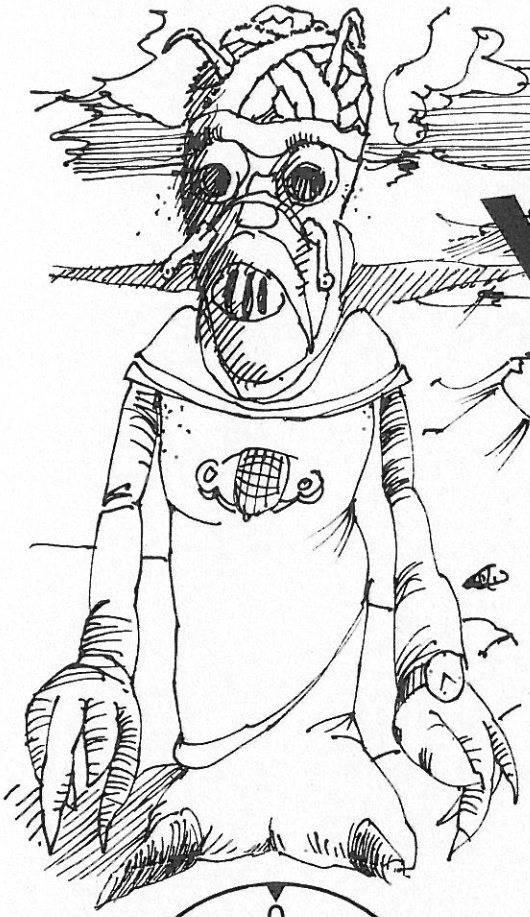
SMILE WORKCARDS

Algebraic Structure Pack One

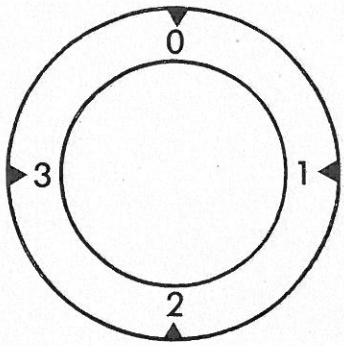
Contents

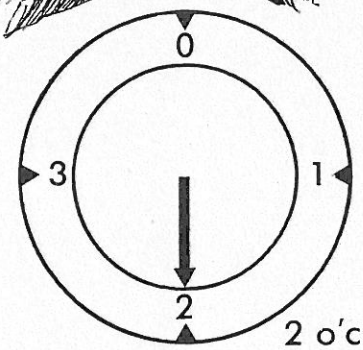
VENUS CLOCK



If there were people on Venus they might have decided to use a **4-hour clock.**

Their clock would look like this. Instead of 4 they put 0 at the top.

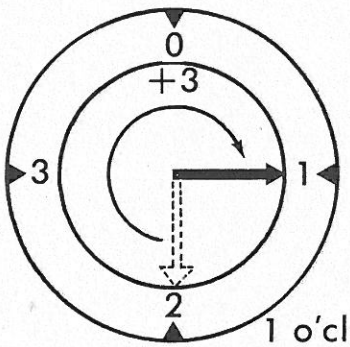




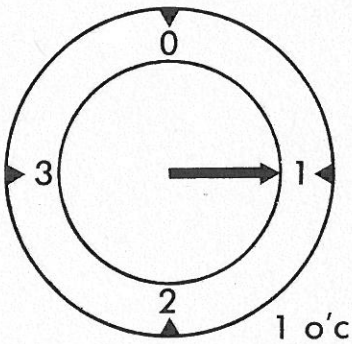
2 o'clock

+3

2+3=1

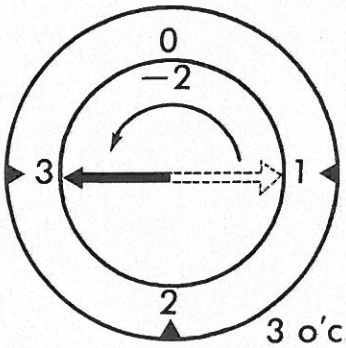


1 o'clock



1 o'clock

−2

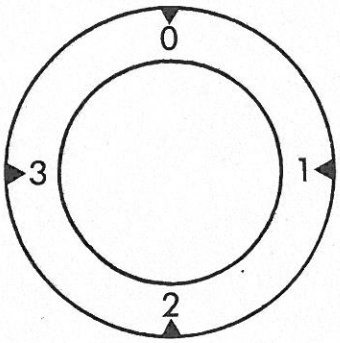


3 o'clock

Do the following questions on a 4-hour clock:

