

# Mathematical Operations


Mathematical operations are basically the simplification of an expression containing numbers and different Mathematical operations.

In this section, we deal with questions having four fundamental Mathematical operations - addition (+), subtracting (-), multiplication ( $\times$ ) and division ( $\div$ ) and also statements such as 'less than (<)', 'greater than (>)', 'equal to (=)', 'not equal to ( $\neq$ )', etc.

All these operations are represented by symbols, different from usual ones. The candidate is required to substitute the real signs in place of artificial symbols to solve the questions.

We need to follow the VBODMAS rule for simplification of Mathematical operations. This rule gives us the correct order, in which various operations regarding simplification are to be performed. Order of various operations is as same as the order of letters in the 'VBODMAS'.

Letter	Rule	VBODMAS
V	Vinculum	— or bar
B	Brackets	( ) { } [ ]
O	Of	$\times$
D	Division	$\div$
M	Multiplication	$\times$
A	Addition	+
S	Subtraction	-

Do First  Do Last

## Types of Questions

There are four types of questions based on mathematical operations which are usually asked in various competitive examinations.

### Type #1:

#### **Problem Solving by Substitution**

In this type of questions, you have substitutes for various mathematical symbols or numerals followed by a questions involving calculation of an expression or choosing the correct/incorrect equation.

**Example: 1** If + means  $\div$ , - means  $\times$ ,  $\times$  means +,  $\div$  means -, then give the value for  $45 + 9 - 3 \times 15 \div 2$

(a) 40

(b) 36

(c) 56

(d) 28

**Solution** (d) Given,  $45 + 9 - 3 \times 15 \div 2$

Replacing the proper signs in the given expression, we have  $45 \div 9 \times 3 + 15 - 2$

Using VBODMAS rule,

$$5 \times 3 + 15 - 2 = 15 + 15 - 2 = 30 - 2 = 28$$

**Example: 2** If 'K' means 'minus', 'L' means 'divided by', 'M' means 'plus' and 'D' means 'multiplied by', then

$$117 \text{ L } 3 \text{ K } 5 \text{ M } 12 \text{ D } 8 = ?$$

(a) 150

(b) 125

(c) 130

(d) 145

**Solution** (c) Given,  $117 \text{ L } 3 \text{ K } 5 \text{ M } 12 \text{ D } 8 = ?$

Now, change the alphabet into the signs,

$$\Rightarrow ? = 117 \div 3 - 5 + 12 \times 8$$

$$\Rightarrow ? = \frac{117}{3} - 5 + 12 \times 8$$

$$\Rightarrow ? = 39 - 5 + 96$$

$$\Rightarrow ? = 135 - 5 \Rightarrow ? = 130$$

**Example: 3** If '-' stands for '+', '+' stands for '×', '×' stands for '-', then which one of the following is *not* correct?

(a)  $22 + 7 - 3 \times 9 = 148$  (b)  $33 \times 5 - 10 + 20 = 228$  (c)  $7 + 28 - 3 \times 52 = 127$  (d)  $44 - 9 + 6 \times 11 = 87$

**Solution** (c)

**From option (a),**

$$\text{LHS} = 22 + 7 - 3 \times 9 = 22 + 7 + 3 - 9 = 154 + 3 - 9 = 157 - 9 = 148 = \text{RHS}$$

**From option (b),**

$$\text{LHS} = 33 \times 5 - 10 + 20 = 33 - 5 + 10 \times 20 = 33 - 5 + 200 = 233 - 5 = 228 = \text{RHS}$$

**From option (c),**

$$\text{LHS} = 7 + 28 - 3 \times 52 = 7 + 28 + 3 - 52 = 196 + 3 - 52 = 199 - 52 = 147 \neq 127 (\text{RHS})$$

**From option (d),**

$$\text{LHS} = 44 - 9 + 6 \times 11 = 44 + 9 + 6 - 11 = 44 + 54 - 11 = 98 - 11 = 87 = \text{RHS}$$

Hence, equation in option (c) is not correct.

## Type #2:

### **Interchanging the Signs and Numbers**

In this type of questions, certain signs or numbers interchange among each other. The candidate is required to change the given signs or numbers with each other and select the equation which is correct from the given alternatives.

It can also be asked to find the correct pair of signs and numbers to be interchanged from the alternatives to make the given equation correct.

**Example: 4** If signs '+' and '-' and numbers 4 and 8 interchange between each other, then which one of the following four equations would be correct?

