4

“Delightful and Entertaining Particulars”—Problem Solving

Why enigmas and mathematical problems?

4.1 Some Thoughts

Within the past thirty years, much educational attention has been focused on the topic of problem solving, specifically answering the questions of: “How to pose good problems?” and “How to teach the skills of problem solving to children?” A problem exists when an individual or organization is confronted with an obstacle to be overcome. Such obstacles come in many forms: physical, intellectual, psychological and in many other guises. Human existence, and indeed survival, can be described as a sequence of problem-solving events. In school, problem solving is most easily associated with mathematics although learning in any subject involves finding the solution to problems.

In a mathematics class, a student is given a problem, perhaps in symbols such as numbers or x’s and y’s, or in words, and asked to find an answer; hopefully, the correct one. A process for doing this has been instilled: “What is asked for?”; “What is given?”; “Have you done any problems like this before?” … The student should be cognitively engaged, see a direction in which to proceed, a strategy for obtaining a solution, and if that does not get the desired results, alter the strategy or attempt another. She should not become frustrated.
One overriding factor in this scenario is that the one confronted by the problem, the assumed problem solver, must want to solve it. The problem must be attractive in some sense-relevant, interesting, challenging or, at best, a combination of these qualities.

*The Ladies' Diary* was a periodical devoted to problem solving. This feature, combined with the journal’s success in longevity, reflects directly on its audience and the changes taking place within the social milieu. Certainly, enigmas, paradoxes, rebus charades, and mathematical questions are all forms of problems. Since the two features attracting most participation were the enigmas and the mathematical questions, they will now be analyzed in more detail as forms of problem solving.

### 4.2 The Enigma, A Word Maze

A modern reader would probably ask “What's with these enigmas?” And rightly so, for most of us do not encounter enigmas in our daily lives, or if so, they are in forms we don't recognize. For a Lady or Gentleman in eighteenth- and nineteenth-century England, the situation was very different. Such word puzzles were the fashion, an occasion to demonstrate one’s grasp and use of the language, to be “witty” without being offensive, and to demonstrate a cognitive ability to unravel and solve problems. Simply, to show how smart you were. John Tipper was well aware of this fashion.

An enigma, in current parlance, is something that is difficult. It can be a person, a situation, or a statement that requires unraveling and understanding. The lyrics of contemporary “rap music” songs, appear as enigmas to the uninitiated. For the readers of *The Ladies' Diary*, their enigmas were written, and often answered, in verse, another fashion of the time. Verse was more genteel, easy on the ear and befitting Ladies and Gentlemen. The presence and solving of enigmas did not begin in Hanoverian England but are thousands of years old reaching back into Ancient Babylonia and Classical Greece. Enigmas can be found in all ancient languages such as Hebrew, Sanskrit, and Chinese. Professional riddlers amused nobles in Imperial Rome. Enigmas have always been a part of human communication and interaction. They impart a sense of power to the poser—“I know something you don’t and you must find it out.” Some contemporary readers may remember playing “Twenty Questions” as a young partygoer; a game with similar objectives. Lexical and grammatical ambiguities must be overcome. Riddles are a test of knowledge and a nonthreatening challenge, many times evoking laughter among their audience. In their composition and solution, they usually tell something about the culture and society in which they were conceived.

Let us examine and analyze two enigmas from the 1835 *Diary*. The number referencing serves two purposes: the Roman numeral specifies the order of the
enigma within the particular issue of the almanac; the Hindu-Arabic numeral designates the position of the enigma within the total collection of submitted enigmas. These are among ten such word riddles in this issue that had been sent in by Diary correspondents:

III. ENIGMA (1173); by Mr. J. OXENFORD, 37, Finsbury Circus.
The regal crown shines bright
with many a gem,
But I oft bear a brighter diadem;
I own indeed no purple robes I
wear,
[more fair.]
But yet the lily’s self is scarce
A friend, like great Medea, in
dark times,
[climes.]
Am I to learning, patron of all
E’en Jove, when he was ruler of
the sky;
[I;]
Never received more sacrifice than
The lamb, which on the mend is
sporting free,
[me.]
Must soon be a burnt offering to
The mighty whale, the so’erign of
the main,
[slain.]
For me is captured, and for me is
The bee may build his cells with
instinct fine,
Those waxen homes must melt
before my shrine.
And when the sun has fallen from
the skies,
Then, clad in all my glory, I
arise;
I scorn the day, but glory in the
night,
And only shine when I alone am
bright.

