8 Algebra

There are some cupcakes in the box.
3 cupcakes are on a plate.
How many cupcakes are there altogether?

Since I do not know the number of cupcakes in the box, I use a "cupcake image" to represent the number of cupcakes in the box.

+3

This bag contains some buns.
I take out two buns.

How would you represent the number of buns left in the bag if you do not know the number of buns at first?

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STUDENT LEARNING SPACE

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Algebraic Expressions

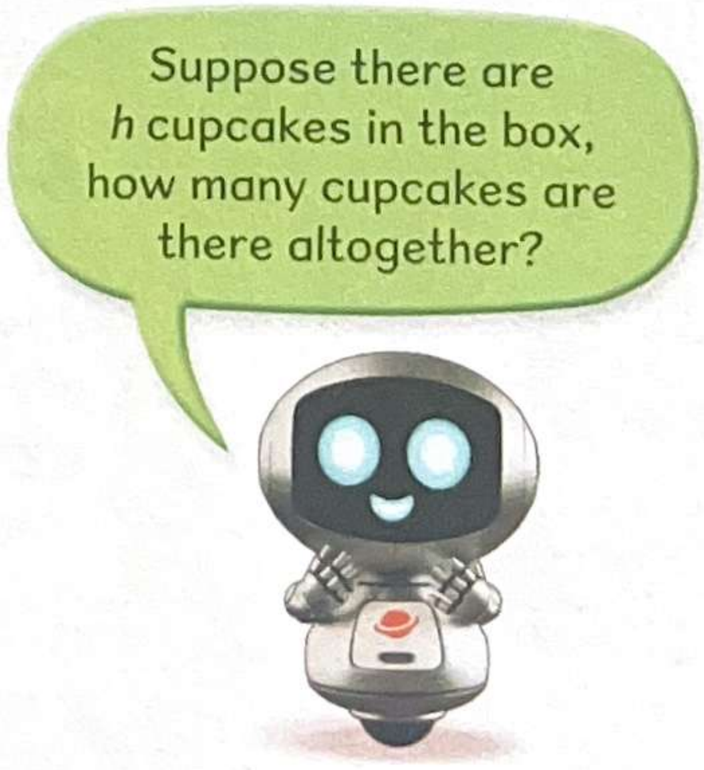
There are some cupcakes in the box and 3 cupcakes on the plate.
How many cupcakes are there altogether?

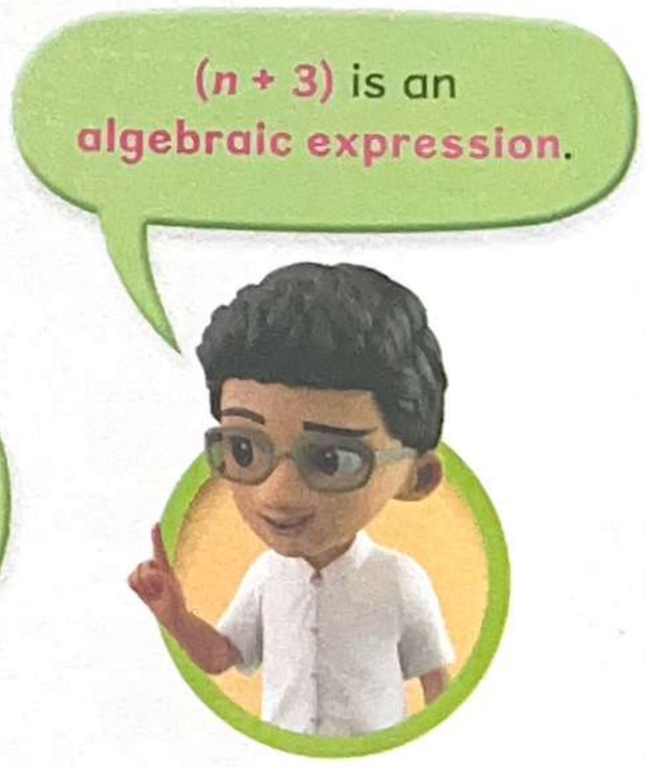
Jiahao makes guesses about the possible number of cupcakes in the box.
He uses a table to record the possible total number of cupcakes.

Possible number of cupcakes in the box	Possible total number of cupcakes
5	$5 + 3 = 8$
6	$6 + 3 = 9$
10	$10 + 3 = 13$
n	?

Jiahao uses the letter n to represent the unknown number of cupcakes in the box.

When there are n cupcakes in the box and 3 cupcakes on the plate, there are $\mathbf{(n + 3)}$ cupcakes altogether.



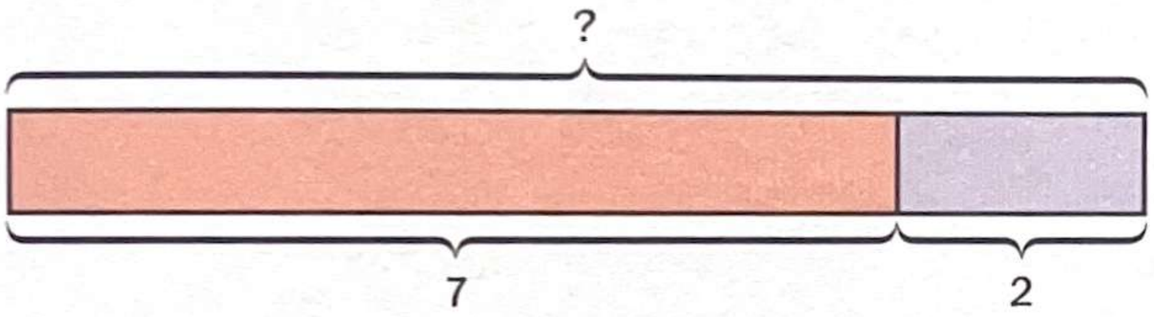


Raju had 7 cookies at first.
How many cookies will he have if his mother gives him

(a) 2 cookies?

