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UIMO
Unified International Mathematics Olympiad

UNIFIED INTERNATIONAL MATHEMATICS OLYMPIAD

CLASS - 7

Question Paper Code : 4P114

KEY

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

EXPLANATIONS

MATHEMATICS - 1

01. (B) $\dfrac{2^{n+4}-2\times 2^{n+1}}{2^{n-3}} = \dfrac{2^{n+1}\times 2^3 - 2\times 2^{n+1}}{\left(\frac{2^n}{2^3}\right)}$

$= \dfrac{2^3\times 2^{n+1}\left(2^3-2\right)}{2^n}$

$= \dfrac{8\times 2^n\times 2\times (8-2)}{2^n}$

$= 16 \times 6 = 96$

02. (A) $11\dfrac{1}{24} - 4 = \dfrac{265}{24} - 4$

$= \dfrac{265-96}{24} = \dfrac{169}{24}$

$1\dfrac{7}{12} - \dfrac{169}{24} = \dfrac{19}{12} - \dfrac{169}{24} = \dfrac{-131}{24}$

$3\dfrac{3}{8} - \left\{1\dfrac{7}{12} - \left(11\dfrac{1}{24} - 4\right)\right\}$

$$= \frac{27}{8} - \left(-\frac{131}{24}\right) = \frac{212}{24} = \frac{53}{6}$$

$$8\frac{5}{6} - \left[3\frac{3}{8} - \left\{1\frac{7}{12} - \left(11\frac{1}{24} - 4\right)\right\}\right]$$

$$= \frac{53}{6} - \frac{53}{6} = 0$$

03. (D) Sum of first 10 odd natural numbers

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19$

$= (1 + 19) + (3 + 17) + (5 + 15) + (7 + 13) + (9 + 11)$

$= 20 + 20 + 20 + 20 + 20$

$= 100$

$\therefore$ Mean $= \dfrac{\text{Sum of the observations}}{\text{no. of observations}}$

$= \dfrac{100}{10} = 10$

04. (B) $\dfrac{1}{2\times2} \times \dfrac{2}{2\times3} \times \dfrac{3}{2\times4} \times \dfrac{4}{2\times5} \times \dfrac{5}{2\times6} \times$ ..... $\times \dfrac{30}{2\times31} \times \dfrac{31}{64} = (4)^x = (2^2)^x$

$= \dfrac{1}{2^{30}\times2^6} = 2^x$

$= 2^{-36} = 2^{2x}$

$2x = -36$

$x = -18$

05. (C) $1 - 2 = -1$ & $3 - 4 = -1$

$\therefore$ There are 26 pairs of numbers from 1 to 52

$\therefore$ $1 - 2 + 3 - 4 + 5 - 6 + ... + 47 - 48 + 49 - 50 + 51 - 52 + 53 = -26 + 53 = 27$

06. (B) Let 'k' to be subtracted from $\left(\dfrac{x}{y}\right)$ to get $\dfrac{y}{x}$

$\therefore \dfrac{x}{y} - k = \dfrac{y}{x}$

$\Rightarrow \dfrac{x}{y} - \dfrac{y}{x} = k \Rightarrow \dfrac{x^2 - y^2}{xy} = k$

07. (C) Given present ages ratio of

A & B = $9 : 11 = 9x : 11x$

Given $9x - 10 : 11x - 10 = 7 : 9$

Product extreemes = Product means

$\therefore 81x - 90 = 77x - 70$

$81x - 77x = 90 - 70 = 20$

$4x = 20$

$x = \dfrac{20}{4} = 5$

$\therefore$ Sum of their present ages

$= 9x + 11x = 20x = 20 \times 5 = 100$ years

08. (C) Distance covered in 6 hours = $\dfrac{1}{2}$ of cirumference

$= \dfrac{1}{2} \times 2 \times \dfrac{22}{7} \times 3.5$ cm

$= 11$ cm

09. (D) Given $(2x + 8)$ cm $= (3x - 2)$ cm

$\therefore 2x - 3x = -2 - 8$

$-x = -10$

$\therefore x = 10$ cm

$\therefore$ Side of square

$= 2x + 8 = 2 \times 10 + 8 = 28$cm

$\therefore$ Perimeter $= 4s = 4 \times 28$ cm

Area $= 5^2 = 28\text{cm} \times 28\text{cm} = 784\ \text{cm}^2$

10. (D) Sum of three prime numbers = 100

All prime numbers are odd except 2

$\therefore$ '2' is the one prime number.

