SIMPLIFICATION

KEY POINTS

1) $(a+b)^2 = a^2 + b^2 + 2ab$

2) $(a-b)^2 = a^2 + b^2 - 2ab$

3) $a^2 - b^2 = (a+b)(a-b)$

4) Square root of a number is a value that, when multiplied by itself, gives the given number.

Example

36 has two square roots 6 and -6;

$6^2 = 36$ *and* $-6^2 = 36$, hence we write $\sqrt{36} = \pm 6$

5) Square root by Factorization method

Find square root of 1089

First find the factors of 1089.

3	1089
3	363
11	121
	11

$1089 = 3 \times 3 \times 11 \times 11$

$\sqrt{1089} = 3 \times 11 = 33$

6) Square root by Division method

Find square root of 2304.

$$\begin{array}{r|l} & 4\ 8 \\ \hline 4 & \overline{23}\ \overline{04} \\ +4 & 16 \\ \hline 88 & 704 \\ & 704 \\ \hline & xxx \end{array}$$

Note:- Make group of two digit from right

$\sqrt{2304} = 48$

7) If $\sqrt{?} = x$, then the required number will be $= x^2$

8) $\sqrt{a^4 \times b^4 \times c^4} = a^2 b^2 c^2$

9) $\sqrt{a^n \times b^m} = a^{\frac{n}{2}} \times b^{\frac{m}{2}}$

10) $\frac{\sqrt{x}}{\sqrt{y}} = \sqrt{\frac{x}{y}}$

11) $\sqrt{x} \times \sqrt{y} = \sqrt{xy}$

10) If any number ends with 1, its square root will end with 1 or, 9, given that the number is a perfect square.

Example: $\sqrt{81} = 9$, $\sqrt{121} = 11$

11) If any number ends with 4, its square root will end with 2 or, 8, given that the number is a perfect square.

Example: $\sqrt{324} = 18$, $\sqrt{124} = 12$

12) If any number ends with 5, its square root will end with 5, given that the number is a perfect square.

Example: $\sqrt{225} = 15$, $\sqrt{625} = 25$

13) If any number ends with 6, its square root will end with 6, given that the number is a perfect square.

Example: $\sqrt{256} = 16$, $\sqrt{676} = 26$

14) If any number ends with 9, its square root will end with 3 or 7, given that the number is a perfect square.

Example: $\sqrt{49} = 7$, $\sqrt{169} = 13$

15) The square of any number always ends with 0, 1, 4, 5, 6 or, 9 but will never end with 2, 3, 7 or, 8.

16) If in a given number, the total number of digits are n and if n is even, the square root of that number will have $\frac{n}{2}$ digits and if n is odd, then the number of digits will be $\frac{n+1}{2}$.

17) $\sqrt{x\sqrt{x\sqrt{x\ldots n}}} = x^{\frac{2^n-1}{2^n}}$

Example

Find the value of $\sqrt{2\sqrt{2\sqrt{2\sqrt{2\sqrt{2}}}}}$

Here, n = 5, $\therefore \sqrt{2\sqrt{2\sqrt{2\sqrt{2\sqrt{2}}}}} = 2^{\frac{2^5-1}{2^5}}$

$= 2^{\frac{31}{32}}$

18) $\sqrt{x\sqrt{x\sqrt{x\ldots\infty}}} = x$;

Example $\sqrt{7\sqrt{7\sqrt{7\ldots\infty}}} = 7$

19) To find the value of $\sqrt{x+\sqrt{x+\sqrt{x+\ldots\infty}}}$, find the factors of x, such that the difference between the factors is 1, then the larger factor will be the result.

20) To find the value of $\sqrt{x-\sqrt{x-\sqrt{x-\ldots\infty}}}$, find the factors of x, such that the difference between the factors is 1, then the smaller factor will be the result.