1) 3+2
2) 2+1
3) 1+3
4) 2−3
5) 3+2+1
6) 0−3
7) 2+3+2
8) 1−3+2
9) 0−2
10) 2+1+0
11) 3+2+1+3
12) 2−3−1
13) 2+2
14) 0−3+2
15) 3+3−2

Turn over



The results of adding or subtracting any pair of numbers on the 4 hour clock can be shown in tables.

16) Copy and complete these tables:

2nd Number

+	0	1	2	3
0				
1		2		
2				1
3				

1st Number

1+1=2

2+3=1

2nd Number

−	0	1	2	3
0			2	
1				
2		1		
3				

1st Number

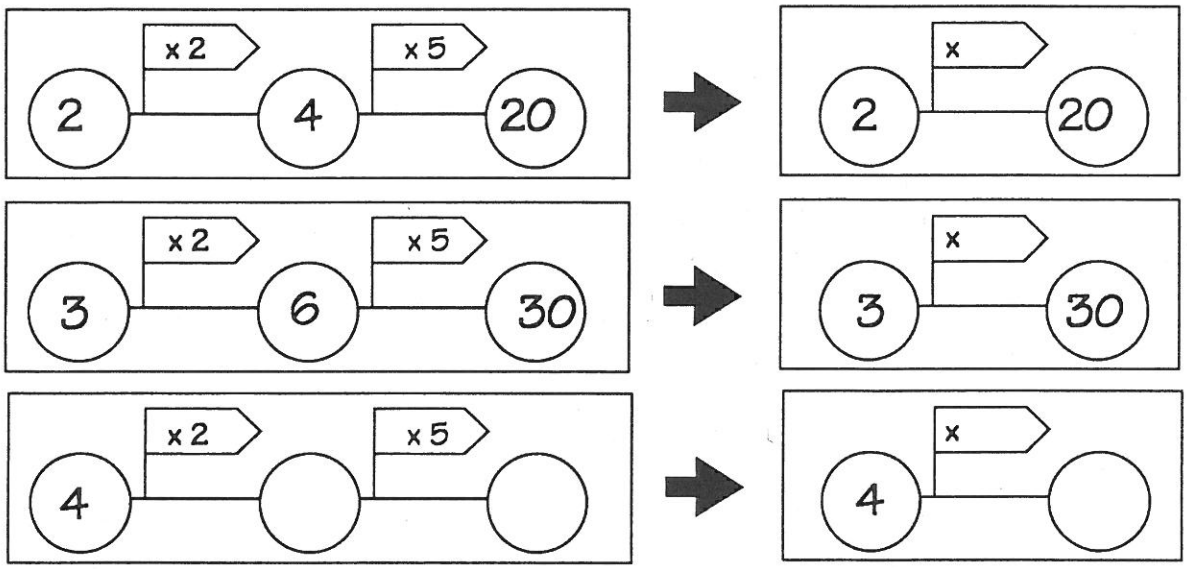
0−2=2

2−1=1

Multiplication Flags

1

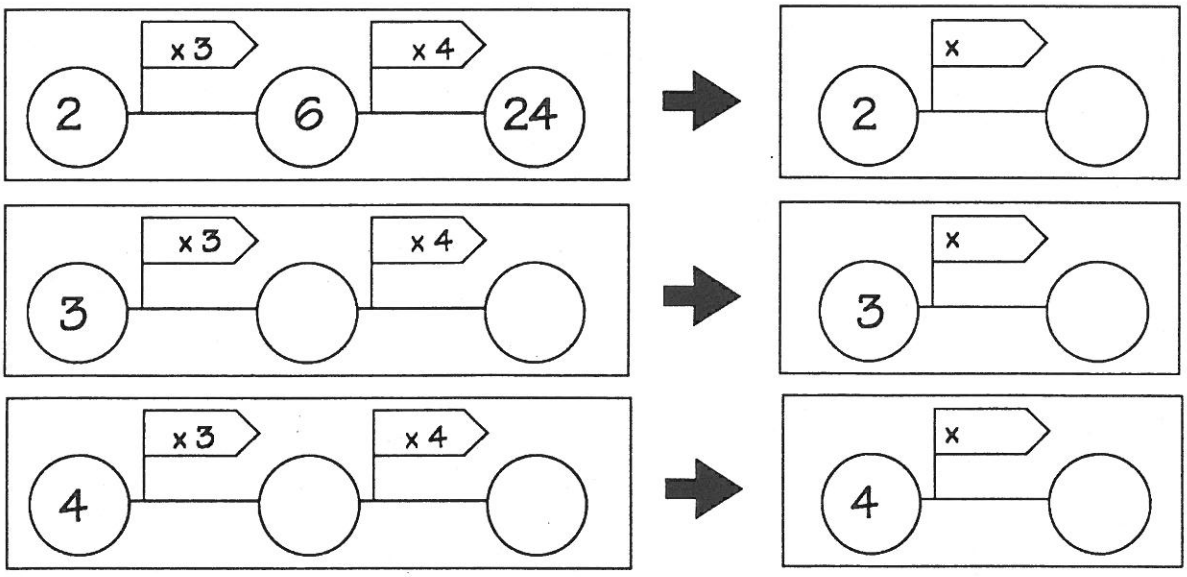
Multiplying by 2 then multiplying by 5 is the same as multiplying by . . ?
Fill in these flag diagrams to help you complete this statement.



Multiplying by **2** then multiplying by **5** is the same as multiplying by ☐

2

Multiplying by 3 then multiplying by 4 is the same as multiplying by . . ?
Fill in these flag diagrams to help you complete this statement.