$2 + x + x + 36 = 100$

$2x = 100 - 38 = 62$

$x = 31$

$\therefore x + 36 = 31 + 36 = 67$ which is a prime

11. (C) LHS $= \dfrac{6 + 12 + 18 + ---- + 60}{24 + 48 + 72 + ---- + 240}$

$= \dfrac{6(1 + 2 + 3 + ---- + 10)}{24(1 + 2 + 3 + ---- + 10)} = \dfrac{1}{4}$

12. (C) $\dfrac{-15208069041}{-12321} = 1234321$

13. (D) The BC = AD = 4 units

Length of 1 rectangle is 4 units.

Breadth of rectangle is 1 unit.

AB = 1 + 4 = 5 units

Perimeter $\rightarrow$ 1 + 4 + 4 + 1 + 4 + 4 = 18 units

18 units $\rightarrow$ 54 cm

1 unit $\rightarrow$ 54 $\div$ 18 = 3 cm

AD = BC = 4 $\times$ 3 = 12 cm

AB = DC = 5 $\times$ 3 = 15 cm

Area of ABCD = AB $\times$ AD = (15 $\times$ 12) cm^2 = 180 cm^2

The area of ABCD is 180 cm^2

14. (C) CP of each apple be Rs. x

CP of 110 apples = $110x$.

Given SP of 100 apples = $110x$

SP of each apple = $\frac{110x}{100}$

Profit = SP – CP = $\frac{11x}{10} - x = \left(\frac{x}{10}\right)$

Profit% = $\frac{\text{profit}}{\text{CP}} \times 100$

$= \frac{\left(\frac{x}{10}\right)}{x} \times 100$ = 10%

15. (C) Let the three consecutive even numbers be $2x - 2$, $2x + 2$.

We have,

$(2x - 2) + 2x + (2x + 2) = 234$

$\Rightarrow 6x = 234 \Rightarrow x = 39$

The greatest even number

$= 2x + 2 = 2(39) + 2 = 78 + 2 = 80$

16. (C) Given profit = ₹ 175

Let CP be ₹ x.

