

Algebraic Expressions Involving Addition and Subtraction

Let's Learn



- 1 (a) There are 5 cupcakes in the box and 3 cupcakes on the plate.



5



3

$5 + 3 = 8$ is an **equation**.
It has an equal sign.



$$5 + 3 = 8$$

There are **8** cupcakes altogether.

- (b) Suppose there are n cupcakes in the box and 3 cupcakes on the plate.
The letter n represents an unknown number of cupcakes.



n



3

$n + 3$ is an **algebraic expression**.
It does not have an equal sign.



There are **$(n + 3)$** cupcakes altogether.

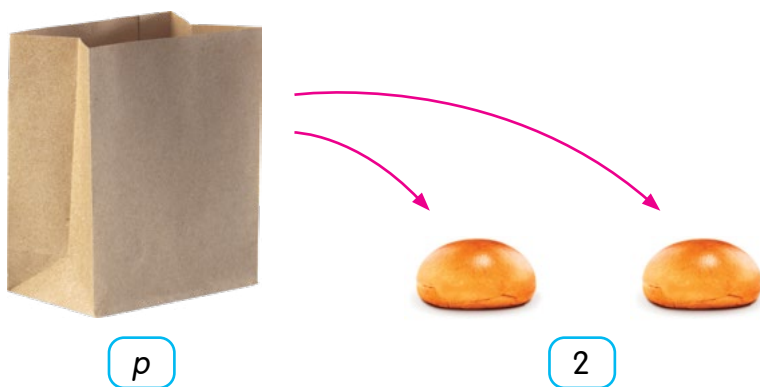
We can use a letter
or a symbol to represent
an unknown number.



Using brackets helps us
see the entire expression
" $n + 3$ " as one unit, to
avoid confusion.



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



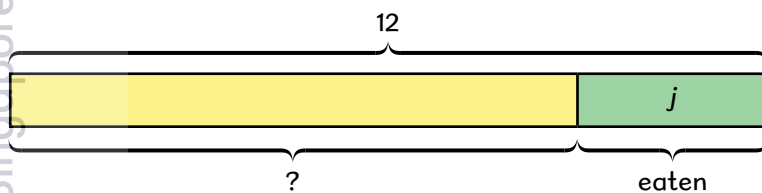
Suppose there are h buns in the bag, how many buns are left?



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

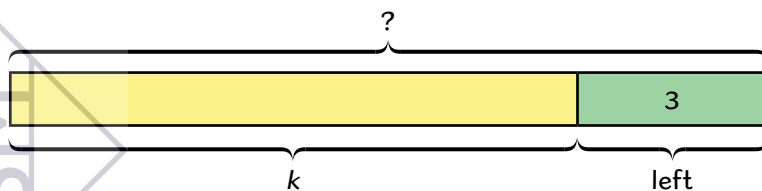
- 3 We can draw bar models to help us understand algebraic expressions.

- (a) There are 12 apples.
 j apples are eaten.
How many apples are there left?



There are $(12 - j)$ apples left.

- (b) After eating k oranges, Alan has 3 oranges left.
How many oranges did he have at first?



He had $(k + 3)$ oranges at first.

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

Time	Daniel's age (years)
now	12
in 3 years' time	$12 + 3 = 15$
in x years' time	$12 + x$
in y more years	$12 + y$
5 years ago	$12 - 5 = 7$
z years ago	$12 - z$

$12 + x$, $12 + y$ and $12 - z$ are examples of algebraic expressions.



- 5 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		$d - 15$

Let's Practise



- Write the algebraic expressions for each of the following.
 - Add 7 to q .
 - 10 less than r .
- Express each answer as an algebraic expression.
 - A pizza costs \$20. A cake costs \$ x more than a pizza. How much does the cake cost?
 - Hazel had \$ p . She bought a pencil case and received \$2 change. How much did the pencil case cost?



