CHAPTER 2

SIMPLIFICATIONS

2.1 FOUR FUNDAMENTAL OPERATIONS

1. Addition

For any two numbers, if :

(i) both the numbers are positive, their sum is also positive.

e.g. (+8) + (+5) = +13 *i.e.* 8 + 5 = 13.

(ii) both the numbers are negative, their sum is also negative.

e.g. (–8) + (–5) = –13 *i.e.* –8 – 5 = – 13

(iii) one number is positive and the other is negative; without considering their signs, subtract the smaller from the bigger and then take the sign of the bigger number.

e.g. (+8) + (–5) = + 3 *i.e.* 8 – 5 = 3

and (–8) + (+5) = – 3 *i.e.* –8 + 5 = – 3

2. Subtraction

Change the sign of the number to be subtracted and then add.

e.g. subtraction of :

(i) 8 from 12 =12 – 8 = 4,

(ii) –8 from 12 = 12 + 8 = 20,

(iii) –8 from –12 = – 12 + 8 = –4

(iv) 8 from –12 = – 12 – 8 = – 20 and so on.

3. Multiplication

(i) The multiplication of two positive numbers is positive.

e.g. (+5) × (+3) = +15; 7 × 4 = 28 and so on.

(ii) The multiplication of two negative numbers is also positive.

e.g. (–5) × (–3) = +15; (–7) × (–4) = 28 and so on.

(iii) The multiplication of a positive number and a negative number is negative.

e.g. (–5) × (+3) = –15; (7) × (–4) = –28 and so on.

The multiplication of two or more numbers is

(i) **positive**; if each number is positive

i.e. 2 × 3 = 6, 4 × 2 × 5 = 40, 7 × 3 × 5 × 6 = 630 and so on.

(ii) **positive**; if the number of negative numbers is even,

(iii) **negative**; if the number of negative numbers is odd.

e.g. (–3) × (–4) × (–5) × (–6) = + 360; as the no. of negative numbers is 4 (even).

(–3) × (–4) × (+5) × (–6) = –360; as the no. of negative numbers is 3 (odd)

(+3) × (+4) × (–5) × (–6) = + 360; as the number of negative numbers is 2 (even)

(+3) × (–4) × 5 × 6 = –360; as the number of negative numbers is 1 (odd)

4. Division

For dividing one number by the other, the same rules are applied as for multiplication. That is, the division between the two given numbers is :

(i) **positive**; if both the numbers are either positive or both are negative.

e.g. $\frac{+8}{+4} = 2$, *i.e.* $\frac{8}{4} = 2$, $\frac{-75}{-15} = 5$ and so on.

(ii) **negative**; if one number is negative and the other is positive.

e.g. $\frac{-8}{+4} = -2$ *i.e.* $\frac{-8}{4} = -2$, $\frac{75}{-15} = -5$ and so on.

Example 1 :

Evaluate : (i) $8 - 3 + 15 - 7 - 14$ (ii) $-25 - 47 + 64 - 12 + 30$

Solution :

Steps : 1. Add all the positive numbers together and all the negative numbers separately together.

2. Add or subtract the resulting numbers as the case may be.

(i) $8 - 3 + 15 - 7 - 14$

$= 23 - 24$ [$\because$ $8 + 15 = 23$ and $-3 - 7 - 14 = -24$]

$= -1$ **(Ans.)**

(ii) $-25 - 47 + 64 - 12 + 30$

$= -84 + 94 = 10$ **(Ans.)**

Example 2 :

Evaluate : (i) $\frac{-4 \times 20}{5 \times -8}$ (ii) $\frac{6 \times (-30)}{4 \times 15}$ (iii) $\frac{6 \times (-10) \times (-4)}{(-8) \times (-2) \times (-3)}$

Solution :

(i) $\frac{-4 \times 20}{5 \times -8} = \frac{-80}{-40} = 2$ **(Ans.)** $\left[\frac{-\text{ve}}{-\text{ve}} = +\text{ve}\right]$

(ii) $\frac{6 \times (-30)}{4 \times 15} = \frac{-180}{60} = -3$ **(Ans.)** $\left[\frac{-\text{ve}}{+\text{ve}} = -\text{ve}\right]$

(iii) $\frac{6 \times (-10) \times (-4)}{(-8) \times (-2) \times (-3)} = \frac{6 \times 10 \times 4}{-8 \times 2 \times 3} = \frac{240}{-48} = -5$ **(Ans.)**

2.2 BRACKETS

The signs for different types of brackets are :

(i) $\overline{\qquad\qquad}$; *Vinculum* or bar brackets,

(ii) ( ) ; *Parenthesis* or small brackets,

(iii) { } ; *Curly brackets* or middle brackets,

(iv) [ ] ; *Square brackets* or big brackets.

In a combined operation, the brackets must be removed in the same order as given above.

Remember, if :

1. there is a + sign or there is no sign before a bracket, the bracket is removed without changing the signs of its terms.

   e.g. $+(17-8) = 17-8$; $(-8+4) = -8+4$ and so on.

