

what number must be added to the smaller number to make it equal to the larger number

The use of objects or lines must be continued. Suppose the given numbers to be two and three, the teacher arranges objects or strokes thus:

|| | |

and asks, "How many strokes must I add to the first of these groups, in order to make it equal to the second of them?" The teacher may proceed: "What must I add to two lines, in order to make three lines?" or, "What must I add to two, if I wish to make it three?"

This method must be pursued with all the numbers up to ten, those numbers being commenced with, which present the difference of one. After this, those exhibiting a difference of two; this progression being maintained till ten is reached. As the lessons proceed, the lines or objects may to some extent be laid aside, and referred to chiefly for correction of error, or for proof of accuracy.

#### EXAMPLES.

To find what must be added to a number to produce another number larger than the first number by one:

To FIVE to produce SIX?  
" SIX " SEVEN?  
" SEVEN " EIGHT?  
" THREE " FOUR? &c.

To find what must be added to a number to produce another number larger than the first by two.

To TWO to make it FOUR?  
" FOUR " SIX?  
" FIVE " SEVEN?  
" EIGHT " TEN? &c.

To produce another number larger than the first by three.

To THREE to form SIX?  
" FOUR " SEVEN?  
" FIVE " EIGHT?  
" SEVEN " TEN? &c.

Larger than the first by four:

To TWO to form SIX?  
" FOUR " EIGHT?  
" FIVE " NINE?  
" SIX " TEN? &c.

#### 2. THE PRODUCING A NEW NUMBER BY COMBINING TWO OTHER NUMBERS.

##### EXAMPLES.

To produce the number FOUR in every possible mode:

In the first place, the teacher questions the children in such a manner as to lead them to dispose objects, or to draw lines on the board, according to the following arrangement:


The class, with their attention closely directed to this arrangement, is then to be required to repeat aloud:

"Four lines are formed by  
Three lines and one line.  
Two lines and two lines.  
One line and three lines."

The children should then be required to describe from memory the various modes of producing the number four, after which they may be called upon singly to come forward and construct the number four in every practicable manner, with objects or by lines.

To produce FIVE in the same manner:

Here also the children should first be led to the construction of the lesson with something they can handle, or examine by the eye. In the present case the arrangement will be this


To be read as before. Suppose the construction to be of books:

"Five books are formed by  
" Four books and one book.  
Three books and two books.  
Two books and three books.  
One book and four books."

This to be followed by the repetition from memory: "Four and one are five; three and two are five; two and three are five; one and four are five."

To produce the number SIX on the same plan:

"One and five are six.  
Two and four are six.  
Three and three are six.  
Four and two are six.  
Five and one are six."

To produce the number SEVEN:

"Six and one are seven.  
Five and two are seven.  
Four and three are seven.  
Three and four are seven.  
Two and five are seven.  
One and six are seven."

These lessons should be extended to the number ten, each of them to be followed by a variety of illustrative examples for practice; such, for example, as the following:

I buy a book for eight cents. If I cannot pay for it in one payment, in how many ways can I pay for it in two payments?

A boy has to visit his aunt, who lives at a town nine miles from his home. His mother tells him he may rest for an hour once on the way. If he rest at the fourth milestone, how many miles will he have to walk when he sets off again? How many if he rest at the fifth? At the sixth? At the seventh?

#### 3. THE SIMPLE ADDITION OF THREE OR FOUR NUMBERS, OR MORE.

The use of objects or lines should at first be adhered to in this exercise also, and the children should repeat aloud the given numbers, as well as each successive step of the process. Thus, supposing the numbers given to be two, three, and four, they should say:

"Two and three more are five; five and three more are eight;" or, "Three and three are six; six and four are ten."

When the class has had some practice in this kind of addition, the teacher may slowly pronounce the given numbers, and the class be required to give the final sum only, the intermediate results being omitted.

The addition of other numbers is to be carried out on the same plan. The exercises on this head will of necessity be limited, as no result exceeding ten should be attempted; but they may be varied, and many examples given of the same nature as those before introduced.

#### 4. THE PRODUCING A FIXED NUMBER BY COMBINING THREE OTHER NUMBERS.

These exercises are to be illustrated in the same manner as those on the combination of two numbers. Where objects are used, the teacher may put them together as the children audibly perform the addition. Two examples of this exercise may suffice.

To produce the number SEVEN by every possible combination of three numbers:

The arrangement of lines or of objects will be this:

					=					
				=						
				=						
				=						

To produce the number TEN:

One and two and seven are ten.  
One " three " six " ten.  
One " four " five " ten.  
Two " three " five " ten.  
Three " three " four " ten.  
Four " four " two " ten.  
Six " two " two " ten.

When the lines have been gone over in this order, it may be useful, without changing the position of the strokes on the board, to calculate each line backward, reading the top line of the second table, for instance, thus: "Seven and two and one are ten," &c.

The producing a number by the combination of four numbers, will suggest itself to the teacher, as a simple extension of the method recommended above.

Each separate exercise should be illustrated by examples having an application to visible objects and the events of every-day life.

#### PHENOMENA OF A TOTAL SOLAR ECLIPSE.

BY C. PRITCHARD, F.R.S., HULSEAN LECTURER IN THE UNIVERSITY OF CAMBRIDGE, ENG.

##### FIRST PAPER.

"CERTAINLY this surpasses Niagara." "When will it occur again? I would go to the world's-end to see it once more." These were the first greetings of two friends who met within half an hour after the termination of the great total eclipse of the sun which they had just witnessed in July, 1860, from two neighbouring stations on the Spanish Pyrenees. There are perhaps very few who have not seen, and that without astonishment, what they believe to have been an eclipse of the sun. An eclipse, that is to say, a partial eclipse of the sun, no doubt most persons have seen, yet the phenomena did not strike them as remarkable; there was a little gloom, and a slight sensation of coldness in the air, and there were unusual forms in the shadows of things, and—this was all. But a total eclipse of the sun has probably not been seen, nor ever will be seen, by as many as twenty out of all our readers. Nevertheless, if we shall succeed in conveying an adequate impression of the