

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY
SIMPLIFICATION

IMPORTANT CONCEPTS:

1. BODMAS rule:

B - Bracket

O - Of

D - Division

M - Multiplication

A - Addition

S – Subtraction

V – BODMAS:

V = virnaculum

Before applying BODMAS, apply V.

2. Types of numbers:

- Natural number – 1,2, 3.....,∞
- Whole number – 0,1,2,3,... ∞
- Integer - $> -\infty, \dots, -3, -2, -1, 0, 1, 2, 3, \dots, \infty$
- Even number – 2,4,6,....
- Odd number – 1,3,5,7,...
- Prime number – 1 & itself (2,3,5,7,11,....)
- Composite number - If a number has more than two factors. Eg: 4,6,9,10,...

1 is neither prime nor composite.

3. Divisibility rule:

Rule 2: Ended by even number = $(20/2) = 10$

Rule 3: Add given number, if that is divided by exactly 3 means divided by '3'

Eg: $135 = 1+3+5 = 9/3 = 3$

**MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY**

Rule 4: Last two digits divided by four means like your number will be divided by four or lost two numbers or zero means divided by four.

Eg: $200/4 = 50$; $634/4 = 156$.

Rule 5: End with 0 or 5.

Eg: $50/5 = 10$ and $65/5 = 13$.

Rule 6: check condition of 2 or 3.

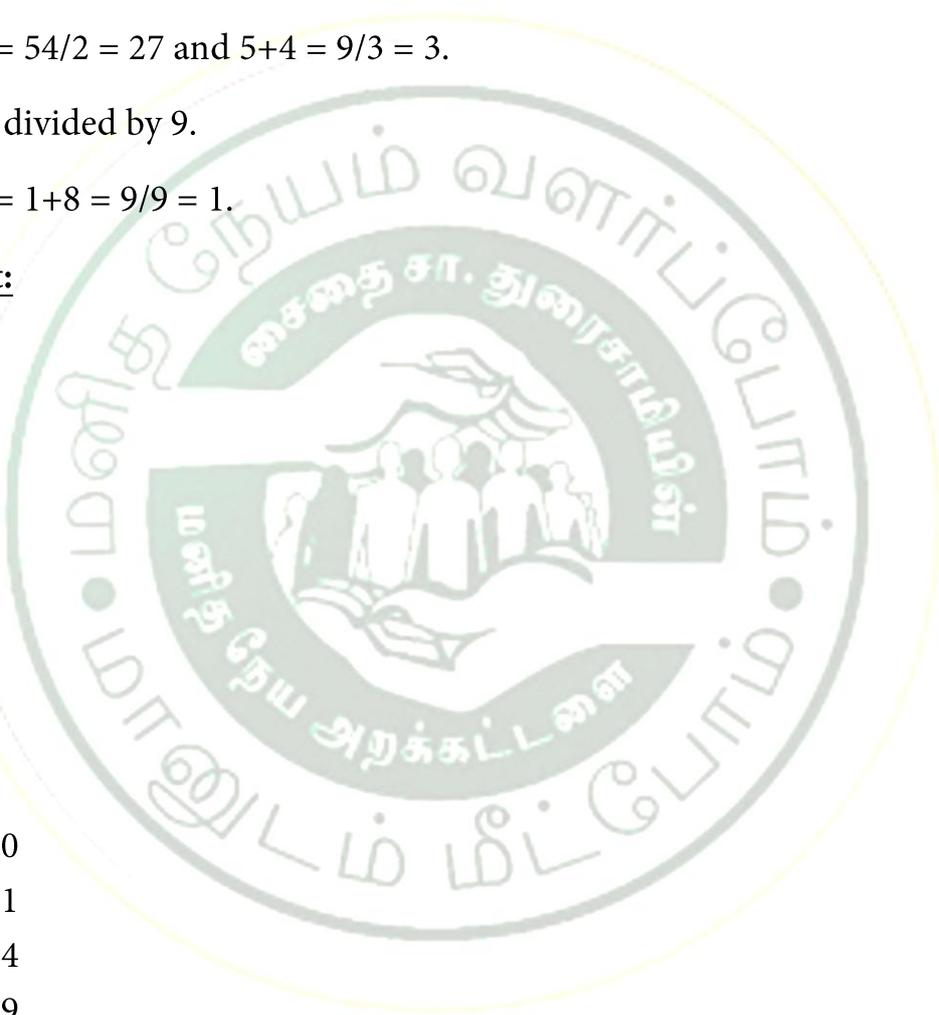
Eg: $54 = 54/2 = 27$ and $5+4 = 9/3 = 3$.

Rule 7: Sum is divided by 9.

Eg: $18 = 1+8 = 9/9 = 1$.

4. Square root:

- $1^2 = 1$
- $2^2 = 4$
- $3^2 = 9$
- $4^2 = 16$
- $5^2 = 25$
- $6^2 = 36$
- $7^2 = 49$
- $8^2 = 64$
- $9^2 = 81$
- $10^2 = 100$
- $11^2 = 121$
- $12^2 = 144$
- $13^2 = 169$
- $14^2 = 196$
- $15^2 = 225$
- $16^2 = 256$
- $17^2 = 289$
- $18^2 = 324$
- $19^2 = 361$
- $20^2 = 400$



MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

Cube root:

- $1^3 = 1$
- $2^3 = 8$
- $3^3 = 27$
- $4^3 = 64$
- $5^3 = 125$
- $6^3 = 216$
- $7^3 = 343$
- $8^3 = 512$
- $9^3 = 729$
- $10^3 = 1000$
- $11^3 = 1331$
- $12^3 = 1728$
- $13^3 = 2197$
- $14^3 = 2744$
- $15^3 = 3375$
- $16^3 = 4096$
- $17^3 = 4913$
- $18^3 = 5832$
- $19^3 = 6859$
- $20^3 = 8000$

