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UNIFIED COUNCIL OLYMPIADS

UIMO
Unified International Mathematics Olympiad

UNIFIED INTERNATIONAL MATHEMATICS OLYMPIAD (UPDATED)

CLASS - 7

Question Paper Code : UM9269

KEY

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

EXPLANATIONS

MATHEMATICS - 1

01. (A) Given $S_1 + S_2 + S_3 = 3322$ units

Given $S_1 - S_2 + S_3 = 2022$ units

$\therefore (S_1 + S_2 + S_3) - (S_1 - S_2 + S_3)$

$= (3322 - 2022)$ units

$\Rightarrow S_1 + S_2 + S_3 - S_1 + S_2 - S_3 = 1300$ units

$\Rightarrow 2S_2 = 1300$ units

$S_2 = \frac{1300}{2}$ units $= 650$ units

02. (C) $\frac{1}{1+2^{a-b}} + \frac{1}{1+2^{b-a}}$

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

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

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

03. (C) In an isosceles triangle equal sides opposite angles are equal

$\Rightarrow \angle B = \angle C = 60°$

But $\angle A + \angle B + \angle C = 180°$

$\angle A + 60° + 60° = 180°$

$\angle A = 180° - 120° = 60°$

04. (D) Let the first number be 'x'

$\therefore$ other number = $10x$

Given $10x + x = 3531$

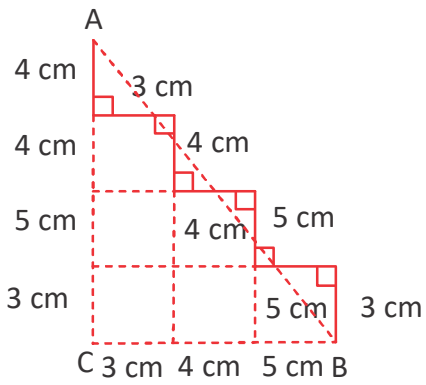
$11x = 3531$

$x = \frac{3531}{11} = 321$

$\therefore$ Difference of numbers = $10x - x = 9x$

$= 9 \times 321 = 2889$

05. (A)



$\therefore$ AC = (4 + 4 + 5 + 3) cm = 16 cm

BC = (3 + 4 + 5) cm = 12 cm

In ΔABC, $\angle C = 90° \Rightarrow AB^2 = AC^2 + BC^2$

($\because$ pythagurus theorem)

$= (16\text{ cm})^2 + (12\text{ cm})^2$

$= (256 + 144)\text{ cm}^2$

$= 400\text{ cm}^2$

$AB^2 = (20\text{ cm})^2$

$\therefore$ AB = 20 cm

06. (C)

2	$2^3 \times 3^2 \times 5^2 \times 7, 2 \times 5^2 \times 7^3$
5^2	$2^2 \times 3^2 \times 5^2 \times 7, 5^2 \times 7^3$
7	$2^2 \times 3^2 \times 7, 7^3$
	$2^2 \times 3^2, 7^2$

