

What Factoring Am I?

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#	Expression in Simplified/Expanded Form	Factoring Type	Expression in Factored Form
1.	$2a + 2b$	COMMON FACTOR	$2(a + b)$
2.	$3x^2 - 6x + 9$		$3(x^2 - 2x + 3)$
3.	$3m^2 - 7m$		$m(3m - 7)$
4.	$x^2 - x - 6$	SIMPLE TRINOMIAL	$(x + 2)(x - 3)$
5.	$x^2 - 6x + 8$		$(x - 2)(x - 4)$
6.	$x^2 + 8x - 48$		$(x - 4)(x + 12)$
7.	$8x^2 + 26x - 7$ $\frac{56}{2 \cdot 28}$	COMPLEX TRINOMIALS	$\frac{(8x-2)(2x+7)}{8} = \frac{2(4x-1)4(2x+7)}{8} = (4x-1)(2x+7)$
8.	$12a^2 - 7a - 10$ $\frac{120}{-15 \cdot 8}$		$= \frac{12a^2 - 15a + 8a - 10}{3a(4a-5) + 2(4a-5)} = \frac{(4a-5)(3a+2)}{3a(4a-5) + 2(4a-5)}$
9.	$2m^2 + 7m - 4$ $-1, +8$		$= \frac{(2m-1)(2m+8)}{2} = (2m-1)(m+4)$
10.	$m^2 - 4$	DIFFERENCE OF SQUARES	$= (m - 2)(m + 2)$
11.	$4x^2 - 25$		$= (2x - 5)(2x + 5)$
12.	$16a^2 - 9b^2$		$= (4a - 3b)(4a + 3b)$
13.	$14m - 7n - 6m + 3n$ $\frac{6CF=7}{7} \quad \frac{6CF=-3}{-3}$	GROUP FACTORING	$= 7(2m - n) - 3(2m - n)$ $= (2m - n)(7 - 3)$
14.	$2x^2 + 8x - x - 4$		$= 2x(x + 4) - (x + 4)$ $= (x + 4)(2x - 1)$
15.	$4x^3 + 10x^2 - 10x - 25$		$= 2x^2(2x + 5) - 5(2x + 5)$ $= (2x + 5)(2x^2 - 5)$
16.	$3t^2 - 9t + 6$ $\rightarrow GCF=3$	MIX Always check your GCF	$= 3(t^2 - 3t + 2)$ $= 3(t - 1)(t - 2)$
17.	$-7x^2y + 28y$ $\rightarrow GCF=-7y$		$= -7y\left(\frac{-7x^2y}{-7y} + \frac{28y}{-7y}\right) = -7y(x^2 - 4) = -7y(x-2)(x+2)$
18.	$x^4 - 81$		$= (x^2 + 9)(x^2 - 9)$ $= (x^2 + 9)(x + 3)(x - 3)$

Check Your Understanding:

#	Expression in Simplified/Expanded Form	Factoring Type	Expression in Factored Form
19.	$3x^2 - 2x - 1$	COMPLEX	$= (3x + 1)(x - 1)$
20.	$x^2 - 25$	D.O.S	$= (x + 5)(x - 5)$
21.	$3a - 18b$	Common Factor	$= 3(a - 6b)$
22.	$6x^2 - 5x - 4$	COMPLEX	$= \frac{(6x+3)(6x-8)}{6} = \frac{-3(2x+1)(2)(3x-4)}{6} = (2x+1)(3x-4)$
23.	$2x^2 + 15x - 27$ $\frac{M}{-54} \mid \frac{A}{+15} \mid \frac{N}{3+18}$	COMPLEX	$= \frac{(2x-3)(2x+18)}{2} = (2x-3)(x+9)$
24.	$20x^2 - 40x + 20$	COMMON FACTOR SIMPLE TRINOMIAL	$= 20(x^2 - 2x + 1)$ $= 20(x-1)(x-1)$
25.	$-3x^2 + 18x - 15$	COMMON FACTOR SIMPLE TRI	$= -3(x^2 - 6x + 5)$ $= -3(x-1)(x-5)$
26.	$2x^2 - 2xy - ax + ay$	GROUP	$= 2x(x-y) - a(x-y)$ $= (x-y)(2x-a)$
27.	$y^2 - 49$	D.O.S	$= (y-7)(y+7)$
28.	$81x^4 - 16$	D.O.S	$= (9x^2 - 4)(9x^2 + 4) = (3x-2)(3x+2)(9x^2 + 4)$
29.	$x^2 - 9x + 14$	SIMPLE	$= (x-2)(x-7)$
30.	$6z^2 + 5z - 4$ $\frac{M}{-24} \mid \frac{A}{+5} \mid \frac{N}{-3, 8}$	COMPLEX	$= 6z^2 - 3z + 8z - 4$ $= 3z(2z-1) + 4(2z-1) \rightarrow (2z-1)(3z+4)$
31.	$w^2 + 8w + 16$	SIMPLE	$= (w+4)(w+4)$
32.	$3p^2 + 3p - 6$	MIX \rightarrow CF \rightarrow SIMPLE	$= 3(p^2 + p - 2) = 3(p-1)(p+2)$
33.	$c^2 - 36$	D.O.S	$= (c-6)(c+6)$
34.	$4x^2 - 3x + 8x - 6$	GROUP	$= x(4x-3) + 2(4x-3)$ $= (4x-3)(x+2)$
35.	$x^4 - 3x^2 - 4$	SIMPLE	$= (x^2+1)(x^2-4)$
36.	$15a^2b^3 + 10a^2b^2 - 5ab^3$	GCF = $5ab^2$	$= 5ab^2(3ab + 2a - b)$
37.	$z^2 + 16$	N/A	
38.	$(x+3)^2 - (2x-1)^2$	D.O.S	$= [(x+3)+(2x-1)][(x+3)-(2x-1)]$ $= (3x+2)(-x+4)$
39.	$2\pi r^2 + 2\pi rh$	COMMON FACTOR	$= 2\pi r(r+h)$
40.	$3x(x-4) - 2(x-4)$	GROUP FACTOR	$= (x-4)(3x-2)$