Given 14% of x = ₹ 175

$\frac{14}{100} \times x$ = ₹ 175

x = ₹ 1250

$\therefore$ CP = ₹ 1250

SP = CP + P = 1250 + 175 = 1425

17. (A) $27^{64} = (3^3)^{64} = 3^{192}$

$9^{100} = (3^2)^{100} = 3^{200}$

$81^{49} = (3^4)^{49} = 3^{196}$

$3^{198} = 3^{198}$

$\therefore$ 9^{100} is the greatest

18. (A) Let the four consecutive odd numbers be $x, x + 2, x + 4, x + 6$

$x + x + 2 + x + 4 + x + 6 = 144$

$4x + 12 = 144$

$4x = 132$

$x = 33$

$\therefore$ $x + 6 = 39$

$\therefore$ $x(x + 6) = 33 \times 39 = 1287$

19. (D) Option A : $\frac{6}{7} - \frac{5}{6} + \frac{4}{9}$

= –0.857 – 0.833 + 0.444 = –1.246

Option B : $\frac{-8}{3} - \frac{1}{4} + \frac{11}{6}$

= –2.66 – 0.25 + 1.83 = –1.08

Option C : $\frac{-13}{20} + \frac{11}{14} - \frac{5}{7}$

= –0.65 + 0.785 – 0.714 = –0.579

Option D : $\frac{4}{3} - \frac{3}{5} - \frac{2}{3}$

= 1.33 – 0.6 – 0.66 = 0.07

$\therefore$ Option D is the greatest

20. (A) Given $a^x = b^y = c^z = k$

$\therefore$ $a^x = k \Rightarrow a = k^{\frac{1}{x}}$

$b^y = k \Rightarrow b = k^{\frac{1}{y}}$

$c^z = k \Rightarrow c = k^{\frac{1}{z}}$

Given $b^2 = ac$

$\left(k^{\frac{1}{y}}\right)^2 = k^{\frac{1}{x}} \times k^{\frac{1}{z}}$

$k^{\frac{2}{y}} = k^{\frac{1}{x} + \frac{1}{z}}$

$$\frac{1}{x}+\frac{1}{z}=\frac{2}{y}$$

$$\frac{x+z}{xz}=\frac{2}{y}$$

$$\frac{xz}{x+z}=\frac{y}{2}$$

$$\therefore \quad y=\frac{2xz}{x+z}$$

21. (C) In ΔBCD, $\angle DBC + \angle DCB$

$= 180° - 130° = 50$

In ΔABC $x + 22° + 23° + 50° = 180°$

$x + 95° = 180°$

$x = 85°$

22. (B) Boys = 50 – 15 = 35

$\frac{2}{7}$ of 35 = 10

Total number of students chosen = 5 + 10 = 15

23. (D) Mean = $\frac{\text{sum of observations}}{\text{Total no. of observations}}$

$$\Rightarrow \quad \frac{82=27+x+31+89+x+107+x+156+x}{5}$$

$\Rightarrow$ $410 = 5x + 410$

$\Rightarrow$ $0 = 5x$

$\Rightarrow$ $x = 0$

Now,

New Mean =

$$\frac{130+x+126+x+68+x+50+x+1+x}{5}$$

$$= \frac{130+126+68+50+1}{5}$$

$$= \frac{375}{5}$$

$= 75$

24. (B) $$2\times\frac{22}{7}\times\frac{3.5}{2}\times\frac{3.5}{2}+\frac{22}{7}\times\frac{3.5}{2}\times 3.6$$

$$=\frac{22}{7}\times\frac{3.5}{2}\left(2\times\frac{3.5}{2}+3.6\right)$$

$$=\frac{11}{2}(7.1)=39.05$$

25. (C) $45^2 + 55^2 + 100^2 + 2 \times 45 \times 55 - 2 \times 100 \times 55 - 2 \times 100 \times 45$

$= 2025 + 3025 + 10,000 + 4950 - 11000 - 9000 = 0$

26. (D) Let principal be ₹ x

Given A = ₹ $2x$

$\therefore$ I = A – P = ₹ $2x$ – ₹ x = ₹ x

But I = $\frac{PRT}{100}$

$$\frac{₹x\times 8}{₹x}=T$$

$\Rightarrow$ T = 8 years

27. (B) $$\frac{3^{2025}+3^{2026}}{3^{2024}+3^{2025}}=\frac{3^{2025}(1+3)}{3^{20254}(1+3)}$$

$= 3^{2025 - 2024}$

$= 3$

28. (C) $0.3(4x + 1) = 2x - 2.1$

$1.2x + 0.3 = 2x - 2.1$

$2.1 + 0.3 = 2x - 1.2x$

$2.4 = 0.8x$

$$x=\frac{2.4}{0.8}\times\frac{10}{10}=\frac{24}{8}\Rightarrow x=3$$

29. (A) Area of Δ ABC = $\frac{1}{2}$ × AB × BC [$\angle B = 90°$]

$$=\frac{1}{2}\times 5.6\,\text{cm}\times 6.7\,\text{cm}=18.76\,\text{cm}^2$$

30. (B) Let the middle strig length be x cm

Given $\frac{x}{2} + x + 2x + 5 = 40$

$\frac{x}{2} + 3x = 35$

$\frac{7x}{2} = 35$

$x = 10$ cm

Longest piece = $2x + 5 = 25$ cm

MATHEMATICS - 2

31. (B, C, D)

