



Unified International
Mathematics Olympiad

UNIFIED INTERNATIONAL MATHEMATICS OLYMPIAD

CLASS - 8

Question Paper Code : 4P114

KEY

1	2	3	4	5	6	7	8	9	10
A	B	B	C	D	A	D	D	C	B
11	12	13	14	15	16	17	18	19	20
A	D	B	C	B	A	D	C	B	A
21	22	23	24	25	26	27	28	29	30
A	A	C	C	C	C	C	C	C	C
31	32	33	34	35	36	37	38	39	40
A,B,C,D	A,B,C,D	B,C	A,C,D	A,B,C,D	B	D	B	C	C
41	42	43	44	45	46	47	48	49	50
B	C	A	D	A	B	B	D	B	D

EXPLANATIONS

MATHEMATICS - 1

01. (A) Given $(5x + 4)^2 = 9(2x - 1)^2$
 $25x^2 + 40x + 16 = 9(4x^2 - 4x + 1)$
 $0 = 36x^2 - 25x^2 - 36x - 40x + 9 - 16$
 $11x^2 - 76x - 7 = 0$
 $11x^2 - 77x + x - 7 = 0$
 $11x(x - 7) + 1(x - 7) = 0$
 $\therefore x = 7$ (or) $x = \frac{-1}{11}$ is rejected because

length is never negative

$$\therefore 2x - 1 = 2(7) - 1 = 14 - 1 = 13 \text{ m}$$

02. (B) Volume of cuboid = Volume of cylinder

$$\Rightarrow lbh = \pi r^2 h$$

$$\Rightarrow r^2 = \frac{44 \times 30 \times 15 \times 7}{22 \times 28}$$

$$r = 15 \text{ cm}$$

Hence radius of the cylinder is equal to 15 cm.

03. (B) Given $x^4 + \frac{1}{x^4} = 727$

Adding '2' on both sides

$$(x^2)^2 + \frac{1}{(x^2)^2} + 2 = 727 + 2$$

$$\left(x^2 + \frac{1}{x^2}\right)^2 = 729$$

$$x^2 + \frac{1}{x^2} = \sqrt{729} = 27$$

Subtracting '2' on both sides

$$x^2 + \frac{1}{x^2} - 2 = 27 - 2$$

$$\left(x - \frac{1}{x}\right)^2 = 25$$

$$\left(x - \frac{1}{x}\right) = \sqrt{25} = 5$$

04. (C) Base area of a cylinder = 38.5 cm^2

$$\Rightarrow \pi r^2 = 38.5 \text{ cm}^2$$

$$\Rightarrow r = \frac{7}{2} \text{ cm}$$

$$\text{Lateral surface area} = 176 \text{ cm}^2$$

$$\Rightarrow 2\pi rh = 176 \text{ cm}^2$$

$$\Rightarrow h = 8 \text{ cm}$$

$$\therefore \text{Volume} = \pi r^2 h = \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 8$$

$$= 308 \text{ cm}^3$$

$$\text{Hence volume of the cylinder}$$

$$= 308 \text{ cm}^3$$

05. (D) Volume of each sheet = Volume of

$$\frac{500 \text{ sheet}}{500}$$

$$= \frac{30 \times 20 \times 5 \text{ cm}^3}{500}$$

$$= 6 \text{ cm}^3$$

06. (A) $\frac{xy \times yz}{xz} = \frac{8.4 \times 14.1}{11.04}$

$$y^2 = 12.25$$

$$y = \sqrt{12.25} = 3.5$$

$$xyz = (xz)y = 11.04 \times 3.5 = 38.64$$

07. (D) $\left(\frac{x+4}{x}\right)$

$$\text{LHS} = \left(\frac{x+1}{x}\right) \left(\frac{x+1+1}{x+1}\right) \left(\frac{x+2+1}{x+2}\right) \left(\frac{x+3+1}{x+3}\right)$$

