THE LADIES' DIARY;

OR,

WOMAN'S ALMANACK,

FOR THE YEAR OF OUR LORD 1716.

Being the Bissextile, or Leap Year.

Containing New Improvements in Arts and Sciences, and many entertaining Particulars:

DESIGNED FOR THE USE AND DIVERSION OF THE FAIR SEX.

The Hundred-and-thirteenth Almanack published of this Kind.

Virtue and Sense, with Female Sotiness join'd,
(All that subdues and captivates Man's soul!)
In Britain's matchless Fair resplendent shine;
They rule Love's Empire by a Right Divine:
Justly their Charms th'astonish'd World admires,
Whom Royal Charlotte's bright example fires.

LONDON,

PRINTED FOR THE COMPANY OF STATIONERS,

BY J. ADIARD, 23, BARTHOLOMEW-CLOSE;

And sold by G. GREENHILL, Treasurer, at their Hall, Ludgate-street.

[Price, stitched, Two Shillings and Three Pence.]
CHRONOLOGY of REMARKABLE EVENTS.

1 of Christ. 1733 A great Comet appeared 1735.

33 King Charles I. born 1746. 1734 Rebellion in Scotland. 1735.

88 Q. Elizabeth, K. J. suc. 1736. 1737 Westmoreland Bridge finished.

103 A Great Plague in London. 1738. 1738.

104 Popish Gun-Powder Plot. 1739. 1739.

116 Shakespeare the poet died. 1740. 1740.

125 K. James, died, Ch. I. suc. 1741. 1741.

141 Bloody-Irish Massacre. 1742. 1742.


159 K. Charles I. beheaded. 1744. 1744.

158 Oliver Cromwell died. 1745. 1745.

160 K. Charles II. restored. 1746. 1746.

162 Royal Society instituted. 1747. 1747.

165 Died of the Plag. 1748. 1748.

166 Great Fire in London. 1749. 1749.

167 Halfpence & Farthing coined. 1750. 1750.

179 Habecas Corp. Act passed. 1751. 1751.

185 K. Ch. II. died, Ja. II. suc. 1752. 1752.

188 Prince of Orange landed. 1753. 1753.

188 Prince James II. abdicated. 1754. 1754.

189 Win. and Mary crowned. 1755. 1755.

193 Hackney coaches estab. 1756. 1756.

192 K. Wm. died, Q. Anne suc. 1757. 1757.

197 England & Scotland unit. 1758. 1758.


175 Rebellion in the North. 1760. 1760.

176 A very great Frost. 1761. 1761.

178 Sir Isaac Newton died. 1762. 1762.

177 K. Geo. I. died, Geo. II. suc. 1763. 1763.

179 A very great Frost. 1764. 1764.

180 War against America begun. 1765. 1765.

183 America declared independ. 1766. 1766.

184 French Treaty with Amer. 1767. 1767.

179 War against France begun. 1768. 1768.

180 War against Holland begun. 1769. 1769.

181 Herschel's new Planet disc. 1770. 1770.

183 A general Peace. 1771. 1771.

184 A Revolution in France. 1772. 1772.

185 K. Swe. shot by Ankerstron. 1773. 1773.

186 France declared a Republic. 1774. 1774.


189 Napoleon 1st Emp. France 1776. 1776.

190 Ireland united to England. 1777. 1777.

191 The Planet Piazzi discov. 1778. 1778.

192 The Planet Olbers discov. 1779. 1779.

193 The Planet Harding discov. 1780. 1780.

194 The Planet Olbers's 2d Planet discov. 1781. 1781.

BIRTH-DAYS [N.s.] and YEARS of the ROYAL FAMILY of GREAT BRITAIN.


Duke of York, August 16, 1764. Princess Mary, April 25, 1765.

Duke of Clarence, August 21, 1765. Princess Sophia, Nov. 8, 1766.

Duchess of Wirttem. Sept. 29, 1766. Queen Charlotte, May 19, 1767.


Prs. Augusta Sophia, Nov. 8, 1768. Duchess of York, May 7, 1769.


YEARS of BIRTH of the Principal SOVEREIGN PRINCES of EUROPE.


Alexander, Emp. of Russia, 1777. Ferd. V. K. of Denmark, 1769.

Maria, Queen of Portugal, 1734. Ferd. IV. K. of Italy, 1751.


Francis II. Emp. of Austria, 1767. Louisa, X. K. of France, 1755.
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<th>Day</th>
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<td>6 S</td>
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<td>7 M</td>
<td>Lucian: Plow Mon.</td>
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<td>13 S</td>
<td>Hilary: Cam. T. beg.</td>
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<td>25 Th</td>
<td>Conversion of St. Paul</td>
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<td>27 S</td>
<td>D. of Sussex born</td>
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<td>K. Ch. I, mar. 1649</td>
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**Length of Day Information**

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<th>Sun East</th>
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<th>Stars South</th>
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# February 1846

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Note: The table provides details on the length of the day, solar breaks, twilight ends, and other astronomical data for the month of April in 1810.
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First Quarter: 4th, 8m past 12 Night.
Full Moon: 11th, 40m past 3 After.
Last Quarter: 19th, 3m past 2 Morn.
New Moon: 27th, 7m past 3 Morn.
<table>
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<th>Inc.</th>
<th>Day Inc.</th>
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<th>Tw. ends</th>
<th>Sun East</th>
<th>Ct. aft. Sun</th>
<th>Stars South</th>
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**Note:**
- Days are January 1 to June 30.
- Length of Day is in hours.
- Inc. is in minutes.
- Day Inc. is in seconds.
- D. breaks is the duration of daylight.
- Tw. ends is the time of twilight ending.
- Sun East is the time the Sun rises.
- Ct. aft. Sun is the time the Sun sets.
- Stars South is the visibility of stars south of the horizon.
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**NOVEMBER hath 30 Days.**

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<th>Days</th>
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### December 14th, 1816

#### Moon Phases:
- **Full Moon**: 4th, 51m. past 8 After.
- **Last Quarter**: 12th, 52m. past 3 Morn.
- **New Moon**: 18th, 37m. past 10 After.
- **First Quarter**: 26th, 52m. past 1 After.

#### Events:
- **Moon eclipsed visib.**: 8th, 4:17 p.m.

#### Significant Days:
- **8th**: Nicholas
- **16th**: O Sapientia: Ca. T. e.
- **17th**: Oxford Term ends
- **27th**: Silvester

#### Special Notes:
- **9th**: Lucy
- **11th**: Shortest Day by London.

#### Additional Information:
- **7h. 44m. 17sec.**: Shortest Day at London.
- **Sets after Refraction**: 7h. 44m. 17sec.
- **8th**: 4:52 p.m.
- **9th**: 7:53 p.m.
- **10th**: 6:54 p.m.
- **11th**: 5:55 p.m.

#### Sun Enters:
- **21st**: 14th, 27th.

#### Days of the Week:
- **21st**: Tu
- **22nd**: F
- **23rd**: Th
- **24th**: Tu
- **25th**: W
- **26th**: Th
- **27th**: S
- **28th**: Tu
- **29th**: W
- **30th**: Th
- **31st**: Tu

#### Days Length:
- **1st**: 8 6 28 5 55
- **2nd**: 7 58 56 58
- **3rd**: 50 44 59
- **4th**: 46 48 6 0
- **5th**: 44 50 1 5 59
- **6th**: 46 0 mec. 2 0 6 0

#### Sun Rise:
- **10th**: 10 a 59
- **11th**: 37 37
- **12th**: 15
- **13th**: 53
- **14th**: 31
ECLIPSES, &c.

There will be four eclipses this year; two of the Sun, and two of the Moon; three of which will be visible in these parts.

1. May 27, the Sun is eclipsed, but invis. at 3h. 6m. morning.

2. June 9 and 10, the Moon is totally eclipsed, and visible, from 1h. 30m. at night, till 3h. the next morning.

3. Nov. 19, the Sun is eclipsed, and visible, from 8h. 18m. till 10h. 34m. in the morning.

4. Dec. 4, the Moon is eclipsed, and visible, from 7h. 15m. till 10h. 14m. at night.

Venus is a morning star till Aug. 1; then an evening star to the end.

Jupiter is a morning star till April 25; then an evening star till Nov. 12; then a morning star to the end.

ANSWERS TO THE ENIGMAS.


10. or Prize

ANSWERS TO THE PRIZE ENIGMA.

1. By Amanda, of Kennington.

When first I tried, with searching wit,

The meaning of the prize to hit; I puzzled, pondered in my mind,

What might be in such terms defined:

It seemed at first a thing despised,

[prized; Then afterwards what might be Perplexed, some time thus having past,

I think I've found it out at last.

2. By Miss M. A. Collins, Ladies' Seminary, High-street, Kensington.

In careless numbers poets sing, Of pauper, peasant, prince, and king;

Friend Smart, at last, in mystic guise,

A last has sent us for the prize.


Your language of the former year, Words are but wind, an empty burst;

I hope, dear Smart, was not sincere; It cannot, must not, be your last.

4. Mr. J. Hare, to Miss C. C. Richardson; on having broken her Penknife.

Your knife, unfit for stubborn oak, Fearing, dear Charlotte, to offend,

With usage rough, at last it broke; I strove in vain the knife to mend;

Your once displeased with me, For, were you once displeased with me,

My heart so broken then would be.
5. Acrostic Answer, by Maria.

Long time, my friend Smart, you had puzzled my brain;
And kept me in ignorance fast;
Still I firmly resolved not to spare any pains
To find you out, sly-boots, at last.

6. The Wish, by Mr. Henry Egerton Mussett; Marbury.

When the last dreadful trumpet shall awake the sound,
And every soul with trembling fear rebound,
Then may the immortal Smart with joy arise,
To gain with rapture the celestial skies.

7. Acrostic Answer, by Mr. J. W. Puckle, Koni-Road.

Let Dia's fair their sorrows prove, Ever'd by fate, his magic lyre
And mourn in verse the bard they Too sweetly tells the parting
dire.

8. Mr. Sheridan's Address to Mr. T. R. Smart.

Ingenious Smart! accept the votive line
That friendship offers at Apollo's shrine;
The meed, tho' humble, speaks a grateful heart
For all the bliss thy mystic strains impart.
Long be thy life, and happy be thy days,
To grace Dia with thy dulcet lays;
And, when the last eventful hour shall come,
To waft your spirit to his native home.
May friendship's soothing voice your pains allay,
And angels waft you to eternal day.
While sense and learning bless this happy land,
Thy name among her tuneful bards shall stand,
Join'd with Narcissa's, Bentley's, Tasso's name,
In Dia's pages of immortal fame.

9. Mr. John Smith, on the Death of an Indeared Child.

By sickening blasts assail'd, the budding rose
Its virgin blush to expectation's eye
Is oft forbidden fully to disclose,
And destin'd premature to fade and die:
So Thomas early fell, my much-loved boy.

