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UNIFIED COUNCIL OLYMPIADS

UIMO
Unified International Mathematics Olympiad

UNIFIED INTERNATIONAL MATHEMATICS OLYMPIAD (UPDATED)

CLASS - 7

Question Paper Code : UM9267

KEY

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

EXPLANATIONS

MATHEMATICS - 1

01. (C) Given $x^2 = (0.2)^2$

$\therefore x = 0.2$

cubing on both sides

$x^3 = (0.2)^3 = 0.2 \times 0.2 \times 0.2 = 0.008$

02. (A) $s(s - c) + (s - a)(s - b)$

$= s^2 - sc + s^2 - sb - sa + ab$

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

$= 2s^2 - s(2s) + ab$

$= 2s^2 - 2s^2 + ab$

03. (D) Let the first odd number be 'x'

Given

$x + x + 2 + x + 4 + x + 6 + x + 8 + x + 10 + x + 12 + x + 14 + x + 16 + x + 18 = 1000$

$\therefore 10x + 90 = 1000$

$10x = 1000 - 90 = 910$

$$x = \frac{910}{10} = 91$$

$\therefore$ Greatest number

$= x + 18 = 91 + 18 = 109$

04. (C) $\dfrac{8^{10}+4^{10}}{64^2+4^{11}}=\dfrac{\left(2^3\right)^{10}+\left(2^2\right)^{10}}{\left(2^6\right)^2+\left(2^2\right)^{11}}$

$=\dfrac{2^{30}+2^{20}}{2^{12}+2^{22}}$

$=\dfrac{2^{12}\left(2^{18}+2^8\right)}{2^{12}\left(1+2^{10}\right)}$

$=\dfrac{2^8\left(2^{10}+1\right)}{\left(2^{10}+1\right)}=256$

05. (C) Let the least angle be $x°$

The greatest angle = $x°$ + 60°

Third angle = $\dfrac{x+x+60°}{2}$

= x + 30°

We have,

$x + x + 30° + x + 60° = 180°$

$\Rightarrow 3x + 90° = 180° \Rightarrow x = 30°$

$\therefore$ The angles are 30°, 60° and 90°

Since one of the angles is 90°, the triangle formed is a right angled triangle

06. (B) $\dfrac{64^{\frac{2}{3}}}{8^{\frac{-2}{3}}}\times 2^{-3}$

$=\dfrac{\left(2^6\right)^{\frac{2}{3}}}{\left(2^3\right)^{\frac{-2}{3}}}\times\dfrac{1}{2^3}$

$=\dfrac{2^4}{2^{-2}}\times\dfrac{1}{2^3}$

$=2^{4+2-3}=2^3$

07. (C) LCM of 3, 8, 12 & 6 = 24

$2:3=\dfrac{2}{3}=\dfrac{2}{3}\times\dfrac{8}{8}=\dfrac{16}{24}$

$5:8=\dfrac{5}{8}=\dfrac{5}{8}\times\dfrac{3}{3}=\dfrac{15}{24}$

$5:12=\dfrac{5}{12}=\dfrac{5}{12}\times\dfrac{2}{2}=\dfrac{10}{24}$

$5:6=\dfrac{5}{6}=\dfrac{5}{6}\times\dfrac{4}{4}=\dfrac{20}{24}$

$\therefore \dfrac{10}{24}<\dfrac{15}{24}<\dfrac{16}{24}<\dfrac{20}{24}$

$\therefore \dfrac{10}{24}=\dfrac{5}{12}=5:12$ is the smallest ratio

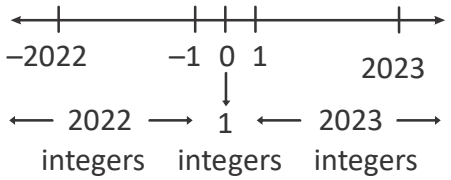
08. (B)

$$\begin{array}{l} 1794\overline{)2139}(1 \\ \quad 1794 \\ \hline \quad 345\overline{)1794}(5 \\ \quad\quad 1725 \\ \hline \text{HCF} \longleftarrow 69\overline{)345}(5 \\ \quad\quad\quad 345 \\ \hline \quad\quad\quad (0) \end{array}$$

$$\begin{array}{l} 69\overline{)4899}(71 \\ \quad 483 \\ \hline \quad\quad 69 \\ \quad\quad 69 \\ \hline \quad\quad (0) \end{array}$$

$\therefore$ HCF of the given three numbers = 69

09. (C)



