Simplification

I. **'BODMAS' Rule:** This rule depicts the correct sequence in which the operations are to be executed, so as to find out the value of a given expression. Here, 'B' stands for 'Bracket', 'O' for 'of', 'D' for Division', 'M' for 'multiplication', 'A' for 'Addition' and 'S' for 'Subtraction'. Thus, in simplifying an expression, first of all the brackets must be removed, strictly in the order (),{} and []. After removing the brackets, we must use the following operations strictly in the order:
(i) of (ii) Division (iii) Multiplication (iv) Addition (v) Subtraction.

Eg: (-5)(4)(2)(-1/2)(3/4)=?
-5*4*2*-1/2*3/4= 15

II. **Modulus of a Real Number:** Modulus of a real number a is defined as

a|= a, if a>0 or
|a|= -a, if a<0
Thus, |5|= 5 and |-5|= -(-5)=5

III. **Virnaculum (or Bar):** When an expression contains Virnaculam, before applying the 'BODMAS' rule, we simplify the expression under the Virnaculum.

Exercise Questions

1.$((469 + 174)^2 - (469 - 174)^2)/(469 \times 174) = ?$
a. 2
b. 4
c. 295
d. 643
Answer: Option b

Explanation: Given exp. = $((a + b)^2 - (a - b)^2)/ab$
=4ab/ab = 4

2. David gets on the elevator at the 11th floor of a building and rides up at the rate of 57 floors per minute. At the same time, Albert gets on an elevator at the 51st floor of the same building and rides down at the rate of 63 floors per minute. If they continue travelling at these rates, then at which floor will their paths cross ?
a. 19
b. 28
c. 30
d. 37

Answer: Option c

Explanation: Suppose their paths cross after x minutes. Then, 11 + 57x = 51 - 63x => 120x = 40

x=1/3

Number of floors covered by David in (1/3) min. = (1/3)*57= 19

So, their paths cross at (11 +19) i.e., 30th floor.

3. A man has some hens and cows. If the number of heads be 48 and the number of feet equals 140, then the number of hens will be:
a. 22
b. 23
c. 24
d. 26

Answer: Option d
Explanation: Let the number of hens be x and the number of cows be y.

Then, x + y = 48 .... (i)

and 2x + 4y = 140 => x + 2y = 70 .... (ii)

Solving (i) and (ii) we get: x = 26, y = 22.

Therefore, The required answer = 26.

4. In a regular week, there are 5 working days and for each day, the working hours are 8. A man gets Rs. 2.40 per hour for regular work and Rs. 3.20 per hours for overtime. If he earns Rs. 432 in 4 weeks, then how many hours does he work for ?
a. 160
b. 175
c. 180
d. 195

Answer: Option B

Explanation: Suppose the man works overtime for x hours.

Now, working hours in 4 weeks = (5 * 8 * 4) = 160.

Therefore, 160 * 2.40 + x * 3.20 = 432

=> 3.20x = 432 - 384 = 48

=> x = 15.

Hence, total hours of work = (160 + 15) = 175.

5. One-third of Rahul's savings in National Savings Certificate is equal to one-half of his savings in Public Provident Fund. If he has Rs. 1,50,000 as total savings, how much has he saved in Public Provident Fund ?
a. Rs. 30,000
b. Rs. 50,000
c. Rs. 60,000
d. Rs. 90,000

Answer: Option C

Explanation: Let savings in N.S.C and P.P.F. be Rs. x and Rs. (150000 - x) respectively. Then,

(1/3)x= (1/2)(150000-x)

x/3+x/2=75000

5x/6=75000

x=75000*6/5= 90000

Therefore, Savings in Public Provident Fund = Rs. (150000 - 90000) = Rs. 60000

6. A sum of Rs. 1360 has been divided among A, B and C such that A gets 2/3 of what B gets and B gets 1/4 of what C gets. B's share is:
a. Rs.120
b. Rs. 160
c. Rs.240
d. Rs.300

Answer: Option C

Explanation: Let C's share = Rs. x

Then, B's share = Rs. x/4; A's share = Rs.2/3 * x/4= Rs. x/6

Therefore x/6 + x/4 + x = 1360

17x/12 = 1360

x= 1360*12/17= Rs.960

Hence, B's share= Rs.960/4= Rs.240

7. If a-b= 3 and a2+b2=29, find the value of ab
a. 10
b. 12
c. 15
d. 18

Answer: Option A

Explanation: 2ab = (a2 + b2) - (a - b)2

= 29 - 9 = 20

=> ab = 10.

