But you say, she’s an atom, each star a huge sun,
And attendant worlds with their moons round ‘em run.
Such a tott’ring strange whirligig you’ve set’s upon,
We wonder ere now we’ve not shak’d off and gone:
If what eyes ne’er saw you so soon can disclose,
Then pray solve this question: The earth we’ll suppose,
Round her axis in thirty-eight minutes to roll;
Shou’d we, who’re degrees thirty-eight from the pole,
Be hurled thro’ the air; where should we descend?
How long wou’d it be ere our circuit did end?
How far from the centre in six hours time
Would they be, who live in the midst o’th’hot* clime?
Kind artist, be pleas’d these things to let us know?
We’d rather believe you, that e’r find them so.

∗ The equator

N.B. We suppose the earth sole actor, and to continue inviolate, and that we shall acquire the same velocity as the place of our residence, 52 deg. Lat. [Diary, 1736, 34; Leybourn, 1817, I, 247; not classified by Leybourn]

(6) Question 507, by Mr. W. Spicer [1763]

Given the area of a plane triangle = 235, and its vertical angle = 73°34′, and the side of its inscribed square = 9.6 to describe the triangle. [Answered by Mr. C. Hutton] [Diary, 1763, 47; Leybourn, 1817, II, 223; Geometrical Problems resolved by pure Geometry]

(7) Question 645, by Mr. Steph. Hodges, at the Right Honorable the Earl Spencer’s at Althorp [1772]

Having given a common parabola; it is required to draw a tangent thereto so that a right line drawn from the point of contact to a given point within the same may be the shortest possible? [Answered by Mr. G. Coughron and by Mr. Burrow] [Leybourn, 1817, II, 355; Geometrical Problems relating to Maxima and Minima]

(8) Question 791, by Master John Brinkley at Harleston [1782]

From a given point A to draw two right lines AB and AC to meet a right line PQ given in position, so that the rectangle under AB and AC may be of a given magnitude, and the angles ABC and ACB have a given difference. [Diary, 1782, 47; 1783, 35; Leybourn, 1817, III, 94–95; Geometry]

(9) Question 904, by Mr. John Bonnycastle [1789]

It is asserted by Mr. Castillioneus,36 in his commentary upon Sir Isaac Newton’s Arithmetic, that any rational cubic equation of the irreducible case (as \( x^3 - 15x = 3 \)), will have, at least one rational root \( z \) it is required to show the truth or falsity of this assertion? [Diary, 1789, 47; 1790, 40–41; Leybourn, 1817, III, 207–209; Algebra, algebraic theorems]

(10) Question 972, by Mr. Olinthus Gregory, Yaxky [1794]

There is an inflexible rod, void of gravity, 26 inches long, at one end of which is suspended 1 cwt. 1 gr. 23\( \frac{1}{2} \) lb. of sugar, in a barrel that weighs 21 lb.; at 1 foot distance from this end hangs a weight of 8\( \frac{1}{2} \) lb. and 4 inches farther a weight of 4\( \frac{1}{2} \) lb. Query the point of the rod, which being made a fulcrum, these weights, &c., will remain in equilibrium? [Diary, 1794, 47; Leybourn, 1817, III, 275–276; Statics]

(11) Question 1069, by Mr. W. Marrat [1800]

Suppose a ball of cast iron, having fallen from an infinite height, in air of the same density as at the surface of the earth, had acquired a uniform velocity of 7285 feet per second, it is required to find the diameter of the ball; the specific gravity of cast iron, and air, being 7425 and \( 1\frac{5}{7} \)? [Diary, 1800, 47; Leybourn, 1817, III, 378–379; Dynamics]

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36 Giovanni Francesco M.M. Salvemini (1708–1791), who is sometimes referred to as “Castillon” from the name of his birthplace [Smith, 1951, vol. 2, 326].
(12) Question 1189, by Mr. P. Barlow, R.M.A. [1808]

Required the probability of a person holding 29 at the game of cribbage? [Diary, 1808, 48; 1809, 40–41; Leybourn, 1817, IV, 107–108; Chances, combinations, permutations, &c.]