Algebraic Expressions Involving Multiplication and Division

Let's Learn



- 1 Siti has 5 times as many stickers as Vani.
How many stickers does Siti have if Vani has

(a) 6 stickers?

(b) q stickers?

(a)

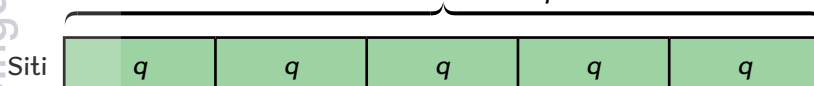
$$6 + 6 + 6 + 6 + 6 = 5 \times 6 = 30$$



Siti has **30** stickers.

(b)

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



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

$5 \times q = q \times 5$.
We write **$5 \times q = 5q$** .



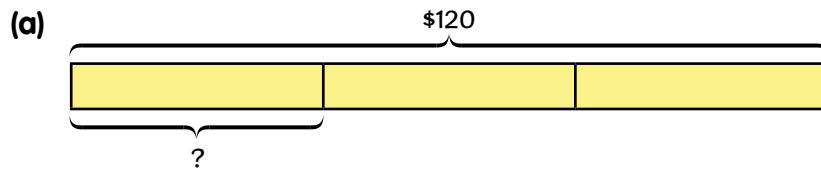
- 2 Each shirt has 8 buttons. How many buttons are there on the given number of shirts?

Number of shirts	Number of buttons
1	$1 \times 8 = 8$
2	$2 \times 8 = 16$
5	$5 \times 8 = 40$
k	$k \times 8 = 8k$

$5q$ and $8k$ are also examples of algebraic expressions.

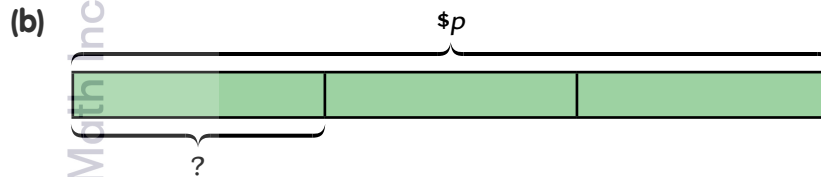


- 3 (a) A sum of \$120 is shared equally among 3 children. Find the amount of money each child receives.
- (b) A sum of \$ p is shared equally among 3 children. Write an algebraic expression to represent the amount of money each child receives.



$$\begin{aligned} \$120 \div 3 &= \$\left(\frac{120}{3}\right) \\ &= \$40 \end{aligned}$$

Each child receives **\$40**.



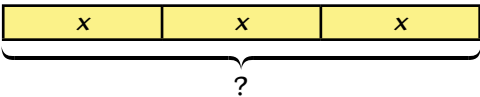
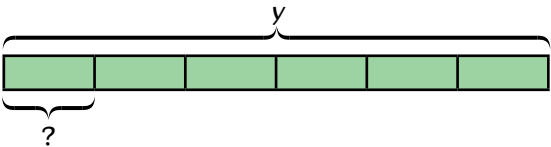
$$\$p \div 3 = \$\left(\frac{p}{3}\right)$$

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

- 4 Each sum of money is shared equally among a number of children. How much money does each child receive?

Sum of money	Number of children	Amount each child receives
\$120	4	$\$120 \div 4 = \$\left(\frac{120}{4}\right)$ $= \$30$
\$ y	2	$\$y \div 2 = \$\left(\frac{y}{2}\right)$
\$ y	4	$\$y \div 4 = \$\left(\frac{y}{4}\right)$

- 5 Here are some ways to write algebraic expressions.

Statement	Model	Algebraic Expression
3 groups of x		$3x$
Divide y by 6		$\frac{y}{6}$

Maths Talk



Four students express $d + d + d + d$ as shown below.

$4d$



Hairul

$4 + d$



Siti

$4 \times d$



Daniel

$d \times 4$



Vani

Who is correct?