IV. ENIGMA (1174); by Mr. J. OXENFORD.
X. OR PRIZE ENIGMA (1180); by Mr. W. Liston, Woodhouse.
[Whoever answers it before Feb. 1, has two chances for twelve Diaries.]
The Muse long wa’d to bask in Dia.’s
smiles,
[wiles.]
Again essays t’amuse with mystic
Diacrast not then, your humble servant
long,
Oblivious, like the subject of my song.
[cast;]
Pore’d for your case in ages long
since past,
Your cares and pleasures on my bosom
To you alone my service was devote,
In humble guise, bedeck’d in woollen
coat:
By day or night a steadfast willing
slave,
[sinewd.]
For you did floods and midnight storms
Plead’d with my charge, so faithful did
I serve,
Proud man ne’er made me from my
duty swerve.

Both enigmas contain references to Classical themes and beings, a popular subject of interest at this time, as were biblical events. As beginners at the task of unraveling such quandaries, let us attempt to glean clues for an answer for Enigma III. Remembering that these are composed for a late eighteenth-century audience, word play is a paramount feature. Some terms and expressions must be interpreted within this contemporary milieu. After reading the puzzle several times, certain phrases and events seem to stand out:

“... regal crown stands bright” → bright (light?) → Function
“... bear a brighter diadem”
“... received more sacrifice than the lamb”
“the mighty whale, the sov’rerign
of the main,
For me is captured and for me is slain.” \( \rightarrow \) fat, oil, \( \rightarrow \) Substance
“The bee may built his cells with \( \rightarrow \) wax
of instinct fine,
Those waxen homes must melt before my shrine.”
“... the sun has fallen from the skies
Then clad in glory I arise \( \rightarrow \) used at night \( \rightarrow \) Purpose
Then:
(Function & Substance & Purpose) \( \rightarrow \) candle
Answer, candle.”

The particular clues are isolated and a solution is obtained through a logical chain of deductive reasoning. A process of deductive problem solving is employed which in its application and structure is the same process used to solve mathematical problems. Heath attempted to convince readers of this fact—that mathematics problems were also enigmas. The prize enigma, \( X \), will be left for the reader to ponder further with one assisting hint: “for your ease” = comfort. (The reference to \( Dia \) in the first line is the affectionate term that the readers use for the \( Diary \), i.e., \( The Ladies’ Diary \).)

### 4.3 The Enigma’s Enduring Popularity

Early historical evidence reinforces the hypothesis that mathematical problem solving and enigmas are closely related. One of the earliest recognized collection of mathematics problems \( Propositiones ad acunendos juvenes (Problems to Sharpen the Young) \), a collection of 56 mathematical puzzles, was devised in the eighth century.\(^4\) Originally intended for the education of youths in Charlemagne’s court, many of these puzzles have appeared over the ensuing centuries in various lists of mathematical exercises and textbooks. Perhaps the most famous of these, often clothed in a variety of cultural and societal guises, concerns a river crossing:

A man had to take a wolf, a goat, and a bunch of cabbages across a river.
The only available boat he could secure could take only two at one time.
But he had to transport all of these to the other side in good condition.
How could he do it?\(^6\)

The problem’s author, Alcuin of York (ca. 732–804), so liked this challenging situation that he employed it in two other of his puzzles: one involving three virgins and their respective brothers who were possible seducers of the women in this party other than their sisters and a family of husband and wife with children,
whose combined weights hindered the transport arrangements. Several, later, notable mathematicians used and studied this “river crossing problem”, among whom are: Luca Pacioli (13th century), Tartaglia [Nicolo Fontana] (1556), Gaspar Bachet de Meziriac (1612), and M. Cadet De Fontenay (1879). By the twentieth century, this problem situation and its implications became a subject for mathematical research as “transport” and “network analysis” problems.

