FACTORING POLYNOMIALS ~Notes~

A polynomial is *an algebraic expression that consists of a term __or__ a sum of several terms.' Where a term is a product of a real number coefficient and a variable (or variables) that is (are) raised to a non-negative integral exponent.* $R \cdot x, y$ → variables, coefficient→ R, $0,1,2,3\ldots$ → exponent

Circle all expressions that are polynomials. Cross out all expressions that are not polynomials. **Explain why an expression is not a polynomial.**

$$\frac{2}{x} = 2x^{(-1)}$$

$5x^9 - 8x^0$	$\frac{3^{-9}}{5}x^3 + \frac{2}{3}x^0$ $R ↗$	$-17x^4 + x^3 - \frac{2}{x}$!
$\sqrt{9}x + 7x^0$ ↓ $R\checkmark$	→ $\pi^3 x^2$ $R ↗$	$\sqrt{-25a^3}$ ↲not R
$-a^5 + 8b^2 - bcd^{-8}$ $-8<0$	$1x^?$	$ab^2 - ab^4$

What is factoring?

➢ Factoring is a procedure that takes a number or an algebraic expression and expresses it as a product of its two or more factors.

➢ Factoring is the inverse process of distributing

Distributing	Factoring
$15x(2x+3)$ $= 30x^2 + 45x$	$30x^2 + 45x =$ $= 15x(2x+3)$

➢ Steps involved in factoring polynomials: (Simple factoring)
  1. Identify the greatest common factor.
  2. Put the gcf in front of brackets.
  3. Place a quotient of the original polynomial and the gcf inside the brackets.

$3x^2 + 6x = 3x(x+2)$	$10a^2b - 5ab^2 = 5ab(2a-b)$

PRACTICE FACTORING BY ISOLATING THE GREATEST COMMON FACTOR:

1	$48x^2 - 64x =$ $16x(3x-4)$	9	$13x^3 + 39x^2 + 26 =$ $= 13(x^3 + 3x^2 + 2)$
2	$-42xy^6 + 7xy^3 - x^2y^3 =$ $xy^3(-42y^3 + 7 - x)$	10	$35a^2 + 7 =$ $= 7(5a^2 + 1)$
3	$121a^2 + 33a =$ $11a(11a + 3)$	11	$0.5y^6 + 1.5xy^2 - 5.0 =$ $= 0.5(y^6 + 3xy^2 - 10)$
4	$-12m^5n^4 - 18m^3n^4 =$ $6m^3n^4(-2m^2 - 3)$	12	$-8b^3 + 24b^2 =$ $8b^2(-b + 3) = -8b^2(b-3)$
5	$2xyz^2 - xyz^3 =$ $xyz^2(2 - z)$	13	$10x^2 + xy^2 =$ $x(10x + y^2)$
6	$\frac{1}{3}x^4 + \frac{2}{3}x^3 = \frac{1}{3}x^3(x+2)$	14	$abc^2 + ab^3c^3 - abc =$ $abc(c + b^2c^2 - 1)$
7	$-25x^2 - 15 =$ $5(-5x - 3)$	15	$14c^5 + 35c^4 =$ $7c^4(2c + 5)$
8	$pr^2 + 3r^2 - p^2r^3 + 9r =$ $r(pr + 3r - p^2r^2 + 9)$	16	$81x^2 - 3 =$ $3(27x^2 - 1)$

Make 2 questions and solve them: Answers will vary:

$$36x^2 - 12x = 3x(13x - 4)$$

$$144a^2b + 48ab^2 = 48ab(3a + b)$$

FACTORING USING THE DIFFERENCE OF SQUARES FORMULA

> **Difference of Squares:**
>
> $$a^2 - b^2 = (a-b)(a+b)$$

➤ **Factoring** using the above formula is possible for **binomials in which both terms are prefect squares and one is subtracted from the other.**

