Factoring Method #2 : Grouping

→ Must have 4, 6, or 8 terms to use this method.

e.g. 1

$$ab + cb + ad + cd$$

Step 1 : create 2 equal-sized groups ; within each group there must be a common factor.

$$(ab+cb) + (ad+cd)$$

Step 2: Remove the common factor from each group.

$$b(a+c) + d(a+c)$$

The two brackets must be the same here. If not, try a different grouping.

Step 3 : Write "leftovers" in one bracket, and the "common" bracket once. This is your answer!

$ab+cb+ad+cd$

$$= (b+d)(a+c)$$

Check by multiplying the factors to see if we get the original polynomial:

$$(b+d)(a+c) = ab+bc+ad+cd$$

(F: first, I: inside, L: last)

To multiply two binomials we must FOIL.

F : first
O : outside
I : inside
L : last

e.g. 2

$$bx + 2x + ab + 2a$$

$$(bx + 2x) + (ab + 2a)$$

$$x(b+2) + a(b+2)$$

$$= \boxed{(x+a)(b+2)}$$

Check: (FOIL)

$$(x+a)(b+2)$$

$$bx + 2x + ab + + 2a$$

e.g. 3

$$x^2 + ab + ax + bx$$

$$(ab + ax) + (x^2 + bx)$$

$$a(b + x) + x(x + b)$$

$$\boxed{(a + x)(b + x)}$$

OR

$$(x^2 + ax) + (ab + bx)$$

$$x(x + a) + b(a + x)$$

$$\boxed{(x + b)(x + a)}$$

$x^2 + ab + ax + bx$

Check

$(x + b)(x + a)$

$x^2 + ax + bx + ab$

e.g. 4 $x^5 - 1 - x^4 + x$

$(x^5 - x^4) + (x - 1)$

↑ always $\pm$

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

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

FOIL

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

$x^5 - x^4 + x - 1$

e.g. 5

$$2ab + 6ad - 4ac + 8b - 16c + 24d$$

→ you can do 2 grps of 3, or 3 grps of 2!

Create 3 grps of 2. (c.f.)

→ each pair should have a common factor

→ Think about what will be left in each bracket after the c.f. is removed.

$$(2ab + 8b) + (6ad + 24d) + (-4ac - 16c)$$

$$2b(a+4) + 6d(a+4) - 4c(a+4)$$

$$(2b + 6d - 4c)(a+4)$$

$$\boxed{2(b + 3d - 2c)(a+4)}$$

Let's do the same one using 2 grps of 3 !

1 3 2 1 2 3

$2ab + 6ad - 4ac + 8b - 16c + 24d$

$(2ab + 6ad - 4ac) + (8b - 16c + 24d)$

$2a(b + 3d - 2c) + 8(b - 2c + 3d)$

$(2a + 8)(b - 2c + 3d)$

$\boxed{2(a + 4)(b - 2c + 3d)}$

e.g. 6

$$a^2x + bx + by + hy + hx + a^2y$$

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3 grps 2

$$(a^2x + a^2y) + (bx + by) + (hx + hy)$$
$$a^2(x+y) + b(x+y) + h(x+y)$$
$$(a^2 + b + h)(x+y)$$

2 grps 3

$$(a^2x + bx + hx) + (by + hy + a^2y)$$

$$x(a^2 + b + h) + y(b + h + a^2)$$

$$\boxed{(x+y)(a^2 + b + h)}$$

Check

$$(x+y)(a^2 + b + h)$$

$$a^2x + bx + hx + a^2y + by + hy$$

e.g.

$$ac - ad - 4bc + 4bd$$

$$(ac - ad) + (-4bc + 4bd)$$

$$a(c - d) - 4b(+c - d)$$

$$\boxed{(a - 4b)(c - d)}$$

Do Worksheet #2

Quiz #2 will be done tomorrow.

15.

$$-4y^4 + 1 - 2y^3 + 2y$$

$$(-4y^4 - 2y^3) + (1 + 2y)$$

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

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

Worksheet #2

① $3a^2c + 5c + 6a^2b + 10b$

$1 \cdot 2 \cdot 3 \cdot 6 \qquad 1 \cdot 2 \cdot 5 \cdot 10$

$(3a^2c + 5c) + (6a^2b + 10b)$

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

$\boxed{(c+2b)(3a^2+5)}$

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

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

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

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

5)

$$bcy + c^2z + cd + b^2y + bd + bcz$$

$b \cdot b$

$$(bcy + b^2y) + (c^2z + bcz) + (cd + bd)$$

$$by(c+b) + cz(c+b) + d(c+b)$$

$$(by + cz + d)(c+b)$$