# Operations on Whole Numbers

Chapter 2

# Operations on whole no.

Whole no. $\Rightarrow$ $0, 1, 2, 3, \ldots \infty$

# Properties of Addition ✓

① **Closure Property :**

If, $\underline{a \ \& \ b \quad \text{whole no.}}$

Then, $a+b$ is also a whole no.

eg: 12, 0 $\Rightarrow$ whole no.

$$12+0 = \underset{\underset{\text{whole no.}}{\downarrow}}{12}$$

Eg: 5 and 6

$$5+6 = \underset{\underset{\text{Whole no.}}{\downarrow}}{11}$$

$\underset{\text{whole no.}}{\downarrow}$

$\Rightarrow$ Whole nos. are closed under addition.

$\Rightarrow$ Closure property holds for add. of whole nos.

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(11) <u>Commutative Property for addition</u>

$a$, $b$ are whole nos.

$$a + b = b + a$$

e.g. 5 and 7 are whole nos.

$5 + 7 = 12$

$7 + 5 = 12$

$$5 + 7 = 7 + 5$$

retains its identity.

$5 + 0 = 5$
↑
Additive identity.

⇒ Zero is additive identity.

⇒ Commutative property holds for addition of whole nos.

(III) **Associative Property**

If        a , b and   c   are    three   whole  nos.    , then

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

eq. $\neq$    5 , 2 , 7   are   whole nos.

$$(5 + 2) + 7 = 14$$
$$5 + (2 + 7) = 14$$

$\Rightarrow$   Associative   property  holds   for    addition  of  whole  nos.

Ex.

$$1 + 2 + 3 + 4 + 996 + 997 + 998 + 999 = 4000$$

Ex. 2

$$2062 + 353 + 1438 + 547$$

$$\Rightarrow (2062 + 1438) + (353 + 547)$$

$$= 3500 + 900$$

$$= 4400$$

$$353 = 300 + 53$$

$$+ \quad 547 = 500 + 47$$

$$= 800 + 100$$

$$= 900$$

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# Properties of Subtraction

① **Closure Property**
└→ does not hold for subtraction of whole nos.

eg.

$$5 - 3 = 2$$
↑   ↑     ↑
W   W     W

$$3 - 5 = -2$$
↑   ↑     ↑
W   W    Not W

(11)   Commutative

$$5 - 3 = \underline{\underline{2}}$$

$$3 - 5 = \underline{\underline{-2}}$$

$$5 - 3 \neq 3 - 5$$

$\Rightarrow$ Commutative property does not hold for subtraction of whole no.

(11)  Associative
<u>Associative</u>

=>

$$5 - (3 - 1) = 3$$

$$(5 - 3) - 1 = 1$$

$$5 - (3 - 1) \neq (5 - 3) - 1$$

=> Subtraction of whole no. is not associative.

(IV) If a, b and c are 3 whole nos. such that,

$$a - b = c \quad , \quad \text{then} \quad b + c = a$$

$-1$

for eg.

$$5 - 3 = 2 \quad , \quad 3 + 2 = 5$$

a    b    c

# Properties of multiplication

① Closure Property

↓

It holds for multiplication

eg.     $7 \times 2 = 14$

↑ ↑ ↑
W W W

---

* $1$ is called multiplicative identity

$13 \times 1 = 13$

$7 \times 1 = 7$

## ⑪ Commutative

$$2 \times 3 = 3 \times 2$$

$\Rightarrow$ multiplication of whole no. is commutative

## ⑪⑪ Associative Property.    a, b & c

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

$$(2 \times 3) \times 4 = 24$$

$$2 \times (3 \times 4) = 24$$

$$(2 \times 3) \times 4 = 2 \times (3 \times 4)$$

$\Rightarrow$ multiplication of whole nos. is associative.