$\therefore$ Total integers from –2022 to 2023

= 2022 + 1 + 2023 = 4046

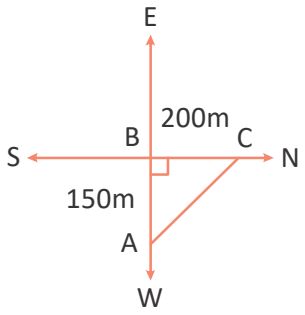
10. (C) Given $\dfrac{1}{2}:x=\dfrac{5}{6}:\dfrac{25}{3}$

$\therefore \dfrac{5x}{6}=\dfrac{25}{3}\times\dfrac{1}{2}$

$x=\dfrac{25}{6}\times\dfrac{6}{5}$

$x = 5$

11. (C)



Given AB = 150 m, BC = 200 m &

$\angle ABC = 90°$

$\therefore AC^2 = AB^2 + BC^2 = (150)^2 + (200)^2$

$= 22500 + 40000 = 62500 = (250\ m)^2$

AC = 250 metres

He is 250 metres away from the starting

12. (D) LHS

$= [-101 \times 13 - 101 \times 14 - 101 \times 15 - 101 \times 16 - 101 \times 17 - 101 \times 18 - 101 \times 19 - 101 \times 20 - 101 \times 21 - 101 \times 22 - 101 \times 23]$

$= 101[-13 - 14 - 15 - 16 - 17 - 18 - 19 - 20 - 21 - 22 - 23]$

$= 101 \times -198 = -19998$

13. (A) $124 \times 4 - 3 + 118 \div 2$

$= 496 - 3 + \frac{118}{2}$

$= 552$

14. (B) The fraction that represents the figure is $\frac{6}{6}$. It is an improper fraction

15. (C) $\text{Mean} = \frac{\text{sum of the observations}}{\text{number of observation}}$

$= \frac{2+4+6+8+10+12+14+16+18+20+22+24+26+28+30+32+34+36+38+40}{20}$

$= \frac{(2+40)+(4+38)+(6+36)+.....+(20+22)}{20}$

$= \frac{42 \times 10}{20}$

$= 21$

(OR)

Mean of the first 'n' even natural numbers

= (n + 1)

= 20 + 1 = 21

16. (B) Let $\left(\frac{1}{6}+\frac{1}{7}+\frac{1}{8}\right)$ be 'a' then

$\text{LHS} = (1+a)\left(a+\frac{1}{9}\right)-\left(1+a+\frac{1}{9}\right)a$

$= a+\frac{1}{9}+a^2+\frac{a}{9}-a-a^2-\frac{a}{9}$

$= \frac{1}{9}$

17. (A) $\angle RPB = 180° - (60° + 50°)$

$= 180° - 110° = 70°$

$\therefore \angle PRQ = x = \angle RPB = 70°$

[$\because$ Alternative angles]

18. (D) In ΔPQS, $\angle PSQ = 90°$ & $\angle P = 34°$

$\therefore 34° + 90° + \angle PQS = 180°$

$\angle PQS = 180° - 124° = 56°$

In ΔSQR, SQ = QR $\Rightarrow \angle R = \angle QSR = x$

But $\angle R + \angle QSR = \angle SQP$

[$\because$ Exterior angle is equal to sum of the interior opposite angles]

$\therefore x + x = 56°$

$2x = 56°$

$x = \frac{56°}{2} = 28°$

19. (C) Let the number of notes of each denomination be 'x'

Given

₹ $10x$ + ₹ $20x$ + ₹ $50x$ + ₹ $200x$ = ₹ 6440

₹ $280x$ = ₹ 6440

$x = \frac{₹6440}{280} = 23$

$\therefore$ Number of notes of each denomination = x = 23

$\therefore$ Total notes = 23 × 4 = 92

20. (D)

$6a^2b = \textcircled{2} \times 3 \times \textcircled{a} \times a \times \textcircled{b}$

$10a^2b = \textcircled{2} \times 5 \times \textcircled{a} \times a \times \textcircled{b}$

$8abc = \textcircled{2} \times 2 \times 2 \times \textcircled{a} \times \textcircled{b} \times c$

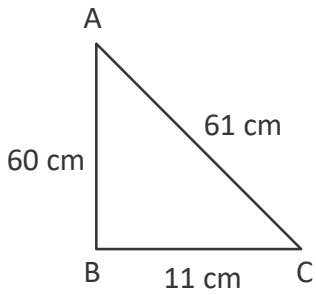
The common in all the three terms are

$2 \times a \times b$

$\therefore$ HCF = 2ab

21. (B) $(11\text{ cm})^2 + (60\text{ cm})^2 = 121\text{ cm}^2 + 3600\text{ cm}^2$

