Your notes

GCSE Maths: revision notes

Expanding brackets and factorising

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Expanding single brackets

- Multiply everything inside the bracket by the term outside: $3(x + 4) = 3x + 12$.
- Watch the signs: $-2(x - 5) = -2x + 10$.
- **Expand** and simplify: $2(x + 3) + 3(x - 1) = 2x + 6 + 3x - 3 = 5x + 3$.

Expanding double brackets

- Multiply every term in the first bracket by every term in the second (FOIL or a grid): $(x + 2)(x + 3) = x^2 + 3x + 2x + 6 = x^2 + 5x + 6$.
- Squared brackets: $(x - 4)^2 = (x - 4)(x - 4) = x^2 - 8x + 16$, not $x^2 + 16$.
- $(x + 5)(x - 5) = x^2 - 25$: the middle terms cancel.

Factorising

- Factorising is the reverse of expanding. Take out the **highest common factor**: $6x + 9 = 3(2x + 3)$; $4x^2 + 8x = 4x(x + 2)$.
- '**Factorise** fully' means take out every common factor.

Factorising quadratics

- For $x^2 + bx + c$, find two numbers that multiply to c and add to b: $x^2 + 7x + 12 = (x + 3)(x + 4)$.
- Signs: $x^2 - x - 6 = (x - 3)(x + 2)$, because $-3 \times 2 = -6$ and $-3 + 2 = -1$.
- **Difference of two squares**: $x^2 - 9 = (x + 3)(x - 3)$.
- (Higher) For $ax^2 + bx + c$, find two numbers that multiply to ac and add to b, then split the middle term: $2x^2 + 7x + 3 = (2x + 1)(x + 3)$.

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Algebraic fractions (Higher)

- Simplify by factorising the top and the bottom, then cancelling common factors: $(x^2 - 9)/(x + 3) = (x + 3)(x - 3)/(x + 3) = x - 3$.
- Add or subtract using a common denominator: $1/x + 2/(x + 1) = (x + 1 + 2x)/(x(x + 1)) = (3x + 1)/(x(x + 1))$.
- Multiply and divide like number fractions: to divide, multiply by the reciprocal of the second fraction. **Factorise** first so you can cancel.
- To solve an equation with **algebraic fractions**, multiply every term by the common denominator: $3/(x - 1) = 2 \rightarrow 3 = 2(x - 1) \rightarrow x = 2.5$.

Worked examples

Expand and simplify (x + 3)(x – 5)

Multiply each term in the first bracket by each term in the second. **$x^2 - 5x + 3x - 15$**

Collect the x terms. **$x^2 - 2x - 15$**

Answer: $x^2 - 2x - 15$

Factorise $x^2 - 7x + 12$

Find two numbers that multiply to +12 and add to –7. **–3 and –4**

Write the brackets. **(x – 3)(x – 4)**

Check by expanding: $x^2 - 4x - 3x + 12$. **$x^2 - 7x + 12$ ✓**

Answer: (x – 3)(x – 4)

Factorise fully $6x^2 + 9x$

Find the highest common factor of $6x^2$ and 9x. **3x**

Divide each term by 3x to find what goes in the bracket. **$6x^2 \div 3x = 2x$, $9x \div 3x = 3$**

Answer: 3x(2x + 3)

Key terms

Expand	Multiply out brackets.
Factorise	Put an expression into brackets by taking out common factors.
Highest common factor	The largest factor shared by all the terms.
Quadratic expression	An expression where the highest power of x is 2.
Difference of two squares	An expression of the form $a^2 - b^2$, which factorises to (a + b)(a – b).
Algebraic fraction	A fraction with algebraic expressions on the top, the bottom or both.

Your notes

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. Expand $3(x + 4)$.
2. Expand $-2(x - 5)$.
3. Expand $(x + 2)(x + 3)$.
4. Expand $(x - 4)^2$.
5. Factorise $6x + 9$.
6. Factorise $4x^2 + 8x$ fully.
7. Factorise $x^2 + 7x + 12$.
8. Factorise $x^2 - 9$.

Answers

1. $3x + 12$
2. $-2x + 10$
3. $x^2 + 5x + 6$
4. $x^2 - 8x + 16$
5. $3(2x + 3)$
6. $4x(x + 2)$
7. $(x + 3)(x + 4)$
8. $(x + 3)(x - 3)$

What to do next

Practise 15 questions on this topic

Try 8 exam questions, with mark schemes

Read the lesson, one step at a time

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