# SOLVE EQUATIONS AND INEQUALITIES

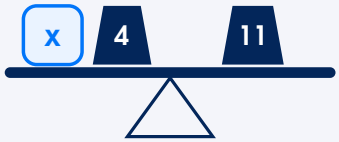
BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

**KEY IDEA**

**Inverse operations undo each other.**

**+ 4 undoes − 4** **× 3 undoes ÷ 3**




Do the same to both sides to keep them balanced:

**x + 4 = 11 → − 4 from both sides → x = 7**

**1** Use the bar model to find the missing number.

a)

| 15 | |
|---|---|
| x | 6 |

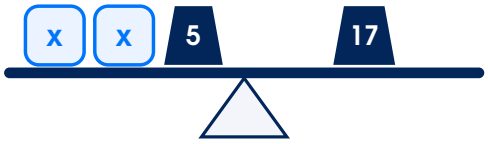
x = ☐

b)

| 21 | | |
|---|---|---|
| y | y | y |

y = ☐

**2** The scales balance. Take 5 from both sides, then share between the two bags.

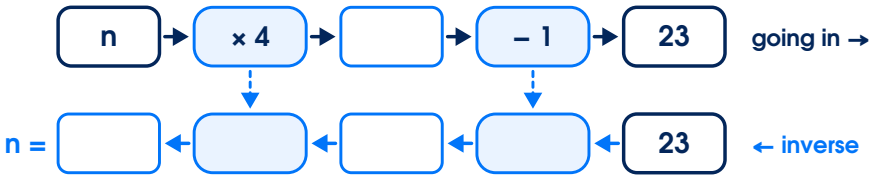



**2x + 5 = 17**

**− 5** → **2x = ☐** → ☐

**÷ 2** → **x = ☐** → ☐

**3** Fill in the function machine. Then work backwards to find n.

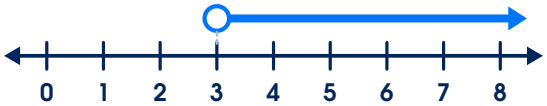



**4** Inequalities show a range of numbers.

○ not included (< or >)

● included (≤ or ≥)

a)




This shows x > 3. Circle the numbers that fit:

1 3 4 7.5 10

b)




Write the inequality it shows:

x ☐ 6

# SOLVE EQUATIONS AND INEQUALITIES

SUPPORT

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**KEY IDEA**

**Equation: one solution**

$3p + 2 = 17$
$3p = 15$ (− 2)
$p = 5$ (÷ 3)

**Inequality: a range of solutions**

$3p + 2 > 17$
$3p > 15$ (− 2)
$p > 5$ (÷ 3)

**1** Solve these one-step equations.

a) $x + 8 = 21$ $x =$ ☐

b) $6y = 54$ $y =$ ☐

c) $\frac{m}{5} = 7$ $m =$ ☐

d) $k - 2.5 = 9$ $k =$ ☐

**2** Solve by doing the same to both sides. Fill in the boxes.

a) $4x + 3 = 31$
− 3: $4x =$ ☐
÷ 4: $x =$ ☐

b) $5y - 8 = 32$
☐: $5y =$ ☐
☐: $y =$ ☐

**3** Solve $2x + 7 > 15$

$2x + 7 > 15$
− 7: $2x >$ ☐
÷ 2: $x >$ ☐

a) Show your answer on the line.




b) x could be: ☐ ☐ ☐

**4** Solve a) $3y + 4 = 22$ and b) $3y + 4 < 22$

a) $3y + 4 = 22$
☐: $3y =$ ☐
☐: $y =$ ☐

b) $3y + 4 < 22$
☐: $3y <$ ☐
☐: $y <$ ☐

c) Which has more than one solution? Explain.

.....

# SOLVE EQUATIONS AND INEQUALITIES

CORE

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**KEY IDEA**

Use inverse operations, doing the same to both sides. An equation has one solution; an inequality has a range of solutions, so keep the inequality sign in every line. Check by substituting your answer.

## FLUENCY

**1** Solve each equation.

a) $7a - 4 = 38$

b) $3 + 2m = 16$

c) $45 = 5 + 8t$

d) $\frac{c}{5} + 1 = 9$

e) $2.5h + 3 = 18$

f) $12 = \frac{w}{3} - 2$

**2** Solve each inequality.

a) $4x - 3 < 25$

b) $11 \leq 2w + 5$

c) $\frac{n}{3} - 2 \geq 4$

d) $6 < 3x < 21$

e) List the integers that satisfy part d).