2. there is a minus (–) sign before a bracket, the bracket is removed with changing the signs of its terms.

   e.g. $-(17-8) = -17+8$; $-(-8+4) = 8-4$ and so on.

Example 3 :

Simplify : $18-[5-\{6+2(7-\overline{8-5})\}]$

Solution :

$18-[5-\{6+2(7-\overline{8-5})\}]$

$= 18-[5-\{6+2(7-3)\}]$ [Removing bar bracket first; $\overline{8-5} = 3$]

$= 18-[5-\{6+2(4)\}]$ [$7-3=4$]

$= 18-[5-\{6+8\}]$ [$2(4) = 2\times 4 = 8$]

$= 18-[5-14]$

$= 18-[-9]$ [$5-14=-9$]

$= 18+9 = 27$ **(Ans.)**

2.3 PRINCIPLE OF 'BODMAS'

For the purpose of simplification (including several operations), we use 'BODMAS' rule.

'BODMAS', actually, is the abbreviation formed by taking the initial letters of six operations and it helps in ***remembering the order*** in which the combined operations should be done.

The rule of BODMAS (*i.e.* the order of operations) is :

1. **B** stands for **bracket** *i.e.* [{ ($\overline{\quad}$) }]
2. **O** stands for **of** (means multiply)
3. **D** stands for **division** (*i.e.* ÷)
4. **M** stands for **multiplication** (*i.e.* ×)
5. **A** stands for **addition** (*i.e.* +)
6. **S** stands for **subtraction** (*i.e.* –)

Example 4 :

Simplify : $7-5\times 2 \text{ of } 3+(19-\overline{7-4})\div 4$

Solution :

$7-5\times 2 \text{ of } 3+(19-\overline{7-4})\div 4$

$= 7-5\times 2 \text{ of } 3+(19-3)\div 4$ [Remove the brackets **(B)** first]

$= 7-5\times 2 \text{ of } 3+16\div 4$

$= 7-5\times 6+16\div 4$ [Simplifying 'of' **(O)** *i.e.* 2 of $3 = 2\times 3 = 6$]

$= 7-5\times 6+4$ [Division **(D)** is done]

$= 7-30+4$ [Multiplication **(M)** is done]

$= 11-30$ [Addition **(A)**]

$= -19$ [Subtraction **(S)**] **(Ans.)**

Example 5 :

Simplify : (i) $48 \div 8$ of 3×2 (ii) 48 of $8 \times 3 \div 2$ (iii) $48 \times 8 \div 3$ of 2

Solution :

Each of the given expressions involves only three operations : Of (O), Division (D) and Multiplication (M). According to the principle of **'BODMAS'** :

(i) **$48 \div 8$ of 3×2**

$= 48 \div 24 \times 2$ [8 of $3 = 8 \times 3 = 24$]

$= 2 \times 2$ [$48 \div 24 = 2$]

$= 4$ **(Ans.)**

(ii) **48 of $8 \times 3 \div 2$**

$= 384 \times 3 \div 2$ [48 of $8 = 48 \times 8 = 384$]

$= 384 \times \frac{3}{2} = \frac{384 \times 3}{2} = 576$ **(Ans.)**

(iii) **$48 \times 8 \div 3$ of 2**

$= 48 \times 8 \div 6$ [3 of $2 = 3 \times 2 = 6$]

$= 48 \times \frac{8}{6} = \frac{48 \times 8}{6} = 64$ **(Ans.)**

Example 6 :

Simplify : (i) $112 - \{121 \div (11 \times 11) - (-4) - (3 - \overline{8-1})\}$

(ii) $15 - (-3)(4 - \overline{6-2}) \div 3\{5 + (-3) \times (-6)\}$

Solution :

(i) **$112 - \{121 \div (11 \times 11) - (-4) - (3 - \overline{8-1})\}$**

$= 112 - \{121 \div 121 + 4 - (3 - 7)\}$

$= 112 - \{121 \times \frac{1}{121} + 4 - (-4)\}$

$= 112 - \{1 + 4 + 4\} = 112 - 9 = 103$ **(Ans.)**

(ii) **$15 - (-3)(4 - \overline{6-2}) \div 3\{5 + (-3) \times (-6)\}$**

$= 15 - (-3)(4 - 4) \div 3\{5 + 18\}$

$= 15 - (-3)(0) \div 3 \times 23$

$= 15 - 0 \div 3 \times 23 = 15 - \frac{0}{3} \times 23 = 15 - 0 = 15$ **(Ans.)**

TEST YOURSELF

1. $5 + 8 =$ ....., $5 + (-8) =$ ....., $(-5) + 8 =$ ....., $(-5) + (-8) =$ .....
2. $15 - 8 =$ ....., $-15 - 8 =$ ....., $-13 + 6 =$ .....
3. $5 \times -8 =$ ....., $-5 \times -8 =$ ....., $-5 \times -8 \times -2 =$ .....,
   $-5 \times -8 \times -2 \times -3 =$ .....
4. $-\frac{12}{3} =$ ....., $\frac{-12}{3} =$ ....., $\frac{12}{-3} =$ ....., $\frac{-12}{-3} =$ .....
5. 6×5 of $3 =$ ....., 6×5 of $3 \div 9 =$ .....,
   6 of $5 \div 3 \times 9 =$ ....., 6 of $3 \times 5 \div 9 =$ .....