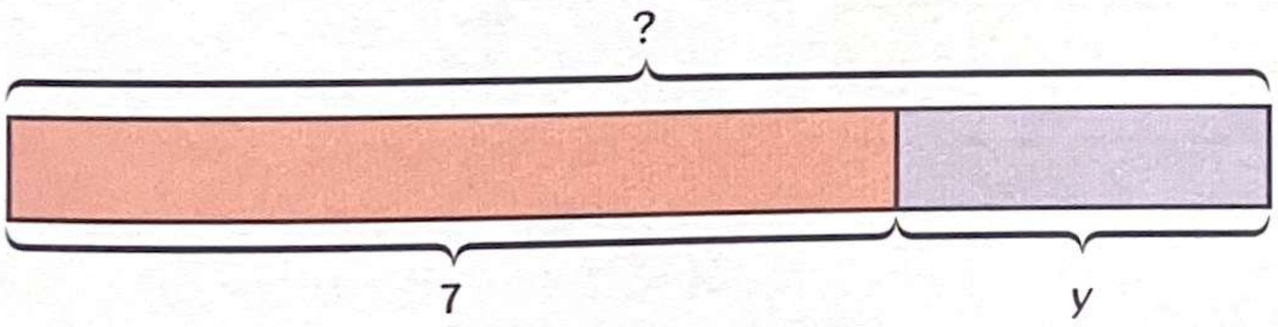
(b) y cookies?

(a)



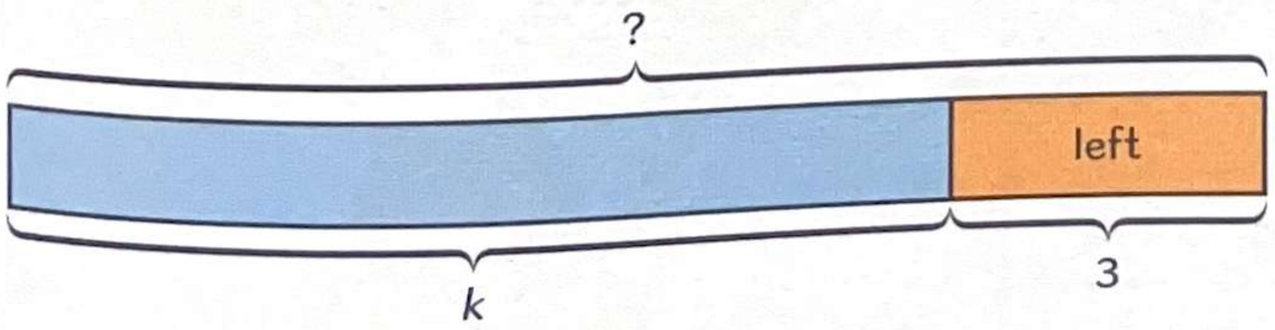
Raju will have **9** cookies.

(b)



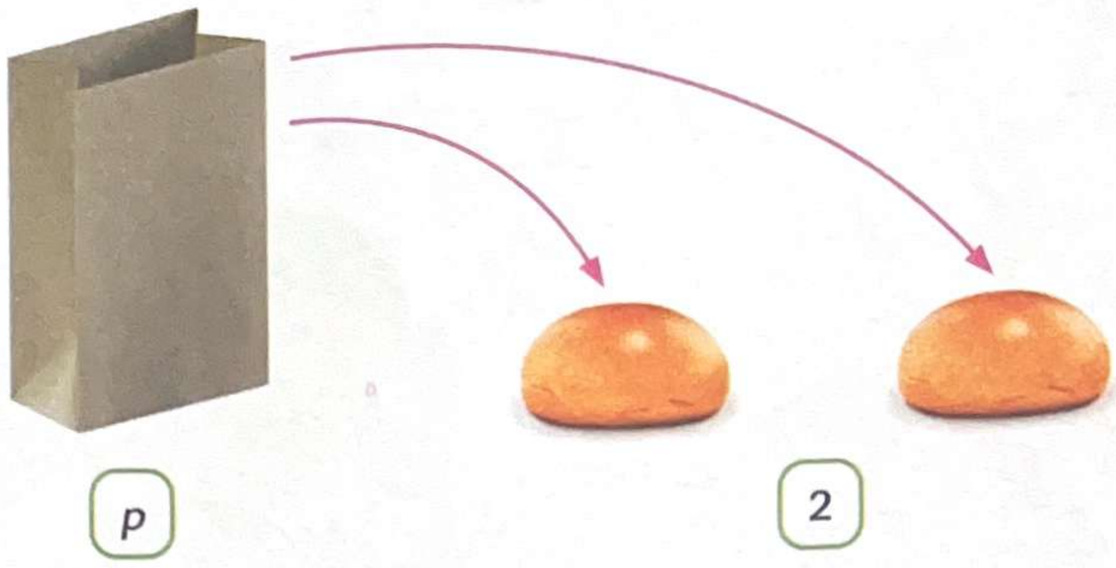
Raju will have **(7 + *y*)** cookies.

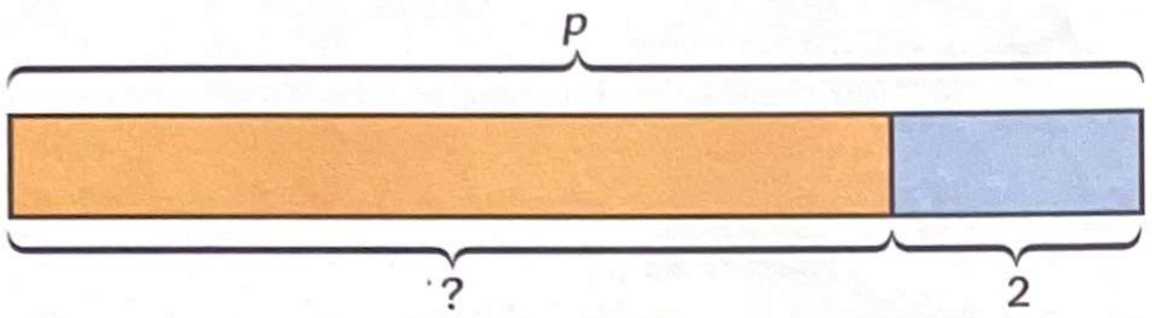
After eating k oranges, Alan has 3 oranges left.
How many oranges does he have at first?
Express your answer in terms of k.



He has **(*k* + 3)** oranges at first.