(a)  $4 - 8 + 12 = 0$

(b)  $8 - 4 \div 12 = 8$

(c)  $4 \div 8 - 12 = 16$

(d)  $8 \div 4 - 12 = 24$

**Solution** (a) Given,  $4 - 8 + 12 = 0$

On interchanging signs '+' and '-' and number 4 and 8 in option (a), we get

$$4 - 8 + 12 = 0 \Rightarrow 12 - 12 = 0 \Rightarrow 0 = 0$$

**Example: 5** Which one of the four interchanges in signs and numbers would make the given equation correct?

$$6 \times 4 + 2 = 16$$

- (a) + and  $\times$ , 2 and 4                      (b) + and  $\times$ , 4 and 6                      (c) + and  $\times$ , 2 and 6                      (d) None of these

**Solution** (b) Given,  $6 \times 4 + 2 = 16$

On interchanging signs '+' and ' $\times$ ' and number 4 and 6 in option (b), we get

$$4 + 6 \times 2 = 4 + 12 = 16$$

### **Type #3:**

#### **Miscellaneous Patterns**

In this type, questions are based on balancing the equation by replacing the actual mathematical signs with some other signs and tricks.

**Example: 6** In the following equation has to be balance, then the signs of which of the following options will be used?

$$24 \ 6 \ 12 \ 16 = 0$$

- (a)  $\div$ , + and -                      (b) -,  $\div$  and +  
(c) -, - and -                      (d)  $\div$ , + and  $\div$

**Solution** (a)

**From option (a),**  $24 \div 6 + 12 - 16 = 0$

$$\text{LHS} = 24/6 + 12 - 16$$

$$= 4 + 12 - 16 = 16 - 16 = 0$$

$\therefore$  LHS = RHS

**Example: 7** If  $5 \times 4 = 15$ ,  $7 \times 8 = 49$  and  $6 \times 5 = 24$ , then  $8 \times 4$  is equal to

- (a) 24                                      (b) 26                                      (c) 28                                      (d) 30

**Solution** (a)

As,  $5 \times 4 = 5 \times (4 - 1) = 5 \times 3 = 15$

$$7 \times 8 = 7 \times (8 - 1) = 7 \times 7 = 49$$

and  $6 \times 5 = 6 \times (5 - 1) = 6 \times 4 = 24$

Similarly,  $8 \times 4 = 8 \times (4 - 1) = 8 \times 3 = 24$

**Example: 8** If  $64 \times 52 = 17$ ,  $48 \times 56 = 23$  and  $74 \times 35 = 19$ , then  $84 \times 37 = ?$

- (a) 32                                      (b) 28                                      (c) 22                                      (d) 20

**Solution** (c)

As,  $64 \times 52 \Rightarrow (6 + 4) + (5 + 2) = 17$

$$48 \times 56 \Rightarrow (4 + 8) + (5 + 6) = 23$$

and  $74 \times 35 \Rightarrow (7 + 4) + (3 + 5) = 19$

Similarly,  $84 \times 37 \Rightarrow (8 + 4) + (3 + 7) = 22$

#### **Type #4:**

#### **Simple and Coded Inequalities**

In this type of questions, certain relationship between different sets of elements is given (in terms of 'less than', 'greater than', or 'equal to'), using either the real symbols or substituted symbols. It is required to read the given statements and then choose which of the conclusions is/are definitely true.

**Directions** (Examples 9-11) *In each of the following questions, relationship between different element is shown in the statements. These statements are followed by two conclusions.*

#### **Given Answer**

- (a) If only conclusion I follows
- (b) If only conclusion II follows
- (c) If either conclusion I or II follows
- (d) If neither conclusion I nor II follows
- (e) If both conclusions I and II follow

**Example 9. Statements**  $P \geq Q = R, Q > S > T$

**Conclusions** I.  $P \geq T$  II.  $T < Q$

**Solution** (b) On combining the two statements, we get  $P \geq Q = R > S > T$

**Conclusions** I.  $P \geq T$  (false)  
II.  $T < Q$  (true)

So, only conclusion II follows.

**Example 10. Statements**  $A \leq B = C,$   
 $D > C = E$

**Conclusions** I.  $E \geq A$  II.  $A < D$

**Solution** (e) On combining the two statements, we get  $A \geq B = C = E < D$

**Conclusions** I.  $E \geq A$  (true)  
II.  $D > A$  (true)

So, both conclusions I and II follow.

