

Exercise walk-through

E2.2

Algebraic manipulation

IGCSE Mathematics

You must be able to

- expand single and double brackets
- factorise by taking out a common factor
- factorise a difference of two squares and a quadratic

1

The method

Method — Expand and factorise

- **Expand:** $(2x + 1)(x - 4) = 2x^2 - 7x - 4$.
- **Common factor:** $9x^2 + 15xy = 3x(3x + 5y)$.
- **Difference of two squares** : $9x^2 - 16 = (3x + 4)(3x - 4)$.
- **Quadratic:** $2x^2 + 7x + 3 = (x + 3)(2x + 1)$ (split the middle term).

Answer shapes: **M1** a correct method, **A1** the correct answer.

Exercises 2.1·2.3

2.1 Expand $3x(2x - 5)$. [1]

2.2 Factorise $6a + 9ab$. [1]

2.3 Expand and simplify $(x + 2)(x - 5)$. [2]

Exercises 2.1·2.3

2.1 Expand $3x(2x - 5)$. [1]

2.1

- $3x(2x - 5) = \mathbf{6x^2 - 15x}$

2.2 Factorise $6a + 9ab$. [1]

2.2

- $6a + 9ab = \mathbf{3a(2 + 3b)}$

2.3 Expand and simplify $(x + 2)(x - 5)$. [2]

2.3

- $x^2 - 5x + 2x - 10$
- $\mathbf{x^2 - 3x - 10}$

Exercises 2.4·3.1

2.4 Factorise fully $12x^2 - 27$.

[2]

2.5 Factorise $ab + 4a + 3b + 12$.

[2]

3.1 Factorise $x^2 - 49$.

[1]

Exercises 2.4·3.1

2.4 Factorise fully $12x^2 - 27$.

[2]

2.4

- common factor 3: $3(4x^2 - 9)$
 - difference of two squares: **$3(2x + 3)(2x - 3)$**
-

2.5 Factorise $ab + 4a + 3b + 12$.

[2]

2.5

- $a(b + 4) + 3(b + 4)$
 - **$(a + 3)(b + 4)$**
-

3.1 Factorise $x^2 - 49$.

[1]

3.1

- $x^2 - 49 = (x + 7)(x - 7)$

Exercises 3.2·3.3

3.2 Factorise $x^2 + 3x - 10$.

[2]

3.3 Factorise $2x^2 + 5x - 3$.

[2]

Exercises 3.2·3.3

3.2 Factorise $x^2 + 3x - 10$.

[2]

3.2

- two numbers multiplying to -10 and adding to 3 are 5 and -2
 - $(\mathbf{x + 5})(\mathbf{x - 2})$
-

3.3 Factorise $2x^2 + 5x - 3$.

[2]

3.3

- $a \times c = -6$, numbers 6 and -1
- $2x^2 + 6x - x - 3 = 2x(x + 3) - (x + 3) = (\mathbf{2x - 1})(\mathbf{x + 3})$

Exercise 3.4

3.4 (a) Factorise fully $18x^2 - 8$.

[3]

(b) Factorise $3x^2 - 11x + 6$.

[3]

(c) Simplify $\frac{x^2 - 9}{x^2 + x - 12}$, showing your factorising.

[3]

(d) Hence solve $\frac{x^2 - 9}{x^2 + x - 12} = 2$.

[3]

Exercise 3.4

3.4 (a) Factorise fully $18x^2 - 8$.

[3]

(b) Factorise $3x^2 - 11x + 6$.

[3]

(c) Simplify $\frac{x^2 - 9}{x^2 + x - 12}$, showing your factorising.

[3]

(d) Hence solve $\frac{x^2 - 9}{x^2 + x - 12} = 2$.

[3]

3.4

(a)

- common factor 2: $2(9x^2 - 4)$
- difference of two squares

Full solution on next slide

Full solution 3.4 (1/2)

3.4

(a)

- common factor 2: $2(9x^2 - 4)$
- difference of two squares
- **$2(3x + 2)(3x - 2)$**

(b)

- numbers multiplying to 18 and adding to -11 are -9 and -2
- $3x^2 - 9x - 2x + 6 = 3x(x - 3) - 2(x - 3)$

Full solution 3.4 (2/2)

- $(3x - 2)(x - 3)$

(c)

- numerator $= (x + 3)(x - 3)$
- denominator $= (x + 4)(x - 3)$
- cancel $(x - 3)$: $\frac{x + 3}{x + 4}$

(d)

- $\frac{x + 3}{x + 4} = 2$ so $x + 3 = 2(x + 4)$
- $x + 3 = 2x + 8$
- $x = -5$