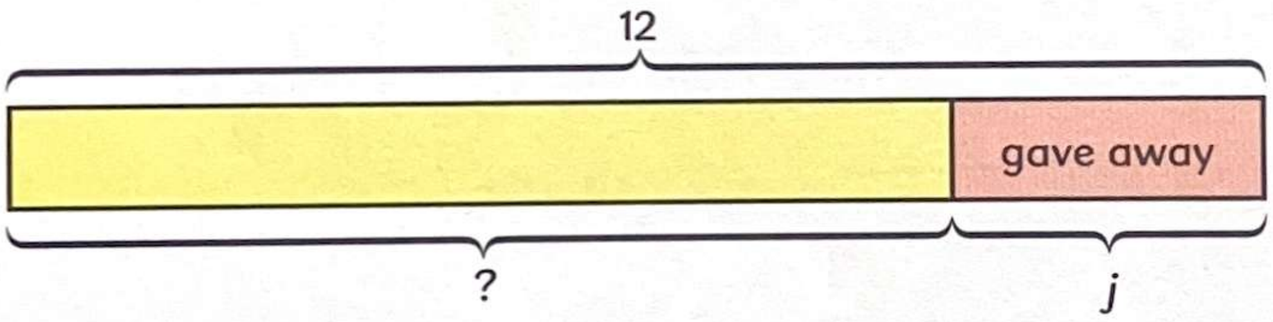
There are p buns in a bag. Leila takes out 2 buns.
How many buns are there left in the bag?





There are **$(p - 2)$** buns left in the bag.

Mary had 12 apples at first.
She gave away j apples.
How many apples had she left?
Express your answer in terms of j.



She had **$(12 - j)$** apples left.

Hassan is 12 years old now. What are his ages at different periods of time?

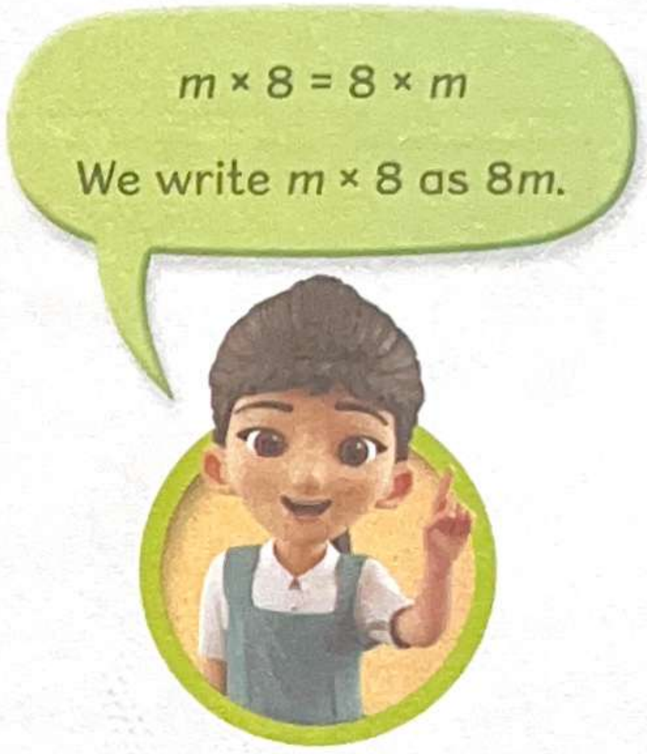
Time	Hassan's age (years)
now	12
in 3 years' time	12 + 3 = 15
in p years' time	**$12 + p$**
in q years' time	**$12 + q$**
5 years ago	12 − 5 = 7
r years ago	**$12 - r$**

$(12 + p)$, **$(12 + q)$** and **$(12 - r)$** are examples of algebraic expressions.

Jiahao has 5 shirts.
Each shirt has 8 buttons.

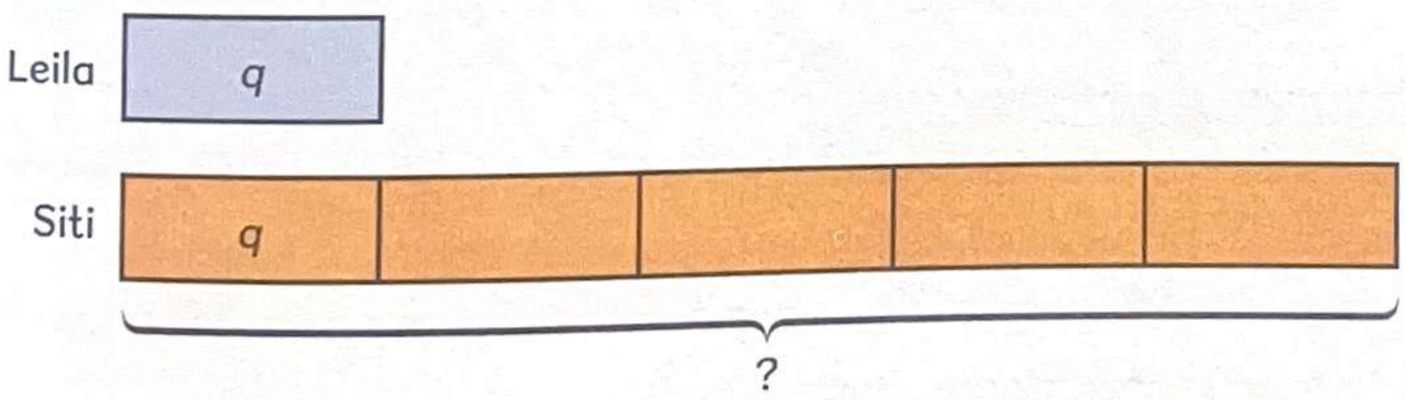
He uses a table to record the total number of buttons.
If he has m shirts, how many buttons are there altogether?

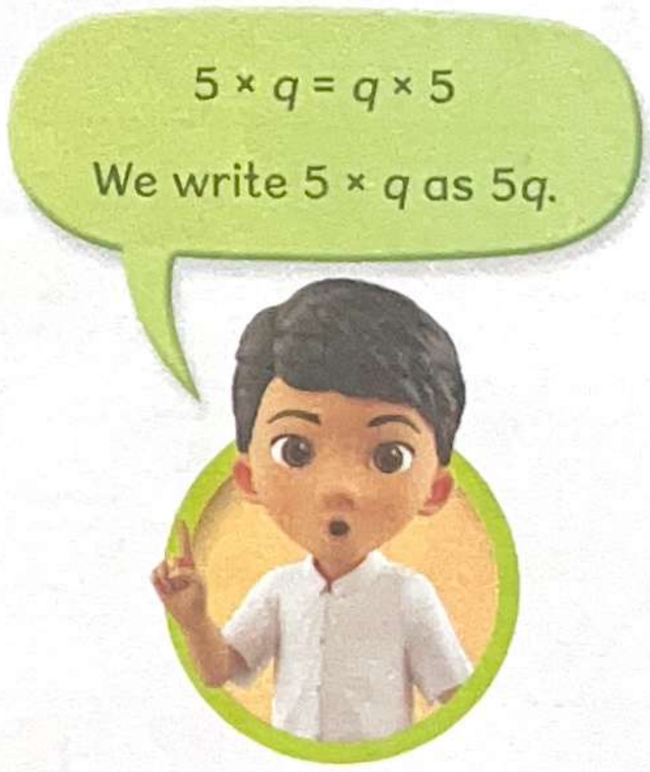
Number of shirts	Number of buttons
1	$1 \times 8 = 8$
2	$2 \times 8 = 16$
5	$5 \times 8 = 40$
m	$\mathbf{m \times 8 = 8m}$



If he has m shirts, there are **$8m$** buttons altogether.