Example: Find the value of $\sqrt{12+\sqrt{12+\sqrt{12+\ldots\infty}}}$

The factors of 12 with a difference of 1 are 4, 3. Here, 4 is the larger number. $\therefore$ Value will be 4.

Conventional method

Let $\sqrt{12+\sqrt{12+\sqrt{12+\ldots\infty}}} = x$

$\Rightarrow \sqrt{12+x} = x$

$\Rightarrow 12 + x = x^2 \Rightarrow x^2 - x - 12 = 0 \Rightarrow$

$x^2 - 4x + 3x - 12 = 0$

$\Rightarrow (x-4)(x+3) = 0 \Rightarrow$

$x = 4$ *and* $x = -3$

$\therefore x = 4$

Example

Find the value of $\sqrt{30-\sqrt{30-\sqrt{30-\ldots\infty}}}$

The factors of 30 with a difference of 1 are 5, 6. Here, 5 is the smaller number. $\therefore$ Value will be 5.

21) If any number is in $\frac{1}{\sqrt{a} \pm \sqrt{b}}$ form, then we multiply by its rationalization factor $\sqrt{a} \mp \sqrt{b}$ in both numerator and denominator.

Example: Find the value of $\frac{1}{\sqrt{9}-\sqrt{8}}$;

$\frac{1}{\sqrt{9}-\sqrt{8}} = \frac{1}{\sqrt{9}-\sqrt{8}} \times \frac{\sqrt{9}+\sqrt{8}}{\sqrt{9}+\sqrt{8}}$

$= \frac{\sqrt{9}+\sqrt{8}}{\sqrt{9}^2-\sqrt{8}^2} = \frac{3+2\sqrt{2}}{1} = 3 + 2\sqrt{2}$

Cube and Cube Root

KEY POINTS:

1) If a number is multiplied two times with itself, then the result of this multiplication is called the cube of that number.

Example: $2 \times 2 \times 2 = 2^3$

Cube root of $2^3 = \sqrt[3]{2^3} = 2^{3 \times \frac{1}{3}}$ 2=2

2) Algebraic method to calculate cube:

$(a+b)^3 = a^3 + 3ab(a+b) + b^3$

$(a-b)^3 = a^3 - 3ab(a-b) - b^3$

Indices and Surds

Key Points:

1) $p^m \times p^n = p^{m+n}$

2) $(p^m)^n = p^{mn}$

3) $\frac{p^m}{p^n} = p^{m-n}$

4) $\left(\frac{p}{q}\right)^n = \frac{p^n}{p^n}$

5) $p^0 = 1$

6) $p^{-n} = \frac{1}{p^n}$

7) $p^{\frac{1}{m}} = \sqrt[m]{p}$

8) $\sqrt[m]{p} = p^{\frac{1}{m}}$

9) $\sqrt[m]{pq} = \sqrt[m]{p} \times \sqrt[m]{q}$

10) $\sqrt[m]{\frac{p}{q}} = \frac{\sqrt[m]{p}}{\sqrt[m]{q}}$

11) $(\sqrt[m]{p})^m = p$

KEY POINTS

1). Conversion of complex arithmetic expression into simple one is called simplification.

2). VBODMAS Rule: Vinculum > Brackets > Of > division > multiply > addition > subtraction

* First solve vinculum i.e. bar.

Eg: $\left(7 - \overline{5-4}\right)$ =?

First solve 5 – 4 i.e. 1 then 7 -1 = 6.

* For brackets open first small brackets (….), then {…} and then […].

* For modulus e.g. |-3| we write magnitude only not sign i.e. 3 in this case.