Given AB = BD

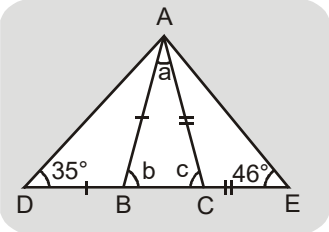
$\Rightarrow \angle BAD = \angle BDA = 35°$

$\angle b = \angle BDA + \angle BAD$

$\Rightarrow \angle b = 35° + 35° = 70°$

Also given AC = CE

$\Rightarrow \angle CAE = \angle CEA = 46°$



Using exterior angle property,

$\Rightarrow \angle c = \angle CAE + \angle CEA$ 150

= 46° + 46° = 92°

In ΔABC, $\angle a + \angle b + \angle c = 180°$

(Since sum of angles in a triangle is 180°)

$\Rightarrow \angle a = 180° - \angle b - \angle c$

$\Rightarrow \angle a = 180° - 70° - 92° = 18°$

$\therefore \angle a = 18°, \angle b = 70°$

and $\angle c = 92°$

$\angle BAC + \angle ABC = 18° + 70° = 88°$

$\angle ABC + \angle ACB = 70° + 92° = 162°$

$\angle ACB - \angle BAC = 92° - 18° = 74°$

32. (A,B,D)

$\frac{-4}{9} = -0.444, \frac{-7}{17} = -0.411$

$\frac{-9}{20} = -0.45$, does not lie between –0.44 and –0.41

$\frac{-6}{17} = -0.35$ does not lie between –0.44 and –0.41

$\frac{-135}{311} = -0.434$ lie $\frac{-2}{5} = -0.4$

does not lie between –0.44 and –0.41

33. (A,C,D)

Let $x = 4, y = -3$ then $3x + 4y = 0$

$\therefore x + y = 4 + (-3) = 1$

Let $x = -4$ and $y = 3$ then $3x + 4y = 0$

$\therefore x + y = -4 + 3 = -1$

Let $x = 8$ and $y = -6$ then $3x + 4y = 0$

$\therefore x + y = 8 + (-6) = 2$

34. (A,B,C,D)

$\frac{-7}{8} = -0.875$

Option A : $\frac{-1}{2} = -0.5 > -0.875$ *i.e* $\frac{-7}{8}$

Option B : $\frac{-5}{9} = -0.55 > -0.875$

Option C : $\frac{-7}{9} = -0.77 > -0.875$

Option D : $\frac{-11}{16} = -0.6875 > -0.875$

35. (A,B,D)

Option A : If all are integers are –1, –1, –1, –1, –1, –1

Their product

= (–1)(–1)(–1)(–1)(–1)(–1) = 1

The sum = (–1) + (–1) + (–1) + (–1) + (–1) + (–1) = –6

Option B : If four integers are –1, –1, –1, –1 and two integers are 1 and 1

$\therefore$ Their product = (–1)(–1)(–1)(–1) × 1 × 1 = 1

Their sum = (–1) + (–1) + (–1) + (–1) + 1 + 1 = –4 + 2 = –2

Option D : If two integers are –1, –1 and other 4 integers are 1, ,1, 1, 1

$\therefore$ Their product = 1, Their sum 2

REASONING

36. (A) EVF, FVE, GVH, HVG, IVJ

37. (A) Only in S, the 3rd row does NOT combine shapes from the first two rows; it has a different arrangement.

38. (A) First letter → Shade

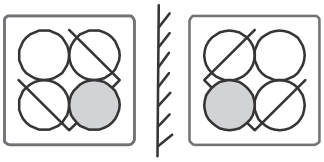
H if the part is shaded

G if the part is not shaded

Second letter → Diagram rotation

This depends on how the figure is rotated compared to the original.

