Consequently the 2^{10} power of 16, or the 2^{12} power of 2, increased by 1, is divisible by $7 \times 2^{14} + 1$

In the second case, we find the remainders

$r_3 = -$ 4	0	0	0	0	1	10
$r_4 = -$ 7	9	9	9	7	0	11
$r_5 = -$ 9	8	2	10	9	9	4
$r_6 = -$ 4	6	6	11	8	8	11
$r_7 = -$ 2	2	3	12	10	8	5
$r_8 = -$ 9	14	1	0	14	6	10
$r_9 = -$ 6	9	14	11	8	11	0
$r_{10} = -$ 3	14	4	6	15	1	3
$r_{11} = -$ 7	7	10	5	12	10	4
$r_{12} = -$ 7	12	1	4	5	1	4
$r_{13} = -$ 7	3	7	12	8	1	2
$r_{14} = -$ 5	1	13	9	4	6	4
$r_{15} = -$ 3	15	2	2	4	13	3
$r_{16} = -$ 1	5	6	9	1	2	6
$r_{17} = -$ 2	5	9	12	5	9	3
$r_{18} = -$ 7	13	11	14	2	8	5
$r_{19} = -$ 8	3	0	0	6	15	7
$r_{20} = -$ 3	14	3	10	2	11	0
$r_{21} = -$						1

Consequently, the 2^{21} power of 16, or the 2^{23} power of 2, increased by 1, is divisible by $5 \times 2^{25} + 1$.

The work involved in the first verification can be done by a good calculator in less than half-an-hour; the second is, I think, not more than thrice as long, for the divisions are more easily performed.

Here is one of the eighteen stages of the work of the second verification, namely, the getting of r_6 from r_5.

```
r5 = 9  8  2 10  9  9  4
     ____________________

     9                       5  1
  1  2  8                       9  4  0
  1  3  0  2                       2  6  0  4
  1  3  0  4 10                       11 14  2 14  4
  1  3  0  5  4  9                       10 11  2 15  9  1
  1  3  0  5  5  2  9                       10 11  2 15 14  7  1
  1  3  0  5  5  3  2  4                       4 12  1  5  4 12  9  0
                             ___________________________________________
                             5 10  7  2  9 13  1  2
                             5  0  7  4  3  1  7, 4 10  4 11 13  0  0 +
                                                  9  0 11  7  6  1 11 -
                                                  _____________________
                                         r6 = -  4  6  6 11  8  8 11
```

The last four lines of the work are made up thus:—In adding the parts of the square depress the last six places to line 2, leaving the rest in line 1; then proceeding to the extreme left, carry the tens figure, in this case 0, six places to the right, for subtraction into line 3, and depress the units figure (5) into line 2. Multiply the just depressed figure (5) by 16, and add to it what is found (10) in the place to the right of it in line 1 (giving 90); again carry the tens figure (9) for subtraction into line 3, and depress the units figure into line 2; repeat the process, moving to the right, until line 1 is exhausted; then the difference between line 3 and the last seven places of line 2 gives line 4, the result required.

For the sake of safety, before proceeding to calculate r_7, calculate r_6 again from the complement of r_6 with reference to the divisor, in this case from + 7 13 5 6 6 13. If the same result is again obtained, you may go on confidently.

Hampstead JOHN BRIDGE

Vulcan and Bode's Law

IN the year 1778—just a hundred years ago—the astronomer Bode published an approximation to a law respecting the planetary distances. He took the numbers

0, 3, 6, 12, 24, 48, 96, 192, 384,

each after the second being double the preceding; to these he added 4, giving

4, 7, 10, 16, 28, 52, 100, 196, 388,

numbers which, with the exception of the last, agree very well with the distances of the planets from the sun:—

3·8, 7·2, 10, 15·2, (27), 52, 95·3, 191·8, 300·3.

The publication of this law, at a time when the asteroids between Mars and Jupiter were as yet undiscovered, drew attention to Kepler's speculation that a planet was wanting between Mars and Jupiter. Twenty-one years after Ceres, the first of the asteroids, was discovered, and then others, until now there are nearly 200, the average distance of the whole being 27, and agreeing very well with Bode's number 28. All this is doubtless known to the majority of your readers.

In calling attention to the law, while not wishing to attach too much importance to it, I would point out one or two suggestions which present themselves. If we place 3 before the 0 in the first row of figures the line becomes

− 3, 0, 3, 6, 12, &c.

If 4 be now added the numbers are

1, 4, 7, 10, 16, &c.

The number 4 in this line represents the relative distance of Mercury from the sun; may not the number 1 represent the distance of Vulcan, or more probably the mean distance of a ring of asteroids, of which Vulcan is the brightest?

Referring now to the modified law, represented by the numbers

1, 4, 7, 10, 16, 28, 52, 100, 196, 388,

if 1 represents the mean distance of the Vulcan-asteroids, and 28 that of the Ceres-asteroids, it is a fact that after the first ring come four planets, Mercury, Venus, Earth, Mars, and after the second ring four planets, Jupiter, Saturn, Uranus, Neptune, the two sets of planets having marked differences as regards axial rotation and density.

What, then, is beyond Neptune? The law seems to say, a ring of asteroids at an average distance of 772. The motion of Neptune does not lead astronomers to suspect a planet beyond. Perhaps the optical instruments of the future may help to answer this question, Is there a ring of asteroids beyond Neptune? B. G. JENKINS

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Irish Bog Oak

CAN you or any correspondent kindly give me the scientific name of the Irish "bog-oak" (fossil)? It should be either *Quercus pedunculata* or *Q. sessiliflora*, the existing species, but though I have seen many specimens, I never got hold of one which would enable me to determine the species, and, for aught I know, there may be some of both. W. F. SINCLAIR

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OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF JANUARY 11, 1880.—The central line in this eclipse ends soon after reaching the coast of California, where it is possible totality may be witnessed close upon sunset. Tracing the previous path of the shadow through its long course across the Pacific with the aid of the Admiralty chart, it will be found that the only islands included within it are the Coquille, Bonham, and Elizabeth Islands, lying near together, between 169° and 170° E. longitude, and belonging to the Marshall Islands group. The eclipse passes centrally over the largest of the Coquilles, as laid down in the Admiralty chart of this group, according to a calculation in which the moon's place has been made to accord very nearly with Hansen corrected to Newcomb, which gives the following track:—

Long. E.	Lat. N. limit.	Lat. Cent. line.	Lat. S. limit.
°	° ′	° ′	° ′
168	+ 6 44·6	+ 6 28·0	+ 6 11·6
170	6 20·3	6 3·8	5 47·3
172	5 57·8	5 41·4	5 24·8

So that the breadth of the shadow in the direction of the meridian does not exceed 33′. Reading off from the chart, it will be found that the centre of the largest of the Coquille Islands is in about 169° 35′·5 E. and 6° 8′·5 N., and, calculating directly for this point, it appears that the total eclipse will commence at 8h. 41m. 25s. A.M. on January 12, local mean time, and continue 1m. 16s., and this represents the most favourable condition under which the eclipse can be observed on land. For any other point within the shadow in this vicinity the duration of totality may be determined by the fol-