Riddles and enigmas could always be found in literature. Geoffrey Chaucer (1342–1400) in his *Canterbury Tales* perplexes his reader with the situation of four competing pilgrims: John, Geoffrey, Martin, and Stephen, on the road to Canterbury, boasting of their forthcoming benevolence upon arrival at their destination.

John says: “I usually only tithe two pence, but if I beat Stephen to Canterbury, I’ll gladly tithe double!”

Martin utters: “If I get to Canterbury first, I shall show my gratitude by tithing six pence! If I don’t, I shall tithe four pence anyway.”

Stephen responds: “You wayward fools are tossed by the wind! No matter what happens before here and Canterbury, I shall tithe three pence only. Heaven forgive your false piety!”

Geoffrey speaks: “Shut up Stephen. I pledge three pence if I beat you to Canterbury, but nothing if I don’t. We’ll see who’s right!”

Everyone was true to his word, and a total of thirteen pence was tithed at Canterbury.

The question remains “In what order did these pilgrims arrive?”

Jane Austen (1775–1817), the British novelist whose books and characters have contributed much to an understanding of the life and customs of the landed gentry of the period we are investigating, was noted for her riddling ability and capacity. She incorporated several riddles into her novels.

### 4.4 The Enigma in the Period of *The Ladies’ Diary*

So throughout history, solving enigmas and finding the answers to mathematical questions have always been closely associated as forms of problem solving. But “Why did they so appeal to the British audience of the eighteenth and nineteenth centuries?” First, one of the benefits of economic prosperity is the rise of a leisure society. The Ladies and Gentlemen were members of this leisure society—they
required pastimes and entertainment. Enigmas helped fill time and favorably reflected on the intellect and wits of their proponents. At that time parlor games were very much a part of the social scene where the interaction between men and women via an enigma posing/contest would not be considered improper. Ladies actually carried around small notebooks in which they could record new enigmas. The intellectual dynamics also contained the psychological factors previously mentioned. Across the channel, the French had their fashionable “witty” salons; the enigma interchange of *The Ladies’ Diary* served a similar function but on a more egalitarian scale.

The long life of *The Ladies’ Diary* has been attributed to its enigma feature. This is true, but also true is that throughout the *Diary’s* existence, Ladies excelled in the composing and solving of enigmas. They quite amply and continually demonstrated their ability as formal problem solvers where they worked from a set of premises and logically arrived at a solution! Now Dear Reader, we leave this section with one more of the *Diary’s* wordy gems from the year 1744 for you to unravel:

III Enigma 262, by Miss Ch__bers.
I am a very useful thing, extracted from the earth
By art and labour, roughly us’d before and after birth.
My maker’s ingenuity appoints the shape I wear.
Sometimes like a wheel am round but mostly I am square.
Tho’ homely be my garb and mien, in courts of kings I’m us’d
Lord O__d he made use of me, or else he is abus’d.
In almost every family I’m held in great request.
Because I’m known to give new gust to scraps of Christmas feast.
Further I say, and true I may, that altho’ I am able
To fill the purse and belly too, I ne’re appear at table.
Now, ladies, as I’m pretty sure, each of you is a lover
Of what I prepare for you, I pray my name discover.

For the more adventurous wordplay enthusiasts, several more challenging word puzzles from *The Ladies’ Diary* can be found in Appendix A.