Leila has q stickers.
Siti has 5 times as many stickers as Leila.
How many stickers does Siti have?
Express your answer in terms of q.





$$q + q + q + q + q = 5 \times q$$
$$= 5q$$

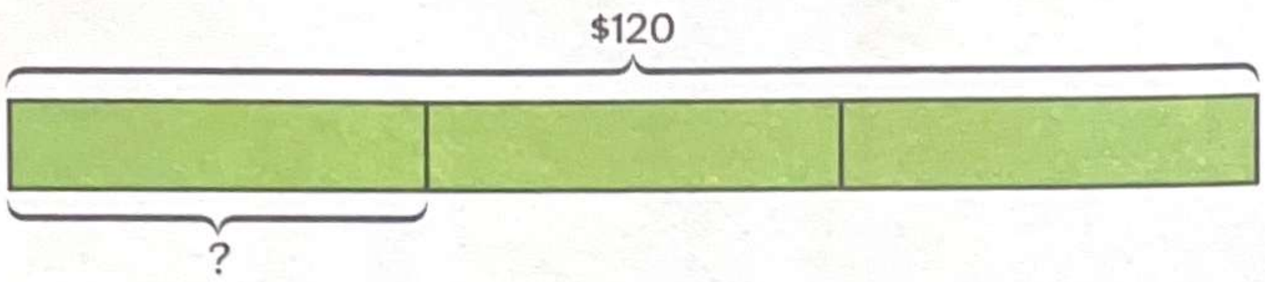
Siti has **$5q$** stickers.

Find the amount of money each child has.

(a) \$120 is shared equally among 3 children.

(b) \$$p$ is shared equally among 3 children.

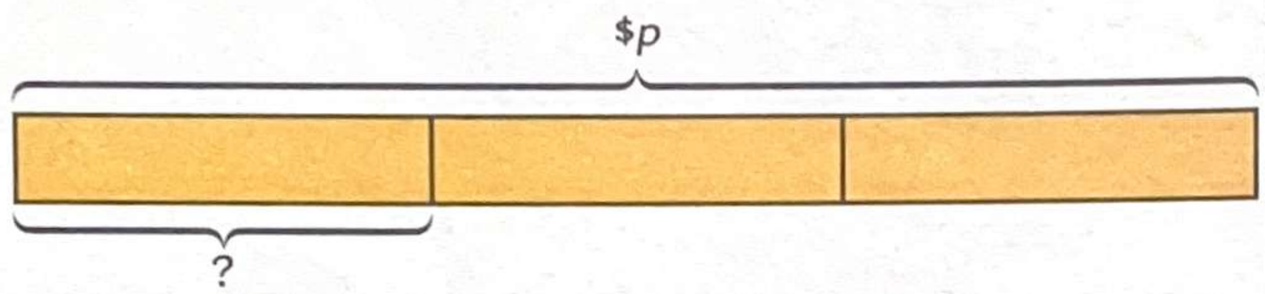
(a)



$$\$120 \div 3 = \$\left(\frac{120}{3}\right)$$
$$= \$40$$

Each child has **\$40**.

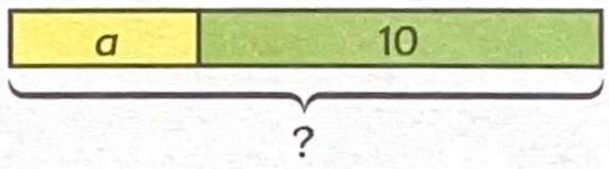
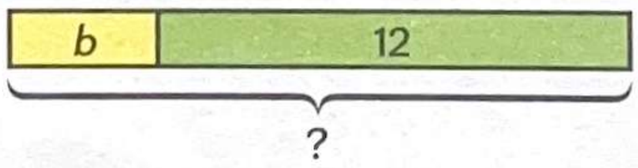
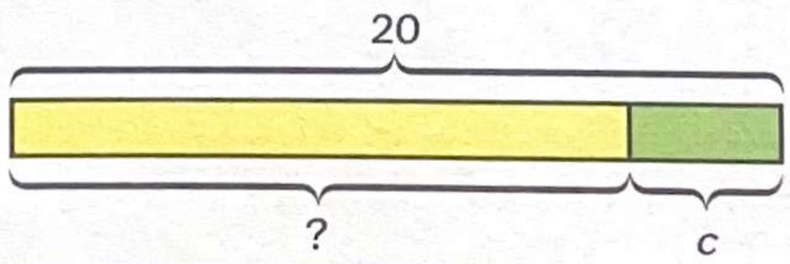
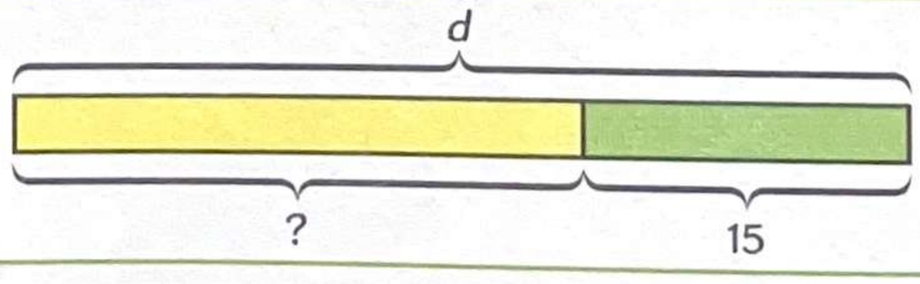
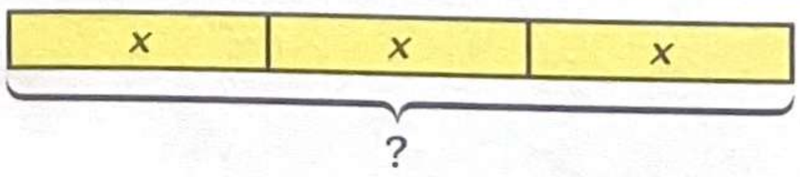
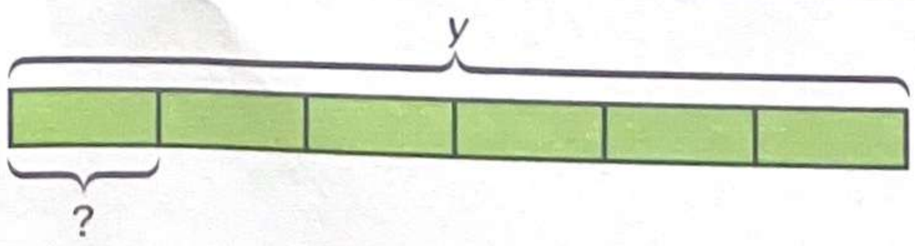
(b)



$$\$p \div 3 = \$\left(\frac{p}{3}\right)$$

Each child has $\$\left(\frac{p}{3}\right)$.