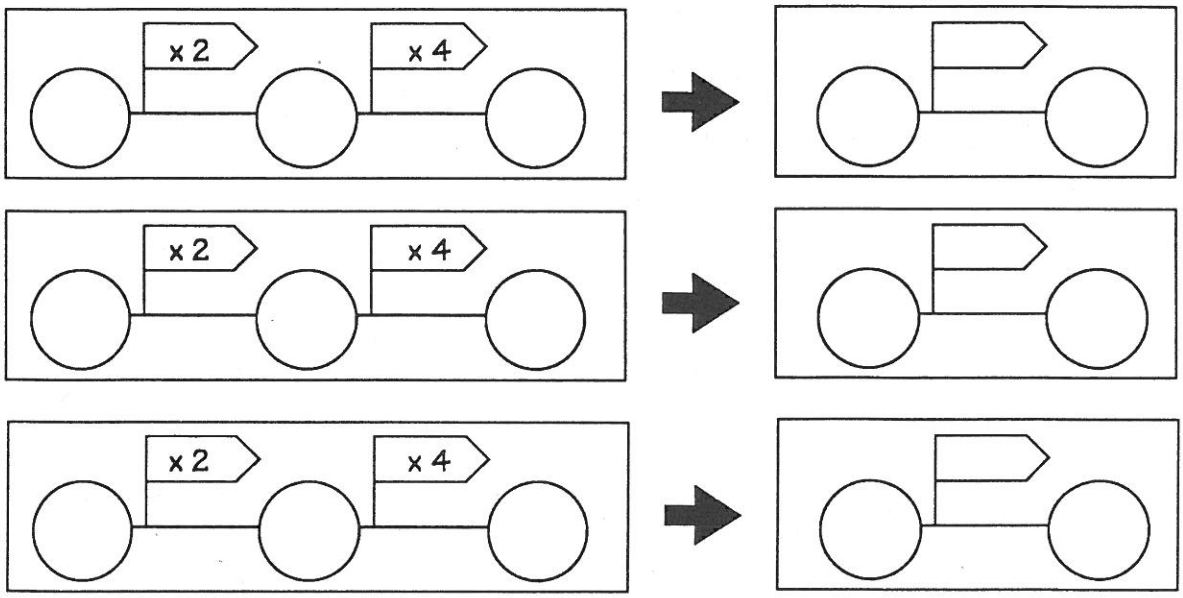


Multiplying by 3 then multiplying by 4 is the same as multiplying by ☐

3

Multiplying by 2 then multiplying by 4 is the same as multiplying by . . ?

Fill in these flag diagrams to help you complete this statement.



Multiplying by **2** then multiplying by **4** is the same as multiplying by ☐

4

Try some examples to complete these statements.

Multiplying by **3** then multiplying by **6** is the same as multiplying by ☐

Multiplying by **5** then multiplying by **3** is the same as multiplying by ☐

5

Choose some numbers to complete these statements.

Multiplying by ☐ then multiplying by ☐ is the same as multiplying by ☐

Multiplying by ☐ then multiplying by ☐ is the same as multiplying by ☐

Multiplying by ☐ then multiplying by ☐ is the same as multiplying by ☐

Short Orders

Here is the menu board of a café.

MENU	EAT-IN	TAKE-AWAY
SANDWICH	95p	80p
ROLL	75p	70p
BISCUIT	25p	25p
COFFEE	50p	45p
TEA	40p	35p
JUICE	70p	60p

The café gets very busy so instead of writing out an order in full, the staff use a code using letters to stand for prices.

Instead of writing

One coffee, one sandwich and one juice.

they write

C + S + J

The cost of this order is:

To Eat-In	50p + 95p + 70p	=	£2.15
To Take-Away	45p + 80p + 60p	=	£1.85