8. If 45-[28-{37-(15-*)}]= 58, then * is equal to:

a. -29
b. -19
c. 19
d. 29

Answer: Option c

Explanation: 45-[28-{37-(15-*)}]= 58 => 45-[28-{37-15+*}]=58

45-[28-37+15-*]=58 => 45[43-37-*]=58

45-[6-*]=58 => 45-6+*=58

39+*=58 => *=58-39

= 19

Exercise Questions

1. If a * b = $\frac{a+b}{ab}$, find the value of 5 * (5 * -2) :

a. -3

b. -10

c. -1.66

d. 3/5

2. If (a – b) is 9 more than (c + d) and (a + b) is 3 less than (c – d), then (a – c) is:

a. 6

b. 2

c. 3

d. None of these

3. The value of $1 + [1/(8 \times 2)] + [1/(8 \times 2^2)] + [1/(8 \times 2^3)]$ is :

a. 71/64

b. 1/16

c. 1/4

d. None of these

4. If $\frac{a}{2} = \frac{b}{3} = \frac{c}{5}$, then the value of $\frac{a+b+c}{c}$ is :

a. $1/\sqrt{5}$

b. $\sqrt{2}$

c. 2

d. 5

5. When simplified, the product $(1 - 1/2)(1 - 1/3)(1 - 1/4)\ldots\ldots(1 - 1/n)$ gives:

a. $1/n$

b. $2/n$

c. $2(n - 1)/n$

d. $2/n(n + 1)$

6. The value of $\frac{(x - y)^3 + (y - z)^3 + (z - x)^3}{12 (x - y)(y - z)(z - x)}$ is equal to :

a. 0

b. 1/12

c. 1

d. 1/4

7. The value of $99^{\frac{95}{99}} \times 99$ is:

a. 9989

b. 9896

c. 9890

d. 9809

8. $\frac{(12)^3 + (6)^3}{(12)^2 + 6^2 - ?} = 18$

a. 6

b. 18

c. 72

d. None of these

9. If a * b = 2a – 3b + ab, then 5 * 7 + 7 * 5 is equal to:

a. 33

b. 36

c. 34

d. 38

10. If x = a/(a – 1) and 1/(a – 1), then:

a. x is equal to y

b. x is equal to y only if a < 1

c. x is greater than y

d. x is greater than y only if a < 1

e. y is greater than x only if a < 1

11. If a, b, c are integers; $a^2 + b^2 = 45$ and $b^2 + c^2 = 40$, then the values of a, b and c respectively are :

a. 2, 6, 3

b. 3, 2, 6

c. 5, 4, 3

d. None of these

12. A girl was asked to multiply a certain number by 43. She multiplied it by 34 and got his answer less than the correct one by 1206. Find the number to be multiplied.

a. 130

b. 132

c. 134

d. 136

13. In a garden, there are 12 rows and 14 columns of mango trees. The distance between two trees is 2 metres and a distance of one metre is left from all sides of the boundary of the garden. The length of the garden is

a. 20m

b. 22m

c. 24m

d. 26m

14. In a group of donkeys and pigs, the numbers of legs are 16 more than twice the number of heads. The number of donkeys is

a. 6

b. 8

c. 11

d. 13

15. The value of 40 coins of 10 p and 20 p is Rs. 5.50. The number of 20 p coins is

a. 15

b. 25

c. 30

d. 35

16. An enterprising businessman earns an income of Re 1 on the first day of his business. On every subsequent day, he earns an income which is just double of that made on the previous day. On the 20^{th} day of business, he earns an income of:

a. Rs 2^{19}

b. Rs 2^{20}

c. Rs 20^{2}

d. Rs 20

17. In an examination, a student scores 4 marks for every correct answer and loses 1mark for every wrong answer. If he attempts all 90 questions and secures 140 marks, the number of questions he attempts correctly, is:

a. 35

b. 40

c. 42

d. 46

18. Anitha had 80 currency notes in all, some of which are of Rs 95 denomination and the remaining of Rs 45 denomination. The total amount of all these currency notes was Rs. 4000. How much amount (in Rs) did she have in the denomination of Rs 45?

a. 3500

b. 72

c. 2000

d. None of these

19. How many 1/8s are there in $37\ ^{1}/_{2}$?

a. 300

b. 400

c. 500

d. Can't be determined

20. How many pieces of 0.85 metres can be cut from a rod 42.5 metres long?

a. 30

b. 40

c. 60

d. None of these

Answer & Explanations

1. Exp: $(5 * -2) = \frac{5 \times (-2)}{5 + (-2)} = \frac{-10}{3}$

So, $5 * (5 * -2) = 5 * (-10/3) = \frac{5 * (-10/3)}{5 + (-10/3)} = (-50/3) * (3/5) = -10.$