ALGEBRA

FORMULA:

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

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

**MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY**

6. $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
7. $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
8. $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
9. $(a+b)^2 - (a-b)^2 = 4ab$
10. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$
11. $a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2+b^2+c^2-ab-bc-ac)$
12. If $a+b+c=0$, then $a^3+b^3+c^3=3abc$
13. $a^4 + a^2 + 1 = (a^2+a+1)(a^2-a+1)$
14. $(a^4-b^4) = (a^2+b^2)(a+b)(a-b)$
15. $a^8-b^8 = (a^4 + b^4)(a^2 + b^2)(a+b)(a-b)$
16. $a^m \times a^n = a^{m+n}$
17. $\frac{a^m}{a^n} = a^{m-n}$
18. $(a^m)^n = a^{mn}$
19. $(ab)^x = a^x b^x$
20. $\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$
21. $a^{\frac{1}{x}} = x\sqrt{x}a$
22. $(a+b)^2 + (a-b)^2 = 2(a^2+b^2)$
23. $(a+b+c)^3 = a^3+b^3+c^3 + 3(a+b)(b+c)(c+a)$

SHORTCUTS:

1. If $x + \frac{1}{x} = a$, then $x^2 + \frac{1}{x^2} = a^2 - 2$
2. $x^2 + \frac{1}{x^2} = a$, then $x + \frac{1}{x} = \sqrt{a + 2}$
3. $x - \frac{1}{x} = a$, then $x^2 - \frac{1}{x^2} = a^2 + 2$
4. $x^2 - \frac{1}{x^2} = a$, then $x + \frac{1}{x} = \sqrt{a - 2}$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM

UNIT – X – APTITUDE & MENTAL ABILITY

5. $x + \frac{1}{x} = a$, then $x - \frac{1}{x} = \sqrt{(a^2 - 4)}$

6. $x - \frac{1}{x} = a$, then $x + \frac{1}{x} = \sqrt{(a^2 + 4)}$

7. $x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right) \times \left(x - \frac{1}{x}\right)$

8. $x + \frac{1}{x} = a$, then $x^3 + \frac{1}{x^3} = a^3 - 3a$

9. $x - \frac{1}{x} = a$, then $x^3 - \frac{1}{x^3} = a^3 + 3a$

10. $x + \frac{1}{x} = a$, then $x^4 + \frac{1}{x^4} = (a^2)^2 - 2$

11. $x - \frac{1}{x} = a$, then $x^4 - \frac{1}{x^4} = (a^2)^2 + 2$

12. $x + \frac{1}{x} = a$, then $x^5 + \frac{1}{x^5} = a^5 - 5a^3 + a(5)$

13. $x - \frac{1}{x} = a$, then $x^5 - \frac{1}{x^5} = a^5 + 5a^3 - a(5)$

14. $x^2 + \frac{1}{x^2} = a$, $x^3 + \frac{1}{x^3} = a^3 - 3a$

E.g: $x^2 + \frac{1}{x^2} = 23$

$23+2 = 25$

$23-2 = 21$

$a^3-3a = 5^3 - 3(5)$

$=125-15$

$=110$

15. To find the quadratic equation.

$X^2 - (\alpha+\beta)x + \alpha\beta$

16. $\sqrt{\left(5\sqrt{\left(5\sqrt{\left(5\sqrt{5}\dots\dots\right)}\right)}\right)}\dots\dots\infty$

∞ and multiply = so given no is ans.

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$17. \sqrt{\left(6 + \sqrt{\left(6 + \sqrt{\left(6 + \sqrt{6} \dots \dots\right)}\right)}\right)} \dots \dots \infty$$

Consecutive numb is $6 = 2 \times 3$

(+) is given so bigger numb is ans

(-) is given so small number is ans

$$18. x \sqrt{\left(y \sqrt{\left(z \sqrt{a}\right)}\right)} = xyz \sqrt{a}$$

$$19. (((a)^x)^y)^z = a^{xyz}$$

$$20. 999 \frac{995}{999} 999$$

995 = numerator + 1

999 = denominator - 1

AM = 998996

21.

$999 \frac{27}{28} 196$
→ If numerator small
↓
 196000
→ 000 is for 999.

Then $999 \frac{27}{28} 196 \Rightarrow \left(\frac{196}{28}\right) = 7$

$\begin{array}{r} 196000 \\ - 7 \\ \hline \text{AM} = 195993 \end{array}$
(numerator small (-))

MANIDHANA EYAM FREE IAS ACADEMY - TNPSC GROUP - IV & VAO EXAM
UNIT - X - APTITUDE & MENTAL ABILITY

22.

$$999 \times \frac{5}{4} \times 296 \rightarrow \text{if numerator } \underline{\text{big}}$$

$$296000$$

Then $999 \times \frac{5}{4} \times 296 \Rightarrow \frac{296}{4} = 74$

so
$$\begin{array}{r} 296000 \\ + 74 \quad (\text{numerator big}) \\ \hline \end{array}$$

so (+)

Ans - 296074

23.

$$999 \times \frac{40}{47} \times 47 \rightarrow \text{same, so take } 47$$

$$47000$$

Difference \Rightarrow numerator & denominator

$$999 \times \frac{40}{47} \times 47 \Rightarrow 7$$

Numerator small so (-).

$$\Rightarrow \begin{array}{r} 47000 \\ - 7 \\ \hline \end{array}$$

Ans \Rightarrow 47993

MANIDHANAAYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

24.