10. To Mr. T. R. Smart, by Timid.

To solve your enig,
I put on my wig,
That emblem of wisdom so vast;
To Crispin, I trow,
I hasten'd, when, lo!
The first thing I saw was the last.

11. Ne Sutor ultra crepidam, by Mr. James Wood.

Apelles once a picture drew,
And placed the same to public view:
A cobler bold, with face demure,
Must needs become a connoisseur.
Apelles cries, Well, cobler bold,
Tell me what fault you can behold.

The latchets, Sir, they are too few,
I'd place them better to a shoe.
Apelles, angry at what past,
Cries, Cobler keep unto your last,
Nor vainly try to amend
What you can never comprehend.
12. The Simile, by Mr. Richard Worrell.

Behold, vain man! thy transient moments glide,
Like empty bubbles sporting in the tide,
That raise their heads above the glazy wave,
But soon they mingle in one common grave:
Thou too shalt perish, when thy life is past;
Then live this hour as if it were the last.


GENERAL ANSWERS TO THE ENIGMAS.

1. The Feeling Heart; by Mr. Richard Clay.

What soothes the mind, with grief opprest,
And calms the tempest in the breast;
What bids the tongue of scandal rest?

What longs to drag from worldly strife,
Friend, husband, bachelor, or wife;
What gives to reputation, life?

What joys to rescue from distress
The hungry, sad, and patternless;
What round the fire delights to bless?

What gives to fame the humble lay,
And blunt the thorns that clog the way;
What cheers the ball on new-year's day?

Where'er on earth my lot is cast,
Thou, fancy pictures many a blast,
I hope to prize, while life will last,

2. Content; by Miss M. A. Collins, Kensington.

Content, thou source of human joys,
Religion's master-piece on earth,
Who dwellest in mid or strife or noise,
Of envious or malicious breath.
Thou summit of all human art,
Not form'd by fame's precarious aid;
Come, Oh! come, thy joys impart.
Till Nature all her debt has paid,
Let maddens balls or routes pursue,
Or listen to the winding horn;
Still none so pleasing are as you,
For thou'ret immortal, heaven-born.
Each day then let me hear thy voice,
By holy whispers guide my soul;
Oh! ever let me be thy choice,
Till time and tide shall cease to roll.
With holy fire inspire my breast,
Be thou my pattern and my guide;
Then shall I breathe content my last,
And in the realms of bliss reside.

3. On May; address'd to Miss B.; by Mr. Tho. Collins.
May returns, the face of nature
Wears an aspect cheerful, gay:
Come, lovely animating creature,
O'er the woodlands let us stray.
The lark soars high, with swelling note,
Superior to the clanging horn;
The thrush expands his little throat,
And hails the day-returning morn.
These strike the ear and rouse the sense;
The beauteous landscape charms
Oh! could we e'er with this dis pense
For artful mimic's vain delight.

4. Cruel Sports disgrace the Nation; by a Female Diarist.
Tis hard, with true poetic fire,
To touch at all a tuneful lyre,
And join the strange discordant strings
That Lady Di this new year brings.
A ball the bachelor may join,
But pattens ill with fume combine.
But, hark! what savage sounds are there,
That seem to rend the ambient air?

5. On the Year; by Mr. Wm. Oats, St. Just, in Penwith.
The new-born year we hail with joyful sound,
(Tho' rigid winter spreads a gloom around)
And sympathetic fancy charms the soul,
To view the varying seasons as they roll.
See now th’ extended lawmills now array’d;
Emblem of white-robed innocence display’d,
Whose native beauties from this earth will rise;
And shine resplendent ’yond the blazing skies.

Now lovely Spring unfolds each vernal grace,
By Nature’s pencil drawn;—what art can trace?
The charming birds now in the tuneful grove
Attract the ear with innocence and love:
Faint emblem of the songs by seraphs given,
That sound triumphant thro’ the vault of heaven.

Next glowing Summer comes, in fervent rays,
Warm’d with the fire of Sol’s meridian blaze,
Whose mighty influence off the brook detains,
And fades the verdure of the blooming plains.

Then rich luxuriant Autumn spreads her train,
The great variety of fruit and grain:
’Tis now the produce of the fruitful vine,
For Bacchus’s sons produce the much-loved wine.

Hark! how the silence of the tranquil morn
Is interrupted with the loud-toned horn:
Seek how the huntsmen, with thr’ unkenneled hounds
Pursue their game with mighty leaps and bounds:
With rapid speed the victim pants for breath,
Till, seised at last, his eye-ball rolls in death.

Again stern Winter comes, with winged-haste,
And so concludes the fleeting year at last.

6. Ancient Love; by Mrs. E. R.
Put took the hint, and nam’d the day
To join love, honour, and obey;
So then they laugh’d and cried heigh ho!
I love, and dare to tell you so.

Now, happy o’er their social fire,
With horn of ale and other cheer,
They crack their jokes, and cry heigh ho!
I love, and dare to tell you so.

7. Mrs. Richardson in London, to her Daughter in Hindwell, Yorks.
From Hilda’s springs, my dear, my long-lost child,
Well hast thou drawn thy Robin’s hapless fate;
E’en so relentless Death, with ravage wild,
Tore from thy mother’s arms her dear-lov’d mate.

Long had his numbers graced Diaria’s page;
Oft had he given departed worth to fame;
But not a friendly bard, would e’er engage
To mourn his loss, or celebrate his name.

Ten years, the Muse had sorrowing in his tomb,
Find’ by thy strains, shall now triumphant rise.
Lift her weak wings, and pierce the sullen gloom,
To meet her tow'ring offspring in the skies.
And, ere ten moons have fill'd their course on high,
I'll drop a parting tear in mistress's urn;
To clasp thee to my aching heart I'll fly,
And never to the faithless world return.
Perhaps sweet peace may bless my closing day,
When safe immur'd in Hilda's happy bowers,
Where erst I turn'd my simple rural lay,
And living pleasure strew'd my way with flowers.

8. The Early Primrose; by Miss Charlotte Caroline Richardson, Hindwell.

Ah! lovely primrose, tell me why
Thou thus darest tempt the frowning sky
With thy untimely bloom;
And why so willingly unfold
Thy bosom to the bitter cold.
That threatens thy instant doom?
Was it some warm and kindly beam
Or didst thou, flowret, fondly dream
That fragrant breath of thine Would soothe the furious winds to rest,
Or the rude tempest's angry breast?
To pity would incline?

9. To a Friend; by Mr. T. D. Sheridan, of Stafford.

Upon this mossy seat reclin'd at ease,
Inhaling fragrance from the balmy breeze,
Where blooming cowslips, and the primrose pale,
And modest violets perfume the gale;
From Sow's green banks, beneath a shady tree,
These lines, dear friend, I dedicate to thee.
Oh! were you here, how would your bosom glow
To see this limpid stream meandering flow.
Thro' fertile meadows wind its devious way,
While sportive lambskins on its margin play,
The glow of genius would your fancy fire,
The youthful year would happiness inspire;
The freaks of fortune, and the echoing horn,
Would only move our laughter or our scorn.
The crazy bachelor, whose ball imparts
Overflowing joy to female ears and hearts,
At last prepares the pattens for the fair,
And cautions them against the midnight air.
But what's his flimsy joy compared to ours,
In classic groves and academic bowers,
From Dia's page extracting various sweets,
And solving problems in our calm retreats?
These are the joys that soothe our anxious breast,
These are the sweet employments of the blest.

10. Contemplation; by Mr. Rd. Worrell, Ransdell.
The setting sun now gilds the western sky,
Staining the fleecy clouds with crimson dye;
He sinks serenely, glittering in the flood,
His last departing beams (divinely bright!) 10
Fill contemplative minds with pure delight.
At eve's approach I often trace the meads
From whence the slow meand'ring stream proceeds,
Where odoriferous flowers perfume the vale.
And whispering Zephyr-breathes a gentle gale.
In silent scenes, where placid Nature dwells,
My musing mind with secret rapture swells,
My wond'ring eyes survey'd the flow'ry plain,
Charm'd with the beauties in great Nature's chain:
And view'd the unshorn lambkins' antic skill.
Whose wanton steps attempt'd the lofty hill:
Then drew the picture which I truly lov'd.
Should man's few years in smooth succession glide,
And virtue be the sole directing guide,
And fortune bless us in this earthly sphere,
And calm content in purest form appear,
We all must quit this transitory state,
And yield to heav'n's decree—the will of fate.
The charms of fancy, and the pomp of pow'r,
And beauty's pride, perhaps, may live an hour;
But soon such sublunary things decay,
Quick'as imagination wings its way.
If I search th' earth, the page, the rolling wave,
I find life's but a journey to the grave.
When Death's cold hand enfeebles ev'ry limb
And ev'ry active nerve, and sense grows dim,
Then earthly ties and fond endearments cease,
This clay-built form shall rest in perfect peace.

Other ingenious answers to the enigmas were given by the following
Ladies and Gentlemen; viz. Rd. Addison, John Baines, Teasdale Bell,
Rob. Boatby, B. Brooke, Caroline Caines, Ant. Cook, T. Coulson, John
Davey, R. Froude, Lucy Grundy, John Herdson, James Hood, Tho. H.
Mudge, Rob. Maffett, F. Martin, W. Milburn, R. J. Morgan, Tho.
Nield, Paul Ninnis, W. Purssrey, Alex. Ruby, John E. Savage, J. Sarise,
John Smith, W. D. Snooke, Theana, Sam. Treby, John Tyen, R. W.,
J. Wilkinson, &c.
ANSWERS TO THE REBUSES AND CHARADES.

Rebuses.
1. Slaley. 2. Sheridan.

Charades.
1. Manage. 2. Love-knot.

1. By Mr. John Davey, of St. Just, in Penwith, Cornwall.
At some distance from Slaley, a slattern did dwell,
(If 'tis true what I've heard Mr. Sheridan tell),
Who to keep her shoes clean never pattens would wear,
Nor once sand her cottage throughout the whole year;
To manage things frugally ne'er was her end,
For a coat, shift, or love-knot she never would mend;
To 'tend her sweet rosebuds would often neglect,
And therefore fine tea-cups could never expect.

2. The same, by Mr. R. Proud, and Mr. I. H. Parsons.
The blooming nymphs of Slaley town,
Rose-water use, if fair or brown;
And some with pattens thro' the mud,
And some with love-knots red as blood;
Will from their mansion haste away,
For, on the sands, a holiday;
There Sheridan, perhaps, they'll meet,
And rose-buds make the whole complete.

3. Address to Mr. Bell, of Slaley, by Mr. John Herdson, London.
To Slaley, dear Bell, you entice me to love,
To see your sweet nymphs and to offer my love;
So when I arrive I shall wait upon you,
And make you my friend and companion too;
But the Rose of your villa, just now budding forth,
Shall claim my attention, sweet damsel of worth;
And, if I should manage to make her my prize,
The love-knot, the tea-cup, and pattens likewise,
Shall be at her service; but mark, my dear friend,
We first will be married, and you shall attend.