Let's Practise



- 1 Write the algebraic expression representing each of the following.
 - (a) The product of 12 and h .
 - (b) Divide k by 9.
- 2 Express each answer as an algebraic expression.
 - (a) There are 6 cans of drinks in a carton. Mr Raj bought y cartons of drinks. How many cans of drinks did he buy?
 - (b) j stickers were shared equally among 4 girls. How many stickers did each girl receive?



Simplifying Algebraic Expressions

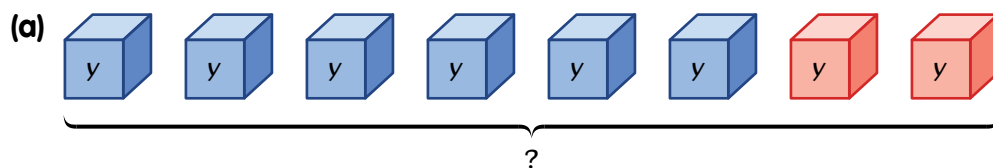
Let's Learn



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

- How many clips did he have altogether?
- How many more blue clips than red clips did he have?
- 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 .

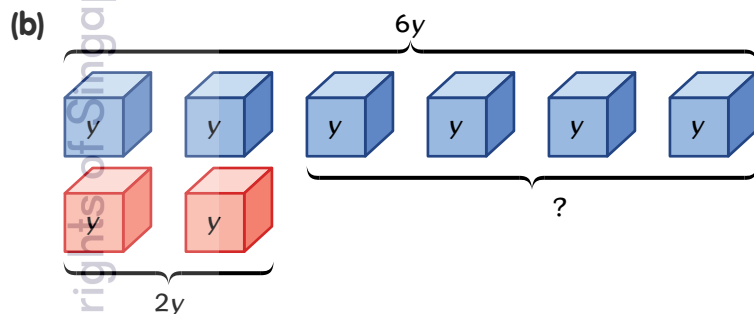


$$\begin{aligned}\text{Number of blue clips} &= y + y + y + y + y + y \\ &= 6 \times y \\ &= 6y\end{aligned}$$

$$\begin{aligned}\text{Number of red clips} &= y + y \\ &= 2 \times y \\ &= 2y\end{aligned}$$

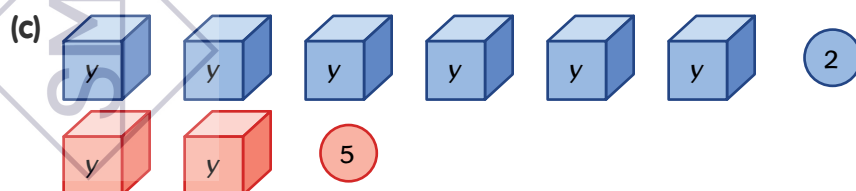
$$\begin{aligned}\text{Total number of clips} &= 6y + 2y \\ &= 8y\end{aligned}$$

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



$$\begin{aligned}\text{Number of blue clips more than red clips} &= 6y - 2y \\ &= 4y\end{aligned}$$

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



$$\begin{aligned}\text{Number of clips in the end} &= 6y + 2 + 2y + 5 \\ &= 8y + 7\end{aligned}$$

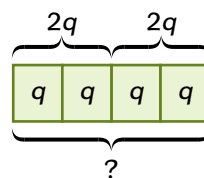
He had **$(8y + 7)$** clips in the end.

$$\begin{aligned}6y + 2y &= 8y \\ 2 + 5 &= 7\end{aligned}$$

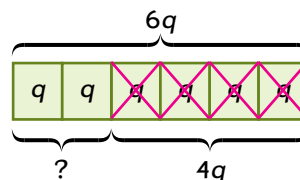


- 2 Simplify each algebraic expression.