Example 1:

$$4x^2 - 49 = (2x)^2 - 7^2 = (2x-7)(2x+7)$$

Example 2:

$$1 - 25x = 1^2 - (5x)^2 = (1-\sqrt{5}x)(1+\sqrt{5}x)$$

Example 3:

$$16x^2 - y^4 = (4x)^2 - (y^2)^2 = (4x - y^2)(4x + y^2)$$

Example 4:

$$121p^2 - 289q^6 = (11p)^2 - (17q^3)^2$$
$$= (11p - 17q^3)(11p + 17q^3)$$

Ex 5:

$$-81x^2 + 100 = 100 - 81x^2 = 10^2 - (9x)^2$$
$$= (10 - 9x)(10 + 9x)$$

PRACTICE FACTORING BINOMIALS USING THE DIFFERENCE OF SQUARES FORMULA:

1	$81x^2 - 144y^2 =$ $(9x - 12y)(9x + 12y)$	13	$100x^2 - 324y^2 =$ $4(25x^2 - 81y^2) =$ $= 4(5x - 9y)(5x + 9y)$
2	$-x^2 + 169 = -(x^2 - 169)$ $= -(x - 13)(x + 13)$	14	$9x^2 - y^2 =$ $(3x - y)(3x + y)$
3	$121x^2 - y^2 =$ $(11x - y)(11x + y)$	15	$49x^4 - 100y^6 =$ $(7x^2 - 10y^3)(7x^2 + 10y^3)$
4	$25a^2 - 225c^2 =$ $(5a - 15c)(5a + 15c)$ $= 5(a - 3c)5(a + 3c) = \circledast$	16	$16x^2 + 121y^2 =$ this is not a DOS
5	$64m^2 - 100n^2 = 4(16m^2 - 25n^2)$ $= 4(4m - 5n)(4m + 5n)$	17	$-9a^2 + 144b^4 = \quad 144b^4 - 9a^2 \text{ (swap)}$ $(12b^2 - 3a)(12b^2 + 3a)$
SWAP 6 →	$-289x^2 + 49y^2 = 49y^2 - 289x^2$ $= (7y - 17x)(7y + 17x)$	18	$64 - p^2 =$ $(8 - p)(8 + p)$
7	$4x^2 - 16y^2 = 4(x^2 - 4y^2)$ $= 4(x + 2y)(x - 2y)$	19	$x^2 - y^8 =$ $(x - y^4)(x + y^4)$
8	$16x^4 - 81z^4 = (4x^2)^2 - (9z^2)^2$ $= (4x^2 - 9z^2)(4x^2 + 9z^2) = \circledast\circledast$	20	$18x^2 - 72y^2 = 18(x^2 - 4y^2)$ $= 18(x - 2y)(x + 2y)$
9	$a^2 - 441d^2 = (a - 21d)(a + 21d)$	21	$50x^2 - 96z^2 =$ $\nabla = 2(25x^2 - 48z^2)$ $0 \qquad$ this is not a DOS
∇ 0 10	$-36c^2 - 36d^4 =$ this is not a DOS	22	$48a^2 - 75b^2 = 3(16a^2 - 25b^2)$ $= 3(4a - 5b)(4a + 5b)$
11	$196x^2 - 256y^2 =$ $(14x - 16y)(14x + 16y) =$ $= 2(7x - 8y)2(7x + 8y) = \circledast\circledast\circledast$	23	$242x^2 - 128y^2 = 2(121x^2 - 64y^2)$ $= 2(11x - 8y)(11x + 8y)$
12	$a^2x^2 - b^2c^2 = (ax)^2 - (bc)^2$ $= (ax - bc)(ax + bc)$	24	$300m^2 - 108n^2 =$ $12(25m^2 - 9n^2)$ $12(5m - 3n)(5m + 3n)$

$*\quad 25(a - 3c)(a + 3c)$

$\circledast\circledast \quad (4x^2 + 9z^2)(2x)^2 - (3z)^2) = (4x^2 + 9z^2)(2x - 3z)(2x + 3z)$

$\circledast\circledast\circledast) \quad 4(7x - 8y)(7x + 8y)$