$$1) x^2 - 5x + 6 \quad \begin{array}{c|c|c} M & A & N \\ \hline 6 & -5 & -2, -3 \end{array}$$

$$= (x-3)(x-2)$$

$$2) a^2 - 4a - 5 \quad \begin{array}{c|c|c} M & A & N \\ \hline -5 & -4 & +1, -5 \end{array}$$

$$= (x-5)(x+1)$$

$$3) b^2 + 11b + 30 \quad \begin{array}{c|c|c} M & A & N \\ \hline 30 & 11 & +5, +6 \end{array}$$

$$= (b+5)(b+6)$$

$$4) m^2 + 7m - 30 \quad \begin{array}{c|c|c} M & A & N \\ \hline -30 & 7 & 3, +10 \end{array}$$

$$= (m-3)(m+10)$$

$$5) z^2 + 2z - 15 \quad \begin{array}{c|c|c} M & A & N \\ \hline -15 & 2 & -3, +5 \end{array}$$

$$= (z-3)(z+5)$$

$$6) r^2 - 3r - 40 \quad \begin{array}{c|c|c} M & A & N \\ \hline -40 & -3 & +5, -8 \end{array}$$

$$= (r-8)(r+5)$$

$$7) w^2 - 9w + 8 \quad \begin{array}{c|c|c} M & A & N \\ \hline 8 & -9 & -1, -8 \end{array}$$

$$= (w-1)(w-8)$$

$$8) m^2 + 6m + 5 \quad \begin{array}{c|c|c} M & A & N \\ \hline 6 & 5 & 1, 5 \end{array}$$

$$= (m+1)(m+5)$$

$$9) b^2 + 11b - 12 \quad \begin{array}{c|c|c} M & A & N \\ \hline -12 & +11 & -1, +12 \end{array}$$

$$= (b-1)(b+12)$$

$$10) t^2 + 6t - 27 \quad \begin{array}{c|c|c} M & A & N \\ \hline -27 & +6 & -3, +9 \end{array}$$

$$= (t-3)(t+9)$$

$$11) 3b^2 + 24b + 45 \quad \rightarrow \text{looks like a tricky trinomial. BUT check the GCF first}$$

$$\text{GCF} = 3$$

$$= 3(b^2 + 8b + 15)$$

\rightarrow this is simple trinomial

$$= 3(b+3)(b+5)$$

$$\begin{array}{c|c|c} M & A & N \\ \hline 15 & 8 & 3, 5 \end{array}$$

$$12) 2s^2 + 4s - 6 \quad \rightarrow \text{looks like a tricky trinomial. Common factor first}$$

$$\text{GCF} = 2$$

$$= 2(s^2 + 2s - 3)$$

a simple trinomial was hidden.

$$= 2(s-1)(s+3)$$

$$\begin{array}{c|c|c} M & A & N \\ \hline -3 & +2 & -1, +3 \end{array}$$

$$13) 3v^2 + 9v - 30 \quad \rightarrow \text{let's see if there is a simple trinomial hidden.}$$

$$\text{GCF} = 3$$

$$= 3(v^2 + 3v - 10)$$

yes there is...

$$= 3(v-2)(v+5)$$

$$\begin{array}{c|c|c} M & A & N \\ \hline -10 & +3 & -2, +5 \end{array}$$

$$14) 3x^2 + 7x + 2 \quad \rightarrow \text{Looks like a tricky trinomial. Could there be a simple tri hidden? There is no GCF; therefore, it's a tricky one. Multiply (3) and (2) = 6. Adds to 7. Numbers are 1, 6.}$$

$$= \underbrace{3x^2 + 1x}_A + \underbrace{6x + 2}_B$$

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

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

$$15) 6b^2 + 13b + 6 \quad \text{No GCF, it's tricky. Multiply (6) and (6) = 36. Adds to 13. Numbers must be 4, 9.}$$

$$= \underbrace{6b^2 + 4b}_A + \underbrace{9b + 6}_B$$

$$= 2b(3b+2) + 3(3b+2)$$

$$= (3b+2)(2b+3)$$

$$16) d^2 - 16 \quad \rightarrow \text{looks like a difference of squares. is each term a perfect square?}$$

$$d^2 = d \cdot d \rightarrow \text{YES}$$

$$16 = 4 \cdot 4 \rightarrow \text{YES}$$

$$= (d-4)(d+4)$$

17) $9 - a^2 \rightarrow$ Is a difference of squares?
 $9 \rightarrow 3 \cdot 3$
 $a^2 \rightarrow a \cdot a$ } YES
 $= (0+3)(a-3)$