Important Formulas

1). $(a+b)^2 = a^2 + 2ab + b^2$

2). $(a-b)^2 = a^2 - 2ab + b^2$

3). $(a^2 - b^2) = (a+b)(a-b)$

4). $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$

5). $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$

6). $(a^3 + b^3) = (a+b)(a^2 - ab + b^2)$

7). $(a^3 - b^3) = (a-b)(a^2 + ab + b^2)$

8). $a^3 + b^3 + c^3 - 3abc$

$= (a+b+c)\left(a^2 + b^2 + c^2 - ab - bc - ca\right)$

$= \frac{1}{2}(a+b+c)[(a-b)^2 + (b-c)^2 + (c-a)^2]$

Here, if $(a+b+c) = 0$,

then $a^3 + b^3 + c^3 - 3abc = 0$

$\Rightarrow a^3 + b^3 + c^3 = 3abc$

9). $(a+b+c)^2$

$= \left(a^2 + b^2 + c^2\right) + 2(ab + bc + ca)$

Variety Questions

Q1. If $[\{(\frac{2}{3})^3\}^{(2x+3)}]^{\frac{-3}{4}} = [\{(\frac{2}{3})^{\frac{2}{3}}\}^{(3x+7)}]^{\frac{-6}{5}}$ then the value of $\sqrt{2-42x}$ is:

SSC CHSL 18-03-2020 (Morning shift)

(a) 5 (b) 6 (c) 3 (d) 4

Q2.If the following interchanges are made in signs and numbers, which equation would be correct?

Interchanges:

Signs: ÷ and -

Numbers: 15 and 5

SSC CHSL 13-10-2020 (Morning Shift)

(a)4 × 30 - 15 ÷ 5 + 12 = 21

(b)12 × 30 - 15 ÷ 5 + 4 = 37

(c)4 × 30 - 15 ÷ 5 + 12 = 27

(d)4 × 30 - 5 ÷ 15 + 14 = 21

Q3.If '+' means '-', '-' means '+', '×' means '÷' and '÷' means '×' then the value of $\frac{42-12\times3+8\div2+15}{8\times2-4+9\div3}$ is:

SSC CGL 3 March 2020 (Morning)

(a) $-\frac{5}{3}$ (b) $-\frac{15}{19}$ (c) $\frac{15}{19}$ (d) $\frac{5}{3}$

Q4. The value of $\frac{(4.6)^4+(5.4)^4+(24.84)^2}{(4.6)^2+(5.4)^2+24.84}$ is:

SSC CGL Tier II - 13 September 2019

(a) 24.42 (b) 24.24

(c) 25.42 (d) 25.48

Q5. The value of $\frac{(0.545)(0.081)(0.51)(5.2)}{(0.324)^3+(0.221)^3-(0.545)^3}$ is:

SSC CGL Tier II - 12 September 2019

(a) -1 (b) 1 (c) 3 (d) -3

Q6. The value of $22.\overline{4} + 11.5\overline{67} - 33.5\overline{9}$ is :

SSC CGL Tier II - 11 September 2019

(a) $0.\overline{32}$ (b) $0.\overline{412}$

(c) $0.3\overline{1}$ (d) $0.4\overline{12}$

Q7. If x = $\frac{1}{12.13} + \frac{1}{13.14} + \frac{1}{14.15} \ldots + \frac{1}{23.24}$, y = $\frac{1}{36.37} + \frac{1}{37.38} + \frac{1}{38.39} \ldots + \frac{1}{71.72}$ then $\frac{x}{y}$ is equal to :

SSC CHSL 10 July 2019 (Evening)

(a) $\frac{1}{3}$ (b) $\frac{1}{24}$ (c) $\frac{1}{72}$ (d) 3

Q8. The value of $99\frac{95}{99} \times 99 - 95$ is:

SSC MTS 9 August 2019 (Morning)

(a) 9897 (b) 9993

(c) 9999 (d) 9801

Q9. Find the value/ मान ज्ञात करें :

$\left\{\frac{(0.7)^2\div0.14+(0.6)^2\div0.18+(0.5)^2\div0.05}{4(2.5\ of\ 4-13\times0.25\times3)}\right\}$

SSC MTS 7 August 2019 (Morning)

