

F Michaelmas Expanding & Factorising

You must always collect like terms when simplifying an expression. So, for example,

$$a^2b + b + 3a^2b = 4a^2b + b.$$

Get into the habit of ordering the letters alphabetically so that it is easier to see like terms

$$3a^2b + 2ba^2 - a^2b = 3a^2b + 2a^2b - a^2b = 4a^2b.$$

1. Expand the following and collect like terms:

- | | | | |
|---|----------------------------|---|--------------------------------|
| (a) $5(x - 2y) + 7(x + y)$. | $12x - 3y$ | (i) $y(7x - 2) + 5x(y - 2x) - 12xy$. | $-2y - 10x^2$ |
| (b) $x(x + 4) - 2(2x - 3)$. | $x^2 + 6$ | (j) $a^2b(b + 2) - 2ab(a + 1) - (ba)^2$. | $-2ab$ |
| (c) $a^2(a + b) - a(ab + b)$. | $a^3 - ab$ | (k) $ab - a(2b + c) + b(a + c)$. | $bc - ac$ |
| (d) $3x(x + 1) + x(2x - 1)$. | $x^2 + 2x$ | (l) $y^3(8y - 1) + y^2(7y^2 - 2y + 2)$. | |
| (e) $x(x^2 - 3x + 4) + x^2(3 - x)$. | $4x$ | | $15y^4 - 3y^3 + 2y^2$ |
| (f) $x(2x + 3) - (x^2 + 2) + x + 3$. | $x^2 + 4x + 1$ | (m) $2(x^3 - 3x^2 - x + 1) - x(2x^2 - 3x + 1) + 3x$. | |
| (g) $x(x^2 - 3x + 4) - 3(x - x^2) + x^3$. | $2x^3 + x$ | | $2 - 3x^2$ |
| (h) $2x^2(x^2 + 3x + y) + 3x(x - 2x^2 + 1)$. | $2x^4 + 2x^2y + 3x^2 + 3x$ | (n) $a(b^2 - 2b - 5) - b(a^2 - 8a - 2) + ab(2a + 7b)$. | $8ab^2 + a^2b + 6ab - 5a + 2b$ |

2. Factorise fully the following expressions:

- | | | | |
|-----------------------------|--------------------------|---|--------------------------|
| (a) $6x - 8$. | $2(3x - 4)$ | (h) $120l^3h - 100h^2l^4$. | <input type="checkbox"/> |
| (b) $10z^2 + 5z$. | $5z(2z + 1)$ | (i) $y(2x + 4y) - 6y$. | <input type="checkbox"/> |
| (c) $5x^2 - 20xy$. | <input type="checkbox"/> | (j) $8xy(x^2 + y^2) + 2x(yx^3 + y^3)$. | <input type="checkbox"/> |
| (d) $36x^3y + 30xy^2$. | <input type="checkbox"/> | (k) $30d^3e^4 - 15d^2e^3$. | <input type="checkbox"/> |
| (e) $8ab^2c - 16a^2b^2c$. | <input type="checkbox"/> | (l) $14b^3c + 28b^3c^2 + 7a^2b^3c$. | <input type="checkbox"/> |
| (f) $6d^3e - d^4e$. | <input type="checkbox"/> | (m) $6x^5y^2 - 8y^3x^3 - 10x^8y$. | <input type="checkbox"/> |
| (g) $\pi r^3 - 2\pi r^2h$. | <input type="checkbox"/> | (n) $5a^{20}b^{17} + 20a^{30}b^{14} - 15a^{20}b^{15}$. | <input type="checkbox"/> |

3. Expand the following brackets and collect like terms:

- | | | | |
|----------------------------|-------------------------|---|---------------------------|
| (a) $(x + 1)(x + 3)$. | $x^2 + 4x + 3$ | (i) $(x + 4)(x - 6) + x(2x + 1)$. | <input type="checkbox"/> |
| (b) $(2x + 3)(x + 5)$. | $2x^2 + 13x + 15$ | (j) $(x + 3)(2x + 3) - (2x + 7)(x - 1)$. | <input type="checkbox"/> |
| (c) $(3x + 1)(5x + 3)$. | $15x^2 + 14x + 3$ | (k) $x^2(x - 2)(3x + 1)$. | $3x^4 - 5x^3 - 2x^2$ |
| (d) $(x + y)(x - y)$. | $x^2 - y^2$ | (l) $(x + 1)(x + 4)(x + 3)$. | $x^3 + 8x^2 + 19x + 12$ |
| (e) $(2a + b)(a - 3b)$. | $2a^2 - 5ab - 3b^2$ | (m) $(2x - 1)(x + 5)(3x - 1)$. | $6x^3 + 25x^2 - 24x + 5$ |
| (f) $(4 - 3x)(3 - x)$. | $3x^2 - 13x + 12$ | (n) $(2x - 5)(x - 3)(3x - 4)$. | $6x^3 - 41x^2 + 89x - 60$ |
| (g) $4(x - 7)(2x + 3)$. | $8x^2 - 44x - 84$ | (o) $(x - 1)^2(x + 2)$. | $x^3 - 3x + 2$ |
| (h) $3x(2x - 5)(6x - 7)$. | $36x^3 - 132x^2 + 105x$ | (p) $(x - 2)^3$. | $x^3 - 6x^2 + 12x - 8$ |