(IV) <u>Distributive property</u>

→ Distibutivity of multiplication over <u>addition</u> / <u>subtraction</u>

(i) <u>a, b & c are</u> <u>whole nos.</u>

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

$$2 \times (5 \oplus 3) = 2 \times 5 \, \textcircled{+} \, 2 \times 3$$
$$= 10 + 6$$
$$= 16$$

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eg.
$$3 \times (7 + 15) = 3 \times 22 = 66$$

$$3 \times (7 + 15) = 3 \times 7 + 3 \times 15$$
$$= 21 + 45$$
$$= \underline{66}$$

eg.
$$5 \times (19 - 2) = 5 \times 17 = \underline{85}$$

$$5 \times (19 - 2) = 5 \times 19 - 5 \times 2$$
$$= 95 - 10$$
$$= \underline{85}$$

Q. Find the products:

(i)   $4 \times 4957 \times 25 = 4957 \times 25 \times 4$

$= 4957 \times 100$

$= 495700$

(ii)  $37256 \times 25 \times 9 \times 40 = (37256 \times 9) \times (25 \times 40)$

$= \underline{335304} \times 1000$

$= 335304000$

eg: multiply : 475 by 64 using distributive property.

Multiply 5217 by 325 : using distributive property

$$5217 = (5000 + 200 + 10 + 7) \times \boxed{325}$$

$$= 5000 \times 325 + 200 \times 325 + 10 \times 325 + 7 \times 325$$

$$= 1625000 + 65000 + 3250 + 2275$$

$$= 1695525$$

$$72398 \times 416$$

$$= 3011568$$

$$\textcircled{1} \overset{\frown}{0000} \times 416 = \underline{4160000}$$

$$\underset{\underbrace{\phantom{20000}}}{20000} \times 4\overset{\textcircled{1}}{0}6 = 832000$$

$$\cancel{800} \times 42 = 8400$$

$$= \boxed{\textcircled{7}0000 \times 416} + \boxed{2000 \times 416} + \boxed{300 \times 416} + \boxed{90 \times 416} + \boxed{8 \times 416}$$

$$= \underline{2912000} + 832000 + 124800 + 37440 + \boxed{\begin{array}{c} 70000 \\ \times \ 416 \end{array}}$$

$$\overset{\textcircled{1}\textcircled{4}}{7} \times 416 = \underline{2912000}$$

$$\begin{array}{r} 416 \\ \times \ 7 \\ \hline \end{array} 0000$$

$$736 \times 103$$

$$736 \times (100 + 3)$$

$$736 \times 100 \; \oplus \; \boxed{736 \times 3}$$

$$\Rightarrow \quad 73600 \; + \; 2208$$

$$\Rightarrow \quad 75808$$

$$1245 + 4960$$

$$\boxed{6205}$$

$$816 \times 745$$

$$816 \times (700 + \textcircled{40} + 5)$$

$$(\overset{.}{800} + \underline{10} + 6) \times 7\overset{34}{4}5$$

$$596000 + 7450 + \quad 4470$$

:)

$$607920$$

$$\begin{array}{r} 4\,6 \\ \times\ 3\,2 \\ \hline 1\,2\,7\,2 \\ \hline \boxed{1472} \end{array}$$

$$\begin{array}{r} 1\,8 \\ 8 \\ \hline \textcircled{26} \end{array}$$

$$\begin{array}{r} 1\ 9 \\ 1\ 4 \\ 2\ 4 \\ \hline 2\,5\,6 \end{array} \quad \boxed{456}$$

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# Properties of division of whole nos.

$$20 \div \boxed{5}$$

$$5 \overline{)20} ( \quad 4$$

① Division is repeated subtraction

$20 - 5 = \boxed{15} \checkmark$

$15 - 5 = 10 \checkmark$

$10 - 5 = 5 \checkmark$

$5 - 5 = 0 \checkmark$

⑤ is subtracted 4 times from ㉑

Hence ④ is the quotient.

Division   is   (inverse) of   multiplication

eg.
$$12 \div ③ = ④ \qquad \mid \quad 4 \times 3 = 12$$

(i)  Closure property

$$12 \div \frac{5}{9} \quad = \quad \frac{2.4}{\downarrow}$$

↑           ↓           not a whole no.
W       W

∴  Division of whole nos.  is  not closed.

