

## Integers

- The set of natural numbers, zero and the negatives of natural numbers form the set of Integers (I or Z).
- There is no smallest integer.
- 1 is the smallest positive integer and -1 is the largest negative integer
- The sum of two positive integers results in a positive integer
- The sum of two negative integers results in a negative integer
- The sum of a positive and a negative integer is the difference of the numbers with the sign of the larger
- On the number line when we:
  - (i) add a positive integer, we move to the right
  - (ii) add a negative integer, we move to the left
  - (iii) subtract a positive integer, we move to the left
  - (iv) subtract a negative integer, we move to the right
- The additive identity for integers is 0
- If a is an integer,  $-a$  is the additive inverse of a and a is additive inverse of  $-a$ ;  $a + (-a) = (-a) + a = 0$
- Subtraction is the opposite of addition, Therefore, to subtract two integers, we add the additive inverse of the integer that is being subtracted to the other integer  
Ex:  $23 - 43 = 23 + (\text{Additive inverse of } 43) = 23 + (-43) = -20$
- The multiplicative identity for integers is 1 ; for any integer a,  $1 \times a = a$   $\times 1 = a$ .
- Product of two positive integers is a positive integer :  $(+) \times (+) = (+)$
- Product of two negative integers is a negative integer:  $(-) \times (-) = (+)$
- Product of a positive and a negative integer is a negative integer:  
 $(+) \times (-) = (-)$  or  $(-) \times (+) = (-)$
- Product of even number of negative integers is positive
- Product of odd number of negative integers is negative
- When an integer is multiplied by  $-1$ , we get the additive inverse of the integer

- $\frac{1}{a}$  is the multiplicative inverse or reciprocal of a where  $a \neq 0$ , also a  $\frac{1}{\frac{1}{a}}$  is the multiplicative inverse of  $\frac{1}{a}$ ;  $a \times \frac{1}{a} = \frac{1}{a} \times a = 1$
- Multiplicative inverse of 1 =1 and Multiplicative inverse of -1 =-1
- The division of a positive integer by a positive integer results in a positive integer :
- The division of a negative integer by a positive integer results in a negative integer or the division of a positive integer by a negative integer results in a negative integer:  $\frac{-a}{b}$  or  $\frac{a}{-b}$
- The division of a negative integer by a negative integer results in a positive integer :

For any integer a, the below properties hold :

$a \times 0 = 0 \times a = 0$	Where, $a \neq 0$
$a \div 0$ is not defined	
$0 \div a = 0, a \neq 0$	
$a \times 1 = 1 \times a = a$	•  •

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Properties of Integers	Basic operations			
	Addition	Subtraction	Multiplication	Division
Closure property (for any 2 integers a and b)	a + b is an integer; integers are closed under addition	a – b is an integer ; integers are closed under subtraction	a x b is an integer ; integers are closed under multiplication	Integers are not closed under division. ,but
Commutative property (for any 2 integers a and b)	a + b = b + a ;addition is commutative	a – b ≠ b – a ; subtraction is not commutative	a x b = b x a ;multiplication is commutative	; division is not commutative
Associative property: (For any 3 integers a, b and c)	a +( b + c) = ( a + b) + c ;addition is associative	Subtraction is not associative	a x (b x c)= (a x b ) x c ; multiplicative is associative	Division is not associative

Distributive property of multiplication over addition:

For any three integers a, b and c:

$$a \times (b + c) = (a \times b) + (a \times c)$$

Ex:  $-2 (4 + 3) = -2 (7) = -14$   
 $= (-2 \times 4) + (-2 \times 3)$   
 $= (-8) + (-6)$

Distributive property of multiplication over subtraction:

For any three integers, a, b and c :

$$a \times (b - c) = (a \times b) - (a \times c)$$

Ex:  $-2 (4 - 3) = -2 (1) = -2$   
 $= (-2 \times 4) - (-2 \times 3)$   
 $= (-8) - (-6)$

$$= -14.$$

$$= -2.$$

Commutative, Associative and Distributive properties help in making calculations easier

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