

Lesson 3.1: Other Factoring Techniques

Factor. $x^4 - 7x^2 + 12 =$

$(x^2 - 3)(x^2 - 4)$ → factors more

$-3x^2$

$+ \frac{-4x^2}{-7x^2}$

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

Factor. $3x^8 + x^4 - 2$

Bottoms Up

$$x^8 + x^4 - 6$$

$$\left(x^4 - \frac{2}{3}\right)\left(x^4 + \frac{3}{3}\right)$$

$$\boxed{(3x^4 - 2)(x^4 + 1)}$$

Factor. $\underline{3x^8} + x^4 - \underline{2}$

Diagrams

$$(\underline{3x^4} - \underline{2})(x^4 + \underline{1})$$

$$\begin{array}{r} -2x^4 \\ + 3x^4 \\ \hline x^4 \checkmark \end{array}$$

$$20) \quad x^5 - 16x$$

$$\text{GCF: } x$$

$$x(x^4 - 16)$$


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

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

Factor. $\underbrace{5x^3 + 4x^2}_{\text{GCF: } x^2} + \underbrace{10x + 8}_{\text{GCF: } 2}$

Grouping!
- 4 terms

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



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

Factor. $\frac{3x^3}{3} - \frac{6x^2}{3} - \frac{27x}{3} + \frac{54}{3}$

GCF: 3

$$3 \left(\underbrace{x^3 - 2x^2}_{\text{GCF: } x^2} - \underbrace{9x + 18}_{\text{GCF: } -9} \right)$$

$$3 \left(x^2(x-2) - 9(x-2) \right)$$

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

$$3(x-2)(x+3)(x-3)$$

$$4) \frac{3x^3 + 8x^2 - 12x - 32}{\text{GCF: } x^2} \quad \text{GCF: } -4$$

$$x^2 (3x + 8) - 4 (3x + 8)$$

$$(3x + 8)(x^2 - 4)$$

$$(3x + 8)(x + 2)(x - 2)$$

Sum/Difference of Perfect Cubes

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

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

Ex: $x^3 - 8$

$$a = \sqrt[3]{x^3} = x$$

$$b = \sqrt[3]{8} = 2$$

$$(x - 2)(x^2 + x \cdot 2 + 2^2)$$

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

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

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

Ex: $27x^4 - 125x$

GCF: x

$$x(27x^3 - 125)$$

$$a = \sqrt[3]{27x^3} = 3x$$

$$b = \sqrt[3]{125} = 5$$

$$x(3x - 5)((3x)^2 + (3x)(5) + (5)^2)$$

$$x(3x - 5)(9x^2 + 15x + 25)$$

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

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

$$16) \quad 250x^3 + 128$$

GCF: 2

$$2(125x^3 + 64)$$

$$a = \sqrt[3]{125x^3} = 5x$$

$$b = \sqrt[3]{64} = 4$$

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

$$2(5x + 4)(25x^2 - 20x + 16)$$

How to Know When to Use What Method

1. Grouping Method: 4 terms
2. Diagram/Bottoms Up: 3 terms (highest exponent is twice as big as middle term's exponent)
3. Perfect Squares: 2 terms
4. Perfect cubes: 2 terms