4. Address to Lady Di, by Mr. Tho. H. Madge, Plymouth.
Dear Di, I hope you'll not refuse,
Nor rashly check my youthful muse,
Tho' not like Sheridan or Bell,
Who oft in Dia's page excel;
Yet emulation warms my breast,
When musing o'er that welcome guest,
That in stern winter, 'mid bleak winds,
Appears to cheer and warm our minds.
O lovely fair one, what divine
And heavenly radiance in the shine!
Thy rebuses attract the heart,
As pattens, sand, and Slaley smart;
Thy charades also fix our thoughts.
On rose-bugs, tea-cups, and love-knots.
What though no mansion I possess,
I always will my love confess
To Diá, where I give my lays,
And who deserves my warmest praise.

5. The same, by Mr. John Savage, of Greenshoreton.

May Slaley's bard's harmonious song,
Like Sheridan's, amuse us long;
Or Herdson's, who a pattern sends,
To entertain his female friends;
Or Virtet, who the sandy shore,
For shells to treat them, does explore.

Ah! would I venture to disclose
What they in mystic dress propose,
Or love-knots or on rose-bud made,
Or lover bid in deepest shade.

6. To Madam Diá, by Mr. John Smith, Alton Park.

Again, dear Di, thy votary tries
To free thy puzzles from disguise;
To manage which is hard;
Yet Sheridan, with piercing view,
Their mystic veils would soon see thro',
So too would Slaley's bard.
These, and some others of thy band,
Can, well depict the countless sand,
Or paint the rose-bud gay;
Show how in patterns Patty trips,
How tea-cups kiss her cherry lips,
Or love-knots fine pourtray.


ANSWERS TO THE QUERIES.

QUERY I. answered by Mr. Wm. Makinson, Manchester.

All oxides are heavier than the metal which produces them, because oxygen, by whose union with the metal the oxid is effected, is heavier than atmospheric air. The increase of weight is so great in some bodies, that, in the instance of the formation of red lead, 26 cwt. of lead will give 22 cwt. of that oxide: so that 2 cwt. of oxygen are absorbed from the atmosphere during the process. By making iron red hot, and passing over it a continued stream of aqueous vapour, the metal receives an increase of weight of near 30 per cent. arising from its decomposing the water and imbibing its oxygen.

The same answered, by Mr. W. D. Snooke, Woolbridge.

Metals become oxides by their combination with oxygen, and are, of course, as much heavier as the weight of the oxygen imbibed.
Thus, 10 lb. of lead, in its oxidation, imbibes 1 lb. of oxygen, and consequently the whole oxide weighs 11 lb.; but, though the oxide is thus absolutely, it is not specifically, heavier than the metal.

**QUERY II. answered by Mr. John Baines, jun., mathematical master in the Mathematical School, Reading.**

It appears, by the hygrometer, that substances dilate or contract when the atmosphere becomes humid or dry, and that these dilations and contractions take place alternately as the weather changes from one to the other. The hairs and sinews of animals exhibit this as well as corns, which thus expand with the imbibed humidity of the atmosphere, even before indication by the other senses.

The same, by Mr. W. D. Snook.

Any change in the atmosphere produces also a change in the animal frame: hence, corns, wounds, sprains, &c. being affected by them, usually occasion pain; consequently the shooting of corns, as well as the variations in the barometer and thermometer, are the effects of an alteration which has taken place in the atmosphere: so that, these being perceived before any obvious change in the weather, they are considered as indications of such a change.

**QUERY III. answered by Mr. Wm. Mackinson.**

As it respects the formation of butter; milk is divided into two substances, one consisting of butter, the other of whey; and churning is only a violent motion, by which the former is coagulated and separated from the latter. This process is facilitated by an admixture of warm water, for its caloric unites with the hydrogen of the milk, and carries part of it off in hydrogen gas; while the oxygen, the other component part of water, unites with the remaining milk, and by its acidity separates the butyrous matter from the serous.

Mr. D. T. Snook says,

The application of heat to the water tends towards its decomposition; whence the oxygen of the water readily combines with the oil of the cream, and thus the formation of butter is facilitated. If, instead of warm water, a moderate heat be communicated to the cream, in the open air, a like result would take place, and the butter obtained by this method be preferable to the other: and hence the propriety in the practice of placing the churn near the fire during the operation.

**QUERY IV. answered by Mr. F. Martin, Birmingham.**

My opinion on the subject of this query, however erroneous it may be, is, that it proceeds from appearance more than from reality.

The same, by Mr. Paul Ninnis, St. Agnes, Cornwall.

White hairs appear more conspicuous among black than any other colour; so that, according to my notion of the word grey, it cannot possibly be composed of any other colours than black and white.

Thus ingenious answers to the queries were given by Messrs. John Baines, J. Crowther, Wm. Makinson, F. Martin, Paul Ninnis, W. Purssey, W. D. Snook, Joseph Williams, &c.
NEW ENIGMAS.

I. ENIGMA (962), by Mr. Teasdale Bell, of Skelton.

My master sought me in the shady grove,
Where sylvan songsters chant their tales of love;
When found, convey'd me to his snug retreat,
Improved my form, and made me quite complete.
This done, behold how lovingly we roam
Our hills and dales, and journey far from home;
See me, with glee, my airy gambols play,
And sport and frisk along the devious way.
I hop before, where I a space remain,
Till he overtakes, then off I hop again.
'Tis in my worth my master does confide;
I'm his defender, advocate, and guide.
If thro' some public place you chance to stray,
Whole groups of us you'll meet upon the way;
Some tall young striplings, comely to the sight;
Others uncomely, devoid of beauty quite;
Yet true it is—with what wild phrenzy fir'd!
This is the species that is most admir'd.
But hold, I've said enough to tell my name,
So next year place me in the list of fame.

II. ENIGMA (983), by Mr. Tho. Coulson, East-Gate.

Frown not, dear ladies, should I try
to once your piercing eye.
No matter when, nor how, nor where,
I first was born and breath'd the air;
I came, and cratty man gave me a name.
I'm such an envious puny elf,
I scarcely can describe myself.
When fair Aurora gilds the skies,
I wink with both my squallid eyes;
When Phoebus reigns, I soon grow pale,
My power does in an instant fail!
But see the wondrous change of fate,
On silver plac'd, on kings I wait:
In station high, with quick advancement,
I join with you the sprightly dance;
Or should you unto court repair,
You'll find me grace the ball-room there:
My uses such, the learned say,
I show to erring man his way;
And should the wand'reng sceptic stray,
Thro' mazes dire I mark the way;
I aid the philosophic sight,
And bring the darkest things to light.
Ye bards, who shine in lists of fame,
Record my worth and tell my name.

III. ENIGMA (984), by a Female Diarian.

Severe and harsh, I come with frowning face,
Hopes long indulg'd and pleasing dreams to cheat;
In various ways I poignant sorrows bring,
Distress the subject, and afflict the king;

B
From rosy lips I dash the cup of joy,
And all their visionary schemes destroy.
O'er youth and age, a despot like, I reign,
And often give the gentle bosom pain;
Nor those who sail thro' life's meridian day
Exemption find from my tyrannic sway.
But why thus brand me with a tyrant's name?
Look at my end, and see if I'm to blame.
For beauteous Rachel long had Jacob strove,
And thought secure the object of his love;
Just when his hopes seem'd crown'd, his wish possess'd,
I rose to agitate his troubled breast,
With poignant grief his faithful bosom wrung,
And sad complainings dwelt upon his tongue.
Yet think not, fair ones, that I'm never good;
I'm sometimes kind, when rightly understood:
Nay, often to the virtuous and the wise
I prove a real blessing in disguise.
Involve'd in clouds, that beam no cheering ray,
I prove to future happiness the key;
And some there are who, to their joy, have found
I've been with great and lasting blessings crown'd.

IV. ENIGMA (985), by Forrester, Chorley.

Say not, fair maids, when Winter's midnight gloom
Obscures the shining lamps of heaven's high dome,
Or beauteous bright, in mazy orbits flow,
Diffuse mild radiance on this world below,
Should I, afar, your wand'ring eye detain,
Near upland mountain or the lowland plain,
Where restless ghosts from haunted shades advance,
Or blue-eyed fairies to the night-bird dance,
That I'm by fate charg'd with vindictive ire
When my fair womb glows with devouring fire;
From fifty mouths volcanic smoke ascends,
Quick light'ning dart so far as the eye extends,
And the last remnantsof the dead consume,
Of such as may receive the dreadful doom.
But should, perchance, at noon-day I be seen,
Remote, alone, meand'ring o'er the green,
Then might you judge, with more prophetic skill,
That I'm the herald of some baleful ill;—
Some earthquake dire or deluge near at hand,
Omniscient vengeance on some guilty land;
Or fierce Bellona, in her blood-stain'd car,
Rushing with frenzy to fresh scenes of war,
With crimson hand to lash th'ensangrin'd steed,
While harpies fell and furies urge her speed;
Some mighty monarch tumbl'd from his throne,
Or "gasping nature's last tremendous groan!"
No, beauteous nymphs! believe no fabled wiles,
I calm your terror and command your smiles;
Yes, ye in whom celestial graces charm,
Sent to protect you by a powerful arm.—
Of matter form'd; tho' young, in beauty's prime,
Of age coeval with the wheels of time;
My fairer part in yon large orb is found,
And darker limb in dungeons under ground:
Still to enlighten the enlighten'd race,
Launch'd by my maker into aerial space;
Guide the lone traveller down the mountain's steep,
Point the glad mariner on the "vasty deep;"
Above, below, around, both wide and far,
I vie with Luna and the polar star.
I have a younger brother on the earth,
Who from conspiring elements took his birth,
And, while I range the hills and vallies wide,
Takes his fix'd station as some servile guide,
Who oft befriends the foes of social weal,
And sure directs the vile assassin's steel!
Such deeds avault! such kindred I disown,
While woo'd and prized by you, and you alone.

V. ENIGMA (986), by Mr. Henry Lee, formerly of Bingham,
Let others seek a surreptitious name,
Prop a weak cause, or bolster up their fame
I need it not: when statesmen justly deal,
They rest on me—the constitution's weal!
The crown—the monarch—on this basis placed,
I form the body-guard, with trappings grac'd!
Let History, with her thousand tongues relate
Eastern magnificence, its pomp, and state,
Where bloated despots, on a gore-dy'd throne,
Proudly conceit the subject world their own;
Thro' deluges of blood they reckless haste,
And lay whole provinces in desert waste;
Nor would their profusion end e'en here,
But nature stops them in their mad career:
Man's strength is finite, and this truth they gain,
Exhausted power relies on me in vain.
Not so the monarch, where the people's voice
On him reverberates the nation's choice;
Who, only proud when proudly great he reigns,
And every subject's happiness maintains,
On me reposing, his best comfort finds,
Tranquillity unknown to guilty minds.
In times of danger men court me the less,
Tho', seamen-like, I'm subject to the press,
When beat, I shrunk, and never fled the coast;
I rose again—was ready at my post.
Let naturalists my name and species trace,
By some affix'd on quadrupedal base:
But doctors differ—terms may change or meet,
One thinks my head what 't'o'other calls my feet.
The Ladies' Diary. 1816.

