### Q Big idea Tino Rangatiratanga - the self-determination principle

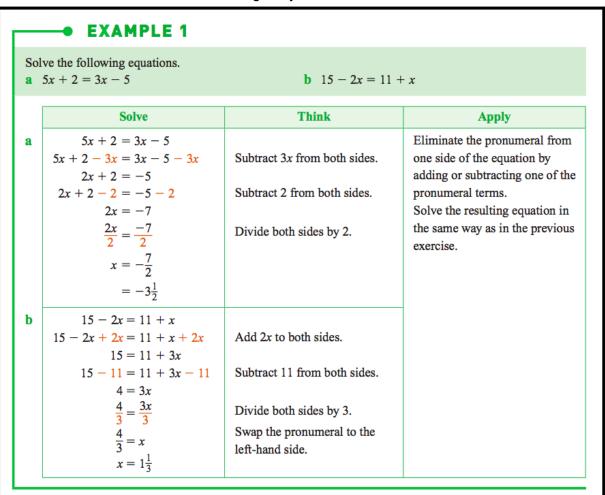
#### DO Now

View the video

**WALT** - solve equations with pronumerals (Variables) on both sides **Success Criteria**:

I know when solving equations with pronumerals on both sides. I have to transfer pronumerals from both sides to one side.

I know I need to isolate the variables to get my answer.



Solve the equation with the unknown on both sides

### **Practice**

Use the link for extra practice

1 Solve the following equations with integer solutions.

a 
$$5x + 2 = 2x + 14$$

c 
$$5 + x = 8 - 2x$$

**e** 
$$3 - x = x + 7$$

$$2x - 3 = x + 6$$

i 
$$3x - 5 = 7 - x$$

**b** 3x + 7 = 11 - x

**d** 
$$3x - 4 = 5x - 2$$

$$f 4 - 2x = 3 - x$$

**h** 
$$5x - 9 = 1 + 6x$$

2 Solve the following equations.

a 
$$8x + 7 = 4x - 2$$

c 
$$5 + 2x = 11 - x$$

$$e 3 + x = 17 + 4x$$

$$\mathbf{g} \ 2x + 5 = 9 - 2x$$

i 
$$5 - 7x = 3x + 2$$

$$k 4 - 3s = 2s + 17$$

$$m 11a - 7 = 5a + 12$$

$$7p = 15 - 3p$$

**b** 
$$7x + 3 = 2x + 7$$

**d** 
$$x - 3 = 5x + 7$$

$$f 15 - 3x = 2 - x$$

h 
$$3x - 5 = 5x = 9$$

$$j$$
 5a + 3 =  $a$  - 1

$$1 9x - 4 = 3 + 4x$$

$$\mathbf{n} \ 3y - 5 = -14 - 2y$$

### **EXAMPLE 2**

By substituting, check the solutions to the following equations.

**a** 
$$2x - 5 = 10 - 3x$$
  $(x = 3)$ 

**b** 
$$5x + 2 = 2x - 7$$
  $(x = 2)$ 

	Solve	Think	Apply
a	Does $2x - 5 = 10 - 3x$ when $x = 3$ ? LHS: $2 \times 3 - 5 = 1$ RHS: $10 - 3 \times 3 = 1$ LHS = RHS $\therefore x = 3$ is the solution.	Substitute 3 for $x$ on both sides of the equation. Left-hand side = 1 Right-hand side = 1 x = 3 is a solution.	Substitute the value of $x$ and evaluate both sides of the equation. Both sides must give the same value for that value of $x$ to be a solution.  The actual value of the sides is not relevant.
b	Does $5x + 2 = 2x - 7$ when $x = 2$ ? LHS: $5 \times 2 + 2 = 12$ RHS: $2 \times 2 - 7 = -3$ $12 \neq -3$ $\therefore x = 2$ is not the solution.	Substitute 2 for $x$ on both sides of the equation.  Left-hand side = 12  Right-hand side = $-3$ This is not a solution.	