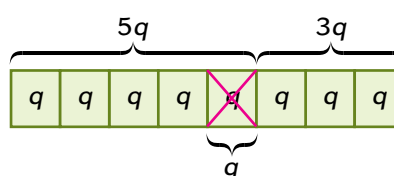
(a) $2q + 2q = 4q$



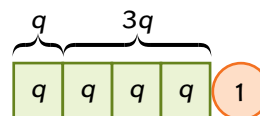
(b) $6q - 4q = 2q$



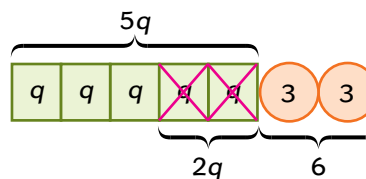
(c) $5q - q + 3q = 4q + 3q = 7q$



(d) $q + 3q + 1 = 4q + 1$



(e) $5q + 3 - 2q + 3 = 5q - 2q + 3 + 3 = 3q + 6$



Let's Practise



- 1 Fill in the boxes.

(a) $9p = 4p + \boxed{}$

(b) $5q = \boxed{} - 3q$

(c) $7h = \boxed{} \times h$

(d) $15r = 15 \times \boxed{}$

- 2 Simplify each of the following.

(a) $2k + 5k = \boxed{}$

(b) $15q - 6q = \boxed{}$

(c) $9d - 5d + 10 = \boxed{}$

(d) $c + 9 + 12c = \boxed{}$

(e) $30 + h - 1 + 6h = \boxed{}$

(f) $20a + 8 - 14a - 3 + a = \boxed{}$

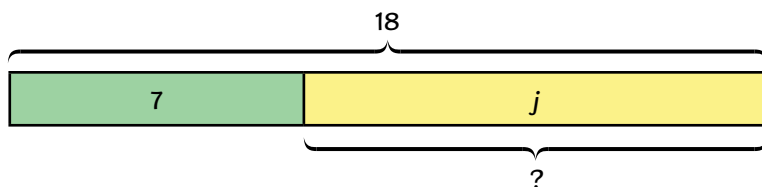


Solving Algebraic Equations

Let's Learn



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



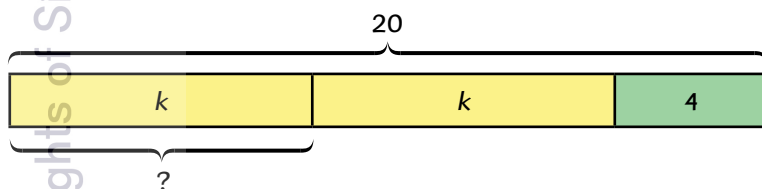
$7 + j = 18$ is an
algebraic equation.



$$\begin{aligned} 7 + j &= 18 \\ j &= 18 - 7 \\ &= 11 \end{aligned}$$

Siti bought **11** crayons.

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



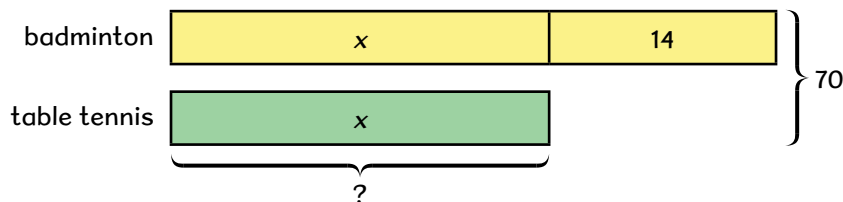
$$\begin{aligned} 4 + 2k &= 20 \\ 2k &= 20 - 4 \\ &= 16 \end{aligned}$$

$$\begin{aligned} k &= \frac{16}{2} \\ &= 8 \end{aligned}$$

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

- 3 There are 70 children playing badminton or table tennis in total.
There are 14 more children playing badminton than table tennis.
How many children are playing table tennis?

Let the number of children playing table tennis be x .