It matters not, or whether feet or head, Or bath, or neither, stand in case or stead; It boots not if ethereal or terrestrial, Doctors may call me, if they please, celestial! E'en man and wife, like doctors, disagree— Their broils, alas! are oft referred to me; Impressions change as this or that divides, I vary with them as they each change sides.

But haste we now to where loud billows rise, And seas tempestuous dash the clouded skies; Can it be thought that I, a foe to strife, Acknowledged comforter of humble life, And who in courts could tranquil ease maintain, Should yet be found within the stormy main? Yet, so it is; nay, nearer home repair, Search well old father Thames—you'll find me there.

Again we'll range: behold the ensanguined plain, Where Victory hovers o'er her heaps of slain; There too I'm found—at least, so bards declare— The pamper'd sons of honour find me there. The proverb says, that, since the world began, Mankind find nothing new beneath the sun? Hence my great progeny, by human aid, Are oft found old, e'en when they're newly made. Write then, ye fair! for, should your fancy doze, My genial influence helps you to compose: Read and digest—at length, my name declare, For happy lovers all my blessings share!

VI. ENIGMA (987), by Mr. Jas. Wm. Puckle.

To form me lovely Nature took delight, And cloth'd me in a robe of spotGay pass'd my hours, in fields and fragrant air, And oft my bathing in the water fair. My form is tall, and slender is my waist, And, to adorn me, I'm with fringes Happy to-day, and thoughtless of to-morrow, Till cruel man admir'd me, to my He tore me from, my tender mother's side, Strip'd off my skin and all my early My head he lopp'd, and shorten'd me at foot, And tore my marrow out, in strange Then, like a magpye serv'd, my tongue he slit, And certainly by that improv'd my I prattle without speech, and oft disguise The honest truth by telling shame— My master can from me no secret hide— I plainly see his arts, his silly pride, And, in revenge for all my wrongs, expose His greatest follies to his greatest All languages alike I can command, Yet not one single sentence understand. Without my aid, the wise and grave divine, Or learned lawyer, would not know a line: But now adieu; while my case relate, I often give command to kill or save. Nay, man, although my master, is my slave; I hurt myself, and hasten on my
VII. ENIGMA (988), by Mrs. E. Richardson.

Fair Emma rose at early dawn,
Wak'd by the voice of love,
And tripp'd across the flow'ry lawn,
To view the spreading grove:
An infant-crow, with fall astound,
Her tender bosom wrings,
While, gasping on the dewy ground,
It flaps its feeble wings.

"The orphan-linnet, widow-dove,
Demand affection kind,
(Dear objects of pathetic love;)
But interest lurks behind:
The linnet's song, the pigeon pie,
Ensure a sweet reward;
But thou, poor fated bird, may die,
Unblest with fond regard."

Soft pity all her soul possest,
And sorrow fill'd her eyes;
She snatch'd the sufferer to her breast,
And homeward bore the prize:
Reviv'd and nourish'd by her care,
He rear'd his pinious high;
Joyful, she saw him float in air,
And lost him in the sky.

Transcendant fair, thy choice is made,
Thy lot is with the blest;
I lead to joys that never fade,
Go, enter into rest.
Thy happy soul, with balance even,
Shall sign celestial bear,
Unlock the mystic gates of heaven,
And find her treasure there.

VIII. ENIGMA (989), by Serena.

In a gentleman's family liv'd a cook-maid;
The footman admir'd her, and sought the kind aid
Of pen, ink, and paper, his mind to reveal,
And hope that the wound in his heart she would heal,
And at Hymen's blest altar his happiness seal.
The damsel prov'd kind, and she wish'd to impart
The tender emotions that rose in her heart;
But how to effect it now puzzled her quite,
She could read his fond strains, but, alas! could not write:
Yet love will a thousand devices invent—
So, wrapt in a small bit of paper, she sent
What her kitchen produc'd, and an emblem might prove
Of what she much wish'd might result from their love.
The swain took the hint: ye wits, pray discover
What the damsels made use of to send to her lover.

IX. ENIGMA (990), by Mr. D. T. Sheridan, of Stafford.

The wily politician's selfish schemes,
The moon-struck prophet's visionary dreams,
The lover's lunacy, the coxcomb's cant,
The self-created preacher's mystic rant,
Dissolve to air; while thus my hero tells
His artless story to the listening belles.

I had no place in Eden's blissful bowers,
Nor ever breathed the fragrance of its flowers;
From later times my humble birth I date,
When arts and commerce civilised the state.
Among the ornamental class I stand,
Adorn'd with all the trappings of command.
Unto the fair one's fascinating face,
I add the charms of elegance and grace;
The easy motion and the graceful mien,
That to be lov'd needs only to be seen.
Those juvenile sensations I impart,
That cheer the mind and elevate the heart;
Confer amusement, appetite, and health;
And various needs superior to wealth:
Yet Esculapius, anxious for his fee,
In his prescriptions never mentions me!
The Lunar motions, 'mid the stellar host,
More regularity than mine can boast:
In central and eccentric orbs I glide,
Describe Hyperbolas, and Euclid's pride;
In horizontal lines perform my part;
And please all eyes with my surprising art.
Around my orb see secondaries move,
Like sparkling planets in the realms above,
Partake my motions, imitate my ways,
And gain the plaudits of maternal praise.
Some virtuosos say they heard me speak
Italian, English, Arabic, and Greek!
And some aver that they have heard me sing,
Sweet as the sylvan songsters of the spring—
That I produce harmonious sounds, is true,
And, like Amphion, built a mansion too;
But as to emulate the blackbird's strain,
Were an attempt impertinent as vain!
Kings, queens, fair princesses, and lords likewise,
And smirking courtiers, in their dark disguise,
At various seasons grace'd my throng'd levee,
And owe their easy elegance to me.
Among the ancients, as some sage indites,
I taught the initiated sacred rites:
Though all the pious brethren of this isle
Conceive my precepts would their race defile;
And gravely tell you, from the sacred word,
That I'm a detestation to the Lord!
But from such partial judges I appeal,
To well-bred belles, who my importance feel.
On Gaul's gay viny hills, and vernal vales,
Where mirth and music swell the balmy gales,
I most abound;—congenial to my mind
Is that sweet rural bliss which there we find.
Among the gay, the gayest I appear,
And crown the blessings of the smiling year.

X. Or Prize Enigma (991), by Mr. W. Hannaford, of Totnes.

[Whoever answers it before Feb. 1, has two chances for eight Diaries.

Heav'n-born, and near related to the plain,
I come, ye fair, your kind regards to gain;
When your soft bosom heaves th' impressive sigh,
And the big tear hangs pendant in the eye;
'Tis not myself—my emblem 'tis you see;
As much alike as any two can be.
Wide is my empire, boundless my domain;
I kiss the uplands, and embrace the plain.
What time the cock awakes th' labouring swain,
And warns the milk-maid to the fields again,
With laugh and song they pass my beauties by,
Nor note my virtues, nor my worth descry.
Thus, heedless youth the path of science flies,
To catch at bubbles as the vapours rise.
The violet, lily, pink, and blushing rose,
Perfume my bed,—on these I take repose.
The wanton zephyr often woos my charms;
But his rude touch my chastity alarms:
I fly th' embrace,—to earth my form consign;
Then, phoenix-like, I rise again and shine.
A pow'r there is, that mortal strength defies,
That works unseen, and takes me by surprise:
'Twere vain to plead, where Mercy has no ears,
Though I, like Niobe, dissolve in tears.
When the gay morn awakes the lark to sing,
Love swells his breast and flutters on his wing;
The smiling hills rejoice in humid show'rs;
And the rich glebe its grateful incense pours:
Then I appear, in shining vestments gay;
A splendid scene;—but short, ah! short's my stay:
A little hour, perchance, and I'm no more;
But time will soon my wonted charms restore.
The morning breaks, and I again appear,
With countless numbers in my front and rear:
I represent, in miniature, the spheres,
I nurse your hopes, alleviate your fears;
Like the pale moon, I shine in borrow'd light;
For I'm the offspring of the shades of night.
Name me, ye fair;—define this mystic tale,
And I'll to-morrow greet you in the vale.

NEW REBUSES, CHARADES, AND QUERIES.

I. REBUS; by Camilla.
If the name of a wine
With yourself you combine,
And a partnership place in the rear;
You'll an ornament view,
Which, if taste you pursue,
At the front of your house will appear.

II. REBUS; by Clancularius.
A Trojan leader brave and bold;
A Latin poet fam'd of old;
A hill most sacred to the nine;
The place where all the blest recline;
Join th' initials.—I from heaven
To frail humanity was given;
A friend when sad afflictions low'r,
In dire adversity's dark hour.
III. REBUS; by Mr. John Herdson.
A weight, and half a league sub- | What's in a windy cave confin'd,  
 joined, will quickly bring to view.

IV. REBUS; by Mr. Wm. Oats.
An emblem of beauty; an elegant stone;  
What oft gives us warning; a Muse next make known;  
Add a Greek tragic poet; then th' initials unite;  
And a term you'll discover in which we delight.

I. CHARADE; by Aurora.
My first's an appendage of high birth and state,  
And follows most closely the steps of the great;  
My next, though but small, if its merits you scan,  
For prudence and foresight's a lesson to man;  
My whole is most pompous, and makes a great glare  
For wisdom to smile at, and folly to stare.

II. CHARADE; by Mr. Richard Claye.
My second doth my first contain,  
Yet lawyers clearly will explain  
And both within my whole are found.

III. CHARADE; by Mr. James Hood.
With shepherd lads my first is seen;  
My whole's a bard of Dia's page,  
My second gambols on the green:  
The pride and glory of this age.

IV. CHARADE; by Tasso.
To court with my first lawyers oftentimes walk;  
And why?—from my mouth they're enabled to talk:  
My next, form'd by man, and design'd for deceit;  
The ladies now use, in their turn, as a cheat.  
My whole oft at levees with nobles hath been,  
And, courtier-like, bowed to the king and the queen:  
Yet, if with a bishop was seen more than half,  
How the courtiers would stare, and the Prince Regent laugh.

I. QUERY; by Mr. John Herdson.
If a tea-cup be inverted upon a saucer nearly half-full of water,  
in a few minutes all the water will go under the cup: required the reason.

II. QUERY; by Mr. Wm. Makinson.
It is a curious fact that inanimate substances have a tendency to  
become of the temperature of the surrounding medium, but man and  
other animals retain their heat in intense cold. How is this accounted for?