**Example 11. Statements**  $F \geq G = H, G > J \geq K$

**Conclusions** I.  $F \geq K$  II.  $K < H$

**Solution** (b) On combining the two statements, we get  $F \geq G = H > J \geq K$

**Conclusions** I.  $F \geq K$  (false)  
II.  $K < H$  (true)

So, only conclusion II follows.

**Directions** (Examples 12-14) *In the following questions, the symbols  $\delta$ , @, ©, %, and ★ are used with the meaning as indicated below.*

- 'P © Q' means 'P is not smaller than Q'.
- 'P % Q' means 'P is neither smaller than nor equal to Q'
- 'P ★ Q' means 'P is neither greater than nor equal to Q'.
- 'P  $\delta$  Q' means 'P is not greater than Q'.
- 'P @ Q' means 'P is neither greater than nor smaller than Q'.

Now, in each of the following questions assuming the given statements to be true, find which of the four conclusions I, II, III and IV given below them is/are definitely true, give your answer accordingly.

**Example 12.****Statements**  $D \delta T$ ,  $T @ R$ ,  $R \odot M$ ,  $M \% K$ **Conclusions**  
I.  $R @ D$   
II.  $R \% D$   
III.  $K \star T$   
IV.  $M \delta T$ 

- (a) Only either I or II is true  
 (b) III and IV are true  
 (c) Either I or II and III are true  
 (d) Either I or II and IV are true  
 (e) Either I or II and III and IV are true

**Solution(e)**

$\odot \Rightarrow \geq$   
 $\% \Rightarrow >$   
 $\star \Rightarrow <$   
 $\delta \Rightarrow \leq$   
 $@ \Rightarrow =$

Here,  $D \delta T \Rightarrow D \leq T$   
 $T @ R \Rightarrow T = R$   
 $R \odot M \Rightarrow R \geq M$   
 $M \% K \Rightarrow M > K$   
 So,  $D \leq T = R \geq M > K$

Now conclusions

- I.  $R @ D \Rightarrow R = D$  (may be)  
 II.  $R \% D \Rightarrow R > D$  (may be)  
 III.  $K \star T \Rightarrow K < T$  (true)  
 IV.  $M \delta T \Rightarrow M \leq T$  (true)

From first two conclusions only one can be true.  
 Hence, either I or II and III and IV are true.

**Example 13.****Statements**  $J @ F$ ,  $F \delta N$ ,  $N \% H$ ,  $H \odot G$ **Conclusions**  
I.  $G \star N$   
II.  $N \odot J$   
III.  $F \star J$   
IV.  $J \delta G$ 

- (a) I and II are true  
 (b) I, II and III are true  
 (c) I, III and IV are true  
 (d) All I, II, III and IV are true  
 (e) None of the above

**Solution(a)**

$\odot \Rightarrow \geq$   
 $\% \Rightarrow >$   
 $\star \Rightarrow <$   
 $\delta \Rightarrow \leq$   
 $@ \Rightarrow =$

Here,  $J @ F \Rightarrow J = F$   
 $F \delta N \Rightarrow F \leq N$   
 $N \% H \Rightarrow N > H$   
 $H \odot G \Rightarrow H \geq G$   
So,  $J = F \leq N > H \geq G$

Now, conclusions

- I.  $G \star N \Rightarrow G < N$  (true)
- II.  $N \odot J \Rightarrow N \geq J$  (true)
- III.  $F \star J \Rightarrow F < J$  (false)
- IV.  $J \delta G \Rightarrow J \leq G$  (false)

Hence, I and II are true.

**Example 14.**

**Statements**  $R \star K, K \% D, D @ V, V \delta M$

- Conclusions**
- I.  $R \star D$
  - II.  $V \star R$
  - III.  $D @ M$
  - IV.  $M \% D$

- (a) None is true
- (b) Only III is true
- (c) Only IV is true
- (d) Either III or IV is true
- (e) Either III or IV and II are true

**Solution** (d)

- $\odot \Rightarrow \geq$
- $\% \Rightarrow >$
- $\star \Rightarrow <$
- $\delta \Rightarrow \leq$
- $@ \Rightarrow =$

Here,  $R \star K \Rightarrow R < K$   
 $K \% D \Rightarrow K > D$   
 $D @ V \Rightarrow D = V$   
 $V \delta M \Rightarrow V \leq M$   
So,  $R < K > D = V \leq M$

Now, conclusions

- I.  $R \star D \Rightarrow R < D$  (false)
- II.  $V \star R \Rightarrow V < R$  (false)
- III.  $D @ M \Rightarrow D = M$  (may be)
- IV.  $M \% D \Rightarrow M > D$  (may be)

Hence, either III or IV is true.