1. Write down the price codes and work out the **Eat-In** and the **Take-Away** cost for each of these orders.

   a) One tea, one sandwich.

   b) One coffee, one biscuit and one roll.

   c) One juice, one tea, one sandwich and two rolls.

Beat the code

The length of a note of music is shown by the musical symbol.

A single beat is known as a **crochet** and is written as ♩

In the table below each symbol is worth half of the one above.

1. Copy and complete this table:

Musical symbol	Name of note	Number of beats
𝅜	Brieve	■
𝅝	Semi-brieve	■
𝅗𝅥	Minim	2
♩	Crochet	1
♪	Quaver	$\frac{1}{2}$
𝅘𝅥𝅯	Semi-quaver	■
𝅘𝅥𝅰	Demi-semi-quaver	■

This code can be used to write equations

e.g. ♩ + ♩ = 𝅗𝅥 = 2 beats

4𝅘𝅥𝅯 = ♩ = 1 beat

2. Solve these equations using musical symbols:

a) 2♩ = ■ = ■ beats

b) 𝅗𝅥 + ♩ + ♩ = ■ = ■ beats

c) ♪ + ♪ = ■ = ■ beats

d) 𝅗𝅥 + 𝅗𝅥 = ■ = ■ beats

e) ♪ + 2𝅘𝅥𝅯 = ■ = ■ beats

f) ♪ + 4𝅘𝅥𝅯 = ■ = ■ beats

g) 2♪ + 3♩ = ■ = ■ beats

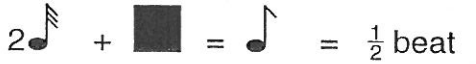
h) 4𝅘𝅥𝅯 + 2♪ = ■ = ■ beats

i) 𝅝 + 𝅗𝅥 + ♩ + 2♪ + 4𝅘𝅥𝅯 = ■ = ■ beats

3. Find the missing note in these equations:

a)  = 2 beats

b)  = 4 beats

c)  = $\frac{1}{2}$ beat

d)  = 8 beats

e)  = 4 beats

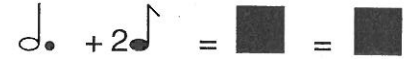
A dot after any musical symbol increases the length by 50% or makes it $1\frac{1}{2}$ times as long.