III. QUERY; by Mr. F. Martin.
Which, of all common vices, has the least grounds for a plea in its behalf?

IV. QUERY; by Mr. W. Pulsey.
What female accomplishment is the most amiable; and how is it to be obtained?
Mathematical Questions Answered.

The sum of the proportional numbers 4 + 2 + 1 = 7; then 180° - 7 = 25° 42' = \angle A, its sine 43388376; the double 51° 25' = \angle B, its sine 7818343; the double again 102° 51' = \angle C, its sine 97437944; the sum of which sines is 21900975. Then, as 21900975 : 400 = 43388376 : 79247 = BC : 7818343 : 14279 = AC : 97437944 : 17796 = AB; the three sides of the triangle.

The same, by Mr. Alfred For, of Falmouth.

The angles are easily found to be as follows, viz. \angle A = \frac{1}{4} of 180° = 25° 42', \angle B = \frac{1}{2} of 130° = 51° 5', \angle C = 102° 51'. Then, from Hutton's Course, vol. 3, ch. 3, ex. 4, we deduce the following proportion: as \sin A + \sin B + \sin C : 400 :: \sin A : BC = 77.225 :: \sin B : AC = 142.758 :: \sin C : AB = 178.017.

Schol. Let \( s \) = sine of the smallest \( \angle A \); then the sine of the largest 4A will be \( (4s-8s) \sqrt{1-s} \), and that of its supplement 3A is 3s - 15t. These must be equal, and, by making them so, we arrive at the equation \( s^6 - \frac{3}{4} s^4 + \frac{1}{8} s^2 - \frac{1}{16} = 0 \), the three positive roots of which are the sines of the three angles.

The same, by Mr. John Smith, of Alten Park.

Since the three angles together contain 180°, it will be, 1 + 2 + 4 = 7180; 1 : 51° 42' = \angle A :: 2 : 51° 25' = \angle B :: 4 : 102° 51' = \angle C.

Then \sin A + \sin B + \sin C : BC + AC + AB = 400 :: \sin A : BC = 77.225 :: \sin B : AC = 142.758 :: \sin C : AB = 178.017.

After a scientific solution by Mr. A. Glendenning, he adds, For a neat synthetical solution, and an easy mode of calculation deduced, from it, see the Mathematician, quest. 44.


The same, by mistake inserted over again, after having been answered the former year.
In CE take CD = \sqrt{AC}. CB, a mean proportional between CA and CB; then will CD be a tangent to the circle drawn through the three points A, B, D (cor. to theor. 61 Hutton's geom.). Draw AD, BD; then the \angle ADB is the greatest that can be subtended by AB, when D falls on CE. — For, take any other point F in CE; and draw AF, BG, BF. Now the exterior \angle AGB (of the triangle BGF) = \angle ADB in the same segment (geom. theor. 50) is greater than the interior \angle AFB (geom. theor. 8). And the same may be proved of any other point in CE. Therefore ADB is the greatest angle that can be subtended by AB when D falls in CE.

The same, by Miss Mary Weston, near Gainsborough.

Let AC be the given line, and CE another, making a given angle with it; also B the given point in AC. Then, by prop. 48 Simp. Algeb. describe the circle ADB, touching CE in D; and from the point of contact D, draw the lines DA, DB; then will the \angle ADB be the greatest possible. — For, from any other point F, in the line CD, draw the lines FA, FB; as also from the point G where FA cuts the circle, draw GB. Then the \angle AGB, being external with regard to the triangle BGF, will be greater than the \angle AFB. Therefore ADB, on the same segment with AGB, will be also greater than AFB. Consequently \angle ADB is the greatest possible.

The same, by Mr. John Wills, Kentish Town.

Let AC be the given line divided in the point B. By prob. 42 Simpson's geom. describe the circle ABD through the two given points A, B, and touching the line CE given by position, in the point D, which will be the point required. — For, if any other two lines be drawn, either above or below that point, the angle will fall without the circle, and will of course be less than the angle which falls in the circle.


IV. Quest. ans. by Mr. John Baines, Math. Master, Reading School.

Let ABC represent the inclined plane, ABC the cone, its axis CF, AGH perp. to the horizon AD; then H is the highest point on the side where a weight may be laid without oversetting the cone; G is the centre of gravity, FC = 4FG, AF = FB = 3; the \angle BAD = 80^\circ = \angle G, \angle BAH = 60^\circ. Then, by trigon. FG = 3\sqrt{3}, CF = 4FG = 12\sqrt{3}.

In the \triangle CBF are given \overline{GC} and \overline{BF}, to find the
Questions answered.

The same, by Mr. Anthony Cook, of Woolsey.

Draw the horizontal line AD, and the inclined plane AE elevated 30°; set off AB = C, the cone's base, which bisect in F; erect FC perp. AB and AG perp. AD meeting FC in G, make FC = 4FG, join AC, BC; then will G be the centre of gravity, and ABC a vertical section of the cone (see prop. 38, vol. 2, Hutton's Course.)—Now the AGF = BAD = 30°, theruf AG = 2AF = 6, and FG = AF√3 = 3√3, hence FC = 12√3, and the solidity AB²×1/3 FC×7854 = 195.89. —Also, if AG be produced to meet the slant side in H, it is obvious that H will be the highest point where a weight can be placed without overturning the cone.

The same, by Mr. A. Glendenning, North Yarmouth.

Let AB be the inclined plane, making with the horizon the BAD = 30°; having made AB = 6 feet, let CF be perp. to and bisect AB in F, and intersect AH, drawn perp. to AD in G; make GC = 3GF, and FC is the altitude of the required cone.—For G is the centre of gravity of the cone by constr. and Dr. Hutton's Dictionary under Centre: and, since AH is perp. to the horizon, and passes through that centre, the body is supported (Machan. prop. 38 course, vol. 2): and, because the base AB and inclination BAD are constant, and the cone is merely supported, it is consequently the greatest which can be constituted on that base under those limitations.—It is further obvious that the point H, at which AG produced meets BC, is the highest point at which a weight may be placed without overturning the cone. For, were the weight placed higher than H, the common centre of gravity of that and the cone would not be supported.

Calcul. In the right-angled Δ AFG, AF is given = 3 feet, and the GAF = 60°, to find FG = 3√3, theruf FC = 12√3, and the solidity 6×7854×4√3 = 7854×144√3 = 195.89 &c.

Ingenious solutions were also given by Messrs. Abram, Atkinson, Bagshaw, Bowden, Bell, Burden, Butterworth, Chapman, F. G. and T. Chavton, J., and T. Collins, Craggs, Crowther, Curtin, Dalton, Darby, Darby, Dawe, Douten, Ducket, Fox, Furnass, Holt, Horn, Susan Jackson, Jones, Lamplugh, Maffett, Makinson, Mason, Milburn, Page, Pritty, Pursey, Pulsley, Ruby, Riddle, W. S. Sheridan, Smith, Snoke, Swinburn, Taylor, Thompson, Trevy, Truman, Mary Weston, Whitley, Williams, Wills, Wiseman, Wood, &c.

V. Quest. ans. by Mr. John Collins, Teach. of Mathem. Hatton Garden.

Let AB and BC be the shadow and the pole; also AE and CE the given lines drawn from the extremity of each to the middle of the other, viz. CD = 2a = a and 4E = 36 = b; put x = AD = DB, or 2x = AB; then BC² = a²−x² = 4 (a²−4x²) by theor. 34. Hutton's Geom.; this
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2. *reluctasiesz-vºtº-4vº-ºff, PAR tº wº."...t. 

Let AD = DB be = x, and BE = EC = y. Then $4x^2 + y^2 = 56^2$, and $x^2 + 4y^2 = 20^2$; hence $x = 4\sqrt{29.5}$, and $y = 4\sqrt{12.5}$; therref. $AB : BC : radius : \sqrt{29.5}$, the tangent of $\angle A = 14^\circ 5' 55"$ the sun's apparent altitude; which corrected by allowance for semidiameter, refraction, and parallax, gives $13^\circ 49' 86"$, its true altitude. Then we have two sides of a spherical triangle given, and an angle opposite to one of them, to find the 3d side, which (by prop. 95, pa. 167, Dr. Hutton's Tables, 5th edit.) is $103^\circ 17' 35"$, and hence the declination is $13^\circ 17' 35"$, answering to Feb. 14, and Oct. 29, 1814.

The same, ans. by Mr. A. Glendening, North Yarmouth.

Here is given $\angle A = 14^\circ 5' 55"$ the sun's apparent altitude at the time of observation. Then, in an oblique-angled spherical triangle, we have two sides and an angle opposite to one of them, viz. the complement of the latitude, the complement of the sun's altitude, and the time from noon, to find the sun's polar distance $= 102^\circ 59' 36"$; hence his declination was $12^\circ 59' 16"$ south, corresponding to Feb. 15, and Oct. 28, 1814.

The same, by Mr. Jos. Williams. Schoolmaster, Cardiff.

Ingenious solutions were also given by Messrs. Abram, Baines, Butterworth, Bagshaw, Bauden, Bell, Bircham, Chapman, Charlton, T. Collins, Cook, Craggs, Crouch, Curnin, Dalton, Davey, Datchet, Ducket, Fox, Furniss, T. H., Hull, Susan, Jackson, J. T. Lamplugh, Langton, Maffett, Mason, Mokinson, Milburn, Mundel, Page, Pussy, Putney, Raby, Riddle, Sheridan, Smith, Snooke, Swinburn, Taylor, Thompson, Treby, Mary Weston, Whiby, Willis, Wiseman, Wood, &c.

Suppose \( ACB \) is the triangle, \( O \) the centre of the circumscribing circle, \( OD \) the given perp. and \( CD \) the given bisecting line. Then, by theor. 38 in the Course, \( AC^2 + BC^2 - 2 CD^2 = 2AD^2 \); but \( AC^2 + BC^2 \), and \( 2CD^2 \), being given, \( 2AD = AB \) will also be given. Therefore take \( AB = \) to the given base, bisect it in \( D \), erect the given perp. \( DO \), with the centre \( O \) and distance \( OA \), describe the circle \( AFB \), apply \( DC = \) the given bisecting line, join \( AC, BC \), and \( ABC \) is evidently the triangle required.

The same answered, by Messrs. Wm. Burdon, Geo. Dalton, A. Fox, Wm. Makinson, and W. S.

By Dr. Hutton's Geom. theor. 38, \( 2AD^2 + 2CD^2 = AC^2 + BC^2 \); and since \( AC^2 + BC^2 \) is given, as also the line \( CD \), therefore \( AD \) is also given, and the radius \( AO = \sqrt{(AD^2 + DO^2)} \) is obtained; hence the construction.—Draw \( AB \), which bisect by the given perp. \( DO \); with radius \( AO \) and centre \( O \) describe a circle; then from \( D \), with the given line bisecting the base, cut the circle in \( C \), and \( ABC \) will be the required triangle.

