EXERCISE 4B.1

1 For the following rules,

i rewrite using variables, explaining what each variable represents, and

ii make up a pattern which fits the rule.

a The number of matchsticks is three times the figure number plus one.

b The number of matchsticks is six times the figure number.

c The number of matchsticks is twice the figure number plus one.

d The number of matchsticks is four times the figure number minus one.

2 Write each of the following rules in words given that M represents the number of matchsticks and n represents the figure number:

a $M = 3 \times n$ **b** $M = n + 2$ **c** $M = 4 \times n + 1$

d $M = 3 \times n - 1$ **e** $M = 5 \times n + 4$ **f** $M = 6 \times n - 2$

PRODUCT NOTATION

The rules written above can be simplified even more. As the symbolism of algebra was developed, it was decided to eliminate the $\times$ (multiplication sign) whenever possible so that if no operation sign appeared between numbers and variables, it meant multiplication. It was also decided to always write numerals before variables when they are multiplied together.

So, $n = 1 + 3 \times y$ becomes $n = 1 + 3y$,

$c = n \times 5 - 2$ becomes $c = 5n - 2$,

$p = 2 \times (b + 1)$ becomes $p = 2(b + 1)$.

So, ab is the shorthand way of writing $a \times b$

$2d$ is the shorthand way of writing $2 \times d$ or $d \times 2$.

EXERCISE 4B.2

1 Rewrite the following rules leaving out the multiplication sign and writing the variables and numerals in the accepted order:

a $a = 3 \times b + 4$	**b** $h = 7 \times d + 2$	**c** $c = d \times 8 - 2$
d $k = n \times 3 + 6$	**e** $b = 4 \times (c + 5)$	**f** $d = 2 \times (4 - j)$
g $g = 7 - 2 \times a$	**h** $h = 5 - 3 \times b$	**i** $c = n \times 6 + 6$
j $y = z \times 2 - 9$	**k** $c = 8 \times (a - 2) + 4$	**l** $l = (d + 3) \times 5$

2 Use the variables to rewrite the following rules using accepted algebraic conventions:

a The number of matches (M) is three times the figure number (n).
b The number of shapes (s) is two more than the figure number (n).
c The number of matches (M) is five times the figure number (n) plus three.
d The number of shapes (N) is twice the figure number (n) minus four.
e The number of matches (M) is two more than three times the figure number (n).
f To obtain the number of shapes (N) you add one to the figure number (n) then double the result.

Rules are not the only things that can be written in a shorthand way using algebra.

A vital part of algebra is the ability to convert **word sentences** into algebraic form.
This skill can be acquired by practice.

The following is a **list of words** commonly associated with the 4 operations $+$, $-$, $\times$, $\div$

$+$ add, sum, exceeds, more than, plus
$-$ subtract, minus, take, less than, difference
$\times$ multiply, times, product, ($\times 2$: double, twice; $\times 3$: treble, triple)
$\div$ divide, quotient, share

EXERCISE 4B.3

1 Write the following in algebraic form:

a a plus b **b** b minus a **c** x times y

d half of m **e** a squared **f** y cubed

g double d **h** treble c **i** 1 more than n

j 2 less than t **k** c more than d **l** p less than q

2 Write in algebraic form:

a three times x **b** four more than y

c twice x, add 5 **d** twice the sum of x and 5

e treble the sum of y and 2 **f** double the product of m and n

g double the sum of p and q **h** the sum of squares of x and y

i the average of a and b **j** the average of a, b and c

3 Copy and complete:

a The product of 3 and 8 is .....
The product of 3 and m is .....
The product of a and m is .....

b If I subtract 5 from 9 I get .....
If I subtract 5 from d I get .....
If I subtract c from d I get .....

c The number 2 less than 6 is .....
The number 2 less than a is .....
The number x less than a is .....

d The number which exceeds 7 by 5 is .....
The number which exceeds 7 by t is .....
The number which exceeds r by t is .....

e The number of cents in \$3 is .....
The number of cents in \$$D$ is .....

f The number of dollars in 400 cents is .....
The number of dollars in c cents is .....

g The next odd number after 13 is .....
The next odd number after the odd number n is .....

h Three consecutive integers, the smallest being n, are ....., ... and .....