3 By substituting, check the solutions to the following equations.

$$3x + 9 = 4 + 2x$$

$$(x = 1)$$

**b** 
$$9a + 2 = 7a - 4$$

$$(a = -3)$$

c 
$$7a - 5 = 3 - a$$

$$(a = 2)$$

**d** 
$$15 - 2x = 6 + x$$

$$(x = 3)$$

e 
$$2x - 3 = 7 - 4x$$

$$(x = \frac{5}{3})$$

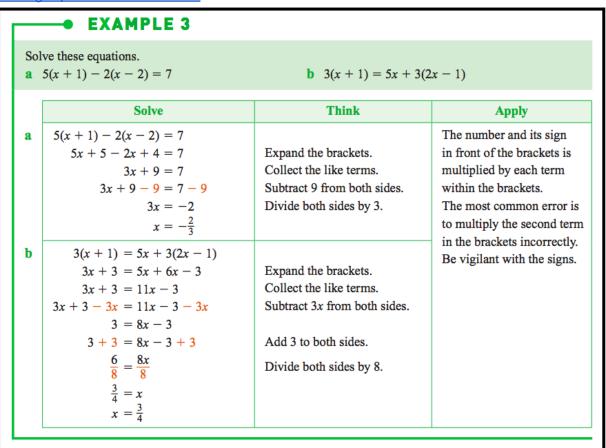
$$\mathbf{f} \quad 5x - 7 = 3 + x$$

$$(x=3\frac{1}{2})$$

## **Extension Activity**

# involves expanding brackets and collecting like terms

Solving equations with brackets



- 4 Solve for x in these equations given that all answers are integers.
  - **a** 3(x+1) 2(x-4) = 13
  - 4(x-5)+5(x+1)=12
  - e 4(x-2) = 3x + 4(x-2)
  - $\mathbf{g} \ 4 x = 2 3(x + 2)$

- - **b** 2(x-5)+3(x+2)=-9**d** 2(x-1) = 3(x+5) - 22
  - $\mathbf{f}$  2(x 1) = 4(2x + 1) 9x
  - **h** 6-2(x+5)=2(2x-1)-5x

- 5 Solve for x in each equation.
  - 2(x+1)-1=8
  - (x+2)-7=11
  - e 4(2x-1)+7=0
  - $\mathbf{g} \ 3 2(x+1) = -4$
  - i 5x 4(4 x) = x + 1
  - $k \ 2(x-1) = 1 (3-x)$

- **b** 5(1-3x)=-4
- **d** 2(x+1)+3(x-1)=6
- $\mathbf{f}$  11 2(x 1) = 7
- **h** 7 (2 x) = 2x
- $\mathbf{j} \quad 3 x = 5 2(x+1)$
- 1 x + 7(4 x) = 2x + 3(x 1)

#### EXAMPLE 4

If y = 3 - 5(x + 4), find x when y = -32.

Solve	Think	Apply
y = 3 - 5(x + 4) $-32 = 3 - 5(x + 4)$ $= 3 - 5x - 20$ $-32 = -17 - 5x$ $-32 + 17 = -17 - 5x + 17$ $-15 = -5x$	Substitute $y = -32$ . Expand. Collect like terms. Add 17 to both sides.	Substitute the value, simplify both sides if possible, then solve the equation. The pronumeral is often on the right-hand side of the equation.
$\frac{-15}{-5} = \frac{-5x}{-5}$ $3 = x$ $x = 3$	Divide both sides by $-5$ .	-

- 6 a Given that y = 7 3(x + 2), find x when y = -5.
  - **b** Given that y = 5 4(x 3), find x when y = 37.
  - c Given that y = 4 5(2x 5), find x when y = 12.
  - d Given that y = 14 3(2x 8), find x when y = 0.
  - e Given that y = 3x 2(5x + 1), find x when y = -16.
  - f Given that y = 4x 3(5 2x), find x when y = 8.
  - g Given that y = 3(2x 1) 4(x + 2), find x when y = -3.
  - h Given that y = 4(1 3x) 2(1 x), find x when y = 2.

## Check your answers

```
b x = 1

e x = -2

f x = 1

i x = 3
1 a x = 4
                x = -2
h x = -10
   d x = -1
   g \ x = 9
2 a x = -\frac{9}{4} b x = \frac{4}{5}
                                        c x = 2
 d x = -\frac{5}{2} e x = -\frac{14}{3} f x = \frac{13}{2}
            h x = -7 i x = \frac{3}{10}
 \mathbf{g} \ x = 1
  y = -\frac{9}{5} o p = \frac{3}{2}
 m x = \frac{19}{6}
3 a No
                   b Yes
                                      c No
d Yes e Yes f No

4 a x = 2 b x = -1 c x = 3
d x = 5 e x = 0 f x = 2

5 a x = \frac{7}{2} b x = \frac{3}{5} c x = 4
  d x = \frac{7}{5} e x = -\frac{3}{8} f x = 3
  g x = \frac{5}{2} h x = 5 i x = \frac{17}{8}
            \mathbf{j} x = \mathbf{0}
            b x = -5 c x = \frac{17}{10}
6 a x = 2
                              f x = \frac{23}{10}
   d x = \frac{19}{3} e x = 2
                     \mathbf{h} x = 0
   g \ x = 4
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