In similar manners were the solutions given by Messrs. Abram, Atkinson, Baines, Butterworth, Bagshaw, Bell, Chapman, Collins, Cook, Craggs, Crocker, Curnin, Darley, Doughten, Duckett, T. H., Harlston, Holt, Horner, Hubert, Jones, Lamplugh, Maffet, Martin, Mason, Mundell, Newbegin, Page, Pursey, Putsey, Raby, Snooke, Swinhburn, Taylor, Thompson, Treby, Mary Weston, Whitley, Williams, Wilks, Wiseman, Wood, &c.


Since the vertical angle and diameter of the circumscribing circle are given, the base is given. Therefore, having made \( AB = \) the base, and divided it at \( E \) in the given ratio of the sides, describe on it the segment of a circle to contain the vertical angle, by Geom. prob. 14; complete the circle, and bisect the arc \( ADB \) in \( D \); draw \( DE \), and continue it to meet the circle in \( C \); join \( AC, BC \), and \( ABC \) will be the triangle required.—For \( AB \) is the given base, and \( ACB \) the given vertical angle, by constr. and because the angles \( ACD, BCD \), stand on equal arcs, \( DC \) bisects the vertical angle; also \( AE \) is to \( EB \) in the given ratio of the sides; therefore, by the Geom. theor. 33 in the Course, \( AC \) and \( BC \) are the sides.
The same answered, by Messrs. Wm. Burdon, Geo. Dalton, John Durley, Rev. J. Furness, A. Glendenning, Alfred Fox, and W. S.

About the given diameter GH describe a circle, and let O be its centre; make the $\angle AOH = \text{the given vertical angle}$; draw the chord AB perp. to GH; take AI to IB in the given ratio of the sides; through the points H, I, draw a straight line to meet the circle in C; join AC, CB, and ABC is the triangle required.—For that triangle is inscribed in the given circle; and because GH is perp. to AB, the arcs AH, BH, are equal (Geom. theor. 40), theref. the $\angle ACB = AOH$ (ibid. theor. 51) = the given vertical angle (by construc.) Also, because the arcs AH, BH, are equal, the $\angle ACB$ is bisected by CH, and consequ. AC : CB :: (ibid. theor. 83) AI : IB the given ratio by construction.

Other ingenious constructions were given by Messrs. Abram, Atkinson, Bagshaw, Baines, Butterworth, Bell, Chapman, Charlton, Collins, Cook, Crowther, Craggs, Curnin, Dotchen, Duckett, T. H., Hulston, Holt, Horner, Jones, Lamplugh, Muffett, Muhkinson, Martin, Mason, Milburn, Mundell, Page, Patsey, Raby, Riddle, Snooke, Swinburn, Taylor, Thompson, Treby, Mary Weston, Whitley, Williams, Wiseman, Wood, &c.

VIII. Quest. ans. by Messrs. J. R. Ambler, Wm. Burdon, and W. S.
Let $x^3 + 2$ and $x^3 - 2$ denote the numbers. Then the diff. of their squares, $8x^3$, is evidently a cube. It remains then to make the diff. of their cubes $12x^6 + 16$, or $3x^6 + 4$ a square. For its root put $2x^3 - 2$; then $3x^6 + 4 = 4x^6 - 8x^3 + 4$; this gives $x^6 = 8x^3$, or $x^3 = 8$; hence $x = 2$; and the required numbers are 10 and 6.

The same, by Mr. John Baines, Math. Master, Reading School.
Let $x+y$ and $x-y$ denote the two numbers; and put the diff. of their squares $(x+y)^2 - (x-y)^2 = 8y^3$, which gives $x = 2y^2$; then the diff. of their cubes $(x+y)^3 - (x-y)^3$ becomes $(2y^2 + 2y^2)^3 - (2y^2 - y^2)^3 = 2y^5 + 2y^3$ a square, or $24y^3 + 2y^1$ a square, which is the case when $y = 2$; hence $x = 2y^2 = 8$; and theref. $x+y = 10$, and $x-y = 6$, the least two numbers that answer the question.

The same, ans. by Mr. John Darcy, the proposer.
Let $x$ be the greater number, and $y$ the less: then is $x^2 - y^2 = a$ cube, and $x^3 - y^3 = a$ square. Put $x^2 - y^3 = z^3$, and assume $x = a^2$; then will $x^2$ or $z^3 + y^3 = n^2z^3 = 2n^2z + y^3$, which reduced gives $y = \sqrt[3]{\frac{z^3}{2n^2}}$, consequ. $x = n^2z - y = \frac{n^2z - z^2}{2n^2}$: theref.

$x^4 - y^4 = \left(\frac{n^4z + z^3}{2n^2}\right)^3 - \left(\frac{n^4z - z^3}{2n^2}\right)^3 = (3n^8 + z^3) \times \frac{z^3}{4n^9} = a$ square, or, striking out square numbers, $Sn^8 + z^2 = a$; square; let its root be $r n^4 - z$, then will $Sn^8 + z^2 = r^2n^8 - 2n^4r^2 + 2z^2$, hence $x = r^2 - \frac{3}{2}n^4$. Now, to get an answer in whole numbers, let $r$ and $n$ be each taken = 2; then will $z = 4$, $y = 6$, and $n = 10$; which appear to be the least numbers that will answer the conditions.

This, and indeed many other diophantine problems, may be expeditiously solved by the very useful and extensive tables of squares, cubes, and roots, in vol. 1 of Dr. Hutton's Course of Mathematics; from which it quickly appears that 10 and 6 will answer the conditions of the question; for $10^2 - 6^2 = 4^2$, and $10^3 - 6^3 = 28^2$.

Ingenious answers were also given by Messrs. Abram, Atkinson, Bagshaw, Charlton, Collins, Craggs, Curnin, Dalton, Darby, Duckett, Davis, Fox, Furnass, Glendenning, Holt, Horner, Susan Jackson, Jones, Lamplugh, Maffett, Mundell, Page, Purssey, Putsey, Ruby, Riddle, Sheridan, Taylor, Treby, Truman, Whitley, Willan, Zyab, &c.


Let $ACBD$ be the elliptic section of the spheroid, $AB$ the transverse axe, $CD$ the conjugate, and $F, f$, the two foci. Then, by the ques. a sound emitted at $F$, after arriving at $f$, will pass on to $B$, and by striking the curve there, reverberate from $B$ to $f$ again, in the 8th part of a second; hence, by the theory of sound, $2fB = 1142\div 8 = 142\frac{1}{8}$ feet, which put $= a$; also put 12 millions $= b$, $5236 = c$, and $1f = x$. Then by the nature of the ellipse (see Dr. Hutton's Course and his Mensuration) we have $AB = x + a$, $AF = \frac{1}{4}a$, $FB = x + \frac{1}{4}a$, and $CD^2 = 4AF \times FB = 2ax + a^2$; hence the solid content $= CD^2 \times AB \times C = ac \left(2x^2 + 3ax + a^3\right) = b$ by the question; this equation solved gives $x = 178.50309$: therefore $AB = 321.25309$, and $CD = 267.09585$.

Note. In this quest. as proposed last year, for axis, read axes.

Other ingenious solutions, little different from the above, were given by Messrs. Abram, Atkinson, Bagshaw, Baines, Bell, Burdon, Butterworth, J. Charlton, J. Collins, Cook, Craggs, Crowther, Curnin, Dalton, Darby, Duckett, Fox, Furnass, Glendenning, Horner, Hubert, Jackson, Lamplugh, Maffett, Mason, Page, Purssey, Ruby, Sheridan, Smith, Snooke, Scinburn, Taylor, Thompson, Truman, Mary Weston, Whitley, Wiseman, Wood, &c.


Take $AB = 50$ feet, the given distance of the two balls; on which describe a segment of a circle to contain an angle of 15°, the given angle between the two planes. Through O, the centre of the circle, draw the diameter $CD$ parallel to $AB$; join $CA$, $CB$, which will be the required planes.—For (by prop. 25, cor. 4, Dr. Hutton's Course, vol. 2) the times of descent down $CA$, $CB$, will be each equal to the time down the diameter $CD$.—Now draw $BF$, $EO$, perp. to $CD$;
then $\angle BOC = \angle BCA = 15^\circ$; therefor, by trigon., if $\angle CBO = \angle OBC = 96^\circ 59' 26''$, also $\angle BRC = \frac{1}{2} \text{arc BC} = 37^\circ 30'$, the elevation of the plane BC above the horizon, and $37^\circ 30' + 15^\circ = 52^\circ 30'$ that of the plane AC. Lastly $\sqrt{\frac{164}{12}} = 3'4658$ seconds, is the time of descent of each ball.

N. B. Mr. Atkinson, at the end of his solution, remarks that the balls would be continually in the same vertical line. And Mr. Davey adds, that, if the friction of the planes be such as will just cause the balls to roll, then will the time down each plane be $3'46576 x \frac{1}{2} = 4'35906$ seconds.

Ingenious answers were also given by Messrs. Abram, Bagshaw, Baines, Bell, Brown, Butterworth, Charlton, Tho. Collins, Cook, Craggs, Crowther, Dalton, Curnin, Darby, Duckett, Furness, Hutt, Horner, Susan Jackson, S. Jones, Lamplugh, Maffett, Makinson, Mason, Milburn, Pursey, Raby, Sheridan, Snooke, Taylor, Thompson, Trely, Truman, Mary Weston, Wood, &c.


Put the transverse diam. AM = t, the conjugate BD = c, and the length of the greatest inscribed rectangle NM = x; then by conics the breadth GP or HR = $\frac{c}{t} \sqrt{t^2 - x^2}$; therefor $t^3 x^2 - x^2 = a$ max. the fluxion of which gives $x = t \sqrt{\frac{1}{4}} = NM$, and GP = $c \sqrt{\frac{1}{4}}$.

Hence the area of the triangle GPR is $\frac{1}{2} tc$. In the same manner it is found that the next inscribed rectangle is $\frac{1}{2} tc$; and that of the next is $\frac{1}{2} tc$ and so on. The sum of which series is $\frac{1}{2} tc \times (1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \&c.)$ to infinity $= \frac{1}{2} tc \times z = tc$. But, by Dr. Hutton's Conics, vol. 2, theor. 10, all parallelograms about an ellipse are equal to one another, and each equal to the rectangle of the two axes, and therefor equal to all the inscribed rectangles.


All parallelograms circumscribing a given ellipse being equal, and double the greatest inscribed one, it follows that if a be put for the area of the circumscribing one, the series of rectangles will be $a + \frac{1}{4} a + \frac{1}{9} a + \&c.$ which put $= z$; then by transpos. $\frac{1}{4} a + \frac{1}{9} a + \&c.$ = $z - a$, and the double is $a + \frac{1}{4} a + \frac{1}{9} a + \&c.$ = $2z - 2a = z$, therefor $z = 2a$, and $a = \frac{1}{4} a + \frac{1}{9} a + \&c.$ ad infinitum.