4 **a** There are 11 people on an aeroplane and x get off. How many are left on the aeroplane?

b A train has 86 passengers and y more get on at the next station. How many are now on the train?

c A hotel has x floors with y apartments per floor and each apartment contains 4 rooms. How many rooms has the hotel?

d A can of soft drink costs c cents. How much would 7 cans cost, in dollars?

5 A man is n years old.

a How old was he 12 years ago?

b His wife is 6 years older than he is. How old is she?

c His mother is twice his age. How old is she?

6 Concert tickets cost \$40 for adults and \$15 for children. If a group of x adults and y children attend, what is an expression for the cost?

7 Choose the correct answer from the set of algebraic expressions below.

a If x is a number, then three more than x squared is written in symbols as .....

b If x is a whole number, then three times the first whole number larger than x is written as .....

c If x is a number, then one more than three times x is written as .....

d If x is a number, then three times x multiplied by itself is written as .....

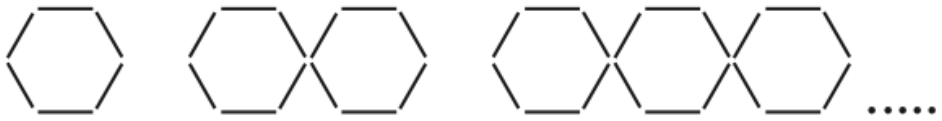
A $3x+1$ **B** x^2+3 **C** $3x^2$ **D** $3x^2+1$ **E** $3(x+1)$

EXERCISE 4B.1

1 **a** **i** $M = n \times 3 + 1$ where M is the number of matchsticks and n is the figure number.

ii 

b **i** $M = n \times 6$

ii 

c **i** $M = n \times 2 + 1$

ii 

d $M = n \times 4 - 1$

ii 

2 **a** Number of matchsticks is three times the figure number.

b Number of matchsticks is the figure number plus 2.

c Number of matchsticks is 4 times the figure number plus 1.

d Number of matchsticks is three times the figure number less 1.

e Number of matchsticks is five times the figure number plus 4.

f Number of matchsticks is six times the figure number less 2.

EXERCISE 4B.2

1 **a** $a = 3b + 4$ **b** $h = 7d + 2$ **c** $c = 8d - 2$
d $k = 3n + 6$ **e** $b = 4(c + 5)$ **f** $d = 2(4 - j)$
g $g = 7 - 2a$ **h** $h = 5 - 3b$ **i** $c = 6n + 6$
j $y = 2z - 9$ **k** $c = 8(a - 2) + 4$ **l** $l = 5(d + 3$

2 **a** $M = 3n$ **b** $s = n + 2$ **c** $M = 5n + 3$
d $N = 2n - 4$ **e** $M = 3n + 2$ **f** $N = 2(n + 1)$

EXERCISE 4B.3

1 **a** $a + b$ **b** $b - a$ **c** xy **d** $\frac{m}{2}$ **e** a^2
f y^3 **g** $2d$ **h** $3c$ **i** $n + 1$ **j** $t - 2$
k $d + c$ **l** $q - p$

2 **a** $3x$ **b** $y + 4$ **c** $2x + 5$ **d** $2(x + 5)$
e $3(y + 2)$ **f** $2mn$ **g** $2(p + q)$ **h** $x^2 + y^2$
i $\frac{a + b}{2}$ **j** $\frac{a + b + c}{3}$

3 **a** 24, $3m$, am **b** 4, $d - 5$, $d - c$
c 4, $a - 2$, $a - x$ **d** 12, $7 + t$, $r + t$
e 300 cents, $100D$ cents **f** 4 dollars, $\frac{c}{100}$ dollars

g $15,\ n+2$ **h** $n,\ n+1,\ n+2$

4 **a** $11-x$ people **b** $y+86$ passengers

c $4xy$ rooms **d** $\dfrac{7c}{100}$ dollars

5 **a** $n-12$ years **b** $n+6$ years **c** $2n$ years

6 $C=40x+15y$ dollars

7 **a** **B** **b** **E** **c** **A** **d** **C**