Here are some ways to write algebraic expressions.

Statement	Model	Algebraic Expression
Add 10 to a		$a + 10$ or $10 + a$
12 more than b		$b + 12$ or $12 + b$
Subtract c from 20		$20 - c$
15 less than d		$d - 15$
3 groups of x		$3x$
Divide y by 6		$\frac{y}{6}$

Simplifying and Evaluating Algebraic Expressions

Mr Tan had 6 boxes of blue clips and 2 boxes of red clips. There were y clips in each box.

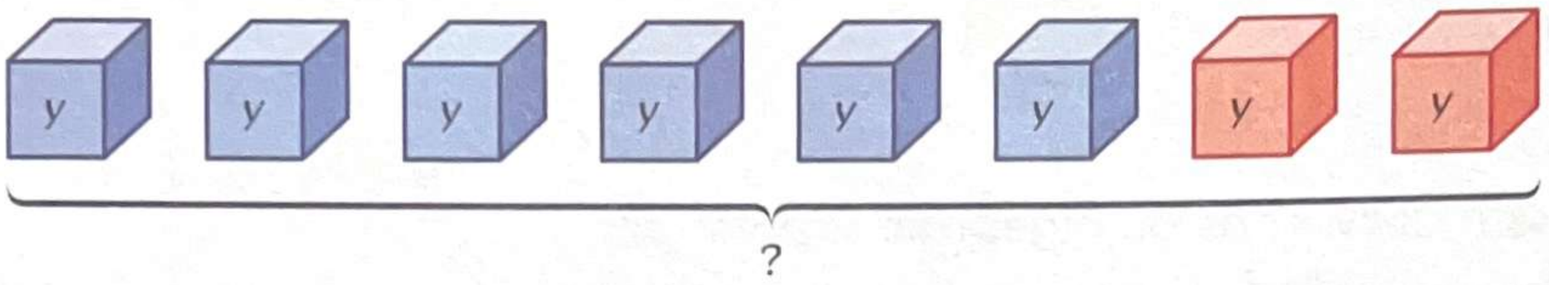
(a) How many clips did he have altogether?

(b) How many more blue clips than red clips did he have?

(c) He found 2 blue clips and 5 red clips. How many clips did he have in the end?

Express each answer in terms of y.

(a)



Number of blue clips $= y + y + y + y + y + y$
$= 6 \times y$
$= 6y$

Number of red clips $= y + y$
$= 2 \times y$
$= 2y$

Total number of clips $= 6y + 2y$
$= 8y$

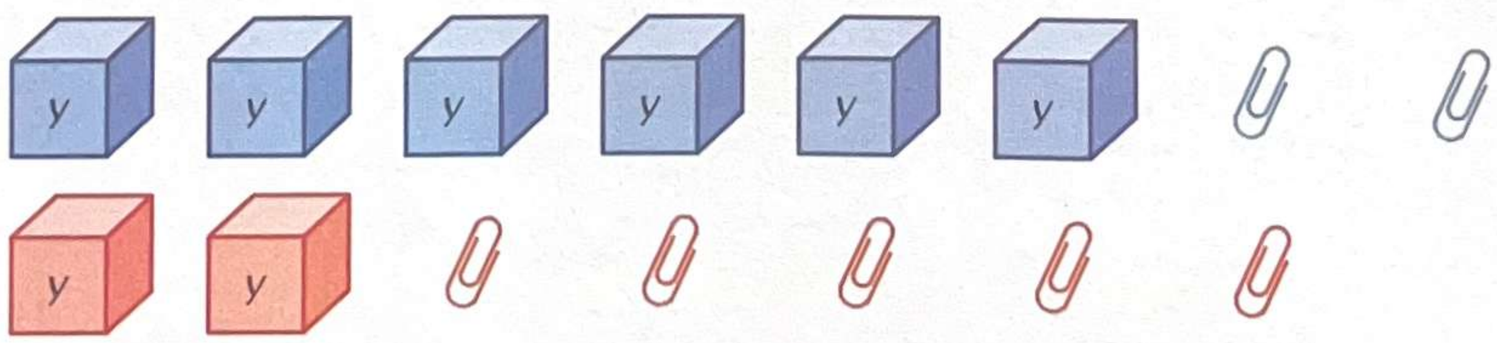
He had **$8y$** clips altogether.

(b)

Number of blue clips more than red clips $= 6y - 2y$
$= 4y$

He had **$4y$** more blue clips than red clips.

(c)