So Option A is correct because it follows this two-step rule: shade determines the first letter, rotation determines the second letter

39. (C) 

40. (B) The month has 5 Mondays, 5 Tuesdays, 5 Wednesdays → it must be a 31-day month starting on Monday.

(Because 1st = Monday, 2nd = Tuesday, 3rd = Wednesday)

- The month before had only 4 Sundays, so it must have had 28 days (like February).
- After a 31-day month starting on Monday, the next month will start on Thursday (31 days = 4 full weeks + 3 days → Monday + 3 = Thursday).
- A 30-day month starting on Thursday will have 5 Thursdays and 5 Fridays, so Saturdays will appear only 4 times.

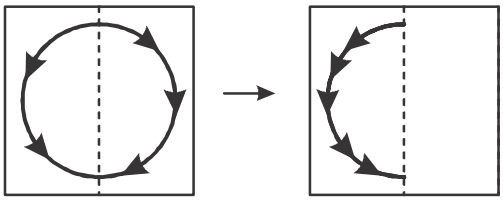
41. (C) East → right → South → right → West → Final direction = West

42. (D) $\sqrt{36} + \sqrt{49} + \sqrt{64} + \sqrt{25} = 26$

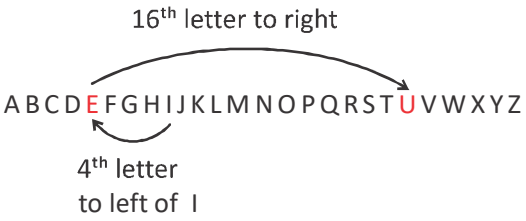
$\sqrt{9} + \sqrt{25} + \sqrt{16} + \sqrt{81} = 21$

Similarly $\sqrt{25} + \sqrt{144} + \sqrt{36} + \sqrt{64} = 31$

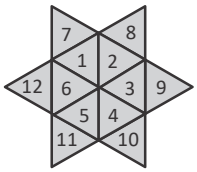
43. (A) When the circle with an arrow is folded arrows in both halves of the paper will face in opposite directions as in option A.



44. (C)



∴ The required letter is U.

45. (A) 

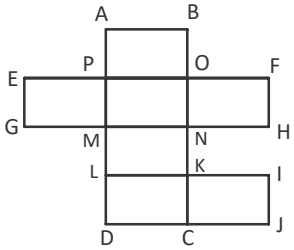
Small triangles = 12

Combination of 4 triangles = 6

Big triangle = 2

12 + 6 + 2 = 20

CRITICAL THINKING

46. (B) 

ABOP, ONMP, NKLM, KCDL, GMPE, NHFO, KIJC = 7

ABNM, PDKL, MNCD, LDJI, EGNO, HMPF = 6

ABKL, OCDP, EFHG = 3

ABCD = 1

7 + 6 + 3 + 1 = 17

47. (D) Arrange in order (longest → shortest)

From the relations:

Tu > Su > Sa > (We = Th) > Fr > Mo

Check the options:

Option A : We = Th → Possible

Option B : Tu at the top → Possible

Option C : Mo at the bottom → True

Option D : Fr = Su → Not possible (Su > Fr)

48. (D) From Expert 4, second is Karan or Kunal.

If Karan is second, then by Expert 2 Kunal must win, which violates Expert 1.

⇒ Karan is not second.

So Kunal is second.

Winner is Kiran or Karan (Expert 1).

If Kiran wins, then Karan is third, violating Expert 3.

⇒ Kiran cannot win.

Hence Karan wins and Kiran is third.

Order: Karan – Kunal – Kiran (Option D).

49. (B) The tiles in each of the vertical column have this pattern: 2, 3, 4, 5, …

Thus the n^{th} figure will have $(n + 1) \times 2 + n = 3n + 2$ tiles

∴ Figure number with 6044 tiles = $(6044 – 2) \div 3 = 2014$

50. (C) By observing the shadows it is clear that the light source is located some where at the top right to the three objects. So, the length of the shadow casted by the three objects varies and need not be of same length. Shadows shown in A, B and D are all of same length.

THE END