

# Foundation unit 5 - Equations, Inequalities and Sequences

## Key point 3

In an equation with **brackets**, expand the brackets first.

In an equation with **brackets**, expand the brackets first.

## Example 2

Solve the equation  $3a + 7 = 13$

$$3a + 7 - 7 = 13 - 7$$

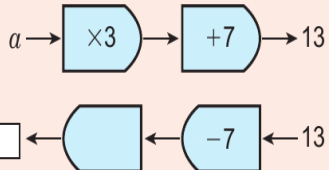
$$3a = 6$$

$$\frac{3a}{3} = \frac{6}{3}$$

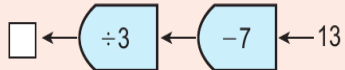
$$a = 2$$

Check:  $3a + 7 = 3 \times 2 + 7 = 13$  ✓

Subtract 7 from both sides.

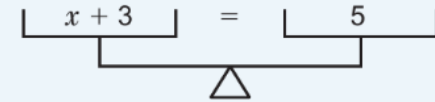


Divide both sides by 3.



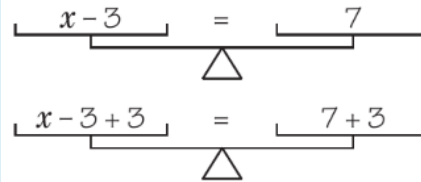
## Key point 2

In an equation, the expressions on both sides of the = sign have the same value. You can visualise them on balanced scales. The scales stay balanced if you complete the same operation to both sides. You can use this **balancing method** to solve equations.



## Example 1

Solve the equation  $x - 3 = 7$



Visualise the equation as balanced scales.

The inverse of  $-3$  is  $+3$ . Do this to both sides to keep the equation balanced.

$$x = 7 + 3$$

$$x = 10$$

Check:  $x - 3 = 10 - 3 = 7$  ✓

## Key point 10

A **formula** shows the relationship between two or more variables (letters). You can use **substitution** to find an unknown value.

An **equation** contains an unknown number (a letter) and an = sign. You can solve it to find the value of the letter.

## Key point 4

Whatever you do to one side of an equation, you must do to the other side.

### Example 3

Solve  $4d + 17 = 8d - 3$

$$\begin{array}{c} \overbrace{4d + 17} \quad = \quad \overbrace{8d - 3} \\ \triangle \\ \underbrace{\quad\quad\quad} \\ 17 = 4d - 3 \\ \triangle \end{array}$$

Visualise the equation as balanced scales. Subtract  $4d$  from both sides.

$$17 + 3 = 4d - 3 + 3$$

The inverse of  $-3$  is  $+3$ . Do this to both sides.

$$20 = 4d$$

Divide both sides by 4.

$$5 = d$$

$$d = 5$$

Check: LHS =  $4d + 17 = 4 \times 5 + 17 = 37$

RHS =  $8d - 3 = 8 \times 5 - 3 = 37 \checkmark$

## Communication

hint 'Satisfy' means 'that would make the inequality true'.

### Key point 5

You can show solutions to inequalities on a number line.

An empty circle  $\circ$  shows the value is *not* included.

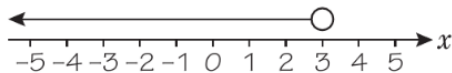
A filled circle  $\bullet$  shows the value is included.

An arrow  $\circ \longrightarrow$  shows that the solution continues towards infinity.

### Example 4

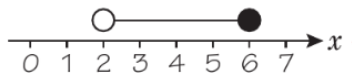
Use a number line to show the values that satisfy each inequality.

a  $x < 3$



This includes all the numbers less than 3 (not including 3).

b  $2 < x \leq 6$



This includes all the numbers greater than 2 (not including 2) and less than or equal to 6 (including 6).

### Key point 8

You can solve **two-sided inequalities** using a balancing method.

### Example 5

Solve  $7 < 2x - 1 < 13$

$$7 + 1 < 2x - 1 + 1 < 13 + 1$$

Add 1 to all the parts.

$$\div 2 \quad 8 < 2x < 14 \quad \div 2$$

$$4 < x < 7$$

Divide by 2.

## Key point 6

An **integer** is a positive or negative whole number or zero. The integer values that satisfy  $2 < x < 3$  are  $-1, 0, 1$  and  $2$ .

### Example 6

Rearrange  $y = 2x + 5$  to make  $x$  the **subject** of the formula.

$$\boxed{y} = \boxed{2x + 5}$$

Use the balancing method.

$$\boxed{y - 5} = \boxed{2x + 5 - 5}$$

The inverse of  $+5$  is  $-5$ . Do this to both sides.

$$\boxed{\frac{y - 5}{2}} = \boxed{\frac{2x}{2}}$$

**Communication hint**  
The subject of a formula is the letter on its own, on one side of the equals sign.

$$x = \frac{y - 5}{2} \checkmark$$

The inverse of  $\times 2$  is  $\div 2$ . Do this to both sides.

### Exam hint

Write an equation that links the lengths of the sides to the given perimeter.

### Key point 12

The  $n$ th term of a sequence tells you how to work out the term at position  $n$  (any position). It is also called the **general term** of the sequence.

### Example 7

a Work out the  $n$ th term of the sequence 7, 11, 15, 19, 23, ...

b Is 33 a term of the sequence?

a  $4n$  4, 8, 12, 16, 20, ...  
7, 11, 15, 19, 23, ...

$+3$   
 $+4$   $+4$

The  $n$ th term is  $4n + 3$

The common difference is 4. Write out the first five terms of the sequence for  $4n$ , the multiples of 4. Work out how to get from each term in  $4n$  to the term in the sequence.

b  $33 = 4n + 3$

Write an equation using the  $n$ th term and solve it.

$$33 - 3 = 4n + 3 - 3$$

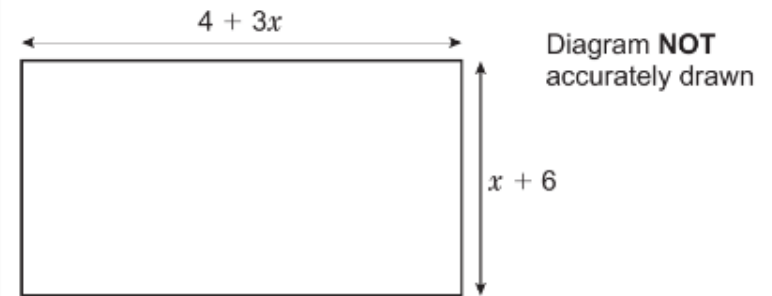
$$30 = 4n$$

$$7.5 = n$$

33 cannot be in the sequence because 7.5 is not an integer.

### Exam-style question

The diagram shows a garden in the shape of a rectangle.



All measurements are in metres.

The perimeter of the garden is 32 metres.

Work out the value of  $x$ .

(4 marks)

June 2013, Q28, IMA0/1F