

## 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) $(x - 2)^3$ .                         | $x^3 - 6x^2 + 12x - 8$    |