$\therefore$ LCM = $2 \times 5^2 \times 7 \times 2^2 \times 3^2 \times 7^2$

$= 2^3 \times 3^2 \times 5^2 \times 7^3$

07. (B) The areas ratio of two squares P & Q

= 4 : 9

$= 4x^2 : 9x^2$

Given $4x^2 + 9x^2 = 468\text{ cm}^2$

$13x^2 = 468\text{ cm}^2$

$x^2 = \frac{468\text{ cm}^2}{13} = 36\text{ cm}^2$

$x^2 = (6\text{ cm})^2$

$x = 6$ cm

$\therefore$ Area of square Q

$= 9x^2 = 9 \times 36\text{ cm}^2 = 324\text{ cm}^2$

$a^2 = (18\text{ cm})^2$

a = 18 cm

Perimeter of square Q

= 4a = 4 × 18 cm = 72 cm

08. (C) Given ABCD is a quadrilateral

$\therefore \angle A + \angle B + \angle BCD + \angle D = 360°$

$70° + 60° + \angle BCD + 120° = 360°$

$\angle BCD = 360° - 250° = 110°$

But $\angle BCD + \angle DCE = 180°$

$110° + \angle DCE = 180°$

$\angle DCE = 180° - 110° = 70°$

09. (A) Given $x^{x^{\frac{3}{2}}} = x^{x \times \frac{3}{2}}$

$\therefore x^{\frac{3}{2}} = x \times \frac{3}{2}$

$\frac{x^{\frac{3}{2}}}{x} = \frac{3}{2}$

$x^{\frac{3}{2}-1} = \frac{3}{2}$

$x^{\frac{1}{2}} = \frac{3}{2}$

10. (C) Sum of three consecutive numbers

= 1 + 2 + 3

= 2 – 1 + 2 + 2 + 1

= 2 × 3 = 6

= Middle number × 3

Similarly sum of 29 consecutive numbers = 29 × middle number

= 29 × 50 = 1450

11. (C) If a = 83° then b = 7° both are prime numbers

∴ Least value of b = 7°

12. (A) $\left(\frac{a-3}{5-c}\right)\left(\frac{b-4}{3-a}\right)\left(\frac{c-5}{4-b}\right)$

$=\left(\frac{a-3}{-c+5}\right)\left(\frac{b-4}{-a+3}\right)\left(\frac{c-5}{-b+4}\right)$

$=-1\left(\frac{a-3}{c-5}\right)\times -1\left(\frac{b-4}{a-3}\right)\times -1\left(\frac{c-5}{b-4}\right)$

$=-1\left[\frac{a-3}{c-5}\times\frac{b-4}{a-3}\times\frac{c-5}{b-4}\right]$

= –1

13. (D) Given $2\pi r = 4s$

$2\times\frac{22}{7}r = 4s$

$\Rightarrow r = 4s\times\frac{7}{22}\times\frac{1}{2}$

$r=\frac{7s}{11}$

Areas ratio of circle & square

$=\pi r^2 : s^2$

$=\frac{22}{7}\times\left(\frac{7s}{11}\right)^2 : s^2$

$=\frac{22}{7}\times\frac{49s^2}{121} : s^2$

$=\frac{14s^2}{11}\times 11 : s^2\times 11$

= 14 : 11

14. (C) We have,

$\left(\frac{12}{5}x^2yz-\frac{3}{5}xyz+\frac{2}{3}x^2y\right)-\left(\frac{3}{2}x^2y+\frac{4}{5}y-\frac{1}{3}x^2yz\right)$

$=\frac{12}{5}x^2yz-\frac{3}{5}xyz+\frac{2}{3}x^2y-\frac{3}{2}x^2y-\frac{4}{5}y+\frac{1}{3}x^2yz$

$=\frac{12}{5}x^2yz+\frac{1}{3}x^2yz+\frac{2}{3}x^2y-\frac{3}{2}x^2y-\frac{3}{5}xyz-\frac{4}{5}y$

[Grouping line terms]

$=\left(\frac{12}{5}+\frac{1}{3}\right)x^2yz+\left(\frac{2}{3}-\frac{3}{2}\right)x^2y-\frac{3}{5}xyz-\frac{4}{5}y$

$=\frac{41}{15}x^2yz-\frac{5}{6}x^2y-\frac{3}{5}xyz-\frac{4}{5}y$

15. (B) $9a^3b^2c = 3\times 3\times a\times a\times a\times b\times b\times c$

$12a^2b^2d = 2\times 2\times 3\times a\times a\times b\times b\times d$

$15ab^3cd = 3\times 5\times a\times b\times b\times b\times c\times d$

∴ HCF = $3\times a\times b^2 = 3ab^2$

[∵ $3ab^2$ is the highest common factor of the given terms]

16. (B) Given $\frac{x}{y}=\frac{3}{4}$

$\therefore x=\frac{3y}{4}$

$\frac{8x-15y}{8x+5y}=\frac{8\times\frac{3y}{4}-15y}{8\times\frac{3y}{4}+5y}$

$=\frac{6y-15y}{6y+5y}$

$=\frac{-9y}{11y}=\frac{-9}{11}$

17. (C) $$\frac{\frac{8}{7}+\frac{2}{5}-\left[\frac{\frac{5}{3}}{\frac{27-2}{9}}\right]}{1-\frac{1}{7}\left[\frac{1}{3}-\frac{\left(\frac{2}{5}\right)}{\frac{5-2}{5}}\right]}=\frac{\frac{8}{7}+\frac{2}{5}-\left[\frac{5}{3}\times\frac{9}{25}\right]}{1-\frac{1}{7}\left[\frac{1}{3}-\frac{2}{5}\times\frac{5}{3}\right]}$$

