

Rule 1 GCF

$$\begin{aligned} \text{Ex) } 7x^5y^2z^8 + 21x^4y^7z^2 - 49x^6y^3z \\ = 7x^4y^2z(xz^7 + 3y^5z - 7x^2y) \end{aligned}$$

Rule 2 Difference of Perfect Squares

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

$$\text{Ex) } 81a^2 - 64x^4 = (9a+8x^2)(9a-8x^2)$$

Rule 3 Trinomial w/Leading Coeff.=1

$$\text{Ex) } x^2 - 4x - 32 = (x-8)(x+4)$$

$$\text{Ex) } c^2d^2 - 12cd + 35 = (cd-5)(cd-7)$$

Rule 4 Sum/Difference of Perfect Cubes

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

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

$$\begin{aligned} \text{Ex) } (8c^3 + 64b^3) &= 8(c^3 + 8b^3) \text{ (look for GCF first!)} \\ &= 8(c+2b)(c^2 - 2bc + 4b^2) \end{aligned}$$

Rule 5 Perfect Square Trinomials

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

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

$$\text{Ex) } 9a^2 - 30ab + 25b^2 = (3a-5b)^2$$

$$\text{Ex) } c^2d^2 + 2cde^3 + e^6 = (cd + e^3)^2$$

I. PRACTICE: Factor Completely.

$$1) a^2 + 5a + 6$$

$$(a+3)(a+2)$$

$$2) a(y-b) - c(y-b)$$

$$(y-b)(a-c)$$

$$3) a^4 + a^3b + a^2b^2$$

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

$$4) 49s^2 - 100$$

$$(7s+10)(7s-10)$$

$$5) p^2 - 4bp + 4b^2$$

$$(p-2b)(p-2b)$$

$$= (p-2b)^2$$

$$6) p^2 - 4bp - 4b^2$$

prime

$$7) a^2 + 5a - 6$$

$$(a+6)(a-1)$$

$$8) x^3 - 8x^2 + 15x$$

$$x(x^2 - 8x + 15) = x(x-5)(x-3)$$

$$9) c^8 - 81$$

$$(c^2+9)(c^2-9)$$

$$= (c^2+9)(c+3)(c-3)$$

$$10) 9m^2 + 64$$

prime

$$11) f^3 - 1$$

$$(f-1)(f^2+f+1)$$

$$12) f^2 - 18f + 81$$

$$(f-9)(f-9) = (f-9)^2$$

Careful with 13 and 14!

$$13) 24a^3 - 81b^3$$

$$= 3(8a^3 - 27b^3)$$

$$= 3(2a - 3b)(4a^2 + 6ab + 9b^2)$$

$$14) 3a^6 - 3$$

$$= 3(a^6 - 1)$$

$$= 3(a^3 + 1)(a^3 - 1)$$

$$= 3(a + 1)(a^2 - a + 1)(a - 1)(a^2 + a + 1)$$

Think! You can do these!

$$15) a^{2n} - 64$$

$$(a^n + 8)(a^n - 8)$$

$$16) x^{3n} - y^{3n}$$

$$(x^n - y^n)(x^{2n} + x^n y^n + y^{2n})$$

II. More Practice: Matching.

QUESTIONS

E 1. $4x^2 - 9 = (2x + 3)(2x - 3)$

D 2. $x^2 + 11x + 28 = (x + 7)(x + 4)$

C 3. $x^4 - 16 = (x^2 + 4)(x^2 - 4) = (x^2 + 4)(x + 2)(x - 2)$

J 4. $x^2 + 9$ prime

I 5. $x^3 - 4x^2 - 21x = x(x^2 - 4x - 21) = x(x - 7)(x + 3)$

A 6. $3x^2 + 9x - 12 = 3(x^2 + 3x - 4) = 3(x + 4)(x - 1)$

G 7. $x^2 - x - 72 = (x - 9)(x + 8)$

B 8. $21xy^2 - 28x^3y^3 + 35x^2y^5 = 7xy^2(3 - 4x^2y + 5xy^3)$

F 9. $x^3 + 64 = (x + 4)(x^2 - 4x + 16)$

H 10. $9x^6 - 72$ (Careful!)

$= 9(x^6 - 8) = 9(x^2 - 2)(x^4 + 2x^2 + 4)$ J. PRIME - Sum of two squares cannot be factored.

ANSWERS

A. $3(x - 1)(x + 4)$

B. $7xy^2(3 - 4x^2y + 5xy^3)$

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

D. $(x + 4)(x + 7)$

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

F. $(x + 4)(x^2 - 4x + 16)$

G. $(x - 9)(x + 8)$

H. $9(x^2 - 2)(x^4 + 2x^2 + 4)$

I. $x(x + 3)(x - 7)$