(a) $\frac{25}{2}$ (b) $\frac{19}{2}$ (c) $\frac{23}{2}$ (d) $\frac{21}{2}$

Q10. The simplified value of $\frac{0.01404}{24^2+6^2-144}$ is:

SSC CHSL 10 July 2019(Evening)

(a) 3×10^{-5} 3 (b) 6×10^{-5}

(c) 2.4×10^{-4} (d) 3×10^{-4}

Q11. Find the value of $\sqrt{4+\sqrt{144}}$

SSC CPO 14 March 2019 (Evening)

(a) 14 (b) 12.17 (c) 4 (d) 3.74

Q12. $\frac{5.75\times5.75\times5.75+3.25\times3.25\times3.25}{57.5\times57.5+32.5\times32.5-57.5\times32.5}$ is equal to:

SSC CPO 12 March 2019 (Evening)

(a) 0.009 (b) 0.0009

(c) 0.9 (d) 0.09

Q13. The simplified value of $\frac{(3\frac{1}{5}-\frac{3}{5})\div\frac{8}{5}}{1\frac{1}{7}\div\{\frac{6}{7}-(\frac{1}{7}\div\frac{1}{5})\}}$ is:

SSC CHSL 5 July 2019(Afternoon)

(a) $\frac{13}{64}$ (b) $\frac{13}{16}$ (c) $\frac{13}{8}$ (d) $\frac{13}{7}$

Q14. What is the simplified value of $5 \div 10\ of\ 10 \times 4 + 4 \div 4\ of\ 4 \times 10 - (10 - 4) \div 16 \times 4$

(a) 1.2 (b) 2.5 (c) 21 (d) 58.5

Q15. The value of 4.5 - (3.2 ÷ 0.8 × 5) + 3 × 4 ÷ 6 is
SSC CGL 10 June 2019 (Afternoon)
(a) -13.5 (b) 4.2 (c) -8.5 (d) 5.7

Q16. The value of $\frac{8}{9}$ *of* (5 $\frac{1}{4}$ ÷ 2 $\frac{1}{3}$ *of* 4) ÷ (8 ÷ $\frac{2}{3}$ *of* $\frac{4}{5}$) of (8 × $\frac{2}{3}$ ÷ $\frac{4}{5}$) is
SSC CGL 7 June 2019 (Morning)
(a) 1 $\frac{1}{8}$ (b) $\frac{4}{15}$ (c) $\frac{1}{200}$ (d) $\frac{1}{100}$

Q17. The value of 16 ÷ 4 of 4 × [3 ÷ 4 of { 4 × 3 ÷ (3 + 3)}] ÷ (2 ÷ 4 of 8) is :
SSC CGL 6 June 2019 (Evening)
(a) 6 (b) 9 (c) 48 (d) 16

Q18. The value of $\frac{9}{15}$ of ($\frac{2}{3}$ ÷ $\frac{2}{3}$ *of* $\frac{3}{2}$) ÷ ($\frac{3}{4}$ × $\frac{3}{4}$ ÷ $\frac{3}{4}$ *of* $\frac{4}{3}$) of ($\frac{5}{4}$ ÷ $\frac{5}{2}$ × $\frac{2}{5}$ *of* $\frac{4}{5}$)is :
SSC CGL 6 June 2019 (Afternoon)
(a) $\frac{20}{9}$ (b) $\frac{4}{25}$ (c) $\frac{18}{125}$ (d) $\frac{40}{9}$

Q19. The value of 5 ÷ 5 of 5 × 2 + 2 ÷ 2 of 2 × 5 - (5-2) ÷ 6 × 2 is:
SSC CGL 4 June 2019 (Afternoon)
(a) $\frac{9}{5}$ (b) $\frac{19}{10}$ (c) 19 (d) $\frac{23}{2}$

Q20. The simplified value of $\frac{1.0025+6.25\times10^{-6}}{0.0025+0.95}$ is:
SSC CHSL 9 June 2019 (Evening)
(a) 1.0025 (b) 1.0525
(c) 1.0005 (d) 1.0505