$$\frac{999}{995} \times 995 \Rightarrow \text{same}$$

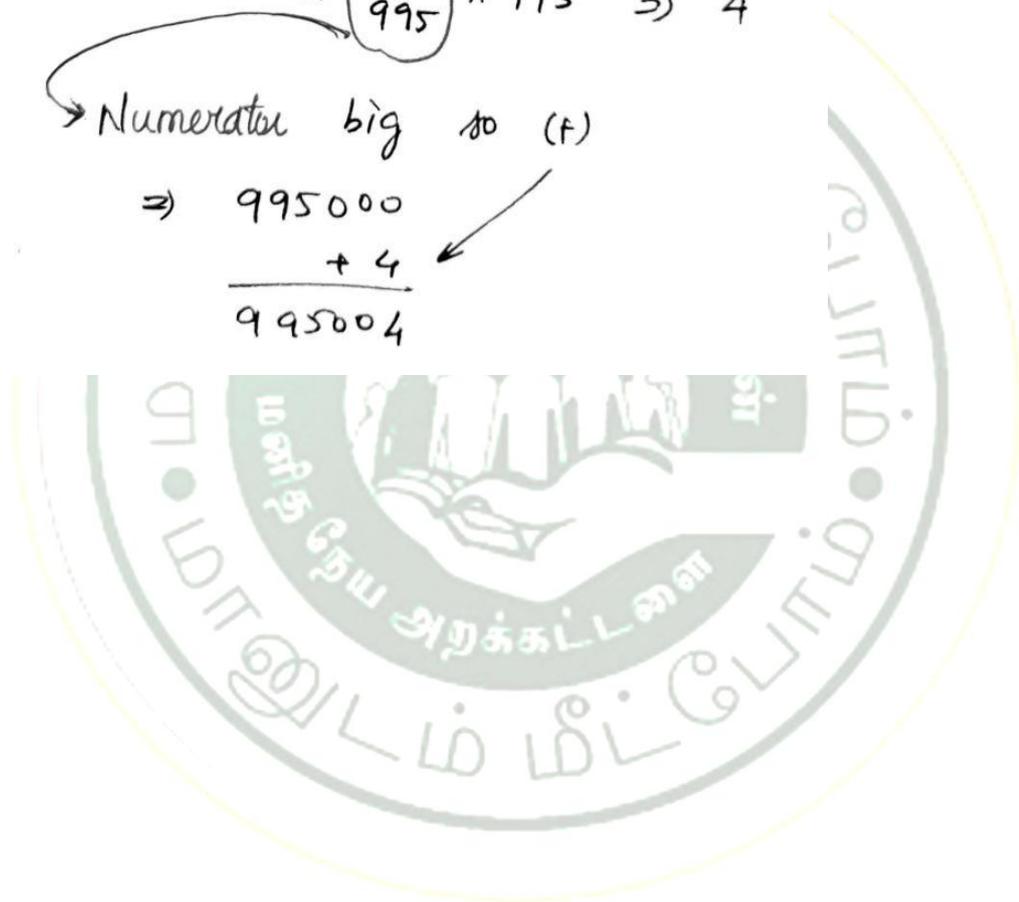
↓
995000

Difference \Rightarrow numerator denominator

$$= 999 \left(\frac{999}{995} \right) \times 995 \Rightarrow 4$$

\rightarrow Numerator big so (+)

$$\begin{array}{r} \Rightarrow 995000 \\ + 4 \\ \hline 995004 \end{array}$$



MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

Problems:

1. If $\sqrt{y} = 6x$, then $\frac{x^2}{y}$ is

- a. $1/26$
- b. $1/36$
- c. $1/16$
- d. $1/6$.

Ans: b

$$\sqrt{y} = 6x$$

$$y = 36x^2$$

$$\frac{x^2}{y} = \frac{1}{36}$$

2. If an operation \ominus is defined as follows $a \ominus b = \sqrt{(a^2 + b^2)}$, where $a, b \in N$, then the value of $(3 \ominus 4) \ominus 5$ is?

- a. $2\sqrt{2}$
- b. $5\sqrt{2}$
- c. $2\sqrt{5}$
- d. $5\sqrt{5}$

Ans: b

$$a \ominus b = \sqrt{(a^2 + b^2)}$$

$$\sqrt{(a^2 + b^2)} = \sqrt{(3^2 + 4^2)}$$

$$= \sqrt{(9 + 16)}$$

$$= \sqrt{(25)}$$

$$= 5$$

MANIDHANAAYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$\begin{aligned} 5\ominus 5 &= \sqrt{(5^2 + 5^2)} \\ &= \sqrt{(25 + 25)} \\ &= \sqrt{(50)} \\ &= \sqrt{(2 \times 25)} \\ &= 5\sqrt{2} \end{aligned}$$

3. In an examination a student scores four marks for every correct answer and losses Van Marg for every wrong. Answer if he answers 80 questions in all and gate 150 marks find the number of questions he answered correctly.

- a. 46
- b. 26
- c. 36
- d. 56

Ans: a

No. Of correct answers be x.

No. Of wrong answers be 80-x.

$$4x - 1(80 - x) = 150$$

$$4x - 80 + x = 150$$

$$5x = 150 + 80$$

$$X = 230/5$$

$$X = 46.$$

4. Simplify $\frac{x^3}{(x-3)} + \frac{27}{3-x}$

- a. x^2-3x+9
- b. x^2+3x+9
- c. x^2-3x-9

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

d. x^2+3x-9

Ans: b

$$\frac{x^3}{(x-3)} + \frac{27}{3-x}$$

We know that, $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

$$\frac{x^3 - 27}{(x-3)} = \frac{(x-3)(x^2 + 3x + 9)}{(x-3)}$$

= x^2+3x+9

5. The value of $999 \frac{991}{999} \times 999$ is

- a. 990809
- b. 998990
- c. 999824
- d. 998992

Ans: d

If all are same, then

$$999 \frac{991}{999} 999 \begin{array}{l} \xrightarrow{+1} \\ \xrightarrow{-1} \end{array}$$