### 4.5 The Mathematical Questions

A few selected mathematical questions will be examined here and relevant implications offered but the mathematical impact of *The Ladies’ Diary’s* mathematical questions is so significant that it deserves further attention to be given below in
The Mathematical Questions

a separate chapter. Let us now look at two categories of these questions: questions that are already referenced in passing, previously having been mentioned above in other contexts, and a few questions representative of each, individual editorship, noting how their emphasis and tenor changed.

Here are the first two mathematical questions to appear in *The Ladies’ Diary* (1707). They were offered by a Mr. John White of Butterly, Devonshire. The copies of problems shown here with their answers are from a later collection assembled by Thomas Leybourn in 1817.

1. **QUESTION 1.**

   *In how long time would a million of millions of money be in counting, supposing one hundred pounds to be counted every minute without intermission, and the year to consist of 365 days, 5 hours, 45 minutes?*

   **Answer.** 19013 years, 144 days, 5 hours, 55 minutes.

   **Solution.**

   The solution of this question is evidently thus: As 100l. : 1 minute :: 1000000000000l. : 1000000000 minutes = 19013 years 144 days 5 hours 55 minutes, the true time required.

   This is a simple computational problem whose impact is the amount of money being considered. In the 1709 *Diary*, the originator Mr. White relates a discussion he heard by local ploughmen (farmers) concerning the problem’s solution. In reporting this conversation, he attempted to capture the tone and dialect of these men in a verse:

   Says *Tom* ’twol be vorty long Days, —— 40 days?
   I and vorty to that says *Will:*——— 40 + 40 = 80 days?
   ’Twant be told in a Year quoth *Jack*,—— a year?
   No nor in zov’n Years cries *Jill:*——— not even 7 years?
   You talk all like Vools saith *Roger*.
   A *Merchant* with’s two vore Veet,
   Will scrape it away in a Month,——— a month?
   And thereto I’ll wage you a Sheep.
   Go Blockhead quoth *Bess* that was brewing,
   The *Boy* that weighed my Hops,
   Woll tell it all in a Week, } ——— a week
   Zo will any Mon in the Shop

   Obviously, these men are just guessing but this bucolic conversational scenario attests to the wide spread readership of *The Ladies’ Diary*—even farmers were reading it or at least knew of and were discussing its questions!
II. QUESTION 2*. 

If to my age there added be
One half, one third, and three times three;
Six score and ten the sum you'd see,
Pray find out what my age may be.

Answer. 66 years.

Solution.

The meaning of the problem is, that the number 9 added to once his age, together with one half and one third of his age, the sum shall be 130; or since the sum of the parts 1, and \( \frac{1}{2} \), and \( \frac{1}{3} \) is \( \frac{11}{6} \), that \( \frac{11}{6} \) of his age is \( 130 - 9 = 121 \); consequently \( 11 : 6 : : 121 : 66 = \) his age. \( \therefore \)

Algebraic Solution.

Let \( 6x \) represent the required age; then, by the question, \( 6x + 3x + 2x + 9 \), that is \( 11x + 9 = 130 \); therefore \( x = 11 \); consequently \( 6x = 66 \), as before. \( \therefore \)

* All the solutions marked with the signature \( \ast \), are by Dr. Hutton, and taken, with permission, from his edition of the Ladies' Diaries.

This, II, is a simple “find my age problem”, a type of puzzle used for over a thousand years and one that would often appear in the Diary in various forms.

A lady, Mrs. Mary Wright, answered the first-prize mathematical question, (1710), VI, 16. During the early years of the Diary, Mrs. Wright was a consistent and fervent mathematics problem solver and composer. She demonstrated her ability by eventually solving several “prize questions”. To obtain her answer for the steeple problem, she had to have had access to longitudinal reference tables. Mary often joined with her nearby cousin, Thomas Wright, in solving problems. Such informal problem-solving gatherings, people working together, finding solutions to the Diary’s mathematical questions, were not uncommon. The Diary’s exercises encouraged these interactions within families and groups of like-minded friends. The question Mrs. Wright confronted, as summarized by Leybourn, and her answer are given below.
VI. PRIZE QUESTION 16.