$$= \frac{(\cancel{x+1})}{x} \frac{(\cancel{x+2})}{(\cancel{x+1})} \frac{(\cancel{x+3})}{(\cancel{x+2})} \frac{(\cancel{x+4})}{(\cancel{x+3})}$$

$$= \frac{(x+4)}{x}$$

08. (D) Area = side $\times$ side

$$= \frac{9}{16} x^2 + \frac{25}{36} y^2 - \frac{5}{4} xy \text{ sq. units}$$

$$= \left(\frac{3}{4}x\right)^2 + \left(\frac{5}{6}y\right)^2 - 2 \times \frac{3}{4}x \times \frac{5}{6}y$$

$$= \left(\frac{3}{4}x - \frac{5}{6}y\right)^2 \text{ sq. units}$$

$$= \left(\frac{3}{4}x - \frac{5}{6}y\right) \left(\frac{3}{4}x - \frac{5}{6}y\right) \text{ sq. units}$$

$$\therefore \text{Side} = \left(\frac{3}{4}x - \frac{5}{6}y\right) \text{ units}$$

09. (C) $(8^{-25} - 8^{-26}) = \frac{1}{8^{25}} - \frac{1}{8^{26}}$

$$= \frac{(8-1)}{8^{26}} = 7 \times 8^{-26}$$

10. (B) It is in direct proportion

$$\therefore x_1 = \text{length of the pole} = 5 \text{ m } 60 \text{ cm}$$

$$y_1 = \text{length of the shadow} = 3 \text{ m } 20 \text{ cm}$$

$$x_2 = ?$$

$$y_2 = \text{length of the shadow} = 6 \text{ cm}$$

$$\therefore \frac{x_1}{y_1} = \frac{x_2}{y_2}$$

$$\frac{5 \text{ m } 60 \text{ cm}}{3 \text{ m } 20 \text{ cm}} = \frac{x_2}{6 \text{ m}}$$

$$\Rightarrow x_2 = \frac{5.6 \text{ m}}{3.2 \text{ m}} \times 6 \text{ m}$$

$$= \frac{\cancel{56}^7 \text{ m}}{\cancel{32}_4} \times 6 \text{ m}$$

$$= \frac{42 \text{ m}}{4}$$

$$= 10 \text{ m } 50 \text{ cm}$$

11. (A) Let the principal be ₹ p

$$\text{Given } p \left(1 + \frac{r}{100} \right)^n - p = \text{CI}$$

$$\Rightarrow p \left(1 + \frac{5}{100} \right) - p = ₹ 1324.05$$

$$p \left(\frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right) - p = ₹ 1324.05$$

$$\frac{9261p}{8000} - p = ₹ 1324.05$$

$$\frac{9261p - 8000p}{8000} = ₹ 1324.05$$

$$1261p = 8000 \times ₹ 1324.05$$

$$p = \frac{₹ 10592400}{1261} = ₹ 8400$$

$$\text{SI} = \frac{\text{PTR}}{100} = ₹ 1260$$

12. (D) $2^8 + 1 = 256 + 1 = 257$

$$\therefore 2^{18} + 1 = (2^6)^3 + 1 = 64^3 + 1$$

$$257 < 7^3 < 64^3 < 64^3 + 1$$

$$\therefore \text{No. of perfect cubes} = 64 - 7 + 1 = 58$$

13. (B) First term

$$= \sqrt{1 + 1 + \frac{1}{4}} = \sqrt{\frac{9}{4}} = \frac{3}{2} = 2 - \frac{1}{2}$$

$$\text{Sum of first two terms} = \frac{3}{2} + \sqrt{1 + \frac{1}{4} + \frac{1}{9}}$$

$$= \frac{3}{2} + \sqrt{\frac{36 + 9 + 4}{36}} = \frac{3}{2} + \frac{7}{6} = \frac{9 + 7}{6} = \frac{16}{6} = \frac{8}{3}$$

$$= 3 - \frac{1}{3}$$

Sum of first three terms

$$= \frac{8}{3} + \sqrt{1 + \frac{1}{9} + \frac{1}{16}} = \frac{8}{3} + \frac{13}{12}$$