EXERCISE 2

1. Fill in the blanks :
   (i) $-5 \times -12 \times 2 \times -3 =$ .....
   (ii) $-5 \times -12 \times -2 \times -3 =$ .....
   (iii) $\frac{-18 \times 5}{3 \times (-10)} =$ .....
   (iv) $\frac{15 \times (-24) \times -18}{-(27) \times (20)} =$ .....

2. Add :
   (i) $52 - 27$ and $67 - 48$
   (ii) $-12 - 15 + 10$ and $-35 + 20$
   (iii) $87 - 35$ and $35 - 87$

3. Subtract :
   (i) 75 from $98 - 25 + 4$
   (ii) -47 from $32 - 18 - 23$
   (iii) $54 - 38$ from $38 - 54$

4. Multiply :
   (i) $(-5) \times 8$ and $3 \times (-2)$
   (ii) $4 \times (-3) \times (-2)$ and $6 \times (-5)$
   (iii) $(-2) \times (-1) \times (-3)$ and $(-4) \times (-5)$

5. Divide :
   (i) $(-60) \times (-72)$ by $36 \times (-15)$
   (ii) $96 \times (-25)$ by $(-75) \times (-16)$
   (iii) $(-54) \times (-64)$ by $(-27) \times (-128)$

6. Evaluate :
   (i) $\frac{(-16) \times (-8) \times (-81)}{(-18) \times 32}$
   (ii) $\frac{5 \times (-144) \times (-27)}{(-15) \times (-18) \times (-16)}$
   (iii) $\frac{(-8) \times 8 \times (-8) \times (-8)}{(-4) \times (-4) \times (-4) \times (-4)}$

7. Evaluate :
   (i) $42 \times 6 \div 3$ (ii) $24 \div 8 \times 2$
   (iii) $18 \times 24 \div 9 \times 4$ (iv) $3485 \div 5 - 200 \times 2$
   (v) $225 - 75 \div 15$ (vi) $1728 \div 144 - 12$
   (vii) $3 + 3$ of $3 \div 3$ of 3×3
   (viii) $72 \div 3 \times 4$ of 6
   (ix) $6 + 6 \div (6 + 6 \div 2)$
   (x) $24 \div 12 + 6$ of $16 \div 32 - 5$

8. Simplify :
   (i) $210 - \overline{185 - 35} + 85$
   (ii) $17\{39 + (38 - 12)(104 - 91)\}$
   (iii) $129 - (129 - \overline{130 - 30})$
   (iv) $56 - [45 - \{56 - (45 - \overline{56 - 45})\}]$
   (v) $841 \div [172 - \{72 + (72 - \overline{44 - 43})\}]$

9. Simplify :
   (i) $29 - [16 - \{17 + 3(18 - \overline{19 - 16})\}]$
   (ii) $[9 - \{14 - (19 - \overline{14 - 12})\}] - (14 - \overline{15 + 12})$
   (iii) $24 \div 3 - 9 \times 3 + (52 - \overline{8 - 4}) \div 6$

10. Simplify :
    (i) $8 \times 45 \div 6$ of $3 - 12$
    (ii) $57 \div 19 \times 2 - 64 \times 2 \div 32 + 96 \div 6$ of 4

11. (i) When a number is divided by 24; the quotient is 15 and the remainder is 7. Find the number.

    Dividend = Quotient × Divisor + Remainder

    (ii) When 225 is divided by 13; the remainder is 4. Find the quotient.
    (iii) When 429 is divided by a certain number, the quotient is 28 and the remainder is 9. Find the number.

ANSWERS

TEST YOURSELF

1. 13, –3, 3, –13 **2.** 7, –23, –7 **3.** –40, 40, –80, 240 **4.** –4, –4, –4, 4 **5.** 90, 10, 90, 10

EXERCISE 2

1. (i) – 360 (ii) 360 (iii) 3 (iv) – 12 **2.** (i) 44 (ii) – 32 (iii) 0 **3.** (i) 2 (ii) 38 (iii) – 32
4. (i) 240 (ii) – 720 (iii) – 120 **5.** (i) – 8 (ii) – 2 (iii) 1 **6.** (i) 18 (ii) – 4·5 (iii) – 16
7. (i) 84 (ii) 6 (iii) 192 (iv) 297 (v) 220 (vi) 0 (vii) 6 (viii) 576 (ix) $6\frac{2}{3}$ (x) 0 **8.** (i) 145 (ii) 6409
(iii) 100 (iv) 33 (v) 29 **9.** (i) 75 (ii) 25 (iii) – 11 **10.** (i) 8 (ii) 6 **11.** (i) 367 (ii) 17 (iii) 15