(13) Question 1396, by Mr. D.T. Sheridan, Stafford [1822]

In what point of the interior surface of a perfectly polished hemispherical bowl, horizontal diameter 12 inches, will the velocity of a smooth heavy ball, descending by the force of gravity, be a maximum estimated in the vertical direction? [Diary, 1822, 47; 1823, 39–40; Calculus of Variations, but a Purely Geometric solution was published]

(14) Question 1403, or Prize Question, by M. Hachette, Professeur de la Faculté des Sciences, à Paris [1822]

AB is a chord in a circle whose radius is OA or OB, and ABNM, ABN’M’, &c. are quadrilaterals, having a common side AB, inscribed in the circle. The sides AM, BN, of the first quadrilateral produced meet in P; and, in like manner, AM’, BN’, . . . meet in P’. The diagonals of the first quadrilateral intersect in Q; those of the second in Q’; and so on. It is required to demonstrate that right lines PQ, P’Q’, &c. drawn through the several points of intersection, all meet in one point C of the perpendicular erected upon the middle of AB. [Diary, 1822, 48; 1823, 45–47; Geometrical Problems resolved by pure Geometry]

(15) Question 1417, by James Thomson, A.M. Professor of Math. In the College of Belfast and Author of a Treatise on Arithmetic [1823]

Prove that of the two infinite series

\[ 1 - \cos \frac{1}{3} \phi + 3^2 \left( 1 - \cos \frac{1}{9} \phi \right) - 3^4 \left( 1 - \cos \frac{1}{27} \phi \right) + 3^6 \left( 1 - \cos \frac{1}{81} \phi \right) + &C \]

\[ 1 - \cos^3 \frac{1}{3} \phi + 3^2 \left( 1 - \cos^3 \frac{1}{9} \phi \right) + 3^4 \left( 1 - \cos^3 \frac{1}{27} \phi \right) - 3^6 \left( 1 - \cos^3 \frac{1}{81} \phi \right) + &C \]

three times the first exceeds the second by \( \frac{1}{8} \phi^2 - \frac{1}{4} \sin^3 \frac{1}{2} \phi \). [Diary, 1823, 48; 1824, 43–44; Calculus; Infinite Series]

(16) Question 1433, Prize Question by the Editor [1824]

In the appendix to Mr. Cavendish’s paper on the mean density of the earth, (Phil. Transac. Vol. 88) when computing the attraction of the mahogany case used in his experiments, he finds the attraction of a rectangular plane, as BCDE, in direction BC, by a logarithmic expression, but the attraction in the direction AC, perpendicular to that plane by a tedious series. Now, if AC = a, CD = b, CB = x, the attraction in the first direction will be the correct fluent of

\[ \frac{bx \dot{x}}{(a^2 + x^2)\sqrt{a^2 + b^2 + x^2}}; \]

while that on A in the direction AC will be the correct fluent of

\[ \frac{ab \dot{x}}{(a^2 + x^2)\sqrt{a^2 + b^2 + x^2}}. \]
It is required to determine both of these in terms either of logarithms or of trigonometric quantities, without series. [Diary, 1824, 47–48; 1825, 45–46; Fluxions; Calculus (the second solution)]

(17) Question 1452, by Investigator [1826]

Find three numbers, such that their sum shall be a square, and the sum of their squares a biquadratic. Then find four numbers, and afterwards five numbers, possessing the same properties. [Diary, 1826, 47; 1827, 37; Algebra]

(18) Question 1482, by Mr. Edw. Rymer, Lumley, Durham [1828]

Demonstrate that any angle of \( m \) times \( 9^\circ \), or of \( \left( \frac{1}{2} \right) m \) times \( 9^\circ \), may be trisected. [Diary, 1828, 46; 1829, 34–35; Pure Geometry (and trigonometry)]

(19) Question 1489, by Mr. C. Gill, near Hull [1828]

Find two pentagonal numbers, such that their sums and differences shall be also pentagonal numbers. [Diary, 1828, 47; 1829, 39–40; Arithmetic; Algebra]

(20) Question 1520 by John Whitley, Bradford [1830]

If \( a \) be any arc of a circle, and if \( t \) its cotangent; it is required to prove that

\[
a = \frac{1}{t} - \arctan \frac{1}{t(4t^2 + 3)} - 2 \arctan \frac{1}{2t(4^2t^2 + 3)} - 4 \arctan \frac{1}{4t(3^2t^2 + 3)} - &c. ad. inf.
\]

[Diary, 1830, 48; 1831, 41–42, Infinite series]

(21) Question 1564, by Mr. T.S. Davies, Bath [1833]