$$\frac{45}{12} = \frac{15}{4} = 4 - \frac{1}{4}$$

$$\therefore \text{Sum of all terms} = 2021 - \frac{1}{2021}$$

14. (C) $2x^2 - 3y^2 = (\sqrt{2})^2 x^2 - (\sqrt{3})^2 y^2$

$$= (\sqrt{2}x)^2 - (\sqrt{3}y)^2$$

$$= (\sqrt{2}x + \sqrt{3}y)(\sqrt{2}x - \sqrt{3}y)$$

15. (B) Since $x + xy = 391$, then $x(1 + y) = 391$.

We note that $391 = 17 \times 23$

Since 17 and 23 are both prime, then if 391 is written as the product of two positive integers, it must be 1×391 or 17×23 or 23×17 or 391×1 .

Matching x and $1 + y$ to these possible factors, we obtain $(x, y) = (1, 390)$ or $(17, 22)$ or $(23, 16)$ or $(391, 0)$.

Since y is a positive integer, the fourth pair is not possible.

Since $x > y$, the first two pairs are not possible.

Therefore, $(x, y) = (23, 16)$

$$\Rightarrow x + y = 39$$

16. (A) $d = 6$ as

$$6^3 = 3^3 + 4^3 + 5^3$$

17. (D) Originally, let there be x men. Less men
 $\Rightarrow$ more days.

$$\therefore (x - 10) : x :: 100 : 110$$

$$\Rightarrow (x - 10) \times 110 = x \times 100$$

$$\Rightarrow 10x = 1100 \Rightarrow x = 110$$

$$\begin{aligned}
 18. (C) \quad & 4(x^2 + 10x + 25) - (4x^2 + 4x + 1) \\
 & = 3x - 15 + 180 \\
 & 4x^2 + 40x + 100 - 4x^2 - 4x - 1 \\
 & = 3x + 165
 \end{aligned}$$

$$36x + 99 = 3x + 165$$

$$33x = 66$$

$$x = 2$$

19. (B) Let the cost price of each candle be ₹x

∴ cost price of 15 candles = ₹15x

selling price of 12 candle = ₹15x

selling price of each candle =

$$\frac{\cancel{₹15}^5 x}{\cancel{12}_4} = \frac{₹5x}{4}$$

$$\therefore \text{Profit} = \frac{₹5x}{4} - ₹x = \frac{₹5x - ₹4x}{4} = \frac{₹x}{4}$$

Profit percentage

$$= \frac{\text{Profit}}{\text{CP}} \times 100 = \left(\frac{₹x}{4} \right) \times 100 = 25\%$$

(OR)

Let CP of each candle be ₹12 &

SP of each candle be ₹15

∴ Profit = ₹15 - ₹12 = ₹3

Profit percentage

$$= \frac{\text{Profit}}{\text{CP}} \times 100 = \frac{₹3}{₹12} \times 100 = 25\%$$

20. (A)

$$\begin{array}{r}
 4 \quad \begin{array}{|l} 18670918 \\ 16 \end{array} \quad 4321 \\
 \hline
 83 \quad \begin{array}{|l} 267 \\ 249 \end{array} \\
 \hline
 862 \quad \begin{array}{|l} 1809 \\ 1724 \end{array} \\
 \hline
 8641 \quad \begin{array}{|l} 8518 \\ 8641 \\ \hline -123 \end{array}
 \end{array}$$

$$4321^2 = 18670918 + 123 = 18671041$$

$$\begin{aligned}
 21. (A) \quad & 2^{2028} + 2^{2027} - 2^{2026} - 2^{2025} = 2^{2025} \times 2^3 + 2^{2025} \\
 & \times 2^2 - 2^{2025} \times 2 - 2^{2025} \times 1 \\
 & = 2^{2025} (8 + 4 - 2 - 1) \\
 & = 9 \times 2^{2025} \\
 & = 3^2 \times 2^2 \times 2^{2023} \\
 & = 6^2 \times 2^{2023}
 \end{aligned}$$