$$=\frac{\frac{8}{7}+\frac{2}{5}-\frac{3}{5}}{1-\frac{1}{7}\left[\frac{1}{3}-\frac{2}{3}\right]}$$

$$=\frac{\frac{40+14-21}{35}}{1-\frac{1}{7}\left(\frac{-1}{3}\right)}$$

$$=\frac{\frac{33}{35}}{1+\frac{1}{21}}$$

$$=\frac{33}{35}\times\frac{21}{22}=\frac{9}{10}$$

18. (D) Let the total distance travelled by him = x km

Distance travelled by train = $\frac{5}{8}x$ km

Distance travelled by bus = $\frac{1}{4}x$ km

$\therefore$ Total distance travelled by train and bus in km $=\frac{5}{8}x+\frac{1}{4}x=\frac{5x+2x}{8}=\frac{7x}{8}$

Remaining distance in km = $x-\frac{7x}{8}=\frac{x}{8}$

He travelled this distance by boat

$\therefore$ We are given that, this distance = 15 km

$\therefore \frac{x}{8}=15$ (or) $x=15\times8=120$

$\therefore$ Total distance travelled = 120 km

19. (A) Let distance be x km

Time taken to walk = $\frac{d}{s}=\frac{x}{4}$ hour

Time taken to return = $\frac{d}{s}=\frac{x}{12}$ hour

Total time $=\frac{x}{4}+\frac{x}{12}=\frac{3x+x}{12}=\frac{4x}{12}=\frac{x}{3}$ hour

Given $\frac{x}{3}$ hour $=\frac{10}{3}$ hour

$\therefore x=\frac{10}{3}\times3$

$\therefore$ Distance = 10 km

Time taken to return $=\frac{d}{12}=\frac{10}{12}$ hour

$=\frac{10}{12}\times60$ min $=50$ min

20. (D) LHS $=1+\frac{1}{1+\frac{1}{1+\frac{1}{\left(\frac{3}{2}\right)}}}$

$=1+\frac{1}{1+\frac{1}{1+\frac{2}{3}}}$

$=1+\frac{1}{1+\frac{1}{\frac{5}{3}}}=1+\frac{1}{1+\frac{3}{5}}$

$=1+\frac{1}{\frac{5+3}{5}}=1+\frac{1}{\left(\frac{8}{5}\right)}$

$=1+\frac{5}{8}$

$=\frac{8+5}{8}=\frac{13}{8}$

21. (C) No. of kilograms of fruits sold during the four hours = 35 + 26 + 45 + 20 = 126

22. (A) Let the son's present age be x years. Then the father's age is $(26 + x)$ years

In 3 years' time, son's age = $(x + 3)$ years and father's age

= $(26 + x + 3)$ years = $(x + 29)$ years

Given that son's age will be one-third the father's age

$\Rightarrow x + 3 = \frac{1}{3}(x + 29)$

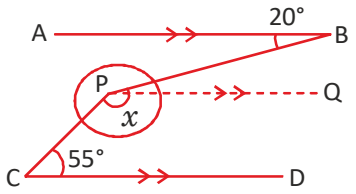
$\Rightarrow 3x + 9 = x + 29$

$\Rightarrow 2x = 20$

$\Rightarrow x = 10$

$\therefore$ The present age of son is 10 years

23. (D) Draw PQ ||AB and CD



From the figure, $x = 20° + (180° - 55°)$ as PQ || AB || CD

$\Rightarrow x = 20° + 125° = 145°$

24. (A) Given $\left(\frac{5}{4}\right)^{-5}\left(\frac{4}{5}\right)^{10} = \left(\frac{5}{4}\right)^{2x}$

$\left(\frac{5}{4}\right)^{-5}\left(\frac{5}{4}\right)^{-10} = \left(\frac{5}{4}\right)^{2x}$