Q21. The value of (5+3 ÷ 5 × 5) / (3 ÷ 3 of 6) of (4 × 4 ÷ 4 of 4+4 ÷ 4 × 4) is
SSC CGL 6 June 2019 (Morning)
(a) 8 $\frac{1}{5}$ (b) 7 $\frac{1}{3}$ (c) 9 $\frac{3}{5}$ (d) 6 $\frac{2}{3}$

Q22. The value of 2 $\frac{7}{8}$ ÷ (3 $\frac{5}{6}$ ÷ $\frac{2}{7}$ *of* 2 $\frac{1}{3}$) × [(2 $\frac{6}{7}$ *of* 4 $\frac{1}{5}$ ÷ $\frac{2}{3}$) × $\frac{5}{9}$] is :
SSC CGL 4 June 2019 (Evening)
(a) $\frac{1}{4}$ (b) 4 (c) $\frac{1}{23}$ (d) 5

Q23. The value of 2 × 3 ÷ 2 of 3 × 2 ÷ (4 + 4 × 4 ÷ 4 of 4-4 ÷ 4 × 4) is:
SSC CGL 4 June 2019 (Morning)
(a) 8 (b) 1 (c) 4 (d) 2

Practice Questions

SSC CGL 2021

Q24. The value of 20 ÷ 5 *of* 8 × [9 ÷ 6 × (6 - 3)] - (10 ÷ 2 *of* 20) is :
SSC CGL 13/8/2021 (Morning)
(a) 6 (b) 1 (c) 0 (d) 2

Q.25. The value of 3 ÷ 18 of 3 × 6 - 22 × 6 ÷ 18 - 3 ÷ 2 + 10 - 3 ÷ 9 of 3 × 9 is:
SSC CGL 13/8/2021 (Afternoon)
(a) -1/3 (b) -1/2 (c) 1/2 (d) 1/3

Q.26 The value of 14 - 20 × [7 - {18 ÷ 2 of 3 - (15 - 25 ÷ 5 × 4)}].
SSC CGL 13/8/2021 (Evening)
(a) 0 (b) 24 (c) 6 (d) 34

Q.27. The value of 90 ÷ 20 of 6 × [11 ÷ 4 of {3 × 2 - (3 - 8)}] ÷ (9 ÷ 3 × 2) is:
SSC CGL 13/8/2021 (Evening)
(a) $\frac{1}{36}$ (b) $\frac{1}{32}$ (c) $\frac{9}{8}$ (d) $\frac{3}{8}$

Q.28. The value of $\frac{52-1170\div26+13\times2}{2+1\frac{1}{8}\ of\ 2-1\frac{1}{4}}$ is:
SSC CGL 16/8/2021 (Morning)
(a) 11 (b) 12 (c) 41 (d) 27

Q.29 The value of 3 $\frac{5}{6}$ +[3 $\frac{2}{3}$ +{ $\frac{15}{4}$ (5 $\frac{4}{5}$ ÷14 $\frac{1}{2}$)}] is equal to:
SSC CGL 16/8/2021 (Afternoon)
(a) 9 (b) 6 (c) 7 (d) 8

Q30. The value of 25 ÷ 15 of 4 × [4 ÷ 5 × (9-7)]-(20 ÷ 5 of 9) is :
SSC CGL 16/8/2021 (Evening)
(a) $\frac{4}{9}$ (b) $\frac{2}{3}$ (c) $\frac{1}{3}$ (d) $\frac{2}{9}$

Q31. The value of 32 ÷ 12 of 3 × [5 - (15-12) ÷ 9] of 3/7 + 4 - 8 ÷ 2 of 4 is:
SSC CGL 17/8/2021 (Morning)
(a) 1 $\frac{7}{9}$ (b) 4 $\frac{7}{9}$ (c) 3 $\frac{1}{3}$ (d) 3 $\frac{1}{6}$