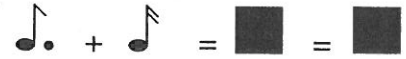
e.g.  (a dotted minim) =  = 3 beats

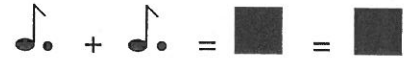
 (a dotted crochet) =  = $1\frac{1}{2}$ beats

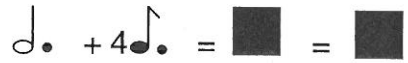
4. Solve these equations using dotted musical symbols:

a)  beats

b)  beats

c)  beats

d)  beats

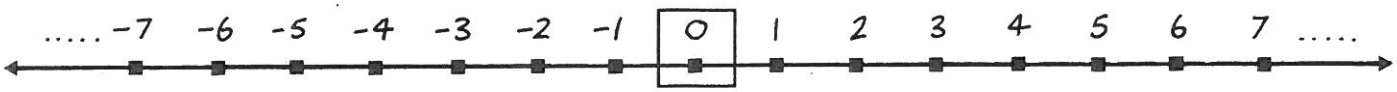
e)  beats

a b c

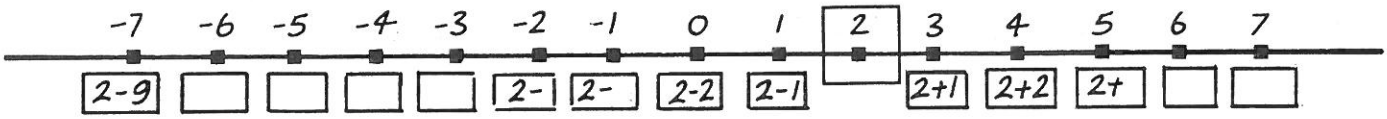
- Match the words with the algebra.
- One expression in words and one expression in algebra do not match. Write a matching expression for each.

"Multiply **b** by 2 then subtract from **a**."	$a(b-c)$
"Subtract **c** from **a** then multiply by **b**."	$\frac{a}{c}-b$
"Add **b** to **a** then divide into **c**."	$\frac{ab}{c}$
"Multiply **a** by **b** then divide by **c**."	$\frac{c}{a+b}$
"Divide **c** by **b** then multiply by **a**."	abc
"Multiply **a** by **c** then divide into **b**."	$b(a-c)$
"Add **b** to **a** then divide by **c**."	$a-2b$
"Multiply **ab** by **c**."	$\frac{b}{ac}$
"Multiply **a** by 4 then subtract **c**."	$\frac{a+b}{c}$
"Subtract **c** from **b** then multiply by **a**."	$\frac{c}{b} \times a$

Anywhere on the number line.

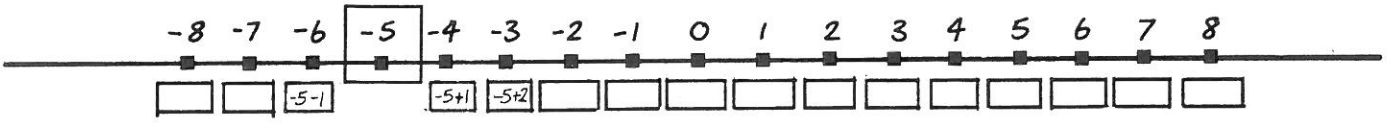


1) If you start at 2, can you continue to rename the number line?