Number of clips in the end $= 6y + 2 + 2y + 5$
$= 8y + 7$

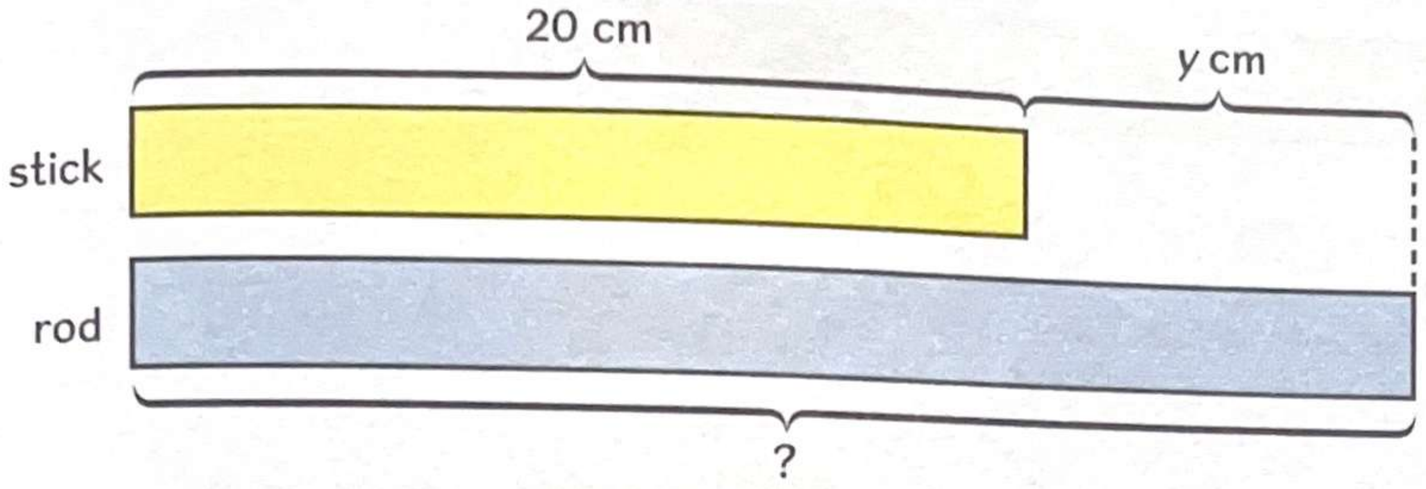
He had **$(8y + 7)$** clips in the end.

The difference in length between a stick and a rod is y cm. The stick is 20 cm long.

(a) Express the length of the rod in terms of y.

(b) When $y = 9$, what is the length of the rod?

(a)



The length of the rod is **(20 + y) cm**.

(b) When $y = 9$,

$$\begin{aligned}\text{length of the rod} &= 20 + y \\ &= 20 + 9 \\ &= 29 \text{ cm}\end{aligned}$$

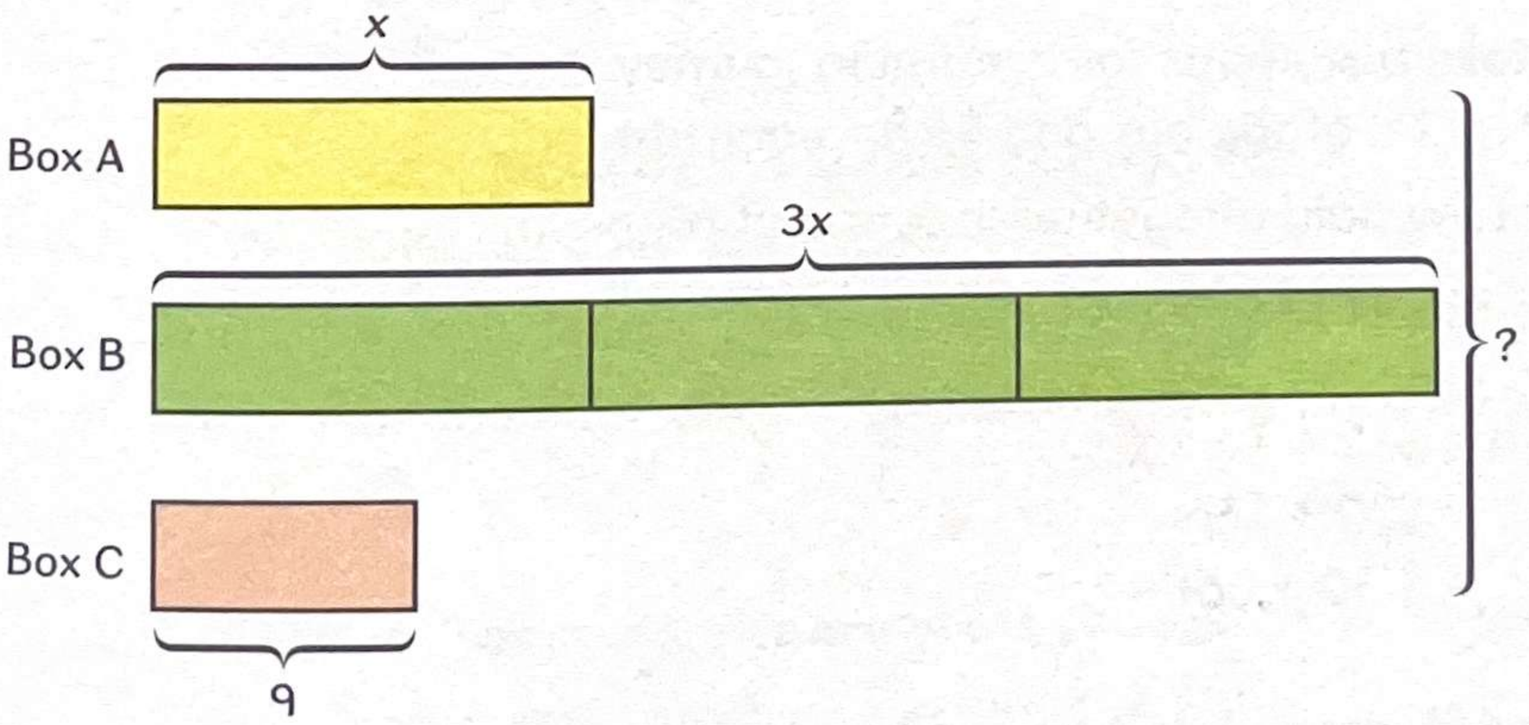
The length of the rod is **29 cm**.

Box A has x cherries. Box B has 3 times as many cherries as Box A. Box C has 9 cherries.

(a) Express the total number of cherries in the 3 boxes in terms of x.

(b) Box A has 15 cherries. How many cherries are there in the 3 boxes altogether?

(a)



$x + 3x + 9 = 4x + 9$

The total number of cherries in the 3 boxes is **4x + 9**.