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 253½ feet; it is required from thence to find the steeple’s height.

Answered by Mrs. Mary Wright.

May 1, 1709.

Sun’s longitude, from its ingress into aries. ............... 51 28 0
Oblique angle of the ecliptic and equator. .................... 23 29 0
Thence the declination that day. ......................... 18 9 45
Consequently its merid. altitude in lat. 51° 32' ............... 56 37 45
The complement thereof to 90 is ......................... 33 22 15

Then as the sine of the angle 33° 22' 15' =
To the base 253·125 feet.
So is the sine of the angle 50° 37' 45' =
To the perpendicular 284·307 feet the height of the steeple.

Note. The true height of Bow steeple is 225 feet, for which at first I had proportioned the length of the shadow, but upon second thoughts I altered it, for fear some, who had read its height in history, should claim the reward, without having art enough to investigate it by trigonometry.

The mathematics involved in obtaining the solution is not difficult but required finding the sun’s angle of inclination for Cheapside, at noon on May first, 1709.

The following “ribald” question was composed by Robert Heath, under the alias “Honorius”, and offered in the 1752 Diary. This question ultimately lost him the editorship. Miss Polly’s French hoop is probably the latest fashion craze acquired from Paris. Hoops were fashionable and carried to such extreme dimensions as to force a wearer to struggle sideways through door openings. Although, in general, the English expressed a poor opinion of the French—being traditional enemies—yet French manners, fashions, and social behavior were much admired and imitated in British society at this time. See Figure 4.1
Figure 4.1. French-inspired women’s attire was elaborate but not very practical. Several magazines were founded to serve British ladies’ needs, primary among which was information on the latest French fashions. One such magazine was *The Ladies’ Magazine*, 1770–1847. This image is entitled “A Lady in Full Dress in Augt. 1770” and was published in *The Lady’s Magazine*, August 1770. Source: Wikimedia Commons.

Just as Editor Heath used a pseudonym in posing the problem, so too did the respondents: Messrs. “Honey” and “Wigglesworth.” The abundant use of pseudonyms in correspondence to the *Diary*, both in posing puzzles and questions and submitting answers, can easily be attributed to the protection of one’s identity and social standing. Contributors did not want to look “foolish” or ignorant, nor write anything that would diminish their position in society. They wished to protect themselves, remain anonymous, and yet have some pseudo
identity. But there is another reason for this practice, a social fad, a quaint custom of the time. Be witty. You are doing puzzles—“Why not make your identity a puzzle also?” The great variety of picturesque, often double entendre, names used in the Diary reflect on the creative wit of their owners: “Miranda Tell Truth”, “Nelly Needless” and “Simon Cucko Esq.” Ladies mindful of their reputations would find such a ruse convenient.
Question "377" is the problem our young gentlemen at the Black Turk Coffee House in London were discussing and to which Mr. Elsmont Potter responded. Several other readers also correctly answered the question but Potter pushed farther requesting the author's age.
Atkinson's retort to the request of her age from "Mr. Potter:"

In this period of confining, imposed, social limitations that included male-female constraints, “correct courting” rituals, such written repartee often took the place of flirting. Within the pages of The Ladies' Diary, young people sometimes found members of the opposite sex whose expressed opinions matched their own or which they found attractive and sought to pursue the source further. This practice was a nineteenth-century forerunner of online dating. For example, in a 1758 Diary encounter, the male inquirer, a "Mr. U. T__r", is more brazen, requesting a more detailed description of a female correspondent’s status including her worth (possible dowry). Her response and its answer were published.
in 1759, whether the gentleman found the information sufficiently attractive to pursue the correspondence farther, we shall never know.

