Algebra 2 Course

Unit 4 – Worksheet 10 -

Factor the Sum of Cubes and

Difference of Cubes, Part 1

Algebra 2 Course - Unit 4 – Worksheet 10 - The Sum of Cubes and Difference of Cubes, Part 1

1. Factor the polynomial below.

$$x^3 - 64$$

2. Factor the polynomial below.

$$27y^3 + 1$$

3. Factor the polynomial below.

$$8x^3 - 27$$

4. Factor the polynomial below.

$$64a^3 + 27$$

5. Factor the polynomial below.

$$64w^3 - 8$$

6. Factor the polynomial below.

$$5x^3 + 625$$

7. Factor the polynomial below.

$$8u^3 - 125$$

8. Factor the polynomial below.

$$125x^3 + 216y^3$$

9. Factor the polynomial below.

$$64b^3 - 27c^3$$

10. Factor the polynomial below.

$$x^3 + y^6$$

Answers - Algebra 2 Course - Unit 4 – Worksheet 10 - The Sum of Cubes and Difference of Cubes, Part 1

1. Factor the polynomial below.

$$x^3 - 64$$

The polynomial is a difference of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$x^3 - 64 = (x)^3 - (4)^3$$

Factor:

$$(x)^3 - (4)^3 = (x - 4)[x^2 + x(4) + (4)^2]$$

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

Answer: $(x - 4)(x^2 + 4x + 16)$

2. Factor the polynomial below.

$$27y^3 + 1$$

The polynomial is a sum of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$27y^3 + 1 = (3y)^3 + (1)^3$$

Factor:

$$(3y)^3 + (1)^3 = (3y + 1)[(3y)^2 - (3y)(1) + (1)^2]$$

$$= (3y + 1)(9y^2 - 3y + 1)$$

Answer: $(3y + 1)(9y^2 - 3y + 1)$

3. Factor the polynomial below.

$$8x^3 - 27$$

The polynomial is a difference of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$8x^3 - 27 = (2x)^3 - (3)^3$$

Factor:

$$(2x)^3 - (3)^3 = (2x - 3)[(2x)^2 + (2x)(3) + (3)^2]$$

$$= (2x - 3)(4x^2 + 6x + 9)$$

Answer: $(2x - 3)(4x^2 + 6x + 9)$

4. Factor the polynomial below.

$$64a^3 + 27$$

The polynomial is a sum of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$64a^3 + 27 = (4a)^3 + (3)^3$$

Factor:

$$(4a)^3 + (3)^3 = (4a + 3)[(4a)^2 - (4a)(3) + (3)^2]$$

$$= (4a + 3)(16a^2 - 12a + 9)$$

Answer: $(4a + 3)(16a^2 - 12a + 9)$

5. Factor the polynomial below.

$$64w^3 - 8$$

After factoring out a greatest common factor of 8, the polynomial becomes:

$$64w^3 - 8 = 8(8w^3 - 1)$$

Now the polynomial contains a difference of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$8(8w^3 - 1) = 8[(2w)^3 - (1)^3]$$

Factor:

$$8[(2w)^3 - (1)^3] = 8(2w - 1)[(2w)^2 + (2w)(1) + (1)^2]$$

$$= 8(2w - 1)(4w^2 + 2w + 1)$$

Answer: $8(2w - 1)(4w^2 + 2w + 1)$

6. Factor the polynomial below.

$$5x^3 + 625$$

After factoring out a greatest common factor of 5, the polynomial becomes:

$$5x^3 + 625 = 5(x^3 + 125)$$

The polynomial contains a sum of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$5(x^3 + 125) = 5[(x)^3 + (5)^3]$$

Factor:

$$5[(x)^3 + (5)^3] = 5(x + 5)[(x)^2 - (x)(5) + (5)^2]$$

$$= 5(x + 5)(x^2 - 5x + 25)$$

Answer: $5(x + 5)(x^2 - 5x + 25)$

7. Factor the polynomial below.

$$8u^3 - 125$$

The polynomial is a difference of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$8u^3 - 125 = (2u)^3 - (5)^3$$

Factor:

$$(2u)^3 - (5)^3 = (2u - 5)[(2u)^2 + (2u)(5) + (5)^2]$$

$$= (2u - 5)(4u^2 + 10u + 25)$$

Answer: $(2u - 5)(4u^2 + 10u + 25)$

8. Factor the polynomial below.

$$125x^3 + 216y^3$$

The polynomial is a sum of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$125x^3 + 216y^3 = (5x)^3 + (6y)^3$$

Factor:

$$(5x)^3 + (6y)^3 = (5x + 6y)[(5x)^2 - (5x)(6y) + (6y)^2]$$

$$= (5x + 6y)(25x^2 - 30xy + 36y^2)$$

Answer: $(5x + 6y)(25x^2 - 30xy + 36y^2)$

9. Factor the polynomial below.

$$64b^3 - 27c^3$$

The polynomial is a difference of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$64b^3 - 27c^3 = (4b)^3 - (3c)^3$$

Factor:

$$(4b)^3 - (3c)^3 = (4b - 3c)[(4b)^2 + (4b)(3c) + (3c)^2]$$

$$= (4b - 3c)(16b^2 + 12bc + 9c^2)$$

Answer: $(4b - 3c)(16b^2 + 12bc + 9c^2)$

10. Factor the polynomial below.

$$x^3 + y^6$$

The polynomial is a sum of cubes, which factors according to the rule:

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

Rewrite the polynomial to identify a and b:

$$x^3 + y^6 = (x)^3 + (y^2)^3$$

Factor:

$$(x)^3 + (y^2)^3 = (x + y^2)[(x)^2 - (x)(y^2) + (y^2)^2]$$

$$= (x + y)(x^2 - xy^2 + y^4)$$

Answer: $(x + y)(x^2 - xy^2 + y^4)$