$= 3721\text{ cm}^2$



$\therefore (11\text{ cm})^2 + (60\text{ cm})^2 = (61\text{ cm})^2$

$\therefore$ Given triangle is a right angled triangle

$\therefore$ Area of the triangle

$$= \frac{1}{2} \times 60\text{ cm} \times 11\text{ cm} = 330\text{ cm}^2$$

22. (A) $$\frac{5.43 \times 5.43 - 3.45 \times 3.45}{8.88}$$

$$= \frac{29.4849 - 11.9025}{8.88}$$

$$= \frac{17.5824}{8.88}$$

$= 1.98$

23. (A) $$(x^{-1} + y^{-1})(x + y)^{-1} = \left(\frac{1}{x} + \frac{1}{y}\right)\left(\frac{1}{x+y}\right)$$

$$= \frac{(x+y)}{xy} \times \frac{1}{(x+y)}$$

$$= \frac{1}{xy}$$

$= x^{-1}y^{-1}$

24. (B) Given loss = SP of 6 apples

SP = SP of 24 apples

$\therefore$ CP = SP + Loss = SP of (6 + 24) apples

= SP of 30 apples

$$\text{Loss\%} = \frac{\text{Loss}}{\text{CP}} \times 100$$

$$= \frac{\text{SP of 6 apples}}{\text{Sp of 30 apples}} \times 100 = 20\%$$

25. (C) In ΔABC, $\angle A + 76° + 50° = 180°$

$\angle A = 180° - 126° = 54°$

In ΔADE, $\angle A = 54°$ & AD = AE

$\Rightarrow \angle ADE = \angle AED = a$

$\therefore a + a + 54° = 180°$

$2a = 180° - 54° = 126°$

$$a = \frac{126°}{2} = 63°$$

In ΔCEF, $\angle C = 50°$ & $\angle E = \angle F$

$\Rightarrow \angle EFC = \angle ECF = b$

$\therefore b + b + 50° = 180°$

$2b = 180° - 50° = 130°$

$$b = \frac{130°}{2} = 65°$$

But $a + x + b = 180°$[$\because$ straight angle]

$\therefore 63° + x + 65° = 180°$

$x = 180° - 128° = 52°$

26. (C) Let the present age of elder be 'x' years

$\therefore$ Present age of younger = $(x - 10)$ years

Given

$x - 15 = 2(x - 10 - 15)$

$x - 15 = 2(x - 25)$

$x - 15 = 2x - 50$

$\therefore 50 - 15 = 2x - x = x = 35$

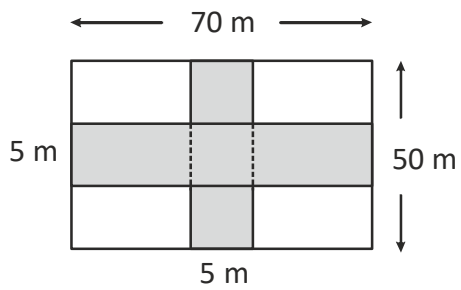
$\therefore x - 10 = 35 - 10 = 25$

$\therefore$ Sum of their present ages

= 35 + 25 = 60years

27. (B) An isosceles right angled triangle has only one line symmetry

28. (B) Total area of the paths



$= 70\text{ m} \times 5\text{m} + 50 \times 5\text{m}^2 - 5 \times 5\text{ m}^2$

$= 350\text{ m}^2 + 250\text{ m}^2 - 25\text{ m}^2$

$= 575\text{ m}^2$

29. (A) From options

Option A :-

$25 - 4 = 21,\ 67 - 4 = 63,\ 77 - 4 = 73,$

$223 - 4 = 219$

$\therefore$ 21, 63, 73 and 219 are in proportion

$\therefore$ '4' to be subtracted

30. (D) LHS

$$= \frac{47}{6} - \left[\frac{27}{8} - \left\{\frac{19}{12} - \left(\frac{265}{24} - 4\right)\right\}\right]$$

$$= \frac{47}{6} - \left[\frac{27}{8} - \left\{\frac{19}{12} - \left(\frac{265-96}{24}\right)\right\}\right]$$

$$= \frac{47}{6} - \left[\frac{27}{8} - \left\{\frac{19}{12} - \frac{169}{24}\right\}\right]$$

$$= \frac{47}{6} - \left[\frac{27}{8} - \left\{\frac{38-169}{24}\right\}\right]$$

$$= \frac{47}{6} - \left[\frac{27}{8} - \left\{\frac{-131}{24}\right\}\right]$$

$$= \frac{47}{6} - \left[\frac{27}{8} + \frac{131}{24}\right]$$

$$= \frac{47}{6} - \left[\frac{81+131}{24}\right]$$

$$= \frac{47}{6} - \frac{53}{6}$$

$$= \frac{-6}{6} = -1$$

MATHEMATICS - 2

31. (A, B, C)

This four triangles are isosceles right angled triangles

32. (B, C, D) B, C, D are correct options.