## REASONING

**3** Zara solves $5x + 4 = 39$. Here is her working.

$5x = 43$

$x = 8.6$

a) Explain the mistake.

b) Find the correct solution.

**4** Sam says, "$12 < 2x + 4$ means $x < 4$." Is Sam correct? Explain how you know.

# SOLVE EQUATIONS AND INEQUALITIES

GREATER DEPTH

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## REASONING

**1** Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

**a)** If $x > 5$, then $2x > 10$. ALWAYS SOMETIMES NEVER

**b)** If b is a whole number, then $4x + b = 19$ has a whole-number solution. ALWAYS SOMETIMES NEVER

**c)** The inequality $3x - 1 \geq 8$ has exactly one solution. ALWAYS SOMETIMES NEVER

## PROBLEM SOLVING

**2** I think of a whole number, multiply it by 7 and then subtract 12. My answer is more than 30 but less than 50.

**a)** Write an inequality to show this.

**b)** What could my number be? Give all the possibilities.

**3** Use the cards 2, 3 and 9 once each to fill the boxes.

2 3 9 □ x + □ = □

**a)** Make the equation with the largest solution.

**b)** Make the equation with the smallest solution.

**c)** Make an equation whose solution is not an integer.

## ★ CHALLENGE FOR ALL

**4** Fractions and inequalities.

**a)** Solve $\frac{3}{5}x + 2 = 11$

**b)** Find all the integers that satisfy $7 \leq \frac{2x + 1}{3} < 11$

# SOLVE EQUATIONS AND INEQUALITIES – ANSWERS

ANSWERS

## BUILDING BLOCKS

1 a) $x = 9$ · b) $y = 7$

2 – 5 both sides: $2x = 12$ · ÷ 2 both sides: $x = 6$

3 box: $4n = 24$ · backwards: $23 + 1 = 24$, then $24 \div 4 = 6$, so $n = 6$

4 a) 4, 7.5 and 10 · b) $x \leq 6$

## SUPPORT

1 a) $x = 13$ · b) $y = 9$ · c) $m = 35$ · d) $k = 11.5$

2 a) $4x = 28$, $x = 7$ (– 3, ÷ 4) · b) + 8: $5y = 40$, ÷ 5: $y = 8$

3 $2x > 8$, $x > 4$ · a) open circle at 4, arrow to the right · b) any three numbers greater than 4, e.g. 5, 6, 7

4 a) $3y = 18$, $y = 6$ · b) $3y < 18$, $y < 6$ · c) the inequality: any y less than 6 works (e.g. 5, 2, 0.5); the equation only has $y = 6$

## CORE

1 a) $a = 6$ · b) $m = 6.5$ · c) $t = 5$ · d) $c = 40$ · e) $h = 6$ · f) $w = 42$

2 a) $x < 7$ · b) $w \geq 3$ ($3 \leq w$) · c) $n \geq 18$ · d) $2 < x < 7$ · e) 3, 4, 5, 6

3 a) She added 4 instead of subtracting 4 (the inverse of + 4 is – 4) · b) $5x = 35$, $x = 7$

4 No: $12 < 2x + 4$ gives $8 < 2x$, so $4 < x$, which means $x > 4$ (e.g. $x = 5$ works, $x = 3$ does not)

## GREATER DEPTH

1 a) always · b) sometimes ($b = 3$ gives $x = 4$; $b = 2$ gives $x = 4.25$) · c) never ($x \geq 3$ has infinitely many solutions)

2 a) $30 < 7n - 12 < 50$ · b) $42 < 7n < 62$, so $6 < n < 8.86...$: $n = 7$ or 8

3 a) $2x + 3 = 9$ ($x = 3$) · b) $2x + 9 = 3$ ($x = -3$) · c) e.g. $3x + 2 = 9$ ($x = 7/3$), $9x + 2 = 3$ ($x = 1/9$)

4 a) $x = 15$ · b) $21 \leq 2x + 1 < 33$, so $10 \leq x < 16$: 10, 11, 12, 13, 14, 15