$\left(\frac{5}{4}\right)^{-5+(-10)} = \left(\frac{5}{4}\right)^{2x}$

$2x = -15$

$x = \frac{-15}{2}$

25. (B) Given

$$\left(\frac{2x+7}{5}\right) - \left(\frac{3x+11}{2}\right) = \left(\frac{2x+8}{3}\right) - 5$$

$$\Rightarrow \frac{6(2x+7) - 15(3x+11) - 10(2x+8)}{30} = -5$$

$\therefore 12x + 42 - 45x - 165 - 20x - 80 = -5 \times 30$

$-53x - 203 = -150$

$-53x = -153 + 203$

$-53x = 53$

$\therefore x = \frac{53}{-53} = -1$

$x = -1$

26. (D) Given in ΔABC, $\angle A - \angle B = 30°$

$\therefore \angle A - 30° = \angle B$ & $\angle A - \angle C = 24°$

$\therefore \angle A - 24° = \angle C$

But $\angle A + \angle B + \angle C = 180°$

$\angle A + \angle A - 30° + \angle A - 24° = 180°$

$3\angle A - 54° = 180°$

$3\angle A = 180° + 54° = 234°$

$\angle A = \frac{234°}{3} = 78°$

But $78° - \angle B = 30°$

$\therefore 78° - 30° = \angle B$

$\angle B = 48°$

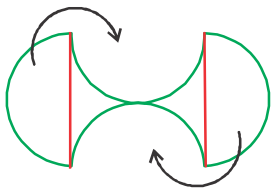
27. (B) Let the number to be multiplied be 'x'

Given $3^{-5} \times x = 4^{-1}$

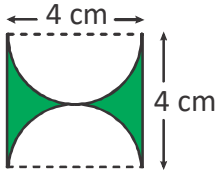
$\frac{x}{(3^5)} = \frac{1}{4}$

$x = \frac{3^5}{4} = \frac{243}{4} = 60\frac{3}{4}$

28. (C) Position I :



Position II :



Area of the square = $(4 \text{ cm})^2 = 16 \text{ cm}^2$

29. (A) $987^2 - 2\times987\times990 + 990^2$

= 974169 – 1954260 + 980100

= 1954269 – 1954260

= 9

30. (C) LCM of 2, 7, 14, 28 = 28

$\therefore \frac{-5}{14} = \frac{-5}{14}\times\frac{2}{2} = \frac{-10}{28}, \frac{-3}{7} = \frac{-3}{7}\times\frac{4}{4} = \frac{-12}{28}, \frac{-1}{2} = \frac{-1}{2}\times\frac{14}{14} = \frac{-14}{28}$

$\therefore \frac{-25}{28} < \frac{-14}{28} < \frac{-12}{28} < \frac{-10}{28}$

ie $\frac{-25}{28}, \frac{-1}{2}, \frac{-3}{7}, \frac{-5}{14}$

MATHEMATICS - 2

31. (B, C)

11 & 13 are two twin primes

$\therefore$ 11 × 13 + 1 = 143 + 1 = 144 = 12^2

$\therefore$ It is an even number and the result is a perfect square

17 & 19 are twin primes

$\therefore$ 17 × 19 + 1 = 323 + 1 = 324 = 18^2

The result is an even number and perfect square

$\therefore$ The result is always an even and perfect square

32. (A, C, D)

Let a = 4 & b = 2 then a – b = 4 – 2 = 2 is a prime number

Let a = 9 & b = 5 then a – b = 9 – 5 = 4 is a composite number

$\therefore$ (a – b) is some times prime number

But a = 6 and b = 5 then

$\frac{a}{b} = \frac{6}{5}$ which is not a prime number

Let a = 15 is a composite number and

Let b = 5 is a prime number

$\therefore \frac{a}{b} = \frac{15}{5} = 3$

Which is a prime

Every composite number is multiplied a prime then we get a compositive number

$\therefore$ The product of a composite and a prime is always composite

33. (A, C, D)

Option A:- $\left(\frac{3x-2}{3}\right) + \left(\frac{2x+3}{2}\right) = x + \frac{7}{6}$

$\Rightarrow \left(\frac{3x-2}{3}\right) + \left(\frac{2x+3}{2}\right) - x = \frac{7}{6}$