At a given time and place a star is observed, and it is found that the azimuth is equal to the altitude, and the hour-angle equal to the declination. Determine its position. [Diary, 1833, 48; 1834, 41–42; Astronomy]

(22) Question 1643, by Rev. P.T., A.M., Vicar of Overton [1838]

Determine how many roots of the two following equations are real, and find those that are so by Horner’s methods, to ten places of decimals, exhibiting the work and reasoning.

\[
x^5 + 3x^4 + 2x^3 - 3x^2 - 2x - 2 = 0
\]

\[
x^5 - 10x^3 + 6x + 1 = 0
\]


(23) Question 1653, by M.Z. Ameen Bey [1839]

It is required to integrate \( \int_0^\infty x e^{-x^2} \), between the assigned limits 0 and \( \infty \); \( e \) being the base of the Naperian logarithm. [Diary, 1839, 52; 1840, 41–42; Calculus]
Table 4
Classifications of the mathematical questions published by *The Ladies’ Diary*, 1708–1840.

<table>
<thead>
<tr>
<th>Branches</th>
<th>Leybourn’s index (1707–1816)</th>
<th>Extended index (1817–1840)</th>
<th>Totals</th>
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<tbody>
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<td></td>
<td></td>
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<tr>
<td>Problems Purely Algebraic</td>
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<td>{30, 1, 7.2%}</td>
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<td>{4, 0, –}</td>
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<td>{35, 1, 1.9%}</td>
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<td>{3, 0, –}</td>
<td>{4, 0, –}</td>
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<td>–</td>
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<td>{18, 1, –}</td>
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<tr>
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<td>{94, 12, 4.9%}</td>
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<td>{17, 1, –}</td>
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<tr>
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<td>{157, 9, 8.1%}</td>
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<td>{1, 0, –}</td>
<td>{10, 0, –}</td>
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<tr>
<td>Geometrical Theorems</td>
<td>{35, 1, 2.3%}</td>
<td>{27, 2, 6.4%}</td>
<td>{62, 3, 3.3%}</td>
</tr>
<tr>
<td>Gnomonics</td>
<td>{18, 1, 1.2%}</td>
<td>{0, 0, –}</td>
<td>{18, 1, –}</td>
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<td>Harmonics</td>
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<td>Hydrostatics</td>
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<td>{6, 0, 1.4%}</td>
<td>{19, 1, 1.0%}</td>
</tr>
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<td>{2, 0, –}</td>
<td>{32, 5, 1.6%}</td>
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<td>Indeterminate Analysis</td>
<td></td>
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<tr>
<td>Equations of the first degree</td>
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<td>{3, 0, –}</td>
<td>{22, 0, 1.1%}</td>
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<tr>
<td>Diophantine, or Indeterminate Problems of the second or high orders</td>
<td>{39, 2, 2.6%}</td>
<td>{13, 0, 3.1%}</td>
<td>{52, 2, 2.7%}</td>
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<tr>
<td>Interest, Annuities, &amp;c.</td>
<td>{28, 1, 1.9%}</td>
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<td>{30, 1, 1.6%}</td>
</tr>
<tr>
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<tr>
<td>Navigation</td>
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<td>Optics</td>
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<td>{2, 1, –}</td>
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<td>{3, 1, –}</td>
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<td>Pneumatics</td>
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<td>{1, 0, –}</td>
<td>{12, 1, –}</td>
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<td>Projections</td>
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<tr>
<td>Series</td>
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<td>{31, 2, 1.6%}</td>
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<tr>
<td>Spheres</td>
<td>{7, 2, –}</td>
<td>{6, 1, 1.4%}</td>
<td>{13, 3, –}</td>
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<tr>
<td>Statics</td>
<td>{39, 1, 2.6%}</td>
<td>{18, 2, 4.3%}</td>
<td>{57, 3, 3.0%}</td>
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<tr>
<td>Approximate Total Number of Problems</td>
<td>1511</td>
<td>419</td>
<td>1930</td>
</tr>
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</table>

Appendix B. Index of mathematical problems in *The Ladies’ Diary, 1707–1840*

At the conclusion of the fourth volume of his republication of the 1511 mathematical Questions and their Solutions that appeared in *The Ladies’ Diary*, 1707 to 1816 (except for the Solutions to the problems posed in 1816), Thomas Leybourn compiled two remarkable “Indexes.” Leybourn first produced an Index “Of the Names of [all] the Persons who have Proposed and Answered the [Mathematical] Questions.” For each name, there was a list of problems posed and a list of problems solved. The pseudonyms were included, and for a very few of them, the person’s true identity was inserted; e.g., “Mancuniensis” was Mr. John Holt [Leybourn, 1817, IV, 415–436].