=> 998992

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM

UNIT – X – APTITUDE & MENTAL ABILITY

6. If $\frac{x}{y} = \frac{12}{13}$, then $\frac{14}{17} + \frac{3y-x}{3y+x}$ is

a. 69/57

b. 27/51

c. 51/69

d. 58/31

Ans: a

$$\frac{14}{17} + \frac{3(13) - 12}{3(13) + 12}$$

$$\frac{14}{17} + \frac{39 - 12}{39 + 12}$$

$$\frac{14}{17} + \frac{27}{51}$$

$$\frac{42 + 27}{51}$$

$$\frac{69}{51}$$

$$\frac{69}{51}$$

$$\frac{69}{51}$$

7. value of $\frac{(9+9+9+9) \div 9}{7+7+7+7 \div 7}$

a. 11/2

b. 2/11

c. 22/4

d. 12/4

Ans: b

BODMAS rule

$$\frac{36 \div 9}{7 + 7 + 7 + 7 \div 7}$$

$$\frac{36 \div 9}{7 + 7 + 7 + (7 \div 7)}$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$\frac{4}{7 + 7 + 7 + 1}$$

$$= \frac{4}{22}$$

$$= \frac{2}{11}$$

8. Find the value of $(6561)^{\frac{5}{4}}$

- a. 56561
- b. 59149
- c. 59049
- d. 59069

Ans: c

$$= (\sqrt[4]{6561})^5$$

$$= (\sqrt[4]{81 \times 81 \times 81 \times 81})^5$$

$$= (81)^5$$

$$= 59049$$

9. If $a+b=2x$, then value of $\frac{x}{a-x} + \frac{x}{b-x}$

- a. 2
- b. -1
- c. 0
- d. 1

Ans: c

$$\frac{x}{a-x} + \frac{x}{b-x}$$

LCM

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM

UNIT – X – APTITUDE & MENTAL ABILITY

$$\frac{x(b-x) + x(a-x)}{(a-x)(b-x)}$$

$$= \frac{bx - x^2 + ax - x^2}{(a-x)(b-x)}$$

$$= \frac{x(b-x+a-x)}{(a-x)(b-x)} \text{ -----1}$$

a+b = 2x in equation 1

$$\frac{x(2x - 2x)}{(a-x)(b-x)} = 0$$

10. Value of $\sqrt{(7\sqrt{7}(\sqrt{7}(\sqrt{7})))}$

- a. 7
- b. Infinity
- c. 0
- d. $\sqrt{7}$

Ans: a

$$\sqrt{(7\sqrt{7}(\sqrt{7}(\sqrt{7})))} = x$$

Square on both sides.

$$\left(\sqrt{(7\sqrt{7}(\sqrt{7}(\sqrt{7})))}\right)^2 = x^2$$

$$(7\sqrt{7}(\sqrt{7}(\sqrt{7}))) = x^2$$

$$(7x) = x^2$$

$$x = 7$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

11. If $\left(\frac{9}{14}\right)^9 \times \left(\frac{9}{14}\right)^{3x} = \left(\frac{9}{14}\right)^{12}$, then the value of x is

- a. 3
- b. 2
- c. 5
- d. 1

Ans: d

$$9 + 3x = 12$$

$$\text{Option d} \Rightarrow 12 = 12$$

$$\text{LHS} = \text{RHS}$$

12. The value of $\frac{3.25 \times 3.25 + 2 \times 3.25 \times 1.25 + 1.25 \times 1.25}{3.25 \times 3.25 - 1.25 \times 1.25}$

- a. 1.25
- b. 2.25
- c. 2.50
- d. 3.25

Ans: b

$$\text{Let } a = 3.25, b = 1.25$$

$$\begin{aligned} \frac{a^2 + 2ab + b^2}{a^2 - b^2} &= \frac{(a + b)^2}{(a + b)(a - b)} \\ &= \frac{(a + b)}{(a - b)} \\ &= \frac{(3.25 + 1.25)}{(3.25 - 1.25)} \\ &= \frac{4.50}{2} = 2.25 \end{aligned}$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

13. Simplify $\left(-2\frac{3}{9}\right) + \left(5\frac{7}{9}\right) + \left(-7\frac{11}{9}\right)$

- a. 22/9
- b. 43/9
- c. -43/9
- d. 42/9

Ans: c

$$\begin{aligned} &= \left(\frac{-21}{9}\right) + \left(\frac{52}{9}\right) + \left(\frac{-74}{9}\right) \\ &= \frac{-21 + 52 - 74}{9} \\ &= \frac{-43}{9} \end{aligned}$$

14. If $a - \frac{1}{a} = 5$, find $a^3 - \frac{1}{a^3}$

- a. 150
- b. 160
- c. 140
- d. 130

Ans: c

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

$$a=a; b= 1/a$$

$$\left(a - \frac{1}{a}\right)^3 = a^3 - \left(\frac{1}{a}\right)^3 - 3\left(a \times \frac{1}{a}\right)\left(a - \frac{1}{a}\right)$$

$$5^3 = a^3 - \left(\frac{1}{a^3}\right) - 3 \times 5$$

$$125 = a^3 - \left(\frac{1}{a^3}\right) - 15$$

MANIDHANAAYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$a^3 - \frac{1}{a^3} = 140$$

15. $\frac{(3^4)^{-2} \times (2^3)^{-4}}{(2^4)^{-2} \times (3^{-5}) \times 4^{-3}}$ Is

a. 4/27

b. 27/4

c. 5/30

d. 5/27

Ans: a

$$\begin{aligned} & \frac{3^{-8} \times 2^{-12}}{(2^{-8} \times 3^{-5} \times 4^{-3})} \\ &= 3^{-8} \times 2^{-12} \times 2^8 \times 3^5 \times 2^6 \\ &= 3^{-8+5} \times 2^{-12+8+6} \\ &= 3^{-3} \times 2^2 \\ &= \frac{2^2}{3^3} \\ &= \frac{4}{27} \end{aligned}$$

