

## MHF4U: Factoring a Sum or Difference of Cubes

Sum of Cubes:  $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$

Difference of Cubes:  $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$

“SOAP”: Same Sign-Opposite Sign-Always Positive

1. Factor fully.

(a)  $x^3 + 64$

(b)  $a^3 + 27$

(c)  $n^3 + 1000$

(d)  $8j^3 + k^3$

(e)  $125p^3 + 8q^3$

(f)  $u^6 + 27w^3$

2. Factor fully.

(a)  $m^3 - 1$

(b)  $z^3 - 343$

(c)  $g^3 - 216$

(d)  $125b^3 - d^3$

(e)  $27y^3 - 1000000x^3$

(f)  $8 - a^6$

3. Factor fully.

(a)  $2x^3 + 16$

(b)  $2h^3 - 128k^3$

(c)  $40a^4b + 5ab^4$

(d)  $m^3n^3 + m^6n^6$

(e)  $x^3 + y^6z^9$

(f)  $64z^6 - 16z^3 + 1$

4. Factor fully.

(a)  $y^6 - 1$

(b)  $x^6 - y^6$

(c)  $m^{12} - n^{12}$

## Solutions

1. Factor fully.

(a)  $(x + 4)(x^2 - 4x + 16)$

(b)  $(a + 3)(a^2 - 3a + 9)$

(c)  $(n + 10)(n^2 - 10n + 100)$

(d)  $(2j + k)(4j^2 - 2jk + k^2)$

(e)  $(5p + 2q)(25p^2 - 10pq + 4q^2)$

(f)  $(u^2 + 3w)(u^4 - 3u^2w + 9w^2)$

2. Factor fully.

(a)  $(m - 1)(m^2 + m + 1)$

(b)  $(z - 7)(z^2 + 7z + 49)$

(c)  $(g - 6)(g^2 + 6g + 36)$

(d)  $(5b - d)(25b^2 + 5bd + d^2)$

(e)  $(3y - 100x)(10000x^2 + 300xy + 9y^2)$

(f)  $-(a^2 - 2)(a^4 + 2a^2 + 4)$

3. Factor fully.

(a)  $2(x + 2)(x^2 - 2x + 4)$

(b)  $2(h - 4k)(h^2 + 4hk + 16k^2)$

(c)  $5ab(2a + b)(4a^2 - 2ab + b^2)$

(d)  $m^3n^3(mn + 1)(m^2n^2 - mn + 1)$

(e)  $(x + y^2z^3)(x^2 - xy^2z^3 + y^4z^6)$

(f)  $(2z - 1)^2(4z^2 + 2z + 1)^2$

4. Factor fully.

(a)  $(y - 1)(y + 1)(y^2 - y + 1)(y^2 + y + 1)$

(b)  $(x + y)(x^2 - xy + y^2)(x - y)(x^2 + xy + y^2)$

(c)  $(m + n)(m - n)(m^2 + n^2)(m^2 - mn + n^2)$   
 $(m^2 + mn + n^2)(m^4 - m^2n^2 + n^4)$