For his second Index, *Leybourn [1817, IV, 437–440]* devised a taxonomy of mathematics, dividing the subject into 25 Branches and further subdividing some of the more popular Branches; our use of capitals and italics in the first column of Table 4 follow Leybourn’s usage. Then, for each such category, Leybourn listed all of *The Diary’s*
Fig. 5. The most popular branches of British mathematics as determined by Leybourn’s index of mathematical questions published by The Ladies’ Diary, 1708–1816. Each of these branches contained 50 or more Diary questions.

Fig. 6. The most popular branches of British mathematics as estimated by the authors when they extended Leybourn’s index of mathematical questions to the questions published by The Ladies’ Diary, 1817–1840. Each of these branches contained 18 or more Diary questions.

Fig. 7. For each of the most popular branches of British mathematics, as determined by Leybourn’s index of mathematical questions published by The Ladies’ Diary, 1708–1816, we compare the number of Diary prize questions with the total number of questions from the branch. As in Fig. 5, each of these branches contained 50 or more Diary questions.

Fig. 8. For each of the most popular branches of British mathematics, as estimated by the authors when they extended Leybourn’s index of mathematical questions to the questions published by The Ladies’ Diary, 1817–1840, we compare the number of prize questions with the total number of questions from the branch. As in Fig. 6, each of these branches contained 18 or more Diary questions.
problems from 1707 to 1816 that, in his judgment, belonged to that Branch of mathematics. In the second column, we have given the totals for each of Leybourn’s categories using the following notation: \( \{m, n, p\%\} \), where \( m \) is the total number of problems Leybourn placed in that category, \( n \) is the number of Prize Problems in the category, and \( p \) is the percentage of that category of problems (we omitted percentages less than one).

In our third column, using the same notation, we have tabulated the mathematical problems from *The Ladies’ Diary* for the years 1817 to 1840. We have not eliminated any of Leybourn’s Branches, although a quick glance at the table suggests some categories that we might have eliminated. On the other hand, we have added three Branches that we believe reflect considerable mathematical activity in these years: Calculus; Calculus of Variations; and Differential Equations. Our goal is to provide a complete Index of the mathematical problems for the whole life of *The Ladies’ Diary*.

For various reasons, all of the values in Table 4, Leybourn’s and ours, must be viewed as approximations. Leybourn overlooked a small number of Questions (e.g., Questions 43 and 388; see also (5)) in forming his Index, and he showed a few ambiguities in categorizing his problems (e.g., he assigned Question 2 to four different Branches) [Diary, 1708, 37; 1709, 28]. We have not made any effort to find these lost problems or to second-guess Leybourn’s individual problem classifications. We also found a number of problems for which we were ambivalent when it came to identification with a specific Branch of mathematics, e.g., (13), (14), (15), and (17). We found the distinctions between Leybourn’s sub-branches within Geometry were often difficult to discern. Leybourn provided no guide as to how he defined the different Branches of mathematics, other than the few brief italicized annotations we have repeated in the table below, and he gave no rationale as to how he assigned each problem to its respective Branch(es). We have tried to make our extension of his Index as consistent with his categories as we could, but there are certainly wide opportunities for different judgments in problem categorization. Furthermore, over the span of more than 130 years in which *The Ladies’ Diary* published mathematics, mathematics itself manifested many changes in emphasis and fashion; thus, we regarded Leybourn’s Branches almost as moving targets rather than as fixed categories.

To help the reader gain some insight into the great variety of mathematical problems that appeared in *The Diary* over 134 years, we have used pie charts (Figs. 5 and 6) to call attention to the more popular Branches. Since each year’s Prize Problem in *The Diary* was almost always more challenging than the rest of the problems in that issue, the Pareto charts (Figs. 7 and 8) are intended to give a rough indication of the relative difficulties of the more popular types of problems in *The Diary*.

Taken as whole, Table 4 and the graphs which follow that table provide a general picture of the kinds of mathematics that appeared over the life of *The Diary*, and by extension, perhaps, an indication of the evolution of English mathematical culture through the 18th century and into the first half of the 19th century.

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