16. Simplify $8\sqrt{(\sqrt[3]{x^4})}$

a. $x^{\frac{1}{6}}$

b. $x^{\frac{1}{4}}$

c. $x^{\frac{1}{2}}$

d. $x^{\frac{1}{8}}$

Ans: a

$$\sqrt[3]{x^4} = (x^4)^{\frac{1}{3}} = \left(x^{\frac{4}{3}}\right)$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$\begin{aligned} 8 \sqrt{\left(x^{\frac{4}{3}}\right)} &= \left(x^{\frac{4}{3}}\right)^{\frac{1}{8}} \\ &= x^{\frac{4}{3} \times \frac{1}{8}} \\ &= x^{\frac{1}{6}} \end{aligned}$$

17. The value of $\frac{2x^2-4x}{2x^2+4x} \times \frac{4x+8}{x-2}$

- a. 2
- b. 4
- c. 8
- d. 16

Ans: b

$$\frac{2x^2-4x}{2x^2+4x} \times \frac{4x+8}{x-2} = 4$$

18. $y^{\frac{3}{2}} : 25 = 36 : \sqrt{y}$, then what is the value of y?

- a. 10
- b. 30
- c. 25
- d. 50

Ans: b

a:b = c:d

$$y^{\frac{3}{2}} \times y^{\frac{1}{2}} = 25 \times 36$$

$$y^2 = 25 \times 36$$

$$y^2 = 25 \times 36$$

$$y = \sqrt{(25 \times 36)}$$

MANIDHANAAYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$y = 5 \times 6 = 30$$

19. Simplify $5\frac{3}{4} + \frac{3}{4}$ of $\frac{8}{9}$

a. $12(5/6)$

b. $6(5/12)$

c. $5(12/6)$

d. $77(5/6)$

Ans: b

$$\begin{aligned} \frac{3}{4} \times \frac{8}{9} &= \frac{2}{3} \\ 5\frac{3}{4} + \frac{2}{3} &= \frac{23}{4} + \frac{2}{3} \\ &= \frac{77}{12} = 6\frac{5}{12} \end{aligned}$$

20. Simplify $\frac{m}{m-1} - \frac{1}{m-1} - \frac{m}{m^2+1}$

a. $\frac{m^2}{m^2-1}$

b. $\frac{m^3}{m^2-1}$

c. $\frac{m^2}{m^2+1}$

d. $\frac{m^3}{m^2+1}$

Ans: c

$$\begin{aligned} \frac{m}{m-1} - \frac{1}{m-1} - \frac{m}{m^2+1} \\ \frac{m}{m-1} - \frac{1}{m-1} &= \frac{m-1}{m-1} \\ 1 - \frac{m}{m^2+1} &= \frac{m^2+1-1}{m^2+1} \end{aligned}$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$= \frac{m^2}{m^2 + 1}$$

21. Chandra and Lekha, each had a number of bangles, Chandra said to Lekha, 'if you give me five of your bangles, my number will be thrice of yours'. Lekha replied 'if you give me 45 my number will be thrice yours'. what is the total bangles together with them?

- a. 70
- b. 80
- c. 90
- d. 100

Ans: d

No. Of chandra bangles = M

No. Of Lekha bangles = L

Total num of bangles = M+L

$$(m+5) = 3(L-5)$$

$$(m+5) = 3L - 15$$

$$M-3L = -20 \text{ -----1}$$

$$3(M-45) = L + 45$$

$$3M-L = 180 \text{ -----2}$$

From 1 & 2

$$3m-9L = -60$$

$$3m-L = 180$$

$$-8L = -240$$

$$L = 30$$

Substituting L in 1

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$M = 70$$

$$L+M= 30 + 70 = 100$$

22.If $a^J = b$, $b^K = c$, $c^L = a$, then what is the value of JKL?

a. 3

b. 4

c. 9

d. 1

Ans: d

$$a^J = b, b^K = c$$

$$b^K = (a^J)^k$$

$$= a^{JK} = c^1$$

$$c^L = a \Rightarrow a^{\frac{1}{2}}$$

$$a^{JK} = a^{\frac{1}{2}}$$

$$JK = \frac{1}{2}$$

$$JKL = 1$$

23.If $ax^2-32x+69= 0$ has equal root, then the value of a is?

a. 1

b. 2

c. 3

d. 4

Ans: d

$$a=a; b= -32; c= 64$$

$$b^2-4ac = 0$$

$$(-32)^2-4(a)(64)=0$$

**MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY**

$$1024 - 256a = 0$$

$$1024 = 256a$$

$$a = 1024/256$$

$$a = 4$$

24. In a two digit number the digit in the units place is twice of the digit in the 10th place. If the digits are reversed the new number is 36 more than the given number. Find the number.

a. 84

b. 48

c. 24

d. 42

Ans: b

From option, b is 48

Unit place = 4

10th place = 8

$$84 - 48 = 36$$

25. $6a+8b = 44$, $8a-5b= 4$, then a^2+b^2+2ab is?