**Questions proposed in 1758, and answered in 1759.**

1. **Question 434, by Miss T. S——e.**

   Addressed to Mr. U. T——r, who took the liberty to ask her the following Questions; viz. What age? What fortune? And what height she was?

   My height, Sir, in inches, is three times my years;
   My fortune their squares will both shew;
   Put all these together, there then, Sir, appears
   The number exposed to your view.
   From which, Sir, determine the things you required;
   And then, if more favours you want,
   As lovers of science I always admired,
   Those favours, perhaps, I may grant.

   **Answered by Mr. Tho. Baker.**

   Let \( x \) represent the lady's age, then her height (in inches) will be \( 3x \), and her fortune (in pounds) \( = 10xx \), by the conditions of the question; from whence we have also given \( 10xx + 3x + x = 4494 \); therefore \( xx + 0.4x = 449.4 \), and consequently \( x = \sqrt{449.4} = -2 \sqrt{449.4} \) — 2 = 21. Hence the lady's age appears to be 21, her height five feet three inches, and her fortune 4410 pounds.

### 4.6 A Sampling of Mathematical Questions with Different Editorships

As we have seen, John Tipper, editor 1704–1713, was extremely careful that mathematical problems were set within the capacity and appreciation of his female readers. The following three problems from 1709 are typical examples.
All of these problems can be solved within the realm of basic algebra and their content would appear gender neutral and non-offensive.

Henry Beighton, the following editor, 1714–1743, leaned more towards theoretical mathematical situations with more conditions imposed. He stressed scientific content involving experience appealing more to mathematicians and skilled technicians such as fellow surveyors. Problems become more masculine in their appeal.

A gentleman has a garden of a rectangular form, the length 100 feet and breadth 80, and he wants to make a walk of equal width half way round to take up half the garden: What must be the width of the walk?

A vintner has wines of 8, 5 and 4 groats per quart, and wants to make a mixture of 56 quarts, worth 22 pence a quart; how many different ways can this be done in whole numbers?

If thirteen tuns of claret cost nineteen pounds, how many pints can be had for a thousand crowns?
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Required the sides and radii of the circumscribing circles of two regular polygons, the less of five sides and the other of seven, from the following data, viz. the less polygon is to the greater as 3 to 13, and the line subtending the angle formed by two adjacent sides of the pentagon is equal to the length of a pendulum which vibrates 61 times in a minute.

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 noted these dimensions, I was informed that there were in the cask a ball of iron weighing 60lb. another ball of lead weighing 90lb. and a cube of box, a foot square. Pray what quantity of liquor was in the cask?

A company of mathematicians, after emptying an elegant glass punch bowl, found themselves quite at leisure to contemplate its figure, &c. The inside had the form of an hyperbolic conoid, the transverse diameter of the generating hyperbola being 6.93 inches, and the conjugate 5.29 inches; the form of the outside of the bowl was that of a cone generated by the revolution of the asymptote of the hyperbola, and the length of the outside was $8 \frac{2}{3}$ inches; also the depth of the bowl was 5.98 inches. Required the internal diameter at the brim, weight of the bowl, and what liquor it contained when full.

Problems now involving statics and dynamics began to appear, such as this one from the 1715 Diary:

Kind sir, I pray, can you to me declare
A lofty tower's height within the air:
I'll tell you how the height you well may know,
Which in a problem unto you I'll show.

If from the tower's height there should be laid
A plain, whose surface fine and smooth is made,
To meet the earth; three hundred foot and four
From the foundation of this lofty tower;
And then a body which in pounds doth weigh
Just fifty six, you on the plain do lay;
Just forty pounds will the same sustain,
From sliding down on this descending plain.
But, artist, I apply myself to you,
(The tower's height) to calculate it true.
The plane geometry investigations became more complex, situations involving mechanics and solid and analytical geometry were introduced: mathematical disciplines and depth more readily available to men rather than women. The tone of mathematical problems became more occupational in nature and masculine related. However, the ladies still held their own in obtaining correct answers. Silvia, a consistent problem solver, supplied the correct answer to the 1715 problem, 310.27 ft., but in her 1716 reply she also gave the following retort as to the perceived disadvantage confronting her cohort female problem solvers:

