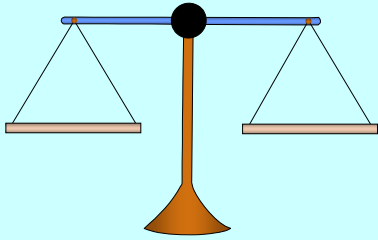


## Solving equations

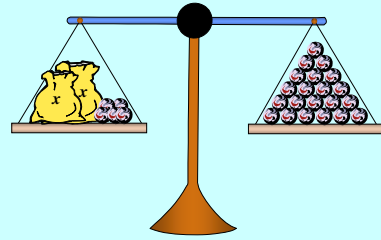
### The balancing method



An **equation** means that **two things** are equal.  
If the scales balance, then the value of each side must be equal.

Two bags of  $x$  marbles plus five extra marbles equals 21 marbles.

If we remove a marble from one side, we must remove a marble from the other side so that the scales still balance.

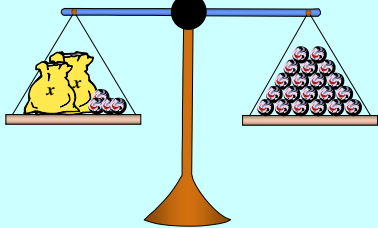


$$2x + 5 = 21$$

$$2x + 4 = 20$$

The scales now show that two bags of  $x$  marbles plus **four** extra marbles equals **20** marbles.

We can continue to remove marbles, as long as we do the same thing to each side.

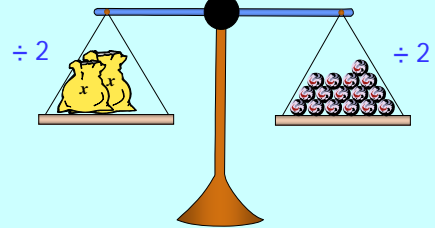


$$2x + 5 = 21$$

$$2x + 0 = 16$$

The scales now show that two bags of  $x$  marbles equals **16** marbles.

We can't remove any more marbles, but we can halve the values on each side.



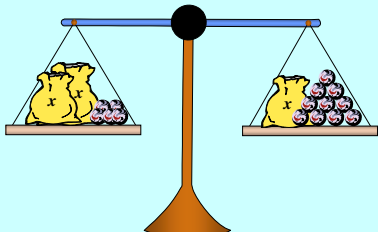
$$2x + 5 = 21$$

$$2x = 16$$

$$x = 8$$

Try another one:

Two bags of  $x$  marbles plus five extra marbles equals one bag of  $x$  marbles plus ten extra marbles.



$$2x + 5 = x + 10$$

$$2x = x + 5$$

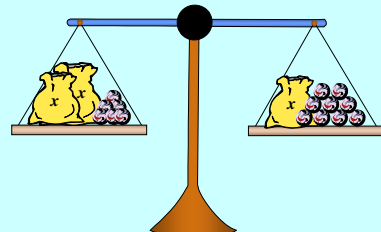
$$x = 5$$

Remove 5 marbles.

Remove a bag of marbles.

Try another one:

Two bags of  $x$  marbles plus six extra marbles equals one bag of  $x$  marbles plus nine extra marbles.



$$2x + 6 = x + 9$$

$$2x = x + 3$$

$$x = 3$$

Remove 6 marbles.

Remove a bag of marbles.

When solving equations, try to imagine the scales.

To make sure the equation balances ...

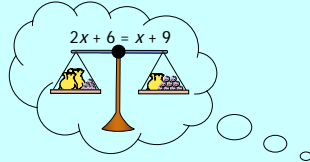
**Whatever we do to one side of the equation we **must do** to the other.**

Example 1:

$$\begin{aligned} 2x + 6 &= x + 9 \\ 2x &= x + 3 & -6 \\ x &= 3 & -x \end{aligned}$$

---


$$\begin{aligned} 2x + 6 &= x + 9 \\ x + 6 &= 9 & -x \\ x &= 3 & -6 \end{aligned}$$



Does it matter if you subtracted the  $x$  or the number first?

When solving equations, try to imagine the scales.

To make sure the equation balances ...

**Whatever we do to one side of the equation we **must do** to the other.**

Example 2:

$$\begin{aligned} 8x - 5 &= 11 \\ 8x &= 16 & +5 \\ x &= 2 & \div 8 \end{aligned}$$

Example 4:

$$\begin{aligned} 3x - 5 &= x + 11 \\ 3x &= x + 16 & +5 \\ 2x &= 16 & -x \\ x &= 8 & \div 2 \end{aligned}$$

Example 3:

$$\begin{aligned} 5p - 17 &= -2 \\ 5p &= 15 & +17 \\ p &= 3 & \div 5 \end{aligned}$$

Example 5:

$$\begin{aligned} 7q + 6 &= 3q + 10 \\ 7q &= 3q + 16 & +6 \\ 4q &= 16 & -3q \\ q &= 4 & \div 4 \end{aligned}$$

When solving equations, try to imagine the scales.

To make sure the equation balances ...

**Whatever we do to one side of the equation we **must do** to the other.**

Solve the following equations:

- a)  $3x + 8 = 20$   $x = 4$
- b)  $7x - 9 = 26$   $x = 5$
- c)  $5x - 40 = -5$   $x = 7$
- d)  $3x + 7 = x + 11$   $x = 2$
- e)  $6x + 5 = 4x + 10$   $x = 2.5$
- f)  $5p - 3 = 2p + 9$   $p = 4$
- g)  $4y - 7 = 2y - 9$   $y = -1$