

FACTORIZING METHODS

Factoring Out Common Factors

Procedure:

EX 1 $15a^6b + 3a^4b^3 + 9ab^2$

15, 3, 9

$\frac{15}{3} = 5$, $\frac{3}{3} = 1$, $\frac{9}{3} = 3$

a^6 , a^4 , a

b , b^3 , b^2

GCF = 3

GCF = a
smallest exponent

GCF = b
smallest exponent

①

② $3ab \left(\frac{15}{3} \cdot \frac{a^6}{a} \cdot \frac{b}{b} + \frac{3}{3} \cdot \frac{a^4}{a} \cdot \frac{b^3}{b} + \frac{9}{3} \cdot \frac{a}{a} \cdot \frac{b^2}{b} \right)$

$3ab(5a^5 + a^3b^2 + 3b)$

EX 2 $3m(n-3)^2 + 4(n-3)$ GCF = $(n-3)$

$(n-3) \left[\frac{3m(n-3)^2}{(n-3)} + \frac{4(n-3)}{(n-3)} \right]$ Factor out GCF

$(n-3)(m+4)$

Note: Factoring is the inverse of distributing

Three Terms

$$x^2 - bx + c$$

x^2 coeff = 1

Procedure:

Ex 1 $x^2 + 8x + 12$

$\begin{array}{r|l} +8 & +12 \\ \hline 6+2 & (6)(2) \end{array}$

$(x+6)(x+2)$

- ① Set-up T-chart
- ② "x" column write $c \rightarrow 12$
" + " column write $b \rightarrow 8$
- ③ Find factors of 12 that add up to 8
- ④ Write factors

Ex 2 $t^2 + 8t + 7t$

$\begin{array}{r|l} +8 & +7 \\ \hline 7+1 & (7)(1) \end{array}$

$(t+7)(t+1)$

Procedure:

- ① Look for GCF
- GCF = $4y$
- ② Factor out GCF
- ③ Factor Three Terms

Ex 3 $4x^2y + 24xy + 20y$

$4y(x^2 + 6x + 5)$

$\begin{array}{r|l} +6 & +5 \\ \hline 5+1 & (5)(1) \end{array}$

$4y(x+5)(x+1)$

Ex 4 $m^2 + 2mn - 15n^2$

$\begin{array}{r|l} +2 & -15 \\ \hline 5-3 & (5)(-3) \end{array}$

$(m+5n)(m-3n)$

- Note: 1. Always look for GCF first and factor out the GCF before starting
2. When two terms have squared variables factored form contains one variable on left and one on right sides of factors (example 4)

Three Terms

$$ax^2 + bx + c \quad a \neq 1$$

EX1 $3y^2 + 16y + 5$

① NO GCF'S

$$\begin{array}{r|l} 16 & (3)(5) = +15 \\ 15+1 & (15)(1) \\ \hline & (5) \end{array}$$

② $3y^2 + (15+1)y + 5$

③ $3y^2 + 15y + y + 5$

④ $3y(y+5) + 1(y+5)$

⑤ $(y+5)(3y+1)$

Procedure

① ID GCF'S

② Set-up t-chart

③ Multiply $a \rightarrow 3$ times $c \rightarrow 5$ and write result in "X" column

④ Write $b \rightarrow 16$ in "4" column

⑤ Find Factors of 15 that add up to 16

⑥ Write problem, but replace $16y$ with $+(15+1)y$

⑦ Distribute y and re-write problem

⑧ Divide problem in middle

⑨ Factor out GCF from 1st two terms

⑩ Drop down sign in middle

⑪ Factor out GCF from 2nd two terms

⑫ Rewrite factors

EX2

$$32x^2y + 24xy - 36y$$

① GCF = $4y$

② $4y(8x^2 + 6x - 9)$

③ $4y[8x^2 + (12-6)x - 9]$

④ $4y[8x^2 + 12x - 6x - 9]$

⑤ $4y[4x(2x+3) - 3(2x+3)]$

⑥ $4y[(2x+3)(4x-3)]$

$$\begin{array}{r|l} + & X \\ +6 & (8)(-9) = -72 \\ 12-6 & (12)(-6) \\ \hline & (5) \end{array}$$

⑦ Distribute y and re-write problem

⑧ Divide problem in middle

⑨ Factor out GCF from 1st two terms

⑩ Drop down sign in middle

⑪ Factor out GCF from 2nd two terms

⑫ Rewrite factors

Two Terms (Difference Between Squares)

Ex 1 $x^2 - 36$ ① No ②

$$(x)^2 - (6)^2 \quad \text{②}$$

$$(x + 6)(x - 6) \quad \text{③}$$

$$(x + 6)(x - 6) \quad \text{①}$$

Ex 2 $t^4 - 16$ ① No ②

$$(t^2)^2 - (4)^2 \quad \text{②}$$

$$(t^2 + 4)(t^2 - 4) \quad \text{③}$$

$$(t^2 + 4)(t^2 - 4) \quad \text{④}$$

$$(t^2 + 4)[(t)^2 - (2)^2] \quad \text{⑤}$$

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

Ex 3

$$32xy^2 - 128x$$

$$\text{GCF} = 32x \quad \text{①}$$

$$32x(y^2 - 4)$$

$$2x[(y)^2 - (2)^2] \quad \text{②}$$

$$2x[(y + 2)(y - 2)] \quad \text{③-④}$$

① Factor out GCF

① ID two squares and difference (-)

② Rewrite each term in form $()^2$

③ Write factors so left letters and numbers are on left and right number and letters are on right

④ Write "+" between one pair and "-" between the other pair

⑤ Repeat if appropriate

Note: Always look for GCF first and factor out the GCF before starting.