\begin{quote}
Your towers lofty and sublime,
Your problem rational and fine,
Your methods just, I like the notion,
Which join with numbers, weight and motion,
But sure it is contriv’d to vex,
Our uninstructed, softer sex;
You try our weakness, search our flaws,
By algebra and statick laws;
Yet to untie your curious knot,
Since ’tis a homely virgin’s lot,
Please to accept my kind, officious aid,
Who am a rural and mechanick maid.
\end{quote}

Robert Heath’s contentious editorship lasted from 1745–1753. His problem situations became more fanciful and even more mathematically difficult.
If the diameter of Syphus's cylindrical stone be two feet, which he continually rolls upon the surface of a semi-globular mountain, half a mile high: Quere what space will a spot on the convex surface of that stone travel through in rolling directly up and down the said mountain? And what will be the time of its descent from the top by the force of gravity?

Observing a horse tied to feed in a gentleman's park, with one end of a rope to his forefoot, and the other end to one of the circular iron rails, inclosing a pond, the circumference of which rails being 160 yards, equal to the length of the rope, what quantity of ground, at most, could the horse feed?

A spider, at one corner of a semi-circular pane of glass, gave uniform and direct chase to a fly, moving uniformly along the curve before him: the fly was 30° from the spider at the first setting out, and was taken by him at the opposite corner. What is the ratio of both their uniform motions?

To find the least number of guineas, which being divided by 6, 5, 4, 3, and 2, respectively, shall leave 5, 4, 3, 2, and 1, respectively remaining?

These problems frequently require knowledge of the concept and use of fluxions and of higher analytic geometry. The last exercise on this list is an example of what would come to be known as the famous "Chinese Remainder Theorem" and was submitted by a lady. The Chinese mathematician Sunzi first recognized a systematic solution method to this problem in the third century; it was not formalized and published in Europe until the appearance of Gauss’s Disquisitiones Arithmeticae in 1801. Here the solution is obtained through computation without the benefit of the Theorem. The "spider problem" is an example of a pursuit problem, amplified in importance by aerial combat during the First World War; such mathematical problems became a topic of later twentieth-century research.

Thomas Simpson, editor 1754–1760, continued in a serious mathematical vein, offering problem challenges even to well-qualified mathematicians.
Simpson's problem-solving challenges exceeded Beighton's in difficulty. Problems in mechanics became more complex and the degree of mathematical analysis (calculus) required was quite high as exhibited in the last problem involving an alternating numerical series.

Edward Rollinson during his editorial tenure continued to maintain a high level of mathematical rigor in his mathematical problems series.

If a straight, uniform, slender rod, or bar, of heavy metal, of a given length, be left to descend after being set leaning, in a given position, with its lower end ($n$) on the immovable horizontal plane $AB$, and its upper end ($m$) full against the immovable vertical plane $AC$ (the lower end being at liberty to slide freely along the first-mentioned plane, while the upper end is descending), what will be the position of the rod when it shall cease to touch the said vertical plane? how long will it then have been in motion? and how far from the point $A$ will the end ($m$) strike the horizontal plane?

In a right-angled triangular field there are three trees, viz. one in each fence: The distance of the tree in the base from that in the hypotenuse, and from the acute angle adjacent, and of the tree in the perpendicular from the right angle, are all equal, and given; and if lines be drawn from the tree in the base to the other two, those lines will form a right angle: The perpendicular of the proposed triangle is known to be the least of its kind (or that the data will admit of): Hence you are desired to find the sides of the triangle, and to construct the same geometrically.

