

Off-Site Instruction Packet Day 2

Factor Review

The first general rule for factoring is

Common Factors

If there is a common factor in every term of the expression, factor out the common factor of the highest degree.

Example 1: **Factor**

$$4x^6 - 8x$$

$$4x(x^5 - 2)$$

You can greatly increase your factoring proficiency by learning to recognize multiplication patterns that appear frequently. Here are the most common ones.

Quadratic Factoring Patterns

Difference of Squares: $u^2 - v^2 = (u + v)(u - v)$

Perfect Squares: $u^2 + 2uv + v^2 = (u + v)^2$

$$u^2 - 2uv + v^2 = (u - v)^2$$

Example 2: **Factor**

a) $x^2 - 9y^2$

$$(x + 3y)(x - 3y)$$

b) $y^2 - 7$

$$(y + \sqrt{7})(y - \sqrt{7})$$

c) $36r^2 - 64x^2$

$$(6r + 8x)(6r - 8x)$$

Example 3: **Factor**

$$4x^2 - 36x + 81$$

$$(2x)^2 \quad (9)^2$$

$$(2x - 9)^2$$

Cubic Factoring Patterns

Difference of Cubes: $u^3 - v^3 = (u - v)(u^2 + uv + v^2)$

Sum of Cubes: $u^3 + v^3 = (u + v)(u^2 - uv + v^2)$

Example 4: **Factor**

a) $x^3 - 125$

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

b) $x^3 + 8y^3$

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

When none of the multiplication patterns applies, use trial and error to factor quadratic polynomials.

Example 5: **Factor**

$$x^2 + 9x + 18$$

$$(x + 3)(x + 6)$$

Example 6: **Factor**

a) $6x^2 + 11x + 4$

$$(2x + 1)(3x + 4)$$

b) $3x^2 + 4x + 1$

$$(3x + 1)(x + 1)$$

Occasionally the patterns above can be used to factor expressions involving larger exponents than 2.

Example 7: **Factor**

a) $x^6 - y^6$

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

b) $x^8 - 1$

$$\begin{aligned} (x^4)^2 - 1 &= (x^4 + 1)(x^4 - 1) \\ &= (x^4 + 1)(x^2 + 1)(x^2 - 1) \\ &= (x^4 + 1)(x^2 + 1)(x + 1)(x - 1) \end{aligned}$$

Example 8: **Factor**

$$x^4 - 2x^2 - 3$$

$$(x^2 - 3)(x^2 + 1) = (x^2 + 1)(x + \sqrt{3})(x - \sqrt{3})$$

Example 9: Factor by Regrouping

$$3x^3 + 3x^2 + 2x + 2$$

$$3x^2(x + 1) + 2(x + 1)$$

$$(3x^2 + 2)(x + 1)$$

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Off-Site Learning Packet Day 3

Factor each completely.

1. $9r^2 - 16$

2. $4x^2 + 20x + 25$

3. $32x^2 - 648y^2$

4. $y^2 + 2xy + x^2$

5. $72u^2 - 128v^2$

6. $1152an^4 + 2496an^3 + 1352an^2$

7. $1053b^2 - 208$

8. $24b^2 - 6$

9. $k^2 - 15k + 54$

10. $b^2 - 3b - 18$

11. $20p^2 - 164p - 144$

12. $5r^3 + 21r^2 + 18r$

13. $15v^2 + 5v - 70$

14. $8x^2 + 30x - 27$

15. $6k^4 + 7k^3 - 24k^2$

16. $-54x^2n - 552xn - 120n$

17. $a^3 + 216$

18. $64m^2 - 125$