## Exercise

- Q. 1.** If '+' means '÷', '×' means '-', '÷' means '+' and '-' means '×', then  $16 \div 8 \times 6 - 2 + 12 = ?$
- (A) 23                      (B) 24                      (C) 17                      (D) 22
- Q. 2.** If '+' means 'subtraction', '×' means 'division', '÷' means 'addition' and '-' means 'multiplication', then  $15 \times 5 + 78 - 5 \div 4 = ?$
- (A) -383                      (B) -460                      (C) -475                      (D) -743
- Q. 3.** If '+' means '×', '-' means '÷', '×' means '-' and '÷' means '+', then find the value of the given equation  $6 + 64 - 8 \div 45 \times 8 = ?$
- (A) 85                      (B) 76                      (C) 87                      (D) 75
- Q. 4.** If '×' means subtraction; '-' means division, '□' means addition and '%' means multiplication, then find the value of  $13 \square 3 \times 6 \% 8 - 4 \square 14 = ?$
- (A) 18                      (B) 14                      (C) 12                      (D) 8
- Q. 5.** If the mathematical signs interchange from '-' to '+', '+' to '÷', '×' to '-' and '÷' to '×', then find out the correct answer of the given equation  $6 \div 8 + 2 \times 5 - 8 = ?$
- (A) 27                      (B) 18                      (C) 32                      (D) 28
- Q. 6.** If 'P' denotes '÷', 'Q' denotes '×', 'R' denotes '+' and 'S' denotes '-', then  $18 Q 12 P 4 R 5 S 6 = ?$
- (A) 95                      (B) 53                      (C) 51                      (D) 57
- Q. 7.** In a certain code language, '÷' represents '+', '-' represents '×', '+' represents '÷' and '×' represents '-'. Find out the answer to the given question  $8 - 14 + 7 \times 10 \div 9 = ?$
- (A) 15                      (B) 28                      (C) 20                      (D) 13
- Q. 8.** In a certain code language, '×' represents '+', '÷' represents '×', '-' represents '÷' and '+' represents '-'. Find out the answer to the given question  $25 \div 2 - 10 + 10 \times 6 = ?$
- (A) 1                      (B) 21                      (C) 19                      (D) 20
- Q. 9.** If 'a' represents '÷', 'b' represents '+', 'c' represents '-', and 'd' represents '×', then  $24 a 6 d 4 b 9 c 8 = ?$
- (A) 20                      (B) 19                      (C) 6                      (D) 17
- Q. 10.** If '>' stands for 'division', 'v' stands for 'multiplication', '->' stands for 'greater than', '×' stands for 'less than', '<' stands for 'addition', '^' stands for 'subtraction', '+' stands for 'equal to', then which of the following equations is correct?
- (A)  $10 \wedge 3 < 5 < 4 + 16$                       (B)  $4 \wedge 6 < 4 < 4 + 16$
- (C)  $12 \wedge 3 < 5 < 4 + 12$                       (D)  $11 \wedge 12 < 5 < 4 + 12$

**Q. 11.** If '+' stands for division; '×' stands for addition, '-' stands for multiplication, '÷' stands for subtraction, which of the following equation is correct?

(A)  $36 + 6 - 3 \times 5 \div 3 = 24$

(B)  $36 \times 6 + 7 \div 2 - 6 = 20$

(C)  $36 \div 6 + 3 \times 5 - 3 = 40$

(D)  $36 - 6 + 3 \times 5 \div 3 = 74$

**Q. 12.** If '+', '-', '×', '÷', '=', '>' and '<' are represented as 'δ', '●', 'γ', 'η', 'ω', 'β' and 'α' respectively, then which of the following is correct?

