Algebraic structure

Whether you are a parent, teacher or home school educator, we've compiled examples of activities, games and puzzles which can be used to support the learning of algebra.

These examples are taken from the algebraic structure packs found in our SMILE resource collection. The mathematical demand increases as you work through the packs. There are lots more ideas in the complete packs, which can be downloaded at https://www.stem.org.uk/rxze9

Answers to cards can be found at https://www.stem.org.uk/rxxo5

Find the operation

In this operation table

a * b means **treble** a then **add** b

so **a * b = 3a + b**

1. Complete the table.

What number patterns do you notice?

				b			
*	0	1	2	3	4	5	
	0			2			
	1				6		
a	**2**	6					
	3				12		
	4		13				
	5					19	20

2. Find the operation in these tables.

*	0	1	2	3
0	0	0	0	0
1	0	2	4	6
2	0	4	8	12
3	0	6	12	18

a * b = _____

*	0	1	2	3
0	0	−1	−2	−3
1	1	0	−1	−2
2	4	3	2	1
3	9	8	7	6

a * b = _____

*	0	1	2	3
0	0	1	2	3
1	1	2	3	0
2	2	3	0	1
3	3	0	1	2

a * b = _____

- -

Find the operation

Designed by _____

for _____

Solution

a * b = _____

*	0	1	2	3	4
0					
1					
2					
3					
4					

Operations

Clock Arithmetic

(1) Draw a clock-face
If it is 10 o'clock now,
then 5 hours later it
will be 3 o'clock so.....

$$10 \oplus 5 = 3$$

(2) If it is 9 o'clock now, what time will
it be in 7 hours?
Write down 9 $\oplus$ 7 = 4

(3) If it is 4 o'clock now, what time will
it be in 10 hours?
Write down 4 $\oplus$ 10 = ■

(4) Work out:-

(a) 6 $\oplus$ 7   (c) 2 $\oplus$ 6   (e) 7 $\oplus$ 7

(b) 11 $\oplus$ 4   (d) 8 $\oplus$ 5   (f) 12 $\oplus$ 12

(6) Copy and complete this table:-

Second Number

⊕	1	2	3	4	5	6	7	8	9	10	11	12
1												
2						8						
3												
4										2		
5												
6							1					
7							2					
8					1							
9							4					
10					3							
11				3								
12												12

First number

(7) List the set of numbers which are <u>in</u> the table.
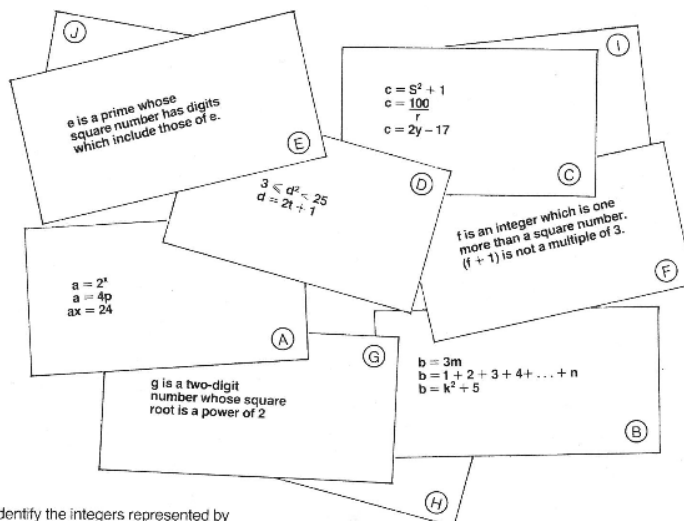
(8) Read this carefully and copy it:

> All the numbers in the table come from the set of clock numbers, so the set is CLOSED under the operation ⊕

(9) Some people say that Mars has a 7 hour clock. Draw a Martian clock-face, make a table for 'addition' and say whether $\{1,2,3,4,5,6,7\}$ is closed under this operation or not.

STEM LEARNING

Number Jumble

Each of the following groups of statements describes a number less than 25.
In fact, all the letters represent an integer less than 25.

Ⓙ

Ⓘ

e is a prime whose
square number has digits
which include those of e.

Ⓔ

$c = S^2 + 1$
$c = \dfrac{100}{r}$
$c = 2y - 17$

Ⓓ

$3 \leqslant d^2 < 25$
$d = 2t + 1$

Ⓒ

Ⓐ

$a = 2^x$
$a = 4p$
$ax = 24$

f is an integer which is one
more than a square number.
$(f + 1)$ is not a multiple of 3.

Ⓕ

Ⓖ

g is a two-digit
number whose square
root is a power of 2

$b = 3m$
$b = 1 + 2 + 3 + 4 + \ldots + n$
$b = k^2 + 5$

Ⓑ

Ⓗ

Identify the integers represented by
a, b, c, d, e, f and g.
Write a description for h, i and j.
Test them on a friend.

Two-digit sums

Choose any 3 digits.

List all the 2-digit
numbers that can be
made with these.

Find x the total of all
these 2-digit numbers.

y the total of the
original three digits.

Calculate the ratio $\dfrac{x}{y}$

Investigate with other sets of 3 digits.

3, 5, 7

35
37
53
57
73
7

Total A =
Total B =

$\dfrac{A}{B} =$

Partners

You wouldn't expect to find that the product of two numbers is the same as their sum.
But it's true for these pairs . . .

$$4\tfrac{1}{2} \xleftarrow{+} \left(\tfrac{3}{2}, 3\right) \xrightarrow{\times} 4\tfrac{1}{2}$$

$$5\tfrac{1}{3} \xleftarrow{+} \left(\tfrac{4}{3}, 4\right) \xrightarrow{\times} 5\tfrac{1}{3}$$

$$6\tfrac{1}{4} \xleftarrow{+} \left(\tfrac{5}{4}, 5\right) \xrightarrow{\times} 6\tfrac{1}{4}$$

Find some more pairs.

Can you find a partner for 1⅝? Do all numbers have a partner?
Can you explain?