To assign the sum of the series $1 - \frac{1}{2} + \frac{1 \cdot 3}{2 \cdot 4} - \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 6} + \&c.$

by means of circular and elliptic arcs.
The legs of a plane triangle being given equal to 30 and 40 respectively; and if a line be drawn from the vertical angle to the middle of the opposite side, the rectangle of the said line and base is a maximum; required the bisecting line and base?

Four spires standing directly north and south, and at the respective distances of 2, 3, and 4 miles from each other, were observed by a traveller, on a road tending to the north-east, the 1st and 2d, and also the 3d and 4th, appearing under equal angles, which they also did a 2d time, after travelling two miles farther on the same road; required his distance from them at each observation?

To determine the equation, the area, and the length of the curve, whose tangent and subtangent have always the same given difference \( d \).

To determine the nature of the curve, whose tangent terminated everywhere by it and an indefinite right line \( cd \), is a constant quantity \( = 100 \); also, to determine the length of the part thereof intercepted between its highest point and that point whose height, above the said right line \( cd \), is \( = 20 \).

These problems have become distinctly academic, that is, textbook dictated. The situations are abstract and removed from practical reality. Charles Hutton was the most experienced and respected mathematician to edit *The Ladies' Diary*, (1774–1818). He attracted young, trained mathematical talent to the challenges of his mathematical exercises and both developed and pressed their abilities with his problem-solving questions.
4.6. Mathematical Questions with Different Editorships

To determine the position of the asymptote of the curve which is the locus of all the angular points formed by drawing three lines, from three given poles, so that the angle formed by the same corresponding two may always be bisected by the third.

To determine how far a man, who pushes with a force of 100 lb. can introduce a sponge into a piece of ordnance whose diameter is five inches, and length 10 feet, when the barometer stands at 30 inches: the vent, or touch-hole, being stopped, and the sponge having no windage, that is fitting the bore quite close.

Required the dimensions of a cone, which if suspended by its vertex will vibrate as often in a minute, as it has inches in altitude?

If \( \frac{1}{4} + \frac{1}{5} + \frac{1}{6} \) be put = \( a \), \( \frac{1}{7} + \frac{1}{8} + \frac{1}{9} \) = \( b \), \( \frac{1}{10} + \frac{1}{11} + \frac{1}{12} \) = \( c \), &c. then shall the arc of 90° be \( a - \frac{1}{4} b + \frac{1}{4} c - \frac{1}{4} \) &c. Query the demonstration?

A quantity of matter being given, it is proposed to determine the figure of a solid of rotation made up of it, which shall have the greatest possible attraction on a point at its surface.

Military personnel from the Royal Military Academy were now submitting questions of a military nature and correspondents were asking for “Proofs”. Note the “sponge and cannon” query. In this period of British history, the staff, officers and cadets at RMA would possess superior mathematical training as compared with common citizens even those of the gentry class. The mathematics considered has moved to a highly abstract plane.

Olinthus Gregory assumed the last editorship, 1819–1841. As a mathematician and RMA colleague of Hutton, he followed the same trend of promoting abstract problem solving.\[28\]
Chapter 4. Problem Solving

These problems are highly academic and approaching the level of minor research endeavors. The “shilling drop problem” is a variant of the French gambling game, “Le jeu de Franc-carriau” where bets were made on the final resting position of a dropped coin upon a grid—did it touch a line or not? This is an example in geometric probability. The problem was analyzed by the French mathematician Georges-Louis Leclerc, Comte de Buffon in 1733. His results were published in 1777. Today, his work is recognized as the “Buffon Needle Drop Problem”.

In scanning the above progression of problems and viewing their content and computational intent, it becomes clearly apparent that from approximately the period 1750 onwards the mathematics required to fruitfully engage in the mathematical problem competitions offered in The Ladies’ Diary, one would require advanced training in mathematics and a high level of personal skill. The problems had seriously moved beyond the talented self-trained or home-schooled amateur to attempt and even for much-determined and mathematically competent ladies. From entertaining diversions, the Diary’s mathematical problem posing evolved into extremely challenging exercises.