

Advanced Arithmetic Properties

Mathematics · Answer Key · 20 Questions

1. Which of the following describes the multiplicative inverse property for a non-zero complex number $z = a + bi$?

- A) z multiplied by its conjugate equals zero
- B) z multiplied by its reciprocal equals the identity 1**
- C) z multiplied by its additive inverse equals zero
- D) z multiplied by its modulus equals the identity 1

2. In modular arithmetic, the multiplicative inverse of an integer 'a' modulo 'n' exists if and only if:

- A) n is a prime number
- B) a is a multiple of n
- C) $\gcd(a, n) = 1$**
- D) a is greater than n

3. When multiplying two matrices A ($m \times n$) and B ($p \times q$), what is the mandatory condition for the product AB to be defined?

- A) $m = q$
- B) $n = p$**
- C) $m = p$
- D) $n = q$

4. Which property of division is NOT universally applicable to real numbers?

- A) Multiplication by a reciprocal
- B) Commutative property**
- C) Distributive property over addition
- D) Associative property

5. What is the product of two odd functions $f(x)$ and $g(x)$?

- A) An odd function
- B) An even function**
- C) A constant function
- D) A linear function

6. Given the division algorithm for integers a and b ($b > 0$), there exist unique integers q and r such that $a = bq + r$. What is the standard range for r ?

- A) $0 < r < b$
- B) $0 \leq r < b$**
- C) $1 \leq r \leq b$
- D) $0 \leq r \leq b$

7. What is the result of multiplying a square matrix by its inverse?

- A) The zero matrix
- B) The identity matrix**
- C) The determinant of the matrix
- D) The transpose of the matrix

8. In the context of polynomial division, if $P(x)$ is divided by $(x - a)$, the remainder is equal to:

- A) $P'(a)$
- B) $P(a)$**
- C) $P(-a)$
- D) a

9. What is the multiplicative identity element in the set of quaternions?

- A) 0
- B) 1**
- C) i
- D) j

10. When multiplying two complex numbers in polar form, $z_1 = r_1(\cos\theta_1 + i \sin\theta_1)$ and $z_2 = r_2(\cos\theta_2 + i \sin\theta_2)$, what happens to the arguments?

- A) They are multiplied
- B) They are subtracted
- C) They are added**
- D) They are squared

11. Which statement accurately defines the quotient rule for differentiation, which involves division of derivatives?

- A) $(f'g - fg') / g^2$**
- B) $(f'g + fg') / g^2$
- C) $(fg' - f'g) / g^2$
- D) $(f'g' / g)$

12. In scientific notation, what happens to the exponents when multiplying two numbers expressed as $a \cdot 10^n$ and $b \cdot 10^m$?

- A) The exponents are multiplied
- B) The exponents are added**
- C) The exponents are divided
- D) The exponents remain unchanged

13. Which of these is the correct multiplicative inverse of 3 modulo 7?

- A) 2
- B) 4
- C) 5**
- D) 6

14. The product of a number and its multiplicative inverse is always:

- A) The number itself
- B) Zero
- C) One**
- D) The square of the number

15. If $a = bq + r$, what is the value of the greatest common divisor $\gcd(a, b)$?

- A) $\gcd(b, r)$**
- B) $\gcd(q, r)$
- C) $\gcd(a, r)$
- D) $\gcd(a, q)$

16. Which operation represents the scalar multiplication of a vector v by a constant k ?

- A) Scaling the magnitude of v by $|k|$**
- B) Rotating the vector v by k degrees
- C) Adding k to each component of v
- D) Dividing the magnitude of v by k

17. What is the result of dividing a non-zero number by its own reciprocal?

- A) The original number squared**
- B) One
- C) The original number
- D) Zero

18. In binary multiplication, what is $1101 * 10$?

- A) 11010**
- B) 11011
- C) 10110
- D) 10010

19. Which algebraic property states that $a(b + c) = ab + ac$?

- A) Associative property of multiplication
- B) Distributive property of multiplication over addition**
- C) Commutative property of multiplication
- D) Multiplicative identity property

20. When dividing two powers with the same base, x^a / x^b , what is the result?

A) $x^{(a*b)}$

B) $x^{(a+b)}$

C) $x^{(a-b)}$

D) $x^{(a/b)}$