a. 36

b. 72

c. 25

d. 49

Ans: a

$$6a+8b = 44 \text{ -----1}$$

$$8a-5b= 4 \text{ -----2}$$

MANIDHANA EYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

Multiply equ 1 by 8 and 2 by 6, then

$$48a + 64b = 352$$

$$48a - 30b = -24$$

$$94b = 376$$

$$b = 4$$

Substitute b in equ 1,

$$6a + 8(4) = 44$$

$$6a = 44 - 32 = 12$$

$$a = 2$$

$$a^2 + b^2 + 2ab = 4 + 16 + 2(8)$$

$$a^2 + b^2 + 2ab = 36$$

26. Simplify $\frac{2}{1.2.3} + \frac{2}{2.3.4} + \frac{2}{3.4.5} + \frac{2}{4.5.6}$ **is equal to.**

a. $\frac{7}{30}$

b. $\frac{11}{30}$

c. $\frac{7}{15}$

d. $\frac{11}{15}$

Ans: c

LCM = 120

$$\frac{2 \times 20}{6 \times 20} + \frac{2 \times 5}{24 \times 5} + \frac{2 \times 2}{60 \times 2} + \frac{2}{120}$$

$$\frac{40}{120} + \frac{10}{120} + \frac{4}{120} + \frac{2}{120}$$

$$\frac{56}{120}$$

$$= \frac{7}{15}$$

MANIDHANA EYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

27. Find the value of

$$\sqrt{\left(58 + \sqrt{\left(31 + \sqrt{\left(21 + \sqrt{\left(11 + \sqrt{\left(21 + \sqrt{\left(31 + \sqrt{(9)}\right)}\right)}\right)}\right)}\right)}\right)}\right)}$$

a. 7

b. 8

c. 9

d. 6

Ans: b

$$\sqrt{9} = 3 \gg \sqrt{(13 + 3)} = \sqrt{16} = 4$$

$$\sqrt{(21 + 4)} = \sqrt{25} = 5 \gg \sqrt{(11 + 5)} = \sqrt{16} = 4$$

$$\sqrt{(21 + 4)} = \sqrt{25} = 5 \gg \sqrt{(31 + 5)} = \sqrt{36} = 6$$

$$\sqrt{(58 + 6)} = \sqrt{64} = 8$$

28. A boy is now twice as old as his sister. Four years ago, he was thrice as old as her. What are their ages now?

a. 18,9

b. 14,7

c. 16,8

d. 12,6

Ans: c

From option c

A boy is now twice as old as his sister i.e., 16 and 8

Four years before he was thrice as old as her i.e., 12 and 4

29. Simplify $\left(-\frac{1}{5}\right) - \left\{1 \div \left(\frac{2}{3} \times \frac{5}{7}\right) + 8 - \left(5 - \frac{1}{2} - \frac{1}{4}\right)\right\}$

A. $-11(5/20)$

b. $-5(11/20)$

c. $-20(11/5)$

d. $-10(11/10)$

Ans: b

$$\left(-\frac{1}{5}\right) - \left\{1 \div \left(\frac{2}{3} \times \frac{5}{7}\right) + 8 - \left(5 - \frac{1}{2} - \frac{1}{4}\right)\right\}$$

$$\left(-\frac{1}{5}\right) - \left\{1 \div \left(\frac{10}{21}\right) + 8 - \left(5 - \frac{1}{4}\right)\right\}$$

$$\left(-\frac{1}{5}\right) - \left\{\left(\frac{10}{21}\right) + 8 - \left(\frac{19}{4}\right)\right\}$$

$$= (-1/5) - (214/40)$$

$$= (-8 - 214)/40$$

$$= (-222)/40$$

$$= -5(11/20)$$

30. Solve $\sqrt{\left(1 + \frac{x}{961}\right)} = \frac{32}{31}$

a. 63

b. 32

c. 31

d. 36

Ans: a

$$\sqrt{\left(1 + \frac{x}{961}\right)} = \frac{32}{31}$$

If numerator is big (+)

MANIDHANA EYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

If numerator is small (-)

$$32 + 31 = 63.$$

$$31. \sqrt{\left(30 - \sqrt{\left(30 - \sqrt{\left(30 - \sqrt{\left(30 \dots \dots\right)}\right)}\right)}\right)} = \infty$$

a. 6

b. 5

c. 30

d. 3

Ans: b

$$\sqrt{\left(30 - \sqrt{\left(30 - \sqrt{\left(30 - \sqrt{\left(30 \dots \dots\right)}\right)}\right)}\right)} = \infty$$

Consecutive number multiplication.

$$6 \times 5 = 30$$

If (-) is given, small number is answer

If (+) is given, big number is answer.

So, ans is 5.

$$32. \text{Solve } \frac{14^{14}}{14^{12}}$$

a. 196

b. 14

c. 14^3

d. 28

Ans: a

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$\begin{aligned}\frac{a^m}{a^n} &= a^{m-n} \\ &= 14^{14-12} \\ &= 14^2\end{aligned}$$

$$= 196$$

33. If $x + \frac{1}{x} = 7$, then find the value of $x^2 + \frac{1}{x^2}$

- a. 7
- b. 17
- c. 49
- d. 47

Ans: d

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

$$\begin{aligned}\left(x + \frac{1}{x}\right)^2 &= 7^2 \\ x^2 + \frac{1}{x^2} + 2(x)\left(\frac{1}{x}\right) &= 49 \\ x^2 + \frac{1}{x^2} &= 49 - 2 \\ x^2 + \frac{1}{x^2} &= 47\end{aligned}$$

34. If $\sqrt{6561} = 81$, then the value of $\sqrt{(6561)} + \sqrt{65.65} + \sqrt{0.006561}$

- a. 81
- b. 891.81
- c. 89.181
- d. 8.9181

Ans: c

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$\sqrt{6561} = 81$$

$$\sqrt{65.61} = 8.1$$

$$\sqrt{0.006561} = 0.081$$

$$\sqrt{(6561)} + \sqrt{65.65} + \sqrt{0.006561} = 89.181$$

35. 1.6666 expressed as a fraction is

- a. 16/10
- b. 16/9
- c. 5/3
- d. 4/8

Ans: c

From option,

$$(5/3) = 1.66666$$

$$(16/9) = 1.7777$$

$$(16/10) = 1.6$$

$$(4/8) = 0.5$$

36. Find quadratic equation whose root are $2 + \sqrt{7}$ & $2 - \sqrt{7}$

- a. x^2+4x+3
- b. x^2-4x+3
- c. x^2-4x-3
- d. x^2+4x-3

Ans: c

$$\alpha = 2 + \sqrt{7} \text{ \& } \beta = 2 - \sqrt{7}$$

$$X^2 - (\alpha + \beta)x + \alpha\beta$$

$$= x^2 - (2 + \sqrt{7} + 2 - \sqrt{7})x + (2 + \sqrt{7})(2 - \sqrt{7})$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM

UNIT - X - APTITUDE & MENTAL ABILITY

$$= x^2 - 4x + (4 + 2\sqrt{7} - 2\sqrt{7} - 7)$$

$$= x^2 - 4x + (4 - 7)$$

$$= x^2 - 4x - 3$$

37. Simplify $\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \dots + \frac{1}{\sqrt{99}+\sqrt{100}}$

a. 9

b. $\sqrt{9}$

c. 81

d. $\sqrt{99}$

Ans: a

If all the signs are (+), then

$$\text{Last term} - \text{first term} = \sqrt{100} - 1 = 10 - 1 = 9$$

38. If $x + \frac{1}{x} = 3$, then find the value of $x^5 + \frac{1}{x^5}$

a. 3

b. 123

c. 81

d. 3^5

Ans: b

$$Z^5 - 5(2^3) + 5(Z)$$

$$3^5 - 5(3^3) + 5(3) = 245 - 135 + 15$$

$$= 123$$

MANIDHANA EYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

39. $a^2 - b^2 = 117$, $ab = 54$, then find the value of $\frac{a-b}{a+b}$

- a. $15/3$
- b. $31/5$
- c. $3/15$
- d. $5/31$

Ans: c

$$\frac{(a-b)^2}{(a+b)^2} = \frac{a^2 + b^2 - 2ab}{a^2 + b^2 + 2ab}$$

$$\frac{(a-b)^2}{(a+b)^2} = \frac{a^2 + b^2 - 2ab}{a^2 + b^2 + 2ab} = \frac{117 - 2(54)}{117 + 2(54)}$$

$$= \frac{117 - 108}{117 + 108}$$

$$= \frac{9}{225}$$

$$\frac{(a-b)}{(a+b)} = \sqrt{\left(\frac{9}{225}\right)}$$

$$\frac{(a-b)}{(a+b)} = \frac{3}{15}$$

40. The sum of x , $x+3$, $x+6$, $x+9$, $x+12$ is 60, then the value of x is

- a. 32
- b. 6
- c. 8
- d. 9

Ans: b

From option, $x=6$

$$6, 6+3, 6+6, 6+9, 6+12 = 60$$

**MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY**

$$6+9+12+15+18 = 60$$

$$60 = 60$$

41. Simplify $(100)^{\frac{1}{2}} \times (0.008)^{\frac{1}{3}} - (0.0016)^{\frac{1}{4}} \times 3^0 - 1(5/4)^{-1}$

a. 0

b. 1

c. 2

d. 3

Ans: b

$$(100)^{\frac{1}{2}} \times (0.008)^{\frac{1}{3}} - (0.0016)^{\frac{1}{4}} \times 3^0 - 1(5/4)^{-1}$$

$$= 10 \times 0.2 - 0.2 \times 1 + (4/5)$$

$$= 2 - 0.2 + 0.8$$

$$= 2 - 1 = 1$$

42. If $\left\{ 4 - \frac{5}{1 + \frac{1}{3 + \frac{1}{2 + \frac{1}{4}}}} \right\}^{\text{th}}$ part of a journey takes 10 minutes, then to complete $(3/4)^{\text{th}}$ of that journey, it will take ?

a. 1hr

b. 1.2hr

c. 55min

d. 57min

Ans: a

$$4 - \frac{5}{1 + \frac{1}{\frac{27+4}{9}}} = 4 - \frac{5}{1 + \frac{9}{31}}$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

$$\begin{aligned}
 &= 4 - \frac{5}{\frac{40}{31}} \\
 &= 4 - \left(5 \times \frac{31}{40}\right) \\
 &= 4 - \frac{31}{8} \\
 &= \frac{32 - 31}{8} \\
 &= \frac{1}{8}
 \end{aligned}$$

Time taken to complete (1/8)th part = 10min

Time taken to complete (3/4)th part = 10 X 8 X (3/4)

= 20 X 3

= 60min

= 1hr

43. The least number that should be subtracted from the number 32145 to make it a perfect square is?

a. 103

b. 105

c. 104

d. 108

Ans: c

$$\sqrt{32145} > 179$$

$$179 \times 179 = 32041$$

$$32145 - 32041 = 104$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

44. Each member of a group contributes as much rupees as much paise as the number of members of the group. If their total contribution is Rs.3 636, the number of members of the club is?

- a. 60
- b. 36
- c. 90
- d. 120

Ans: a

$$\frac{10x^2 + x^2}{100} = 3636$$

$$101x^2 = 363600$$

$$x^2 = \frac{363600}{101} = 3600$$

$$x^2 = 3600$$

$$x = \sqrt{3600}$$

$$= 6 \times 10$$

$$= 60$$

45. The product of two positive integers is 4608 and one of them is twice the other, then the smallest number is?

- a. 48
- b. 96
- c. 42
- d. 84

Ans: a

Smallest number = x

**MANIDHANAAYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY**

Larger number = $2x$

$$x \times 2x = 4096$$

$$2x^2 = 4096$$

$$x^2 = 4096/2 = 2304$$

$$x = 48$$

46. Perfect square numbers between 48 and 1000

a. 23

b. 24

c. 25

d. 21

Ans: c

$$7^2 \text{ to } 31^2$$

$$= (31-7) + 1$$

$$= 24 + 1$$

$$= 25$$

47. If + means \times , \times means $-$, \div means $+$, $-$ means \div , then what will be the value of the following expression $9+3 \div 4-8 \times 2 = ?$

