

## MATH141 - Worksheet FACTORISATION

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2) \quad a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

### 1. Factorise

For example  $2x^2 + 6x = 2x(x + 3)$

- |                         |                            |                           |                            |
|-------------------------|----------------------------|---------------------------|----------------------------|
| (a) $a^x + ay$          | (b) $7m + 7n$              | (c) $4x + 8$              | (d) $6a - 18b$             |
| (e) $3x^2 + x$          | (f) $a^x - x^2$            | (g) $16m^2 + 12m$         | (h) $15x^2 + 30x$          |
| (i) $7ab + 4bc$         | (j) $3x^2 - 3xy$           | (k) $5a^3 - 25a^2b$       | (l) $ax + ay + az$         |
| (m) $4xa^3 + 5x^2 - 2x$ | (n) $at^2 + 2at + 5t$      | (o) $15x^2 + 5xy - 25x$   | (p) $7ab - 7bc + 21b$      |
| (q) $5x^2 + x(y + z)$   | (r) $8m^2n + 6mn^2 + 10mn$ | (s) $m(x + y) + n(x + y)$ | (t) $(a + b)^2 + x(a + b)$ |

### 2. Factorise

For example  $am - an + bn - bm = a(m - n) + b(n - m) = a(m - n) - b(m - n) = (m - n)(a - b)$

- |                                   |                           |                             |                               |
|-----------------------------------|---------------------------|-----------------------------|-------------------------------|
| (a) $ab + ac + bd + cd$           | (b) $5x + 5y + ax + ay$   | (c) $ab + 3bc + 4a + 12c$   | (d) $2xy - y + 2xz - z$       |
| (e) $3ab - 3ac + 7b - 7c$         | (f) $x^3 - 3x^2 + 2x - 6$ | (g) $8b - 80c - b^2 + 10bc$ | (h) $3x^2 - 9xy - xy + 3y^2$  |
| (i) $x(a - b) + y(b - a)$         | (j) $4a - 4b + ay - yb$   | (k) $y^3 - 3y^2 - y + 3$    | (l) $a^2(a + 2b) - b(a + 2b)$ |
| (m) $2a^3 - a^2 - 10a + 5$        | (n) $xy + y^2 - x - y$    | (o) $4 - 4x + cx - c$       |                               |
| (p) $ax + bx + ay + by + az + bz$ |                           |                             |                               |

Difference of squares:  $a^2 - b^2 = (a + b)(a - b)$

### 3. Factorise

For example  $9x^2 - 16 = (3x)^2 - 4^2 = (3x - 4)(3x + 4)$

- |                      |                       |                          |                             |
|----------------------|-----------------------|--------------------------|-----------------------------|
| (a) $a^2 - b^2$      | (b) $y^2 - 16$        | (c) $9 - 4b^2$           | (d) $64 - 36m^2$            |
| (e) $m^2 - 49$       | (f) $x^2 - 1$         | (g) $16x^2 - 25$         | (h) $4x^2 - 9y^2$           |
| (i) $a^2 - 81b^2$    | (j) $25x^2 - 100$     | (k) $1 - 64m^2$          | (l) $a^2 - b^2c^2$          |
| (m) $m^2n^2 - 16k^2$ | (n) $1 - 36a^2b^2$    | (o) $49x^2 - 64y^2z^2$   | (p) $x^4 - 100$             |
| (q) $x^4 - y^4$      | (r) $(x + a)^2 - b^2$ | (s) $(x + 2y)^2 - 16z^2$ | (t) $(y + 4)^2 - (y - 2)^2$ |

$$x^2 + 2xy + y^2 = (x + y)^2 \quad x^2 - 2xy + y^2 = (x - y)^2$$

$$x^2 + (m + n)x + mn = (x + m)(x + n)$$

### 4. Factorise

For example  $x^2 - 4x + 3 = (x - 3)(x - 1)$

- |                      |                      |                       |                      |
|----------------------|----------------------|-----------------------|----------------------|
| (a) $x^2 + 7x + 6$   | (b) $x^2 + 3x + 2$   | (c) $x^2 + 13x + 42$  | (d) $x^2 + 14x + 40$ |
| (e) $x^2 - 10x + 24$ | (f) $x^2 - 12x + 36$ | (g) $x^2 - 10x + 25$  | (h) $x^2 + 2x + 1$   |
| (i) $x^2 - 4x + 4$   | (j) $x^2 - 12x + 35$ | (k) $x^2 - 29x + 100$ | (l) $x^2 - 2x - 35$  |
| (m) $x^2 - 14x - 15$ | (n) $x^2 - x - 42$   | (o) $x^2 - x - 110$   | (p) $x^2 + 4x - 77$  |