2. Exp: $(a - b) - (c + d) = 9$ and $(c - d) - (a + b) = 3$

=> (a – c) – (b + d) = 9 and (c – a) – (b + d) = 3

=> (b + d) = (a – c) – 9 and (b + d) = (c – a) – 3

=> (a – c) – 9 = (c – a) – 3 => 2(a – c) = 6 => (a – c) = 3

3. Exp: $\frac{8 \times 2^3 + 2^2 + 2 + 1}{8 \times 2^3} = \frac{64 + 4 + 2 + 1}{64} = 71/64.$

4. Exp: $\frac{a}{2} = \frac{b}{3} = \frac{c}{5} = k$ (say). Then, a = 2k, b = 3k, c = 5k.

$\frac{a + b + c}{c} = \frac{2k + 3k + 5k}{5k} = \frac{10k}{5k} = 2.$

5. Exp: 1/2 x 2/3 x 3/4 x …..x (n – 1)/n = 1/n

6. Exp: Since (x – y) + (y – z) + (z – x) = 0, so $(x – y)^3 + (y – z)^3 + (z – x)^3$

= 3 (x – y) (y – z) (z – x).

$\frac{3 (x – y) (y – z) (z – x)}{12(x – y) (y – z) (z – x)} = 1/4.$

7. Exp: (100 – 4/99) x 99 = 9900 – 4 = 9896.

8. Exp: Let $\frac{(12)^3 + (6)^3}{12 + 6} = 18$. Then,

$(12)^2 + 6^2 - ?$

$\frac{12^3 + 6^3}{12 + 6} = 12^2 + 6^2 - x \Rightarrow 12^2 + 6^2 - 12 * 6 = 12^2 * 6^2 - x \Rightarrow x = 12 * 6 = 72.$

9. Exp: 5 * 7 + 7 * 5 = (2 * 5 – 5 * 7 + 5* 7) + (2 * 7 – 5 * 5 + 7 * 5)

= (10 + 14 – 25 + 35) = 34.

10. Exp: $x = a/(a - 1) = 1 + 1/(a - 1) = 1 + y$. Therefore, $x > y$

11. Exp: $a^2 + b^2 = 45$ ….(1) and $b^2 + c^2 = 40$

Subtracting, we get: $a^2 - c^2 = 5 \Rightarrow (a + c)(a - c) = 5$.

$(a + c) = 5$ and $(a - c) = 1$.

Solving we get: $a = 3$, $c = 2$. Putting $c = 2$ in (ii), we get $b = 6$.

12. Exp: Let the required number be x. Then,

$43x - 34x = 1206$ or $9x = 1206$ or $x = 134$.

Required number = 134.

13. Exp: Each row contains 14 plants.

Leaving 2 corner plants, 12 plants in between have (12 x 2) metres & 1 metre on each side is left.

Length = (24 + 2) m = 26m.

14. Exp: Let the number of donkeys be x and the number of pigs be y. Then,

$4x + 2y = 2(x + y) = 16$ or $2x + (2x + 2y) = (2x + 2y) + 16$

or $2x = 16$ or $x = 8$.

14. Exp: Let the number of 20 paise coins be x.

Then, number of 10 paise coins = $(40 - x)$.

$10(40 - x) + 20x = 550$ or $10x = 150$ or $x = 15$.

16. Exp: 2^{nd} day he earns = $2 = 2^{(2-1)}$

3^{rd} day he earns = $2^{(3-1)}$

On 20^{th} day he earns $2^{(20-1)} = 2^{19}$ rupees

17. Exp: Let the number of correct answers be x.

Number of incorrect answers = $(90 - x)$.

$4x - (90 - x) = 140$ or $5x = 230$ or $x = 46$.

18. Exp: Let the number of 45-rupee notes = x

Then, the number of 95-rupee notes = (80 – x)

45x + 95(80 – x) = 4000 or x + 2(80 – x) = 95 or x = 72.

19. Exp: Required number = $\frac{(75/2)}{(1/8)}$ = (75/2 x 8/1) = 300.

20. Exp: Number of pieces = $\frac{42.5}{0.85}$ = $\frac{42.50}{0.85}$ = $\frac{4250}{85}$ = 50.