Given $64^a = \frac{1}{256^b}$

$$\Rightarrow 2^{6a} = \frac{1}{2^{8b}}$$

$2^{6a} = 2^{-8b}$

$6a = -8b$

$2 \times 3a = -4 \times 2b$

$3a + 4b = 0$

Given $64^a = 2 \times 2^{\frac{1}{2}}$

$$\left(2^6\right)^a = 2^{1+\frac{1}{2}}$$

$$2^{6a} = 2^{\frac{3}{2}}$$

$$\therefore 6a = \frac{3}{2}$$

$$a = \frac{3}{2} \times \frac{1}{6} = 2^{-2}$$

$$\frac{1}{256^b} = 2^{\frac{3}{2}}$$

$$\frac{1}{\left(2^8\right)^b} = 2^{\frac{3}{2}}$$

$$2^{-8b} = 2^{\frac{3}{2}}$$

$$-8b = \frac{3}{2}$$

$$b = \frac{3}{2} \times \frac{-1}{8} = \frac{-3}{16}$$

33. (B, D)

Options (B) & (D) are correct

34. (B, C)

Required number

= LCM of (2, 3, 4, 5 & 6) – 1

= 60 – 1 = 59

(or) It can be 120 – 1 = 119

(or) It can be 180 – 1 = 179

(or) It can be 240 – 1 = 239

35. (A, B)

$\frac{1}{2}$ and $\frac{5}{6}$ are rational numbers

then $\frac{1}{2}-\frac{5}{6}=\frac{3-5}{6}=\frac{-2}{6}=\frac{-1}{3}$ is also a rational number

$\therefore$ option A true

a(b – c) = ab – ac

is a distributive property

$\therefore$ option 'B' true

$\frac{-7}{4}$ lies between –2 and –1

$\therefore$ option 'C' false

$\frac{1}{4}$ a rational number but zero is a rational number

$\therefore \frac{\left(\frac{1}{4}\right)}{0}$ is not defined

$\therefore$ option 'D' is false

REASONING

36. (B) 

37. (C) Except home, all others are human settlements. So, home does not belong to the group. Hence option (C) is correct.

38. (D) | 4 | 3 |

Gray colour numbers 4 – 1 = 3 placed in white square

White colour numbers 5 – 3 = 2 placed in gray square

Similarly 5 – 1 = 4, 6 – 3 = 3

39. (A) $23 \underset{-4}{\rightarrow} 19 \underset{-2}{\rightarrow} 17 \underset{-4}{\rightarrow} 13 \underset{-2}{\rightarrow} 11 \underset{-4}{\rightarrow} 7 \underset{-2}{\rightarrow} 5 \underset{-4}{\rightarrow} 1$

40. (A) Here, W = 4 and T = 7

Now,

T E N

↓ ↓ ↓

7 + 22 + 13 = 42

Then,

S W E E T

↓ ↓ ↓ ↓ ↓

8 + 4 + 22 + 22 + 7 = 63

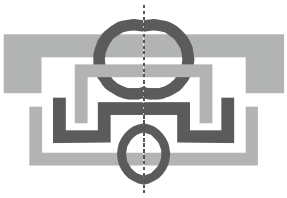
So, the code for SWEET is 63

Hence, option (A) is correct.

41. (C) 26 → 62 + 10 = 72

82 → 28 + 30 = 38

64 → 46 + 10 = 56

42. (A) 

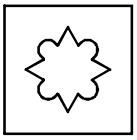
41. (B) 3 → Electrician

5 → Electrification

1 → Electrolysis

4 → Electroplating

2 → Electrotyping

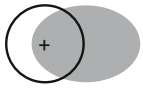
44. (D) 

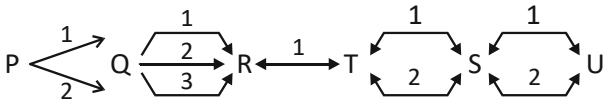
45. (C) On the basis of given information, we can draw the following table.

Students	Dramatic	Computer Science	Physics	History	Maths
A	✘	✔	✔	✔	✔
B	✔	✔	✔	✘	✘
C	✘	✘	✔	✔	✔
D	✔	✘	✔	✔	✘
E	✔	✔	✘	✔	✘

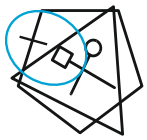
From the table it is clear that C is good in Physics. History and Mathematics, but not in Computer Science. Hence, option (C) is correct.

CRITICAL THINKING

46. (A) 

47. (B) 

48. (D) A culture is the behavior pattern of a particular population, so customs are the essential element. A culture may or may not be civil or educated (choices A and B). A culture maybe an agriculture society (choice C), but this is not the essential element.

49. (C) 

50. (D) Diagonally opposite rectangles have identical dot arrangements but with black/white reversal.

The End