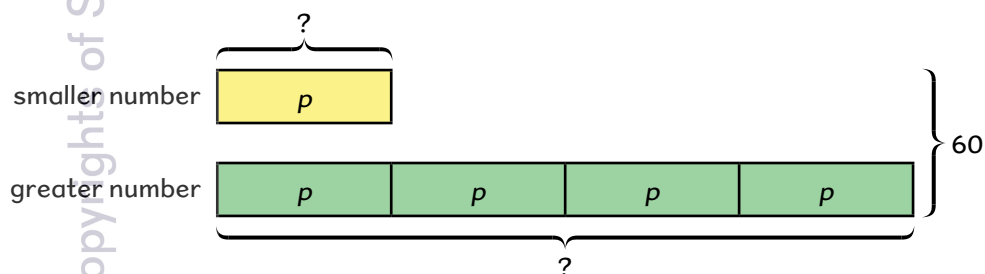


$$\begin{aligned} 2x + 14 &= 70 \\ 2x &= 70 - 14 \\ &= 56 \\ x &= 56 \div 2 \\ &= 28 \end{aligned}$$

28 children are playing table tennis.

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

Let the smaller number be p .



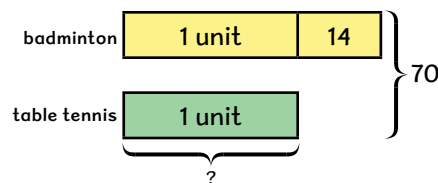
$$\begin{aligned} p + 4p &= 60 \\ 5p &= 60 \\ p &= 60 \div 5 \\ &= 12 \end{aligned}$$

The smaller number is 12.

$$\begin{aligned} 4p &= 4 \times 12 & \text{or} & & 60 - 12 &= 48 \\ &= 48 \end{aligned}$$

The greater number is 48.

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



$$\begin{aligned} 2 \text{ units} + 14 &= 70 \\ 2 \text{ units} &= 70 - 14 \\ &= 56 \\ 1 \text{ unit} &= 56 \div 2 \\ &= 28 \end{aligned}$$

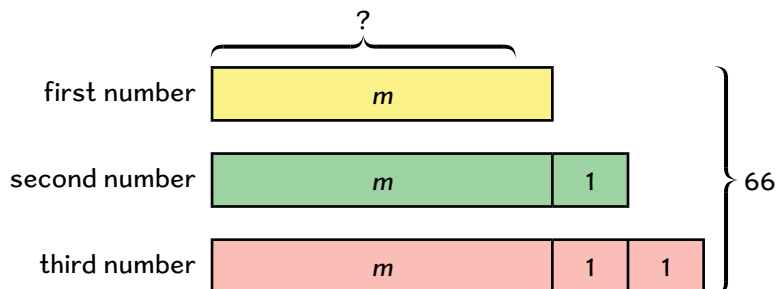


Think of $5p$ as 5 units.
5 units = 60
1 unit = $60 \div 5$
= 12



- 5 The sum of 3 numbers is 66.
The second number is 1 more than the first number.
The third number is 1 more than the second number.
What is the first number?

Let the smallest number be m .



$$\begin{aligned} 3m &= 66 - 3 \\ &= 63 \\ m &= 63 \div 3 \\ &= 21 \end{aligned}$$

The first number is **21**.

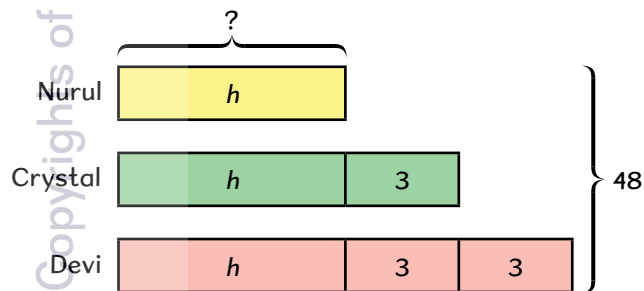
Think of $3m = 66 - 3$
as 3 units = $66 - 3$.

$$\begin{aligned} 3 \text{ units} &= 63 \\ 1 \text{ unit} &= 63 \div 3 \\ &= 21 \end{aligned}$$



- 6 Devi is 3 years older than Crystal. Nurul is 3 years younger than Crystal.
The sum of their ages is 48. How old is Nurul?