18) $25x^2 - 4 \rightarrow$
 $25x^2 \rightarrow 5x \cdot 5x$
 $4 \rightarrow 2 \cdot 2$
 $= (5x+2)(5x-2)$

19) $z^2 + 8z + 16$

M	A	N
16	8	4, 4

 $= (z+4)(z+4)$
 $= (z+4)^2$

20) $4c^2 - 20c + 25$ Could this be a simple trinomial? No b/c there's no GCF.
 $= 4c^2 - 10c - 10c + 25$ Multiply $(4) \cdot (25) = 100$
 $= 2c(2c-5) - 5(2c-5)$ Adds to -20
 $= (2c-5)(2c-5)$ Numbers are $-10, -10$
 $= (2c-5)^2$

OR
 $4c^2 - 20c + 25$ Remember
 $(a+b)^2 = a^2 + 2ab + b^2$
 $(a-b)^2 = a^2 - 2ab + b^2$
 $= (2c)^2 - 2(2c)(5) + (5)^2$ match
 $= (2c-5)^2$
 Let's see if the polynomial could be written like that

21) $49g^2 - 84g + 36$ $(a-b)^2 = a^2 - 2ab + b^2$
 $= (7g)^2 - 2(7g)(6) + (6)^2$ match
 $= (7g-6)^2$

22) $14z^2 - 28z \rightarrow$ looks like a difference of squares but 14 and 28 are not perfect squares. Let's GCF it.
 $GCF = 14z$
 $= 14z(z-2)$

23) $8s^2 - 50 \rightarrow$ always check the GCF to common factor.
 $GCF = 2$
 $= 2(4s^2 - 25) \rightarrow$ hmm. the binomial might be a difference of squares.
 $4s^2 \rightarrow 2s \cdot 2s$
 $25 \rightarrow 5 \cdot 5$ } YUP
 $= 2(2s+5)(2s-5)$

24) $3q^3 - 27q$ Common factor
 $GCF = 3q$
 $= 3q(q^2 - 9)$ $q^2 = 9 \cdot 9$
 $9 = 3 \cdot 3$
 $= 3q(q+3)(q-3)$

25) $ar^2 - 11ar + 28a$ Common factor $GCF = a$
 $= a(\frac{ar^2}{a} - \frac{11ar}{a} + \frac{28a}{a})$
 $= a(r^2 - 11r + 28)$ Simple tri hidden
 $= a(r-4)(r-7)$

26) $z^4 - 13z^2 + 36$

M	A	N
36	13	4, 9

 $= (z^2 - 4)(z^2 - 9)$ Each binomial is a difference of squares
 $= (z+2)(z-2)(z+3)(z-3)$

27) $w^4 - 16$ $w^4 = w^2 \cdot w^2$
 $16 = 4 \cdot 4$
 $= (w^2+4)(w^2-4)$ another difference of squares
 $= (w^2+4)(w-2)(w+2)$

$$\begin{aligned}
 28) & -4k^2 - 4k - 1 \\
 & \quad \quad \quad \wedge \\
 & = -4k^2 - 2k - 2k - 1 \\
 & = -2k(2k+1) - 1(2k+1) \\
 & = (2k+1)(-2k-1) \rightarrow \text{GCF} = -1 \\
 & = -(2k+1)(-1)(2k+1) \\
 & = (-1)(2k+1)^2
 \end{aligned}$$

Multiply $(-4)(-1) = 4$
 Add to -4
 Numbers are (-2) and (-2)

$$\begin{aligned}
 & -4k^2 - 4k - 1 \quad \text{GCF} = -1 \\
 & = -1(4k^2 + 4k + 1) \quad \text{Could this be a Perfect square tri} \\
 & \quad \quad \quad \downarrow \quad \downarrow \quad \downarrow \\
 & = -1 \left[(2k)^2 + 2(2k)(1) + (1)^2 \right] \quad (a+b)^2 = a^2 + 2ab + b^2 \\
 & = -1(2k+1)^2
 \end{aligned}$$

OR

$$\begin{aligned}
 29) & 14 - 5w - w^2 \rightarrow \text{rearrange the terms} \\
 & = -w^2 - 5w + 14 \quad \text{GCF} = -1 \\
 & = -1(w^2 + 5w - 14) \rightarrow \text{S.T.} \\
 & = -1(w-2)(w+7)
 \end{aligned}$$

30) No, b/c it's not a difference but addition.