22. (A)

$$\begin{aligned}
 & \sqrt[3]{\frac{0.2 \times 0.2 \times 0.2 + 0.04 \times 0.04 \times 0.04}{0.2 \times 2 \times 0.2 \times 2 + 0.04 \times 2 \times 0.04 \times 2 \times 0.04 \times 2}} \\
 & = \sqrt[3]{\frac{(0.2 \times 0.2 \times 0.2 + 0.04 \times 0.04 \times 0.04)}{8(0.2 \times 0.2 \times 0.2 + 0.04 \times 0.04 \times 0.04)}} \\
 & = \sqrt[3]{\left(\frac{1}{2^3} \right)} \\
 & = \frac{1}{2} = 0.5
 \end{aligned}$$

23. (C) Given $2\pi r = 220$ cm

$$2 \times \frac{22}{7} r = 220 \text{ cm}$$

$$r = 220 \text{ cm} \times \frac{7}{44} = 35 \text{ cm}$$

Volume of the cylinder

$$\begin{aligned}
 & = \pi r^2 h = \frac{22}{7} \times 35^2 \times 35 \times 63 \text{ cm}^3 \\
 & = 2,42,550 \text{ cm}^3
 \end{aligned}$$

24. (C) The bacteria two hours back be 'x'

$$\text{Given } x \left(1 + \frac{2.5}{100} \right)^2 = 5,37,920$$

$$x \left(1 + \frac{25}{1000} \right)^2 = 5,37,920$$

$$x \times \frac{41}{40} \times \frac{41}{40} = 5,37,920$$

$$\begin{aligned}
 x & = 5,37,920 \times \frac{40}{41} \times \frac{40}{41} \\
 & = 5,12,000
 \end{aligned}$$

MATHEMATICS - 2

25. (C) $(87654322)^2 - (12345678)^2 = (87654322 - 12345678)(87654322 + 12345678)$
 $= 75308644 \times 100000000$
 $= 7530864400000000$

26. (C) $x + y = \frac{1}{x} + \frac{1}{y}$
 $= x + y = \frac{(x+y)}{xy}$
 $= xy = \frac{(x+y)}{(x+y)} = 1$

27. (C) $\text{LHS} = \frac{25}{3} \times \frac{-6}{65} \times \frac{-1}{2} = \frac{5}{13}$

28. (C) Let the smallest angle be x°
 Given $x + 3x + x + 3x + 20^\circ = 180^\circ$
 $8x = 160^\circ$
 $x = 20^\circ$

29. (C) Option A : $18^2 + 27^2 + 32^2 = 324 + 729 + 1024 = 2077$

Option B : $7^2 + 24^2 + 26^2 + 27^2 = 49 + 576 + 676 + 729 = 2030$

Option C : $20^2 + 28^2 + 29^2 = 400 + 784 + 841 = 2025$

Option D : $21^2 + 28^2 + 30^2 = 441 + 784 + 900 = 2125$

$\therefore$ Option 'C' is correct

30. (C) $2x^2 + \sqrt{3}x - 3$
 $= 2x^2 + 2\sqrt{3}x - \sqrt{3}x - 3$
 $= 2x(x + \sqrt{3}) - \sqrt{3}(x + \sqrt{3})$
 $= (x + \sqrt{3})(2x - \sqrt{3})$

31. (A,B,C,D)

BAg 'A' = 6 kg Bag 'B'
 $= 18 \text{ kgs}$ Bag 'c' = 14 kgs.

32. (A,B,C,D)

It is an identify.

Hence it is true for all natural, whole, integers and rational numbers.

33. (B,C)

$2025^2 - 2037 = 2025^2 - 2025 - 12$

$= x^2 - x - 12$ where $x = 2025$

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

$= x(x - 4) + 3(x - 4)$

$= (x - 4)(x + 3)$

$= (2025 - 4)(2025 + 3)$

$= 2021 \times 2028$

2021 & 2028 are the factors of $2025^2 - 2037$. (or)

$2025^2 - 2037 = 4100625 - 2037 = 4098588$

4098588 units place is '8' Hence there is a chance for 2021×2028 .

