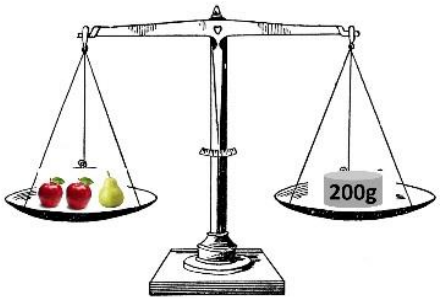
Equality, balancing scales and equivalent equations

An **equation** says that a pair of quantities are equal. It helps to think of a weighing scales in balance and of both sides of the equations 'weighing' the same amount.

$2 + 7 = 5 + 4$

Add 3 to **both sides**

Halve the amount on **both sides**

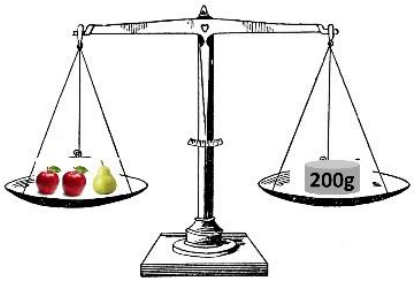


$2a + p = 200$

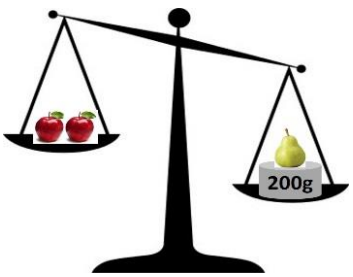
Double the amount (weight) on **both sides**

Add 50 to **both sides**

We must **preserve the equality** thus keep the scales in **balance** at all times. If we **do the same thing** (apply the same operation) **to both sides** of the equation we keep the scales in balance, and create another (equivalent) equation.



$2a + p = 200$



What happened here?!!

$2a = 200 + p$

Concept question 1.1

Can you explain why the scales are no longer balanced?

Key concept:

Concept question 1.2

Which of the following are equations?

Choose all the options that apply.

- ☐ x^2
- ☐ $x^2 = 2x$
- ☐ $x + 5$
- ☐ $x^2 - 5x + 6 = 0$
- ☐ $x = 2b$
- ☐ $T = 2\pi\sqrt{\frac{l}{g}}$

Concept question 1.3

If $3m = 5$ which of the following are true? Explain why.

Choose all the options that apply.

- ☐ $6m = 10$
- ☐ $3m - 2 = 3$
- ☐ $3m^2 = 25$
- ☐ $9m^2 = 25$
- ☐ $\sqrt{3m} = \sqrt{5}$
- ☐ $m = \frac{5}{3}$

Mathematical inverses: operations that **undo** each other

Operation	Inverse	Example
Adding		$a + 2 = b$
Subtracting		$a - 2 = b$
Multiplying		$5 \times a = b$
Dividing		$\frac{a}{4} = b$

× (-1)		$-a = b$
Squaring		$a^2 = b$
Square root		$\sqrt{a} = b$

Exercise 1.1 Transpose the formulae to make x the subject of the equation.

Equation	**Operation** What is being done to x?	**Inverse** operation	**Solution**
$2x = 3$	$\times 2$	$\div 2$	$x = \frac{3}{2}$
$x + 2 = 3$			
$x^2 = 9$			
$x^2 = 5$			
$x^2 - a = 5$			
$\frac{x}{6} = b$			
$\sqrt{x} = 3$			