

Intermediate Algebra
Skill Builder # PF – 11
Factoring the Sum or Difference of Cubes

A polynomial is a **sum of cubes** if it looks like

$$a^3 + b^3$$

and it factors into

$$(a + b)(a^2 - ab + b^2).$$

Likewise, the **difference of cubes** factors into

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

Examples

1. $x^3 + 1$

Solution:

$$\begin{aligned}x^3 + 1 &= x^3 + 1^3 \\ &= (x + 1)(x^2 - x + 1)\end{aligned}$$

2. $8 - y^3$

Solution:

$$\begin{aligned}8 - y^3 &= 2^3 - y^3 \\ &= (2 - y)(4 + 2y + y^2)\end{aligned}$$

3. $a^3 + 27b^3$

Solution:

$$\begin{aligned}a^3 + 27b^3 &= a^3 + (3b)^3 \\ &= (a + 3b)(a^2 - 3ab + 9b^2)\end{aligned}$$

4. $64m^3 - 125n^3$

Solution:

$$\begin{aligned}64m^3 - 125n^3 &= (4m)^3 - (5n)^3 \\ &= (4m - 5n)(16m^2 + 20mn + 25n^2)\end{aligned}$$

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Factor.

1. $x^3 + 8$

2. $27 - x^3$

3. $a^3 + 64b^3$

4. $125n^3 - 1$

5. $8x^3 - 27$

6. $64 + 125y^3$

7. $64a^3 - 27b^3$

8. $125a^3 - 8x^3$

9. $\frac{1}{27}x^3 - \frac{1}{8}y^3$

10. $\frac{1}{8}a^3 + 64$

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Answers

1. $(x+2)(x^2 - 2x + 4)$

2. $(3-x)(9+3x+x^2)$

3. $(a+4b)(a^2 - 4ab + 16b^2)$

4. $(5n-1)(25n^2 + 5n + 1)$

5. $(2x-3)(4x^2 + 6x + 9)$

6. $(4+5y)(16-20y+25y^2)$

7. $(4a-3b)(16a^2 + 12ab + 9b^2)$

8. $(5a-2x)(25a^2 + 10ax + 4x^2)$

9. $\left(\frac{1}{3}x - \frac{1}{2}y\right)\left(\frac{1}{9}x^2 + \frac{1}{6}xy + \frac{1}{4}y^2\right)$

10. $\left(\frac{1}{2}a + 4\right)\left(\frac{1}{4}a^2 - 2a + 16\right)$

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