# Y10 Maths Knowledge Organiser Foundation Tier: Expressions and Formulae

## What must I be able to do?

**New content:**

- Expand a double bracket (two binomials) to give a quadratic expression
  - Sparx U768
- Factorise a quadratic expression into two linear brackets
  - Sparx U178, U858, U963

## Key vocabulary

| | |
|---|---|
| **Binomial** | An algebraic expression with just 2 terms e.g. $3x + 4$ |
| **Quadratic** | An algebraic expression where the highest power is 2 e.g. $x^2 + 3x$ |

## Expanding a linear bracket

Multiply all terms inside the bracket by the term in front of the bracket being careful with any negative numbers

e.g. $4(3a - 6) = 12a - 24$

as $4 \times 3a = 12a$ and $4 \times -6 = -24$

## Substitution

Replace letters with their known values and then work out the answer

e.g. Given that $a = 4$, $b = 5$, $c = -6$

then $a + b = 4 + 5 = 9$ and

$ac + 2b = 4 \times -6 + 2 \times 5 = -24 + 10 = -14$ BIDMAS!

Remember that 2 terms with no sign between mean that you multiply them so $2b$ means $2 \times b$ and $ac$ means $a \times c$

## Identify equations, expressions, formulae and identities

Collection of terms with no equals sign

More than one variable and an equals sign

| | Expression | Equation | Formula | Identity |
|---|---|---|---|---|
| $3x + 4$ | ✓ | | | |
| $3x + 4 = 12$ | | ✓ | | |
| $P = 4x$ | | | ✓ | |
| $3x + 12 \equiv 3(x + 4)$ | | | | ✓ |

Has an equals sign and only one unknown. Can be solved.

Has the 3 lines ≡ in the middle instead of an =

## Factorising linear expressions

Factorising is the opposite of expanding a bracket. Find the largest common factors of all terms and divide by these. The factors are put in front of the bracket.

e.g. $12x + 4 = 4(3x + 1)$

$25y + 15 = 5(5y + 3)$

$18a^2 - 4a = 2a(9a - 2)$

## Expanding a double bracket

### Method 1 – "smiley face"

Draw loops between each pair and multiply the two values at the end of the loops together

$(2x + 4)(3x + 5)$

$2x \times 3x = 6x^2$

$4 \times 3x = 12x$

$2x \times 5 = 10x$

$12x + 10x = 22x$

$4 \times 5 = 20$

So $6x^2 + 22x + 20$

### Method 2 – Separate the brackets

In this method we split the pair of brackets back into single ones

$(2x + 4)(3x + 5)$

$= 2x(3x + 5) + 4(3x + 5)$

$= 6x^2 + 10x + 12x + 20$

$= 6x^2 + 22x + 20$

### Method 3 - Grid

Set the expansion out as a multiplication grid

$(2x + 4)(3x + 5)$

| | $3x$ | $+5$ |
|---|---|---|
| $2x$ | $6x^2$ | $10x$ |
| $+4$ | $12x$ | $20$ |

So $6x^2 + 22x + 20$

## Changing the subject of a formula

This follows the same rules as when solving equations. Always do the inverse (opposite) to leave the subject on its own.

e.g. make $u$ the subject of the formula

$y = 2u + 3p$

$-3p$ ↓ ↓ $-3p$

$y - 3p = 2u$

$\div 2$ ↓ ↓ $\div 2$

$\frac{y - 3p}{2} = u$

e.g. make $c$ the subject of the formula

$m = 5(c - 1)$

There are 2 options here:

Method 1: expand the bracket first

$m = 5(c - 1)$

expand ↓ ↓ expand

$m = 5c - 5$

$+5$ ↓ ↓ $+5$

$m + 5 = 5c$

$\div 5$ ↓ ↓ $\div 5$

$\frac{m + 5}{5} = c$

Method 2: divide by the coefficient first

$m = 5(c - 1)$

$\div 5$ ↓ ↓ $\div 5$

$\frac{m}{5} = c - 1$

$+1$ ↓ ↓ $+1$

$\frac{m}{5} + 1 = c$

Tip – examiners tell schools that method 1 usually has a higher success rate in an exam than method 2 does!

GLUE HERE