Q32. $\frac{5}{1}\div[3\frac{1}{2}-\{\frac{5}{6}-(\frac{3}{5}+\frac{1}{10}-\frac{4}{15})\}]$ is equal to:
SSC CGL 17/8/2021 (Afternoon)
(a) 12/31 (b) 22/31
(c) 52/31 (d) 72/31

Q33. Simplify the following expression $(\frac{7}{16}\div\frac{1}{2}\ of\ \frac{1}{5})\times\frac{4}{5}-\frac{1}{3}\times\frac{5}{8}\div\frac{1}{2}+\frac{3}{4}$
SSC CGL 17/8/2021 (Evening)
(a) 317/96 (b) 10/3
(c) 71/150 (d) 23/6

Q34. Simplify the following expression $\frac{108\times108\times108-92\times92\times92}{108\times108+92\times92+108\times92}$
SSC CGL 17/8/2021 (Evening)
(a) 200 (b) 1 (c) 16 (d) -1

Q35. The value of 18 ÷ [26 – {25 – (15 – 5) ÷ 2}] *of* 12 + 2 – 2 ÷ 4 × 16 is:
SSC CGL 18-08-2021 (Morning)
(a) 9/4 (b) 3/2 (c) -25/2 (d) -23/4

Q.36. Simplify the following expression: 6 ÷ 4 of 3 - 4 ÷ 6 ×(13 - 10) - 2 × 15 ÷ 6 × 6
SSC CGL 18-08-2021 (Afternoon)
(a) – 19 $\frac{1}{2}$ (b) – 27 $\frac{1}{2}$
(c) -31 $\frac{1}{2}$ (d) -29 $\frac{14}{17}$

Q37. Simplify the expression. $441\div[270\div\frac{3}{7}+(17\div\frac{1}{3})-(8\frac{1}{2}-\frac{5}{2})]$
SSC CGL 18-08-2021 (Evening)
(a) $\frac{49}{75}$ (b) $\frac{39}{75}$ (c) $\frac{19}{75}$ (d) $\frac{29}{75}$

Q38. Simplify. $(x-y+z)^2 - (x - y - z)^2$.
SSC CGL 20/8/2021 (Morning)
(a) 2xz + 2yz (b) 4yz - 4xz
(c) 4xz + 4yz (d) 4xz - 4yz

Q39. Simplify the following expression: 3 × 8 ÷ 9 of 6 - 2 ÷ 3 × (5 - 2) × 2 + 18 ÷ 3 of 3.
SSC CGL 20/8/2021 (Morning)
(a) -4 (b) 2 $\frac{12}{13}$ (c) -1 $\frac{5}{9}$ (d) 2 $\frac{1}{3}$

Q40. Simplify the following expression: 15 ÷ 3 of 2 x 4 + 9 ÷ 18 of 2 x 3 - 4 ÷ 8 x 2
SSC CGL 20/8/2021 (Afternoon)
(a) 9 $\frac{3}{4}$ (b) 12 $\frac{3}{4}$ (c) 39 (d) 42 $\frac{3}{4}$

Q41. Simplify the following expression 8 ÷ 4 of 2 - 15 ÷ 2 of 5 - 6 ÷ 5 × (-7 + 5) of 2
SSC CGL 20/8/2021 (Evening)
(a) 31 $\frac{7}{10}$ (b) 7 $\frac{3}{10}$ (c) 4 $\frac{3}{10}$ (d) - $\frac{1}{5}$

Q42. Simplify the following expression: 7 × 4 ÷ 21 of 4 - 5 ÷ 4× (9 - 13) + 2 - 2 ÷ 8
SSC CGL 23/8/2021 (Morning)
(a) 7 $\frac{1}{12}$ (b) 5 $\frac{1}{3}$ (c) 12 $\frac{1}{2}$ (d) 5 $\frac{1}{16}$