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(II) Commutative Property

$$5 \div 2 \neq 2 \div 5$$

Not Commutative.

(iii) Associative

$$(15 \div 3) \div 2 \neq 15 \div (3 \div 2)$$

Not associative

(IV) $\quad 0 \div (\text{whole no.}) = 0$

(V) $\quad (\text{Whole no.}) \div 0 = (\text{can't be done} \{ \text{Not defined})$

$$\boxed{\dfrac{5}{0}} \quad (\text{Not defined})$$

$$\boxed{\dfrac{0}{5} = 0} \quad \underline{\text{defined}}$$

# Division Algorithm

$\Rightarrow$ If a whole no. 'a' is divided by a non-zero whole no. 'b', then there exists whole nos. q and r such that

$$\boxed{a = bq + r}, \text{ where}$$

$$\underline{r = 0} \text{ or } \underline{r < b}.$$

expression :

$$b \overline{\smash{\big)}\, a } \begin{array}{r} q \\ \hline a \\ -bq \\ \hline r \end{array}$$

Quotient

$$\boxed{eg1} \quad 3 \overline{\smash{\big)}\, 7 } \begin{array}{r} 2 \\ \hline 7 \\ -6 \\ \hline 1 \end{array} \quad \leftarrow \text{Dividend}$$

Divisor

$\leftarrow$ Remainder

$$\boxed{\text{Dividend} = \text{Divisor} \times \text{Quotient} + \text{Remainder}}$$

$$\boxed{eg2} \quad 3 \overline{\smash{\big)}\, 6 } \begin{array}{r} 2 \\ \hline 6 \\ -6 \\ \hline 0 \end{array} \leftarrow$$

**Q.** Divide 46087 by 356 and check the result by division algorithm.

**Sl:**

$$
\begin{array}{r}
356 \overline{)46087} \\
\end{array}
$$

b → 356 ) 46087 ← a

quotient 129 ← q

$$
\begin{array}{r}
129 \\
356 \overline{)46087} \\
-356 \\
\hline
1048 \\
-712 \\
\hline
3367 \\
-3204 \\
\hline
163 \longrightarrow r
\end{array}
$$

356 × q

_____ 4

**Check:** Dividend = 46087

$$\boxed{Quotient \times divisor + remainder} = 129 \times 356 + 163$$

$$= 45926 + 163$$

$$= 46087 \implies \underline{Dividend}$$

**Q2:** Find the number which when divided by 46 gives a quotient 11 and remainder 18.

Sol:

$$a = bq + r$$

$$a = 46 \times 11 + 18$$

$a = 506 + 18$

$\quad = 524$

$a = ?$ } To find.

$\left.\begin{array}{l} b = 46 \\ q = 11 \\ r = 18 \end{array}\right\}$ Given

Q3 :→ The the product of two numbers is 504347. If one of the numbers is 1591, find the other.

Sol:

$$317$$

$$1591 \overline{) 504347}$$

$$-4773$$

$$\overline{2704}$$

$$-1591$$

$$\overline{11137}$$

$$-11137$$

$$\overline{0}$$

So the other no. is 317.

Q. On dividing $\underline{55390}$ by $\underline{299}$, the remainder is $\underline{75}$. Find the quotient.

Sol: Given: (a) dividend = 55390

(b) divisor = 299

(r) remainder = 75

To find: (q) quotient = ?

Division algorithm, $\boxed{a = bq + r}$

$$55390 = 299 \times \enclose{circle}{q} + 75$$

Subtract 75 from both side,

$$55390 - 75 = 299 \times q \boxed{+75 - 75}$$

$$55390 - 75 = 299 \times q + 0$$

$$\frac{55315}{299} = \frac{299 \times q}{299}$$

$$\boxed{\frac{55315}{299} = q}$$

$$\boxed{q = \frac{55315}{299}} \quad \boxed{H.w}$$

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