PROPERTIES OF INTEGERS

Properties of addition

Closure Property: Let a and b be any two integers, then a + b will always be an integer. This is called the closure property of addition of integers.
Examples: (a) 7 + 3 = 10
(b) (– 3) + 6 = 3

Commutative Property: If a and b are two integers, then a + b = b + a, i.e., on changing the order of integers, we get the same result. This is called the commutative property of addition of integers.
Examples: (a) 2 + 7 = 7+2 = 9
(b) (– 3) + (12) = (12) + (– 3) = 9

Associative Property: If a, b, and c are three integers, then a + (b + c) = (a + b) + c, i.e., in the addition of integers, we get the same result, even the grouping is changed. This is called the associative property of addition of integers.
Examples :
[(– 3) + (– 4)] + (8) = (– 3) + [(– 4) + 8]
(– 7) + 8 = (– 3) + 4
1 =1

Additive identity : If zero is added to any integer, the value of integer does not change. If 'a' is an integer, then a + 0 = a = 0 + a. Hence, zero is called the additive identity of integers. Examples :
(a) 12 + 0 = 12 = 0 + 12
(b) (– 3) + 0 = (– 3) = 0 +(– 3)

Additive Inverse : When an integer is added to its opposite, we get the result as zero (additive identity). If a is an integer, then (– a) is its opposite (or vice– versa) such that
a + (– a) = 0 = (– a) + a
Thus, an integer and its opposite are called the additive inverse of each other.
Examples:
2 +(– 2) = 0 = (– 2) + 2

Property of 1: Addition of 1 to any integer gives its successor.
Examples : 7+ 1 = 8
Hence, 8 is the successor of 7.
– 5 + 1 = (– 4)
Hence, (– 4) is the successor of (– 5).

Properties of subtraction

Closure Property: If a and b are two integers, then a – b will always be an integer. This is called the closure property of subtraction of integers.
Examples: (a) 3 – 7 = – 4
(b) (– 5) – (– 6) = 1

Commutative Property: If a and b are two integers, then a – b ≠ b – a, i.e., commutative property does not hold good for the subtraction of integers.
Examples : 7– (– 8) = 15 but (– 8) – 7 = – 15
3 – 4 = – 1 but 4 – 3 = 1
Hence, subtraction of integers is not commutative.

Associative Property : If a, b and c are three integers, then (a – b) – C ≠ a – (b – c), i.e., associative property does not hold good for the subtraction of integers.
Example : (8– 4) – 2 ≠ 8 – (4 – 2)
4 – 2 ≠ 8– 2
2 ≠ 6
Hence, subtraction of integers is not associative.

Property of Zero : When zero is subtracted from an integer, we get the same integer, i.e., a– 0 = a, where 'a' is an integer.
Examples: (a) 6– 0 = 6
(b) (– 6) – 0 = (– 6)

Property of 1: Subtraction of 1 from any integer gives its predecessor.
Examples
(a) 7– 1 = 6 (6 is predecessor of 7.)
(b) (– 3) – 1 = (– 4) [(– 4) is predecessor of (– 3).]

Properties of multiplication

Closure Property: If a and b are two integers then a × b will also be an integer. This is called the closure property of multiplication of integers.
Examples: (a) 3 × (– 4) = (– 12)
(b) (– 7) (– 2) = 14

Commutative Property: If a and b are two integers, then a × b=b × a, i.e., on changing the order of integers, we get the same result. This is called the commutative property of multiplication of integers.
Examples: (a) 7 × 2 = 2 × 7 = 14
(b) (– 3) × (– 7) = (– 7) × (– 3) = 21
Thus, commutative property holds good for the multiplication of integers.

Associative Property: If a, b and c are three integers, then a × (b × c) = (a × b) × c. This is called the associative property of multiplication of integers.
Examples: (3 × 4) × 5 = 3 × (4 × 5)
12 × 5 = 3 × 20
60 = 60
Thus, associative property holds good for the multiplication of integers.

Multiplicative Identity: The product of any integer and 1 gives the same integer. If 'a' is an integer, then a × 1 = a = 1 × a.
Hence, 1 is called the multiplicative identity.
Examples: (a) 7 × 1 = 1 × 7 = 7
(a) (– 3) × 1 = 1 × (– 3) = (– 3)

Multiplicative Inverse: The product of any integer and its reciprocal gives the result as 1 (multiplicative identity). If 'a' is an integer, then a × $\frac{1}{a}$ = 1 = $\frac{1}{a}$ × a. Thus, an integer and its reciprocal are called the multiplicative inverse of each other.
Examples: (a) 3 × $\frac{1}{3} = 1 = \frac{1}{3} \times 3$
(b) (-5) × $\frac{1}{(-5)}$ = 1 = $\frac{1}{(-5)} \times -5$

Property of Zero : The product of any integer and zero gives the result as zero. If 'a' is an integer, then a × 0 = 0 × a = 0.
Examples : 6 × 0 = 0 × 6 = 0

Distributive Property: Multiplication distributes over addition. If a, b, and c are three integers, then a × (b + c) = ab + ac. This is called the distributive property of multiplication of integers.
Examples : (– 7) × [3 + (– 4)] = (– 7) (3) + (– 7) × (– 4)
(– 7) × (– 1) = (– 21) + 28
7 = 7

Properties of division

Closure Property: Closure property does not hold good for division of integers.
Examples: 12 ÷ 3 = 4 (4 is an integer.)

Commutative Property: If a and b are two integers, then a ÷ b ≠ b ÷ a.
Examples: (a) 4 ÷ 2 = 2 but 2 ÷ 4 = $\frac{2}{4}$ or $\frac{1}{2}$
(b) (-3) ÷ 1 = -3 but 1 ÷ (-3) = $\frac{1}{-3}$

Associative Property : If a, b, c are three integers, then (a ÷ b) + c ≠ a ÷ (b ÷ c)
Example : (24 ÷ 4) ÷ (– 2) ≠ 24 ÷ [4 ÷ (– 2)]
6 ÷ (– 2) ≠ 24 ÷ (– 2)
(– 3) ≠ (–12)

Property of Zero : When zero is divided by any integer, the result is always zero. If a is and integer, then 0 ÷ a = 0.