### 5. Factorise

For example  $2x^2 - 5x - 12 = (2x + 3)(x - 4)$

- |                       |                       |                           |                          |
|-----------------------|-----------------------|---------------------------|--------------------------|
| (a) $3x^2 + 5x + 2$   | (b) $2x^2 + 5x + 2$   | (c) $2x^2 + 7x + 3$       | (d) $6x^2 + 23x + 7$     |
| (e) $2x^2 - 11x + 12$ | (f) $9x^2 - 39x + 30$ | (g) $5x^2 - 16x + 3$      | (h) $2x^2 - x - 1$       |
| (i) $2x^2 + 5x - 12$  | (j) $3x^2 + 19x - 14$ | (k) $2x^2 + 3x - 2$       | (l) $5x^2 - 33x + 18$    |
| (m) $3x^2 + 7x - 6$   | (n) $2x^2 + 15x - 8$  | (o) $9x^2 + 24x + 16$     | (p) $12x^2 + 7x - 12$    |
| (q) $3x^2 - 13x + 14$ | (r) $3x^2 - 10x + 8$  | (s) $4x^2 + 16xy + 15y^2$ | (t) $5x^2 - 33x + 18$    |
| (u) $12 - 7x - 10x^2$ | (v) $4 - 3x - x^2$    | (w) $26x^2 - 41x + 3$     | (x) $5x^2 - 34xy - 7y^2$ |

### 6. Factorise

For example  $x^3 + 64 = x^3 + 4^3 = (x + 4)(x^2 - 4x + 16)$

- |                  |                       |                              |                             |
|------------------|-----------------------|------------------------------|-----------------------------|
| (a) $x^3 + 27$   | (b) $a^3 - 64$        | (c) $t^3 - 1$                | (d) $x^3 + 125$             |
| (e) $y^3 - 1000$ | (f) $m^3 + 1$         | (g) $8a^3 + 1$               | (h) $8x^3 + 27$             |
| (i) $27a^3 - 1$  | (j) $8x^3 - 125$      | (k) $(2x + 3)^3 - (x - 4)^3$ | (l) $(x + 5)^3 + (x - 2)^3$ |
| (m) $b^6 - a^6$  | (n) $p^7x^4 - p^4x^7$ | (o) $8 - (2 - x)^3$          | (p) $2(x - y)^3 + 54$       |

### 7. Factorise completely

- |                                     |                            |                          |                          |
|-------------------------------------|----------------------------|--------------------------|--------------------------|
| (a) $x^2 - 3x$                      | (b) $3x^2 + 9x$            | (c) $x^2 - 9$            | (d) $3x^2y - 12y^3$      |
| (e) $1 - (b - c)^2$                 | (f) $(a + b)^2 - b^2$      | (g) $a^2 - a - 42$       | (h) $2x^3 + 14x^2 - 14x$ |
| (i) $(x + 27)^2 - 4$                | (j) $a^3 - 1$              | (k) $x^2 - 36y^2$        | (l) $x^2 + x - 12$       |
| (m) $4x^2 - 28x - 480$              | (n) $6y^3 + 3y^2 - 3y$     | (o) $15a^2x - 125x$      | (p) $5t^3 + 5t^2 - 360$  |
| (q) $x^2 - 12xy + 20y^2$            | (r) $mx^2 - xy + ty - mlx$ | (s) $x^2 - 36y^2$        |                          |
| (t) $(x + 3y)(x - 3y) - 3z(x + 3y)$ |                            | (u) $6x^3 - 34x^2 - 56x$ | (v) $x^2 - 10x - 144$    |
| (w) $p^3 + 125$                     | (x) $(x + h)^3 + 1$        |                          |                          |