(A)  $3 \gamma 6 \eta 2 \delta 8 \bullet 4 \omega 5$

(B)  $3 \eta 6 \gamma 2 \delta 8 \bullet 4 \beta 5$

(C)  $3 \gamma 6 \bullet 2 \delta 8 \eta 4 \alpha 5$

(D)  $3 \delta 6 \bullet 2 \gamma 8 \eta 4 \omega 5$

**Q. 13.** Select the correct combination of mathematical signs to replace '★' signs and to balance the following equation

$$6 \star 4 \star 12 \star 12$$

(A)  $\div, -, =$

(B)  $+, -, \div$

(C)  $=, -, \div$

(D)  $\times, -, =$

**Q. 14.** Which of the following sets of operations with the usual notations replacing the stars in the order given makes the statements valid?

$$\sqrt{100} \star \sqrt{16} \star \sqrt{225} \star \sqrt{1}$$

(A)  $\times, =, +$

(B)  $+, =, -$

(C)  $+, =, \times$

(D)  $-, \times, =$

**Q. 15.** Select the correct combination of mathematical signs to replace '★' signs and to balance the given equation.

$$24 \star 34 \star 2 \star 5 \star 12$$

(A)  $+ \div \times =$

(B)  $= \div + -$

(C)  $= \div - +$

(D)  $+ \div = \times$

**Q. 16.** Select the correct combination of mathematical signs to replace '★' signs and to balance the following equation.

$$(8 \star 7 \star 6) \star 5 \star 10$$

(A)  $\times - \div =$

(B)  $- \times \div +$

(C)  $+ - \div \times$

(D)  $\times + = \div$

**Q. 17.** If  $17 \times 64 = 4716$ ,  $28 \times 34 = 4823$ , then  $76 \times 84 = ?$

(A) **6587**

(B) **8764**

(C) **4678**

(D) **4768**

**Q. 18.** If  $9 \times 3 + 8 = 24$ ,  $10 \times 2 + 7 = 35$  and  $80 \times 40 + 3 = 6$ , then find the value of  $12 \times 4 + 3 = ?$

(A) **7**

(B) **9**

(C) **12**

(D) **16**

**Q. 19.** Some equation are solved on the basis of a certain system. On the same basis, find out the correct answer for the unsolved equation.

$$4 - 5 - 1 = 514, \quad 3 - 5 - 6 = 563, \quad 0 - 6 - 8 = ?$$

(A) **860**

(B) **680**

(C) **806**

(D) **068**



- Q. 20.** If  $4 \star 2 @ 3 = 6$ ,  $18 \star 6 @ 4 = 12$ , then what will be the value of  $24 \star 3 @ 7 = ?$   
**(A) 21**                      **(B) 27**                      **(C) 72**                      **(D) 56**
- Q. 21.** If  $2 \& 6 \% 7 = 33$ ,  $4 \& 6 \% 8 = 54$ , then what will be the value of  $6 \& 8 \% 9 = ?$   
**(A) 95**                      **(B) 77**                      **(C) 99**                      **(D) 73**
- Q. 22.** If  $16 - 2 = 2$ ,  $9 - 3 = 0$ ,  $81 - 1 = 8$ , then what is  $64 - 4 = ?$   
**(A) 4**                      **(B) 2**                      **(C) 6**                      **(D) 8**
- Q. 23.** Change symbol and solve accordingly to find correct answer from the alternatives given below:  
 $9 \times 8 \times 7 = 24$ ,       $4 \times 7 \times 3 = 14$ ,       $2 \times 1 \times 9 = ?$   
**(A) 12**                      **(B) 10**                      **(C) 18**                      **(D) 11**
- Q. 24.** If  $879 = 8$ ,  $625 = 1$  and  $586 = 9$ , then  $785 = ?$   
**(A) 6**                      **(B) 7**                      **(C) 8**                      **(D) 9**

### Answer Key

<b>Q. 1.</b>	A	<b>Q. 2.</b>	A	<b>Q. 3.</b>	A	<b>Q. 4.</b>	A	<b>Q. 5.</b>	A	<b>Q. 6.</b>	B
<b>Q. 7.</b>	A	<b>Q. 8.</b>	A	<b>Q. 9.</b>	D	<b>Q. 10.</b>	A	<b>Q. 11.</b>	D	<b>Q. 12.</b>	D
<b>Q. 13.</b>	D	<b>Q. 14.</b>	B	<b>Q. 15.</b>	C	<b>Q. 16.</b>	A	<b>Q. 17.</b>	C	<b>Q. 18.</b>	B
<b>Q. 19.</b>	B	<b>Q. 20.</b>	D	<b>Q. 21.</b>	B	<b>Q. 22.</b>	A	<b>Q. 23.</b>	A	<b>Q. 24.</b>	A