(b) When $x = 15$,

$$\begin{aligned}\text{total number of cherries} &= 4x + 9 \\ &= 4 \times 15 + 9 \\ &= 60 + 9 \\ &= 69\end{aligned}$$

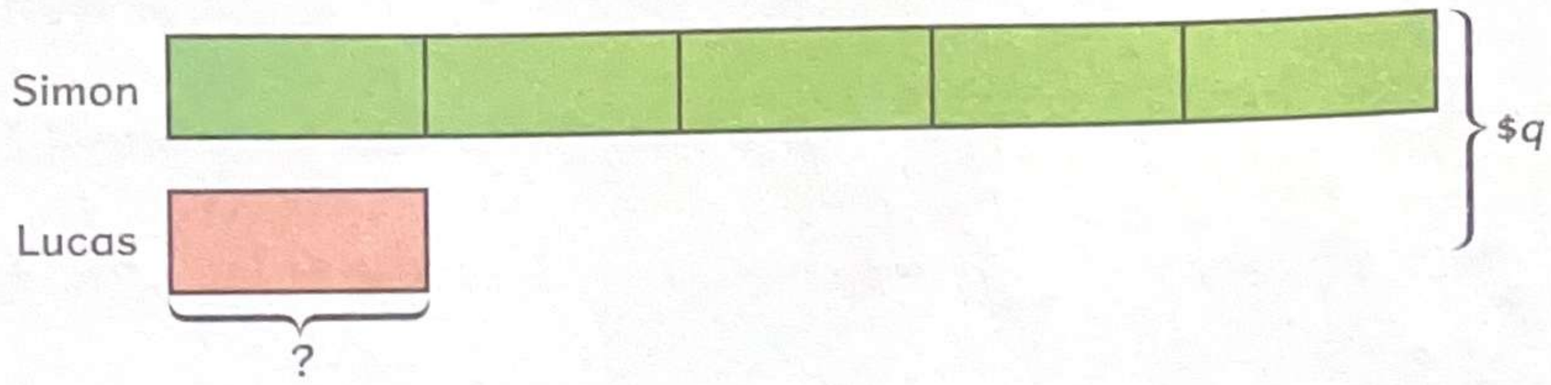
There are **69** cherries in the 3 boxes altogether.

Simon has 5 times as much money as Lucas. They have a total of $\$q$.

(a) Express the amount of money Lucas has in terms of q.

(b) Find the amount of money Lucas has when $q = 84$.

(a)



6 units = $\$q$

1 unit = $\$\left(\frac{q}{6}\right)$

Lucas has $\mathbf{\$\left(\frac{q}{6}\right)}$.

(b) When $q = 84$,

amount of money Lucas has $= \$\left(\frac{q}{6}\right)$

$= \$\left(\frac{84}{6}\right)$

$= \$14$

Lucas has **$14**.

Mr Low rented a bus to take p students for a learning journey.
He was charged $30 for rental of the bus and $6 for each student.

(a) Find the amount Mr Low paid altogether in terms of p.

(b) How much did Mr Low pay altogether when $p = 20$?

(a) Amount Mr Low paid $= \$30 + \$6 \times p$

$= \$30 + \$6p$

$= \$(30 + 6p)$

Mr Low paid **$(30 + 6p)** altogether.

(b) When $p = 20$,

amount Mr Low paid $= \$(30 + 6 \times 20)$

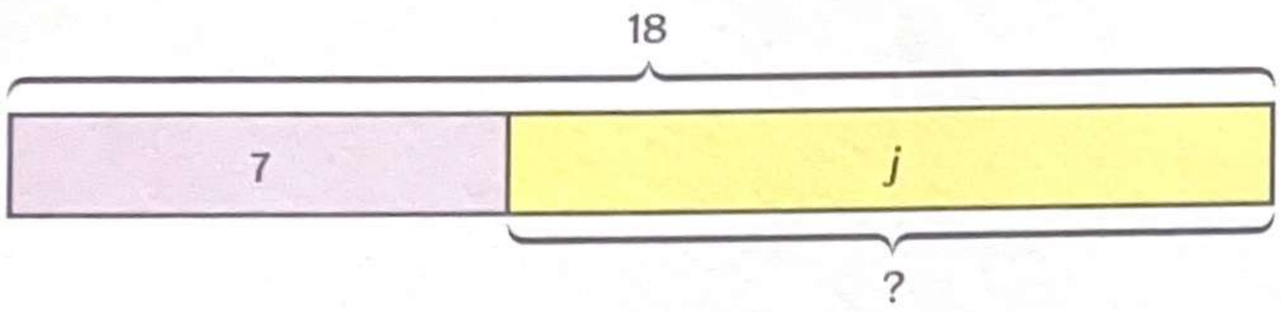
$= \$(30 + 120)$

$= \$150$

Mr Low paid **$150** altogether.

Solving Algebraic Equations

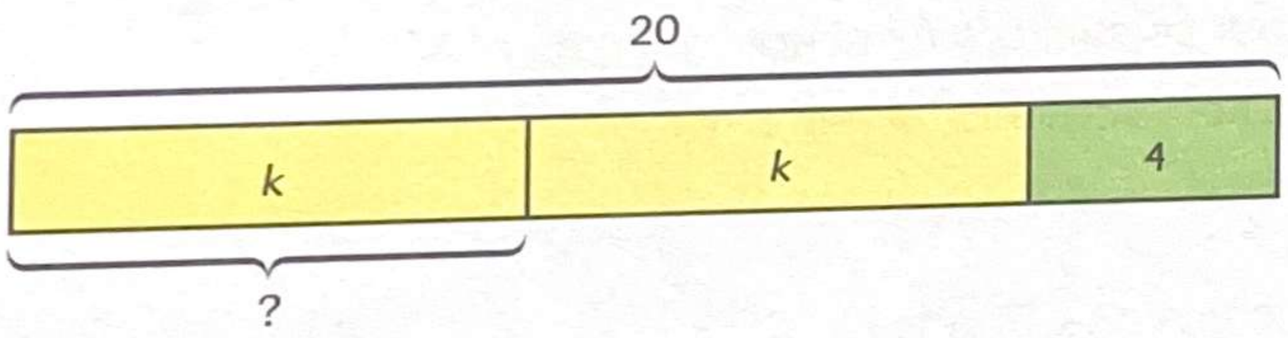
Siti had 7 crayons. She then bought j more crayons.
How many crayons did Siti buy if she had 18 crayons in the end?



$j = 18 - 7$
$= 11$

Siti bought **11** crayons.

A container had k yellow buttons at first. After Mrs Tan put the same number of yellow buttons and 4 green buttons into the container, there were 20 buttons in all.
How many buttons were there in the container at first?