The same, ans, by Mr. W. Truman, Schoolmaster, Exeter.
Questions answered.

and parallelogram IK, are m. 2 to r.
And, by the Conic Sections, vol. 2, P. 1, parallelograms circumscribing an ellipse, are equal to one another, third of the paral. A LMK = \(\triangle LMK\), and the paral. IK = \(\frac{3}{4}\) the paral. EK, so that the greatest inscribed is the least circumscribed paral. Now, let \(a\) be the area of the least circumscribed paral. EG; then \(\frac{\pi}{4} \times \frac{\pi}{4}, \frac{\pi}{4}, \frac{\pi}{4}, \frac{\pi}{4}, \frac{\pi}{4}\), &c. ad infinitum, will express the areas of all the parallelograms inscribed; and the sum of the same series is well known to be equal to \(a\), the area of the least circumscribed paral. as required.


In any triangle, if O denote the centre of the circumscribing circle, G the centre of gravity, and P the intersection of the perps. from the angles upon the opposite sides; then it appears, from Diary quest. 826 and its solution, that the three points O, G, P, are all in the same straight line, and that \(OG = \frac{1}{3} GP\); but GP is given, therefor. OG is a given line, and the prob. is reduced to quest. 1239, the solution of which see in pa. 42 of the Diary for 1813.


1. Let ABC represent the required triangle, O the centre of the circumscribing circle, G the centre of gravity, P the intersection of the perpendiculars. Now, since the base and vertical angle are given the diameter EF is given, and O is a given point; also \(OG = \frac{1}{3} OP\) by parallels and the centre of gravity; \(PF = \frac{1}{3} CP\) is given by similar triangles; therefore draw IC parallel to OP, and I is a given point; hence this

Construction. Describe the circle AEF given by analysis, take \(OI = 2 OH\), and from I as centre, with radius \(3 OG = OP\), intersect the circle in C; join AC, BC, so is ABC the required triangle.—The demonstration is evident from the analysis.

Ingenious solutions were also given by Messrs. Abram, Atkinson, Bains, Brown, Butterworth, Chavilon, Cook, Craggs, Crouther, Darcy, Furman, T. H., Holt, Jones, Makinson, Mason, Millburn, Mundell, Riddle, W. G. Sheridan, Snooke, Taylor, Alm. Wilson, Wright, &c.
XIII. Quest. ans. by Mr. Henry Atkinson, Newcastle.

It is plain that the triangle, by revolving round its side AB, will form the cone ACDF, and that a curve of some kind will be described by the point E. Put $AC = 6 = a$, the circumf. of the base $= 6 \times 3.1416 = c$, $AE = x$, and $CD = y$, also let $mn$ represent $\hat{x}$, then will $Dp$ denote $y$. Now, by sim. tri., $AD : AE :: Dp : Em$, or $a : x :: y : Em = \frac{a}{y}$. and the fluxion of the curve $En = \sqrt{(Em^2 + mn^2)} = \sqrt{\left(\frac{x^2}{a^2} + \hat{x}^2\right)}$. But, by the quest. $a : x :: \hat{x} : \frac{a}{x}$; this value of $y$ substituted in the above fluxion, gives $Em = \sqrt{\left(\frac{x^2}{a^2} + \hat{x}^2\right)} = \frac{a}{b}$.

The same, ans. by Mr. John Davy, of St. Just, Penwith.

Let ABC be the triangle, AEmp the spiral path described by the body, while the triangle, in one revolution round the base AB, describes, with the vortex C, the circle PCDP. Draw ADB indefinitely near ABC, and $\parallel$ parallel to DC; put $PC = x$, $DC = x$, $Av = An = y$, $mn = y$, $AEe = z$, $mv = \hat{z}$, $BC = r = 3$, $AC = 2r = 6$, and $3.1416 = c$. Now, while the vertex C, when at the point P, begins to move and describes the arc PC, let the body move from A to c, and by virtue of both motions describe the spiral AEv; then, as $y : x :: 2r : 2rc :: \hat{y} : \hat{x} = c\hat{y} = DC$, and by similar sectors as $2r : c\hat{y} :: y : \frac{c\hat{y}^2}{2r} = mn$; hence $\hat{z} = \frac{y}{2r}\sqrt{(4r^2 + c^2 y^2)}$.

whose correct fluent $z$, when $y = 2r$, is $r\sqrt{(c^2 + 1)} + \frac{r}{c}$ x hyp. log. $\hat{c} + \sqrt{(c^2 + 1)} = 11.6691$ feet = the length of the whole spiral path.

And exactly in this way was the solution given by Messrs. Baines, Craggs, Dotchen, Miss Weston, and Mr. Whitley.

Other solutions were also given by Messrs. Bawden, Bell, Butterworth, Cook, Crowther, Curnin, Dawce, Ducket, Fox, Furnass, Horner, Jones, Lightfoot, Muffett, Milburn, Ruby, Mason, Sheridan, Snooke, Treby, Wood, Wright, &c.—But, on account of some indistinctness in the
wording of this question, some gentlemen considered the triangle as revolved about the other leg, by which they brought out the length of the spiral 17'91829, instead of 11'6691 as above.

XIV. Question, answered by Omicron, the proposer.

Let P be the given point in a line GPN perp. to the horizon, PMN the required locus in a vertical plane, and suppose the ball to be thrown in the direction MP, so as to strike the point P with a given velocity. Let \( p = 4 \) times the space due to the given velocity, and let PE be the line of direction after impact at P: then the body will describe the parabola PAM, and \( p \) will be the parameter to the diameter PN. Draw MC parallel to PE, which will be an ordinate to the diameter PN. Then, since the \( \angle EPC = EPG = MCP \), theref. MC = MP, and drawing MD perp. to PN, PD = DC, and MC² = PC \( \times p = PD \times 2p \); theref. the locus is a circle of which the diameter is \( 2p = PN \).

Note. The principle of this solution, by the author of the question, is, that the ball is thrown or passes in a direct line to the given point, or, at least, that it strikes the given point in that direction. And on this supposition the solution was given, similar to the above, by Messrs. S. Jones, James Wood, and Wm. Wright. But most of our other contributors have contemplated the question on the supposition that the ball thrown from the hand describes a parabolic curve in its approach to the given point, where it strikes that point in the vertex of the parabola, perpendicular to the given plane, and from whence, being elastic, the ball must necessarily return again in the same curve, and consequently arrive at the hand again. And in this way the solution is given scientifically by Messrs. Abram, Atkinson, Butterworth, Charlton, Cook, Crugge, Dalton, Davey, Fox, Furness, Glendinning, Horner, Maffett, Mason, Raby, Riddle, Sheridan, Treby, Whitley, &c.

XV. or Prize Question, ans. by Llerien, the proposer.

On any line AB, describe a semicircle ACB. Draw any ordinate DC, and produce it to E, making CE = CA. Take DF a 3d proportional to DE, CE; AFB being the locus of F.—Join BC, BF; I say BF bisects the \( \angle CBD \).

For, \( DE : DC :: DC :: DF \), theref. \( AC + DC :: DC :: DF \), theref. \( AC : DC :: CF : DF \), theref. \( BC : BD :: CF : DF \), theref. (by Eucl.) BF bisects the \( \angle CBD \).

Let AY be the cycloid, b the point in the horizontal base AZ; ba equal, and parallel ZY; bfa a semicircle, bfa a curve similar to BFA in the first fig. cutting the cycloid in \( f \); then \( bf \) is the line required.—For draw \( mf \) an ordinate to the semicircle; join \( ba, la, bf \), and draw \( fn \) parallel to \( bi \). Then the \( \angle mfb = \angle fab = \angle nbf \), theref.
The circle described from the centre with the radius, passes through \( \theta \); it also touches the cycloid, for \( \theta \) is parallel to \( AA \), and \( \theta \) is perpendicular to \( \theta \); therefore \( \theta \) is perpendicular to the tangent at \( \theta \). Hence \( \theta \) may easily be shown to be the line required.

This ingenious gentleman first gives a solution by means of a mechanical curve similar to that of the ingenious proposer, above given. He then adds a solution analytically thus: Let \( ACB \) be the base of the cycloid \( AFDB \), and let \( CKD \) be the generating circle, and \( E \) the given point in the base. Now, if a circle be drawn, having its vertex in \( E \), and just touching the cycloid in some point \( F \), it is manifest that \( EF \) will be the line of shortest descent. Draw the other lines as in the figure, and put \( CD = a \), \( CE = b \), \( ID = x \), \( IF = y \), and \( GE = GF = z \); then will \( IK = \sqrt{(ax - x^2)} \), \( FH = y - b \), and \( GH = a - x - z \); now \( FH^2 + HG^2 = FG^2 \), that is \( (y-b)^2 + (a-x-z)^2 \), hence \( z = (y-b)^2 + (a-x)^2 \). Again, from the nature of the cycloid, the triangles \( KID \) and \( GHF \) are similar, hence \( KI : ID :: GH : HF \), that is \( \sqrt{(ax - x^2)} : x :: a - x :: y - b \), hence we have \( x (a - x - z) = (y - b) \sqrt{(ax - x^2)} \); then, by substituting the value of \( z \), and reducing, it is \( x (a - x - y - b) = 2 \sqrt{(ax - x^2)} \); but, from the nature of the cycloid, we know that \( y = (\sqrt{(ax - x^2)} + \text{arc } DK) \); so that, if this value of \( y \) be substituted in the above equation, there will then be only one unknown quantity, and conseq. the value of \( x \) may be found, and thence all the other parts be readily determined.

For example, suppose \( a \) and \( b \) to be each = 2, then \( x \) is found to be \( 8643774 \), the \( \text{arc }KD = 82^\circ 15' 1'' \), \( y = 2.4257443 \), and hence \( EF = 1.21262 \), and \( \angle FEH = \frac{1}{2} \text{arc } KD = 20^\circ 33' 15'' \).

But any example in numbers, Mr. A. continues, may be worked much more expeditiously by trial-and-error, than by the above equation; and then Mr. A. works over the whole calculation by the method, bringing out the very same numbers as those above. And, though it be impossible to find room for this correspondent's calculations, we are greatly obliged by the correct and ample state in which his solutions are conveyed.

In a manner similar to that of the first solution also is the construction very neatly and ably given by Mr. A. Glendenning, of North Yarmouth, by means of another mechanical curve.

Another solution, by Mr. John Abram, of the National School, Canterbury.

Let \( ABGH \) be the given semicycloid, \( P \) a given point in the base, and \( PG \) the line of shortest descent. Suppose \( DG \) parallel to \( AH \), and \( PG \) to \( AB \). \( B \) being the vertex of the cycloid. About \( AB \) describe the semicircle \( F \).
AEB: Put \( AB = r \), \( BD = v \), the arc \( BE = z \), \( DE = s \), \( AB = FG = y \), and \( AP = z \). Then, by the cycloid, \( DG = AF = z + s \), therref. \( DF = AF = AP = z + s - u \). Now, by mechan, the time of descent down \( PG \) varies as \( \frac{FG}{\sqrt{FG}} = \frac{\sqrt{(z + s - a)^2 + y^2}}{\sqrt{y}} \), a min. therer.

