

IDENTITIES: SPECIAL PRODUCTS AND FACTORS

$$1. (\chi + a)(\chi + b) = \chi^2 + \chi(a + b) + ab.$$

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

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

$$4. (a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca.$$

$$5. (a + b)^2 + (a - b)^2 = 2(a^2 + b^2).$$

$$6. (a + b)^2 - (a - b)^2 = 4ab \text{ or}$$

$$(a - b)^2 - (a + b)^2 = -4ab.$$

$$7. (a + b)^3 = a^3 + b^3 + 3ab(a + b) = a^3 + 3a^2b + 3ab^2 + b^3.$$

$$8. (a - b)^3 = a^3 - b^3 - 3ab(a - b) = a^3 - 3a^2b + 3ab^2 - b^3.$$

$$9. (a - b)(a + b) = a^2 - b^2.$$

$$10. (a - b)(a + b)(a^2 + b^2) = a^4 - b^4.$$

$$11. a^3 + b^3 = (a + b)(a^2 - ab + b^2).$$

$$12. a^3 - b^3 = (a - b)(a^2 + ab + b^2).$$

$$13. a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca).$$

$$14. \text{CONDITIONAL IDENTITY: If } a + b + c = 0, \text{ then } a^3 + b^3 + c^3 = 3abc.$$

$$15. a^4 + a^2b^2 + b^4 = (a^2 + ab + b^2)(a^2 - ab + b^2).$$

$$16. a^4 + a^2 + 1 = (a^2 + a + 1)(a^2 - a + 1).$$

$$17. a^6 + b^6 = (a^2)^3 + (b^2)^3 = (a^2 + b^2)(a^4 - a^2b^2 + b^4).$$

$$18. a^6 - b^6 = (a^3)^2 - (b^3)^2 = (a^3 + b^3)(a^3 - b^3) = (a + b)(a^2 - ab + b^2)(a - b)(a^2 + ab + b^2).$$