

Exercise walk-through

2.1

Expanding, factorising and algebraic fractions

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1. Unit 3.2 at a glance

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Core A1-A26: notation through graphs, equations, inequalities and sequences.

Extension additions: subject-twice rearrangement, triple expansions, all quadratic factorising, fractional powers, quadratic fractions, formal proof, the full functions toolkit, line equations, exponential and trig graphs, differentiation with tangents and stationary points, completing the square, variation, all simultaneity, quadratic inequalities, quadratic sequences.

Must-know: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$; $a(x + b)^2 + c$ reads the turning point; $y - y_1 = m(x - x_1)$; $\frac{d}{dx}(kx^n) = knx^{(n-1)}$; the tangent's gradient IS the gradient at the point.

3. Expanding, factorising, fractions

Expanding, factorising, fractions

$(x + 2)(x - 3)(x + 1) = x^3 - 7x - 6$ (two first, then the third). $2x^2 - 7x - 15 = (2x + 3)(x - 5)$; $9x^2 - 25 = (3x - 5)(3x + 5)$.

Quadratic fractions (Extension): factor everything, cancel whole factors - the 2E specimen answers $(11m - 14)/(m^2 - 3m - 4)$ and $(2x + 3)/(x + 4)$ come from this machinery.

Check yourself

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Substitution and subject-twice rearrangement; triple expansions; all factorising; quadratic fractions; formal proof. Functions with domain, range, composite and inverse.

Line equations; curve families sketched; completing the square; differentiation with tangents and stationary points; all solving routes and inequality types; linear and quadratic n th terms.

Exercises 2.1·2.3

2.1 Expand and simplify $(x + 2)(x - 3)(x + 1)$ [3]

2.2 Factorise $2x^2 - 7x - 15$ [2]

2.3 Factorise $9x^2 - 25$ [2]

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2.3 Factorise $9x^2 - 25$ [2]

2.3 $(3x - 5)(3x + 5).$

Exercises 2.4·3.1

2.4 Simplify $\frac{x^2 - 9}{x^2 + 7x + 12}$ [3]

2.5 Express $\frac{3}{x+1} + \frac{2}{x-2}$ as a single fraction [3]

3.1 (*Original, 2E fraction family.*) Simplify fully $\frac{2m^2 - 5m - 3}{m^2 - 3m - 4} \times \frac{m^2 - 2m - 8}{2m^2 + 5m + 2}$ [5]

Exercises 2.4·3.1

2.4 Simplify $\frac{x^2 - 9}{x^2 + 7x + 12}$ [3]

2.4 $\frac{(x - 3)(x + 3)}{(x + 3)(x + 4)} = \frac{x - 3}{x + 4}.$

2.5 Express $\frac{3}{x + 1} + \frac{2}{x - 2}$ as a single fraction [3]

2.5 $\frac{3(x - 2) + 2(x + 1)}{(x + 1)(x - 2)} = \frac{5x - 4}{(x + 1)(x - 2)}.$

3.1 (*Original, 2E fraction family.*) Simplify fully $\frac{2m^2 - 5m - 3}{m^2 - 3m - 4} \times \frac{m^2 - 2m - 8}{2m^2 + 5m + 2}$ [5]

3.1 Factor everything: $\frac{(2m + 1)(m - 3)}{(m - 4)(m + 1)} \times \frac{(m - 4)(m + 2)}{(2m + 1)(m + 2)} = \frac{m - 3}{m + 1}.$

Exercises 3.2·3.3

3.2 (*Original.*) Make a the subject of $ax + 3 = 5xt - 2a$ (subject twice). [4]

3.3 (*Original, specification line not sampled: fractional powers.*) Simplify $\frac{8c^5}{3d^3} \div \frac{2c^2}{d}$, giving the answer in index form. [3]

Exercises 3.2·3.3

3.2 (*Original.*) Make a the subject of $ax + 3 = 5xt - 2a$ (subject twice). [4]

3.2 $ax + 2a = 5xt - 3$, so $a(x + 2) = 5xt - 3$ and $a = \frac{5xt - 3}{x + 2}$.

3.3 (*Original, specification line not sampled: fractional powers.*) Simplify $\frac{8c^5}{3d^3} \div \frac{2c^2}{d}$, giving the answer in index form. [3]

3.3 $\frac{8c^5}{3d^3} \times \frac{d}{2c^2} = \frac{4c^3}{3d^2}$.

Local review guidance: every quadratic factored before cancelling; single simplest fractions; subject-twice answers collect before factorising. This is authored classroom guidance.