\( (z + s - a)^2 + y^2 \) is also a minimum. But the fluxion of \( z + s - a \) is

\( z + s = z' \); also \( y = y \), therer. \( y = y \). Hence \( 2y^2 (z + s - a) \)

\( \frac{z - s - y^2}{v + (z + s - a)^2} \) \( y = y \). therer. By reduction \( y^2 - (z + s - a)^2 = 2y^2 (z + s - a) \).

\( (z + s - a)^2 + y^2 \) = \( 2y^2 (z + s - a) \).

Now, as the value of \( z \) and \( s \) depend on that of \( z \), \( y \) may be found by the method of trial-and-error, by assuming any value of \( z \), till both sides of the equation become equal. Having determined \( y \), make \( AD \) equal to it, and draw \( DG \) parallel to \( \theta \) to meet the curve in \( G \), then \( PG \) joined will be the line of shortest descent.

The same, ans. by Mr. Edw. Riddle, Master of the Trinity House School, Newcastle-on-Tyne.

Let \( EFL \) be a circle inscribed in the cycloid touching the base in the given point \( E \) (last fig. but one), then is \( EF \) the straight line of shortest descent, as may easily be proved. —Draw the diameter \( EL \), and produce it to meet the tangent \( FN \) in \( N \); join \( F \) and the centre \( G \); draw \( FL \) parallel to \( AB \), cutting the generating circle in \( K \), and its diameter in \( I \), and join \( D \). Then, by the property of the cycloid, \( FK = \text{arch} DK \), and the chord \( DK \) is parallel to the tangent \( FN \).

—Put \( CD = a \), \( CE = b \), \( IK = x \), \( DI = v \), and arch \( DK = z \). Then

\( FL = x + z \), \( FH = x + z - b \), \( EH = a - v \); \( EL = \frac{EH}{EH + FH} = \frac{(a - v)^2 + (x + z - b)^2}{a - v} \); \( FG = HG = \frac{(a - v)^2 + (x + z - b)^2}{2(a - v)} \); \( GH \)

\( = \frac{xEH - EG = a - v}{a - v} \frac{(a - v)^2 + (x + z - b)^2}{2(a - v)} \).

But \( GH : HF :: HF : HN :: IK : ID \), or \( \frac{(a - v)^2 - (x + z - b)^2}{2(a - v)} \).

\( z = x + z - b \); \( z = x + z \), hence \( v((a - v)^2 - (x + z - b)^2) = 2x(a - v) \rightarrow (z + z - b) \). From this equation, with the aid of Dr. Hutton's Tables, \( x, v, \) and \( z \), may very easily be determined; for, if \( v \) be as

sumed in degrees, the tables immediately indicate the corresponding values of \( v \) and \( x \), and the length of \( z \); hence the true values may be readily approximated. —If \( a = 2 \), and \( b = 2 \), then \( z = 82^\circ 13' \), and \( EF = 1' 21.2' \).

Many other solutions were given by our ingenious correspondents, Messrs. Bagshaw, Bell, Brown, Burdon, F. Charlton, J. Charlton, Chesterfield, J. Collins, T. Collins, Cooke, Craggs, Curnin, Davey, Darrow, Ducken, Ducket, Fox, Furniss, Hine, Holt, Horner, Lightfoot, Maffett, Mason, Milburn, Rady, W. S., Sheridan, Taylor, Miss Weston, Whitney, Winward, Wright, &c. —Some of our correspondents, howevver, will not fail to perceive, by observing the foregoing solutions, that their own are not always on the most accurate principles.
particularly when they describe a circle through the given point and
cutting the curve of the cycloid, whether that circle be equal, or
greater, or less than the generating circle of that curve. And
though those solutions are not incorrect which only direct to describe
a circle through the given point and touching the curve of the cy-
cloid, yet they are not to be considered as complete, since such a
tangent circle cannot be described geometrically, or by the ruler
and compasses only.

NEW QUESTIONS.

I. Quest. (1299), by Mr. George Brown.
The length of the curve of a parabola is 24, and the parameter 4; 
required its area.

II. Quest. (1300), by Mr. D. T. Sheridan, Math. Acad. Stafford.
A nymph, dear ladies, of superior parts,
Profundely skilled in sciences and arts,
In bloom of beauty, charming, good, and kind,
Possess'd of all that captivates the mind;
And, like your lovely selves, well known to fame:
From these equations please to tell her name.

\[(x^2 + y^2)^3 + xyz = a = 226985140.\]
\[(x^2 + y^2 - z^2) \times \sqrt{(x^2 + y^2)} = b = 228729827.1109005.\]
\[(x^2 + y^2)^3 \times \sqrt{(x^2 + y^2 - z^2)} = c = 3269367185.2242292.\]
Where \(x, y, z\), denote the places of the letters in the alphabet that
compose the fair one's name. To be solved independently of af-
dected equations.

III. Quest. (1301), by Mr. John Darby, Land-surveyor, Sutton.
Given the three chords of three arches completing a semicírcle,
equal to 60, 70, and 80; to find the area of the semicircle.

IV. Quest. (1302), by Mr. John Baines, jun. Mathematical School,
Reading.
There are two dials, both made for the same latitude, one a hori-
zontal, and the other a vertical, dial: the arc included between
the hour-lines of 12 and 1 on the horizontal dial, is equal to that between
2 and 3 on the vertical dial. Required the latitude of the place for
which they were made.

V. Quest. (1303), by Mr. Sam. Treeby, Schoolmaster, Plymouth.
AB is the diameter of a given semicircle, AD a given chord; it is
required to draw geometrically another chord, BC, to intersect the
former in E, so that the triangle ACE may be a maximum.

VI. Quest. (1304), by Mr. John Abram, Master of the National
School, St. Dunstan's, near Canterbury.
Admit two places to be on the same meridian, the one in latitude
40° north, and the other in latitude 50° north, the sun's declination
20° north: it is required to find the time in the morning when the sun’s altitude will be the same at each place, and also the altitude and azimuth at the same time.

VII. QUEST. (1305), by Mr. John Collins, Mathematical Master, Hatton Garden.

If any two sides of a spherical triangle be produced till the continuation of each side be half the supplement of that side, the arc of a great circle joining the extremities of the sides thus produced will be the measure of the angle contained by the chords of those two sides: required the demonstration.

VIII. QUEST. (1306), by Mr. Wm. Burdon, Acaster Malbis.

Find an arc such, that the sum of the natural sines, to every minute of it, may be equal to 1000, the radius being 1.

IX. QUEST. (1307), by Mr. W. G. Horner, of Bath.

A young surveyor has engaged, for a high wager, to lay out an equilateral triangle of 6 chains in each side, with no instrument but a chain and some pickets, and without using his chain for any other purpose than to measure: he now doubts, with Montacla (Recreations, vol. 1, Geom. Prob. 3), the possibility of performing the construction, and applies to the Diarian mathematicians concerning his chance of success.

X. QUEST. (1308), by Mr. A. Glendenning, North Yarmouth.

Theorem. When the distance of the centres of the circumscribing circle, and the circle touching the base and the continuation of the sides of a triangle, are given; those sides are given in magnitude and position: required the demonstration.

XI. QUEST. (1309), by Mr. Geo. Duckett, Northwich.

If a ball of lead, 4 inches diameter, be dropped from the top of a salt pit, 100 yards deep, 20 yards of which is filled with brine, of 1.4 specific gravity: quere, the last velocity of the ball, and the whole time of descent?

XII. QUEST. (1310), by Mr. John Whitley, Rotherham.

A circle and a right line without it being given in position: if from any point in that line, as a centre, a circle be described with a radius equal to a tangent drawn from the same point to the given circle, its circumference will always pass through a certain given point, and which point is also to be found.

XIII. QUEST. (1311), by Omicron, of Penrith.

Three circles, none of which are included within the others, being given in magnitude and position: to determine geometrically a point in a line of any kind, given also in position, so that tangents being drawn from thence to those circles, the figures described on them, given in specie, may be equal to a given quantity.
XIV. Quest. (1312), by Liberian.

A string, without weight, is attached to a point E, in the horizontal table ABCD; with the other end of the string a body G, collected in its centre of gravity, is connected: the string being at full stretch, the body is brought to the edge of the table, as in the figure, and suffered to descend by its weight; required the curve it describes in its descent.—N. B. This question has been proposed in a periodical publication; but is now reproposed for a geometrical solution.

XV. or Prize Quest. (1313), by Mr. Henry Atkinson, Newcastle.

[Whoever answers it before Feb. 1, has two chances for ten Diaries.]

It is now generally admitted by philosophers, that stones have sometimes fallen from the atmosphere; but they are still much divided in their opinions respecting their origin. Some suppose them to be projected from the moon. If this be admitted, with what velocity will a ball, whose specific gravity is 3500, and weight 1 ounce, strike the surface of the earth, supposing its velocity at the point of equal attraction to be 1000 feet per second, taking in the resistance of the air? Also, with what velocity must it have been projected from the moon, supposing her to have no atmosphere.

Errata in last year's Diary.—Pa. 41, line 28, for "invariably" read inversely. And pa. 46, line 3 from the bottom, for "dissected" read bisected.

The Prizes for the several Solutions have been determined by lot as follows: 1st. For the Prize Enigma, to Miss A. Collins, and to Mr. D. T. Sheridan, each 8 Diaries.—2nd. For the General Answer to the Enigmas, to Mr. Rd. Claye, and to Mr. Wm. Oats, each 8 Diaries.—3rd. For the Rebuses and Queries, &c. to Mr. J. Baines, and to Mr. John Herdson, each 6 Diaries.—4th. For the Prize Question, to Mr. John Abram, and to Mr. Henry Atkinson, each 10 Diaries. All of whom will please to send for their prizes to Mr. Greenhill, at Stationers' Hall, London.—It is again requested, that all letters be sent within the limited time, so as to come to hand before the 1st of May, otherwise they cannot be used; and post-paid or franked, otherwise they will not be received; and that the several compositions be made as short as they can, with propriety; but the solutions for the Prize Enigma and Prize Question must come to hand before Feb. 1, to entitle them to a chance for the Prizes. And, along with all new Questions, Enigmas, Rebuses, and Charades, their answers must be sent.

Our ingenious correspondents should recollect that new questions are not inserted that have not been accompanied with their solutions. And we are sorry that the new question of our ingenious young female correspondent, S. J., came not to hand till after the Diary copy had been completed and sent to the printer.—The contributors will also learn with pleasure that Dr. Hutton's new Dictionary and Mr. Leybourn's new edition of the Diaries have both been published; particulars of which to be had of Mr. Leybourn, at the Royal Military College, Bagshot.