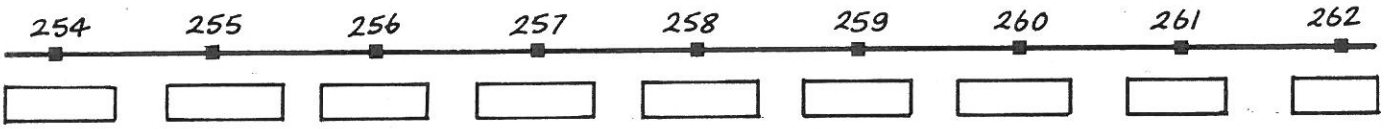


It is possible to rename the number line from any starting point.

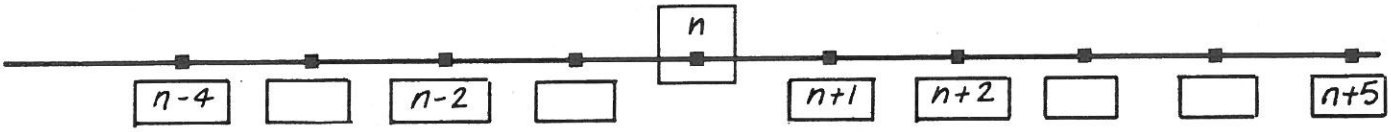
2) Try this one:



3) Choose a starting point of your own:



4) Let n be any position on the number line:



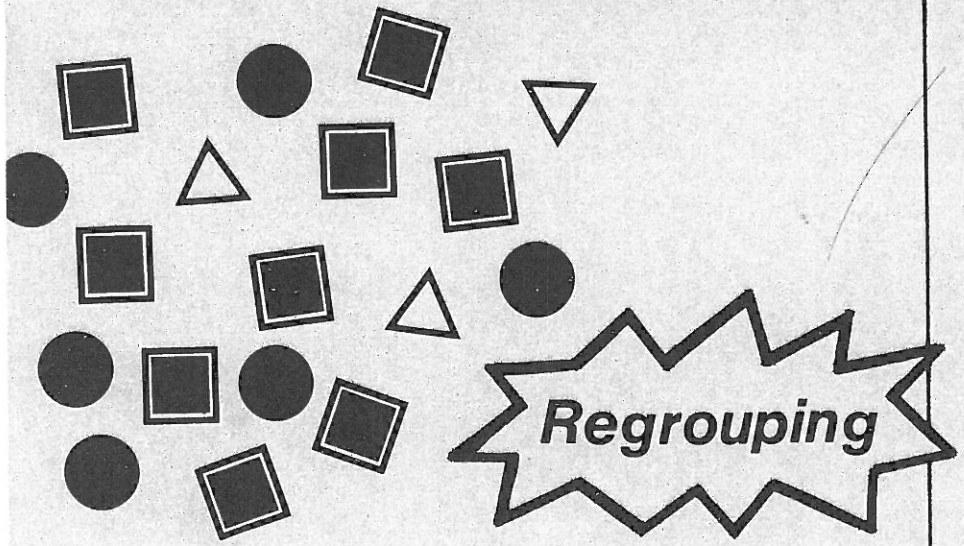
5) If, in question 4, $n = 3$ which number is $(n+1)$? _____
which number is $(n-3)$? _____
which number is $(n+3)$? _____

6) If, in question 4, $n = 7$ which number is:

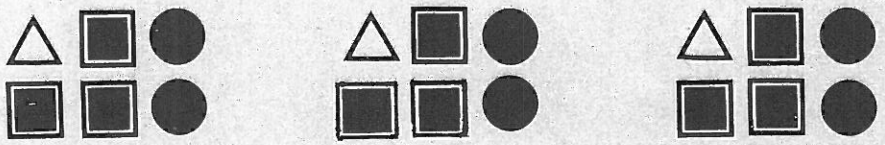
$(n-1)$ _____ $3(n+1)$ _____ $(n-1)(n-4)$ _____

$n(n+3)$ _____ $n(n-4)(n+3)$ _____

You may need: assorted counters



This group of 3T + 9S + 6c can be rearranged into three identical groups:



T+ 3S +2C T+3S+2C T+3S+2C

This identity shows what was done:

3T + 9S + 6C = 3(T + 3S + 2C)

How many triangles, squares and circles are needed for 4(T + 3S + 2C)?

