UNKNOWNS ON BOTH SIDES

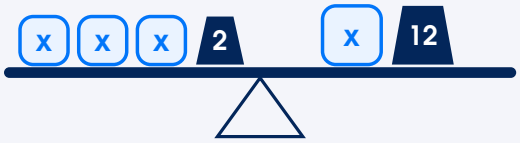
BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

KEY IDEA

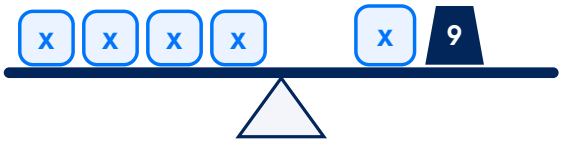
Take the same from both sides to keep the balance.

$3x + 2 = x + 12$ → take x from both sides → $2x + 2 = 12$



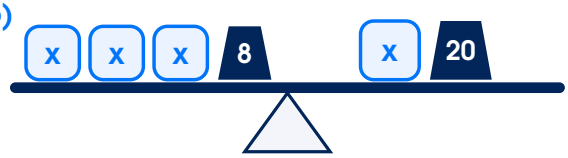
1 Cross out the same number of bags on each side. Then find x.

a)



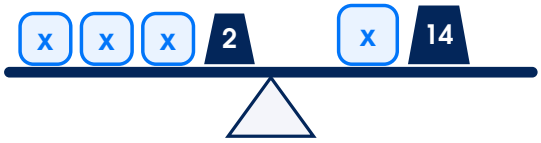
$3x =$ ☐ $x =$ ☐

b)



☐ $x + 8 = 20$ $x =$ ☐

2 The scales balance. Fill in the boxes.



$3x + 2 = x + 14$

$-x$ → $2x + 2 =$ ☐

-2 → $2x =$ ☐

$\div 2$ → $x =$ ☐

3 The two bars are the same length. Cross out one x from each bar.

$4x + 3$ | x | x | x | x | 3 |

$x + 15$ | x | 15 |

$3x + 3 =$ ☐

$3x =$ ☐ $x =$ ☐

4 Check by putting the value into BOTH sides. Circle YES or NO.

a) Is $x = 5$ the solution of $3x + 2 = x + 12$?

$3 \times 5 + 2 =$ ☐ $5 + 12 =$ ☐ YES NO

b) Is $y = 4$ the solution of $5y - 3 = 2y + 7$?

$5 \times 4 - 3 =$ ☐ $2 \times 4 + 7 =$ ☐ YES NO

UNKNOWNS ON BOTH SIDES

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

Take away the smaller number of x's from both sides first.

Then solve as normal.

	$5x + 3 = 2x + 15$	
$-2x$	$3x + 3 = 15$	$-2x$
-3	$3x = 12$	-3
$\div 3$	$x = 4$	$\div 3$

1 Do the first step. Take away the smaller x term from both sides.

a) $6x + 2 = 4x + 10$ $\quad -4x \rightarrow \quad$ ☐ $= 10$

b) $7y - 5 = 3y + 11$ $\quad -3y \rightarrow \quad$ ☐ $= 11$

c) $9 + 2m = 5m$ $\quad -2m \rightarrow \quad 9 =$ ☐

2 Solve. Fill in the boxes.

a)

	$5x + 1 = 2x + 22$	
$-2x$	$3x + 1 =$ ☐	☐
-1	$3x =$ ☐	☐
$\div 3$	$x =$ ☐	☐

b)

☐	$6y - 4 = 2y + 20$	☐
☐	☐ $=$ ☐	☐
☐	$4y =$ ☐	☐
	$y =$ ☐	

3 Solve $4x + 3 > x + 18$

	$4x + 3 > x + 18$	
$-x$	$3x + 3 >$ ☐	☐
-3	$3x >$ ☐	☐
$\div 3$	$x >$ ☐	☐

a) Show it on the number line.



b) Smallest whole number x: ☐

4 Write the equation shown by the balance. Then solve it.



a) Equation: ☐

b) Solve it: x = ☐

UNKNOWNS ON BOTH SIDES

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

Collect the unknowns on one side by adding or subtracting an x term from both sides (usually the one with the smaller coefficient), then solve. Check by substituting into both sides.

