

### Linear and Simultaneous equations

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**Substitution**  
The process of replacing a pronumeral with a given value  
e.g. if  $x = 3$ ,  $2x + 4 = 2 \times 3 + 4 = 6 + 4 = 10$   
e.g. if  $x = 2$ ,  $y = -4$ ,  $xy = 2 \times (-4) = -8$

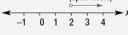
**Expanding brackets**  
e.g.  $2(x + 3) = 2 \times x + 2 \times 3 = 2x + 6$   
 $-3(4 - 2x) = -12 + 6x$

**Expressions**  
e.g.  $2x - 3y + 5$   
term  
coefficient  
constant  
e.g. 2 more than 3 lots of  $m$  is  $3m + 2$

**Addition/subtraction**  
Only like terms can be combined under addition or subtraction.  
Like terms: e.g.  $3a$  and  $7a$   
 $2ab$  and  $5ab$   
not  $4a$  and  $7ab$   
e.g.  $3x + 2y - x - 4y + 7 = 3x - x + 2y - 4y + 7 = 2x - 2y + 7$

**Solving linear equations**  
Finding the value that makes an equation true  
e.g.  $2x + 5 = 9$   
 $2x = 4$  (subtract 5)  
 $x = 2$  (divide by 2)  
e.g.  $5(7 - 3) = 2x + 7$   
 $5x - 5 = 2x + 7$  (expand)  
 $3x - 5 = 7$  (subtract  $2x$ )  
 $3x = 12$  (add 5)  
 $x = 4$  (divide by 3)

**Solving word problems**  
1 Define variable(s)  
2 Set up equation(s)  
3 Solve equation(s)  
4 Check each answer and write in words

**Inequalities**  
These can be represented using  $>$ ,  $<$ ,  $\geq$ ,  $\leq$  rather than  $=$ .  
e.g.  $x > 2$       2 not included (open circle)  


Solving inequalities uses the same steps as solving equations except when multiplying or dividing by a negative number. In this case, the inequality sign must be reversed.  
e.g.  $4 - 2x < 10$  ( $-4$ )  
 $-2x < 6$  ( $\div -2$ )  
 $x > -3$  (reverse sign)

**Formulas**  
Some common formulas  
e.g.  $A = \pi r^2$ ,  $C = 2\pi r$   
An unknown value can be found by substituting values for the other variables.  
A formula can be transposed to make a different variable the subject.  
e.g. make  $r$  the subject in  $A = \pi r^2$   
 $A = \pi r^2$   
 $\frac{A}{\pi} = r^2$   
 $\sqrt{\frac{A}{\pi}} = r$   
 $\therefore r = \sqrt{\frac{A}{\pi}}$  where  $r > 0$

**Simultaneous equations (Ext)**  
Use substitution or elimination to find the solution that satisfies two equations.

**Substitution**  
e.g.  $2x + y = 12$  [1]  
 $y = x + 3$  [2]  
In [1] replace  $y$  with [2]  
 $2x + (x + 3) = 12$   
 $3x + 3 = 12$   
 $x = 3$   
Substitute  $x = 3$  to find  $y$   
In [2]  $y = 3 + 3 = 6$

**Elimination**  
Ensure both equations have a matching pair.  
Add 2 equations if matching pair has different sign; subtract if same sign.  
e.g.  $x + 2y = 2$  [1]  
 $2x + 3y = 5$  [2]  
[1]  $\times 2$      $2x + 4y = 4$  [3]  
[3] - [2]     $y = -1$   
In [1]  $x + 2(-1) = 2$   
 $x - 2 = 2$   
 $\therefore x = 4$