(1) Arrange 4S + 8C into four identical groups.
Complete this identity to show how: 4S+8C = 4(■ + ■)

(2) Can you arrange 12S + 18C... into three identical groups?

12S + 18C = 3 (■ + ■)

... into six identical groups?

12S + 18C = 6 (■ + ■)

... into two identical groups?

12S + 18C = 2 (■ + ■)

(3) How many different identities can you write for 8T+12C?

(4) What is the maximum number of identical groups that can be made with 32C + 8T + 24S? .....
..... in other words write 32C + 8T + 24S = ●(■ + ■ + ■) making ● as large as possible.

(5) Here are some other assortments.
In each case write an identity for the maximum number of groups.

a) 4c + 12T

b) 6S + 12T + 6c

c) 7F + 14L

d) $10x$ + 15y

e) 16a + 4b + 8c + 8d

(6) Write about how you decide on how many groups can be made.

Words won't fail me!

1 Join the expressions in words to the equivalent algebraic expressions.

The product of **a** and **c** is divided by **b**.	$\frac{a-b}{c}$
Divide **a** by **c** then subtract **b**.	$\frac{c}{a-b}$
Subtract **b** from **a** and then divide into **c**.	$\frac{b}{a+c}$
Multiply **a** by **c** then divide into **b**.	$\frac{a-b}{c}$
Subtract **b** from **a** then divide by **c**.	$\frac{b}{ac}$
Divide the sum of **a** and **c** into **b**.	$\frac{ac}{b}$

2 Write algebraic expressions equivalent to these expressions in words.

The sum of **a** and **b** is divided by the sum of **c** and **d**.	→
a is added to **b** then divided into the product of **c** and **d**.	→
Add **a** to **b** and divide by the product of **c** and **d**.	→
The sum of **a** divided by **c** and **b** divided by **d**.	→

3 Write expressions in words equivalent to these algebraic expressions.

$\frac{a+b}{c}$	→
$\frac{c+d}{a+b}$	→
$\frac{cd}{ab}$	→
$\frac{c}{a+b}$	→

How did you write the order in question **(1c)** in code?

You might have written
J + T + S + R + R

A shorter way is
J + T + S + 2R

MENU	EAT-IN	TAKE-AWAY
SANDWICH	95p	80p
ROLL	75p	70p
BISCUIT	25p	25p
COFFEE	50p	45p
TEA	40p	35p
JUICE	70p	60p

An order of **25** teas could be written as

T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T + T

or **25T**

The second method saves time.

Example

Order

One roll, six sandwiches, two teas, four coffees and one juice.

Price Code

R + 6S + 2T + 4C + J

Eat-In Cost

75 + (6 x 95) + (2 x 40) + (4 x 50) + 70
= 75 + 570 + 80 + 200 + 70
= 995p
= **£9.95**

Take-Away Cost

70 + (6 x 80) + (2 x 35) + (4 x 45) + 60
= 70 + 480 + 70 + 180 + 60
= 860p
= **£8.60**

2. Calculate the **Eat-In** and the **Take-Away** cost of the following three orders:

   a) Five coffees, three teas and four biscuits.

   b) Three juices, two teas, four rolls and one sandwich.

   c) **7S + R + 5T + J**

The Algebra Game

Number on the dice.

This is the start of a game using the board for Smile 2321.

Algebra Rule	d	Working		Move	Total Score
START → d + 2	4	d + 2	= 4 + 2 = 6	6	6
2d	5	2d	= 2 x 5 = 10	10	16
12 - 2d	2	12 - 2d	= 12 - (2 x 2) = 21 - 4 = 8	8	24
5 - d	6	5 - d	= 5 - 6 = -1	-1	23
$\frac{2d}{d}$	3	$\frac{2d}{d}$	= (2 x 3) 3 = 6 3 = 2	2	25

Now start a game of your own. Record your moves below.

Algebra Rule	d	Working	Move	Total Score
START →				