FLUENCY

1 Solve each equation.

a) $7x - 3 = 3x + 17$ ☐

b) $2y + 15 = 5y$ ☐

c) $11 - 2m = m + 2$ ☐

d) $8k + 7 = 3k - 13$ ☐

e) $3(x + 2) = x + 13$ ☐

f) $0.5p + 9 = 2p$ ☐

2 Solve each inequality.

a) $6x - 5 < 2x + 19$ ☐

b) $3y + 14 \geq 7y - 2$ ☐

c) $2(n + 6) > 5n - 9$ ☐

d) $4 - x \leq 2x + 10$ ☐

REASONING

3 Three students start to solve $15 - 2x > x + 6$ in different ways.

A $15 > 3x + 6$ B $9 - 2x > x$ C $15 - 3x > 6$

a) What has each student done to both sides?

.....

b) Choose a first step and solve the inequality. ☐

4 Explain why the equation $2x + 5 = 2x + 7$ has no solution.

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UNKNOWNS ON BOTH SIDES

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

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) An equation with x on both sides has exactly one solution. ALWAYS SOMETIMES NEVER

b) If a and c are different, then $ax + b = cx + b$ has the solution $x = 0$. ALWAYS SOMETIMES NEVER

c) $4x + 1 > 4x$ for every value of x. ALWAYS SOMETIMES NEVER

PROBLEM SOLVING

2 The rectangle and the square have the same perimeter.





a) x = _____

b) Perimeter = _____

3 Ali has £(5x + 3). Bea has £(2x + 27).

a) They have the same amount. How much does each person have? _____

b) For which values of x does Ali have more money than Bea? _____

★ CHALLENGE FOR ALL

4 Unknowns on both sides with fractions and decimals.

a) Solve $\frac{2}{3}x + 4 = x - 2$ _____

b) Solve $0.4x + 7 < 1.2x - 1$ _____

c) For what value of x are $3(x - 1)$ and $5x - 11$ equal? _____

UNKNOWNS ON BOTH SIDES – ANSWERS

ANSWERS

BUILDING BLOCKS

1 a) $3x = 9$, $x = 3$ · b) $2x + 8 = 20$, $x = 6$

2 – x: $2x + 2 = 14$ · – 2: $2x = 12$ · ÷ 2: $x = 6$

3 $3x + 3 = 15$ · $3x = 12$ · $x = 4$

4 a) 17 and 17: YES · b) 17 and 15: NO

SUPPORT

1 a) $2x + 2$ · b) $4y - 5$ · c) $3m$

2 a) $3x + 1 = 22$, $3x = 21$, $x = 7$ · b) – 2y: $4y - 4 = 20$, + 4: $4y = 24$, ÷ 4: $y = 6$

3 $3x + 3 > 18$, $3x > 15$, $x > 5$ · a) open circle at 5, arrow to the right · b) 6

4 a) $4x + 1 = x + 13$ · b) $3x = 12$, $x = 4$

CORE

1 a) $x = 5$ · b) $y = 5$ · c) $m = 3$ · d) $k = -4$ · e) $x = 3.5$ · f) $p = 6$

2 a) $x < 6$ · b) $y \leq 4$ · c) $n < 7$ · d) $x \geq -2$

3 a) A added 2x; B subtracted 6; C subtracted x (all correct) · b) $x < 3$

4 Subtracting 2x from both sides gives $5 = 7$, which is false, so no value of x works ($2x + 5$ is always 2 less than $2x + 7$)

GREATER DEPTH

1 a) sometimes ($3x = x + 4$ has one; $x + 1 = x + 2$ has none; $2(x + 1) = 2x + 2$ has infinitely many) · b) always · c) always

2 a) $2(3x - 1) + 8 = 4(x + 5)$: $6x + 6 = 4x + 20$, $x = 7$ · b) 48 cm

3 a) $5x + 3 = 2x + 27$, $x = 8$: each has £43 · b) $5x + 3 > 2x + 27$: $x > 8$

4 a) $x = 18$ · b) $8 < 0.8x$, $x > 10$ · c) $3x - 3 = 5x - 11$, $x = 4$