Let Nurul's age be h years.



$$\begin{aligned} 3h &= 48 - 3 - 3 - 3 \\ &= 39 \\ h &= 39 \div 3 \\ &= 13 \end{aligned}$$

Nurul is **13** years old.

- 7 Raju is m years old. Rajeev is twice as old as Raju.
In 4 years' time, the total age of Raju and Rajeev will be 44 years.

- (a) How old is Raju now?
(b) How old will Rajeev be in 3 years' time?

(a) Raju's age = m
Rajeev's age = $2m$
Total age of Raju and Rajeev in terms of $m = m + 2m$
 $= 3m$

Total age of Raju and Rajeev in 4 years in terms of $m = 3m + 4 + 4$
 $= 3m + 8$

$$\begin{aligned} 3m + 8 &= 44 \\ 3m &= 44 - 8 \\ &= 36 \\ m &= 36 \div 3 \\ &= 12 \end{aligned}$$

Raju is **12** years old now.

(b) Rajeev's age in 3 years' time = $2m + 3$
 $= (2 \times 12) + 3$
 $= 24 + 3$
 $= 27$

Rajeev will be **27** years old in 3 years' time.



Let's Practise

- 1 Find the number represented by each letter.

(a) $9g = 72$

$g =$

(b) $4 + 3h = 16$

$h =$

- 2 Lucy had 18 coins in her savings jar.
She put p more coins in the jar and there were 35 coins in all.
How many coins did she put in the jar?
- 3 Khadijah baked n chocolate cookies, 30 coconut cookies and $2n$ peanut cookies.
She baked 75 cookies altogether.
How many chocolate cookies did she bake?
- 4 James has \$ x .
He has \$14 less than Alex.
They have \$50 in all.
How much money does James have?
- 5 The sum of two numbers is 96.
The first number is 7 times the second number.
What is the first number?
- 6 There are 3 numbers. The second number is 2 more than the first number.
The third number is 2 more than the second number.
The sum of the 3 numbers is 54. What is the greatest number?
- 7 Mary is 45 years old. Susan is p years old. Mary is 3 times as old as Susan.
How old will Susan be in 6 years' time?



Here's a hint. Use a letter to represent the second number.

A pen costs \$2 and Ben has a \$10 note.
How much change will he get if he wants to buy 3 pens?
How does the cash register calculate the change Ben should receive?



The cashier scans the barcode to get the price of the pen.

The cashier keys in the number of pens.

The cashier keys in the amount received.



\$2



$\$2 \times 3$



$\$10 - (2 \times 3)$

We can use algebra to show the mathematical process.
Let p be the number of pens Ben buys.

$\$2$
Cost of each pen

$\$2p$
Cost of p pens

$\$(10 - 2p)$
Change received

What is the value of $\$(10 - 2p)$ if Ben buys

- (a) 2 pens?
- (b) 4 pens?

Can the value of p be greater than 5? Why?





Thinking Aloud

In the magic square below, the sum of the numbers in each row, column and diagonal is 15. What are the missing numbers in the magic square?

		6
	5	
4		2

magic square

Check if you get 15 by adding the 3 numbers in each row, column and diagonal.



Now, make a similar magic square using algebra.

Let the number in the centre of the magic square be x .

The other numbers can be represented using expressions in x , such as $x + 1$.

If $x = 8$, what are the 9 numbers in the 3×3 box?

		$x + 1$
	x	
$x - 1$		$x - 3$

Did you get a magic square?
Check by adding each row, column and diagonal.



Do you get a magic square for any value represented by x ?