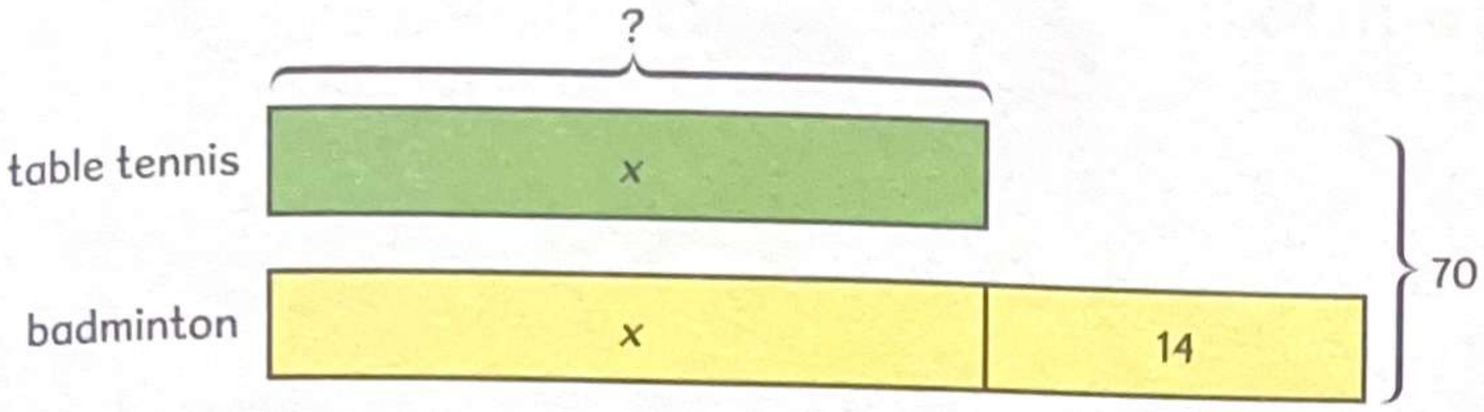


$2k = 20 - 4$
$= 16$

$k = 16 \div 2$
$= 8$

There were **8** buttons in the container at first.

There is a total of 70 children playing table tennis or badminton in a sports hall.
There are x children playing table tennis.
There are 14 more children playing badminton than table tennis.
How many children are playing table tennis?

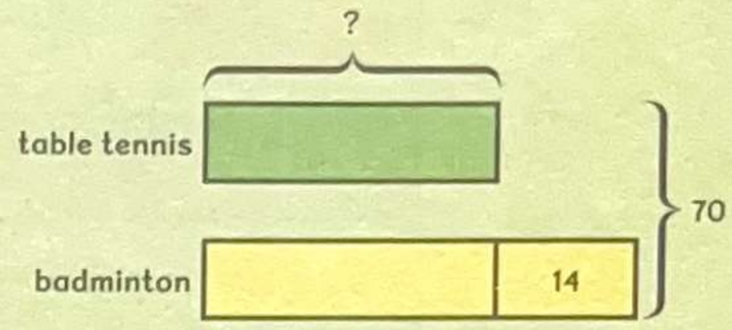


$2x = 70 - 14$
$= 56$

$x = 56 \div 2$
$= 28$

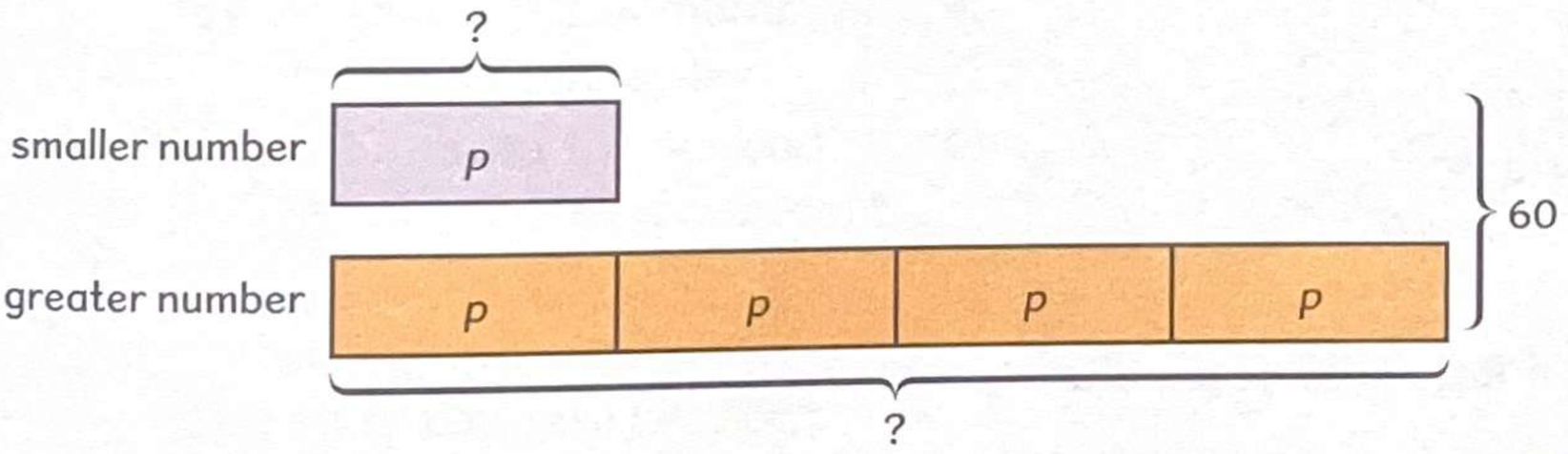
28 children are playing table tennis.

Solving algebraic equations is similar to finding the value for 1 unit.



2 units = 70 − 14
= 56
1 unit = 56 ÷ 2
= 28

The sum of two numbers is 60. The smaller number is p.
The greater number is 4 times the smaller number.
What are the two numbers?



$5p = 60$
$p = 60 \div 5$
$= 12$

The smaller number is **12**.

$4p = 4 \times 12$ or $60 - 12 = 48$
$= 48$

The greater number is **48**.

Think of $5p$ as 5 units.
5 units = 60
1 unit = 60 ÷ 5
= 12

Let's Try! 4

(a) Find the number represented by each letter.

(i) $9g = 72$

$g =$ ____

(ii) $3h = 16 - 4$

$h =$ ____

(b) Lucy had 18 coins in her savings jar at first.
When she put p coins in the jar, there were 35 coins in all.
How many coins did she put in the jar?

(c) Khadijah baked n chocolate cookies, 30 coconut cookies and $2n$ peanut cookies.
She baked 75 cookies altogether.
How many chocolate cookies did she bake?

(d) James has $\$x$.
He has \$14 less than Alex.
They have \$50 in all.
How much money does James have?

(e) The sum of two numbers is 96.
The first number is r.
It is 7 times the second number.
What is the first number?

(f) Andy weighs $(j + 3)$ kg.
Bill weighs j kg more than Andy.
The total mass of the two boys is 45 kg.
Find the value of j.

Go to PB 6 Practice 3