34. (A,C,D)

$13^4 - 11^4 = (13^2)^2 - (11^2)^2 = (13^2 - 11^2)(13^2 + 11^2)$

$= (13 + 11)(13 - 11) | (169 + 121)$

$= 24 \times 2 \times 290$

$\therefore 2, 3 \text{ \& } 29$ are the factors of $13^4 - 11^4$

35. (A,B,C,D)

$\frac{-3}{20} = -0.15$

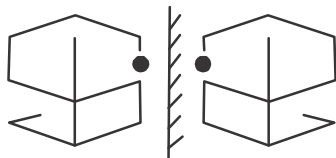
$\frac{-3}{11} = -0.27$

$\frac{-5}{22} = -0.22$ lies between $\frac{-3}{20}$ and $\frac{-3}{11}$

REASONING

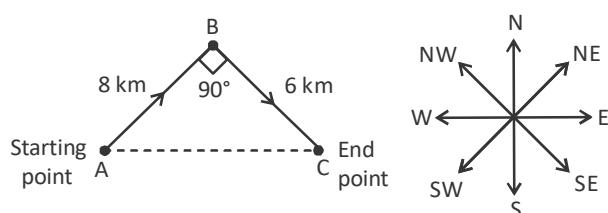
36. (B) Common in sentences 1 & 2: health, problems → common codes ho, la
Common in sentences 2 & 3: rise → common code ta

So, ta = rise.



37. (D)

38. (B) According to the question,



Here, total distance = AB + BC

$$= 8 + 6 = 14 \text{ km}$$

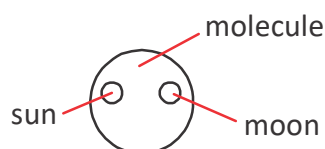
and shortest distance AC = $AB^2 + BC^2$

$$= 8^2 + 6^2$$

$$= 64 + 36$$

$$= 100 = 10 \text{ km}$$

39. (C) Sun and Moon in Molecule



40. (C) In the first fig, $(6 \times 4) + (5 \times 2)$
 $= 24 + 10 = 34$
In the second fig, $(4 \times 3) + (7 \times 9)$
 $= 12 + 63 = 75$
In the third figure $(8 \times 4) + (4 \times 6)$
 $= 24 + 12 = 36$



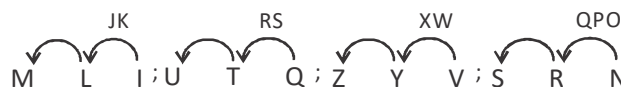
41. (B)

42. (C) Days in January = 31 → days remaining after Jan 1 up to Mar 1 : 31 (Jan) + 28 (Feb, 2025 is not a leap year) = 59 days.

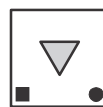
Advance from Jan 1 by 59 days → $59 \bmod 7 = 3$ days forward.

Jan 1, 2025 was Wednesday; add 3 days → Saturday.

43. (A) A king sits on a throne; a judge sits on a bench.
44. (D) In all other groups, there is a gap of two letters between second and third letters in the alphabetical order.



45. (A)



CRITICAL THINKING

46. (B) We need winners' paths. From results:

Madhav beats Teja

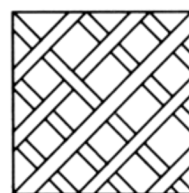
Madhav beats Varun

Madhav beats Rohan So Madhav won three matches → champion. Teja beats Arjun and Krishna but loses to Madhav → Teja reached final and lost to Madhav. Therefore final was Madhav vs Teja.

47. (B) A normal $n \times n$ magic square using the numbers 1 to n^2 has row / column / diagonal sum (magic constant)

$$M = \frac{n(n^2 + 1)}{2} \text{ for } n = 4$$

$$M = \frac{4(16 + 1)}{2} = \frac{4 \times 17}{2} = 2 \times 17 = 34$$



48. (D)



49. (B)

50. (D)