a. $3/4$

b. $4/3$

c. 25

d. 52

Ans: c

$$= 9 \times 3 + 4 \div 8 - 2$$

$$= 9 \times 3 + (1/2) - 2$$

**MANIDHANA EYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY**

$$= 27 + (1/2) - 2$$

$$= (54/2) - 2$$

$$= (54 - 4)/2$$

$$= 50/2$$

$$= 25$$

48. If $(n^2 - pn + 1/4)$ be a perfect square, then the value of p is

a. ± 2

b. 1.2

c. 2.3

d. ± 1

Ans: d

To be a perfect square, $r = 2$, $t = \pm 1$

$$n^2 - n + (1/4) = n^2 - 2n - (1/2) + (1/4)$$

$$= (n - (1/2))^2$$

$$n^2 + n + (1/4) = n^2 + 2n \cdot 1/2 + 1/4$$

$$= (n + (1/2))^2$$

49. The value of $\left(2 - \frac{1}{n+1}\right) + \left(2 - \frac{2}{n+1}\right) + \left(2 - \frac{3}{n+1}\right) + \dots + \left(2 - \frac{n}{n+1}\right)$

a. $(1/2)n$

b. $(2/3)n$

c. $2n$

d. $(3/2)n$

Ans: d

$$2n - \left(\frac{1}{n+1} + \frac{2}{n+1} + \frac{3}{n+1} + \dots + \frac{n}{n+1}\right)$$

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM

UNIT – X – APTITUDE & MENTAL ABILITY

$$\begin{aligned}
 2n - \frac{1 + 2 + 3 + \dots + n}{n + 1} \\
 &= 2n - \frac{n(n + 1)}{2(n + 1)} \\
 &= 2n - \frac{n}{2} \\
 &= \frac{4n - n}{2} \\
 &= \frac{3n}{2}
 \end{aligned}$$



MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY
PREVIOUS YEAR QUESTIONS

1. Let $x = 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \dots}}}$, which of the following is correct?

- a. x^2+x+1
- b. x^2-x+1
- c. x^2+x-1
- d. x^2-x-1

2. $7/5$ of $58 + 3/8$ of 139.2 ?

- a. 133.4
- b. 137.2
- c. 127.8
- d. 131.6

3. The value of

$$\sqrt{\left(10 + \sqrt{\left(25 + \sqrt{\left(108 + \sqrt{\left(154 + \sqrt{(225)}\right)}\right)}\right)}\right)}$$

- a. 4
- b. 6
- c. 8
- d. 10

4. Find the value of $1000^9 \div 10^{24}$

- a. 10000
- b. 1000
- c. 100
- d. 10

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

5. $1 \div \left(\frac{5}{7} \text{ of } 6\frac{3}{10}\right) - \frac{2}{9}$ is

- a. 1
- b. 0
- c. 2
- d. 1/2

6. If $\frac{13^3 + 7^3}{169 + 49 - x} = 20$, then the value of x is?

- a. 6
- b. 20
- c. 91
- d. 42

7. Find the value of $\left(\frac{-1}{216}\right)^{\frac{2}{3}}$

- a. 36
- b. - 36
- c. 1/36
- d. -1/36

8. The simplest form of $\left(\frac{9}{115}\right)$ is

- a. 2/3
- b. 2/5
- c. 3/5
- d. 4/5

9. Which is true for the statements?

1. The degree of the polynomial is the highest power of the variable involved in the term
2. The GCD of co-prime factor is 1

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

3. The LCM of ab, bc, ca is abc

4. One is a prime number

a. 1,2,3

b. 1,2,4

c. 2,3,4

d. all

10. Simplify 1 hectare : 150m²

a. 200: 3

b. 2000: 3

c. 20: 3

d. 2: 3

11. Simplify $\sqrt{48} - 3\sqrt{108} + 2\sqrt{27} + \sqrt{192}$

a. $\sqrt{3}$

b. 0

c. $2\sqrt{3}$

d. $3\sqrt{3}$

12. Simplify $\left(147 + \frac{1}{42}\right)^2 - \left(147 - \frac{1}{42}\right)^2$

a. 7

b. 5

c. 147

d. 14

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

13. Simplify $(\sqrt{2} + 1)^5 + (\sqrt{2} - 1)^5$

- a. $52\sqrt{2}$
- b. $50\sqrt{2}$
- c. $56\sqrt{2}$
- d. $58\sqrt{2}$

14. Simplify $\sqrt[4]{81} + \sqrt[3]{216} + 5\sqrt{32} = ?$

- a. 10
- b. 11
- c. 9
- d. 4

15. $39852 \div \sqrt{\quad} = 81 \times 12$

- a. 41
- b. 1681
- c. 1849
- d. 43

16. Simplify $\frac{(9.8)^3 - (6.8)^3}{(9.8)^2 + 9.8 \times 6.8 + (6.8)^2}$

- a. 0
- b. 1
- c. 2
- d. 3

17. Which of the following is/are true?

1. $(-2, -7)$ is a point in IV quadrant
2. $(0, 3)$ is a point on X-axis

MANIDHANAHEYAM FREE IAS ACADEMY – TNPSC GROUP – IV & VAO EXAM
UNIT – X – APTITUDE & MENTAL ABILITY

3. (-5,2) lies to the left of y axis
4. (5,2) and (-7,2) are the points on line parallel to y axis

a. 2 and 3

b.3 only

c. 2,3,4

d. 1 and 2

18. Find the value of $\frac{\sqrt[3]{729} - \sqrt[3]{27}}{\sqrt[3]{512} + \sqrt[3]{343}}$

a. 5/3

b. 3/5

c. 5/2

d. 2/5

19. If a and b are two non-zero rational numbers and $\frac{2+\sqrt{3}}{2-\sqrt{3}} = a + b\sqrt{3}$, then the value of b is?

a. 4

b. 7

c. 6

d. 8

20. Which of the following shows the highest percentage ?

a. 384/540

b. 425/500

c. 570/700

d. 480/660