$\Rightarrow \frac{2(3x-2)+3(2x+3)-6x}{6} = \frac{7}{6}$

$\Rightarrow 6x - 4 + 6x + 9 - 6x = \frac{7}{6}\times6$

$6x + 5 = 7$

$6x = 7 - 5$

$6x = 2$

$x = \frac{2}{6} = \frac{1}{3}$ is not an integer

Option B:- $\frac{x}{2} + \frac{x}{3} - \frac{x}{6} = 8$

$\frac{3x+2x-x}{6} = 8$

$4x = 8 \times 6$

$x = \frac{8\times6}{4} = 12$ is an integer

Option C :- $\left(\frac{7x-3}{6}\right) - \left(\frac{2x-3}{4}\right) = \frac{5}{4}$

$\frac{2(7x-3)-3(2x-3)}{12} = \frac{5}{4}$

$14x - 6 - 6x + 9 = \frac{5}{4}\times12$

$14x - 6x + 3 = 15$

$8x = 15 - 3$

$x = \frac{12}{8}$ is not an integer

Option D :- $\left(\frac{x+4}{2}\right) + \frac{3(1+2x)}{4} = 0$

$\frac{2(x+4)+3(1+2x)}{4} = 0$

$2x + 8 + 3 + 6x = 0 \times 4$

$8x + 11 = 0$

$8x = -11$

$x = \frac{-11}{8}$ which is not an integer

34. (A, B, D)

In ΔPQR, $42° + 57° + \angle QPR = 180°$

$\angle QPR = 180° - 42° - 57°$

$= 81° \Rightarrow \angle PDI = 81°$

[$\because$ corresponding angles]

$\therefore \angle A = \angle PDI = 81°$

[$\because$ corresponding angles]

Given $\angle PQR = 42°$

$\therefore \angle RQE = 180° - \angle PQR$

$= 180° - 42° = 138°$

[$\because$ Linear pair]

$\therefore \angle BHQ = \angle RQE = 138°$

[$\because$ corresponding angles]

$\angle RGB = \angle PRQ = 57°$

[$\because$ corresponding angles]

$\angle PRQ + \angle PRI = 180°$

$\therefore 57° + \angle PRI = 180°$

$\angle PRI = 180° - 57° = 123°$

$\therefore \angle CIR = \angle PRI = 123°$

[$\because$ Alternative angles]

35. (A,B,C,D)

Option A:- $\frac{-12}{7} \times 17 \times 13 > \frac{-9}{13} \times 17 \times 13$

$-156 > -153$ which is false

Option B :- $\frac{-13}{23} \times 23 \times 29 > \frac{-15}{29} \times 23 \times 29$

$-377 > -345$ whish is false

Option C :- $\frac{-15}{31} \times 31 \times 37 < \frac{-29}{37} \times 31 \times 37$

$-555 < -899$ which is a false

Option D:- $\frac{-98}{101} \times 101 \times 97 < \frac{-96}{97} \times 101 \times 97$

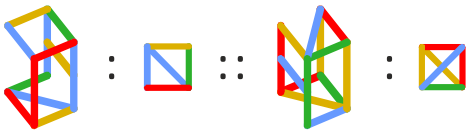
$-9506 < -9696$ which is false

REASONING

36. (A) Every time the image turn 45 degrees left and red & yellow colours interchange their positions.

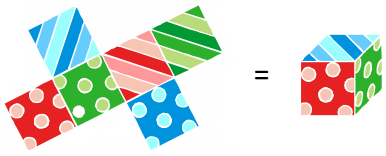
37. (C) Both the inside and outside arrows are moving in clockwise direction in options A, B and D. In option C, the inside arrow is moving in anticlockwise while the outside arrow is moving in clockwise direction.

38. (D)



39. (A) The first vowel from the left is I'. 3rd letter from I is R. The seventh letter to its right is 'S'

40. (A)

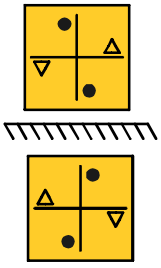


41. (D) (A) $7 > 3$ (B) $47 < 48$

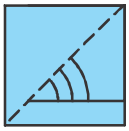
(C) $56 = 56$ (D) $6 < 17$

B and D represents same symbols

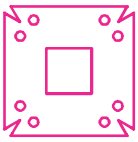
42. (C)



43. (A)



44. (C) It has a circle in a star, a triangle in a square, a circle in a circle and two more white circles and a black circle.

45. (B) 

CRITICAL THINKING

46. (D) f = force required ; w = weight

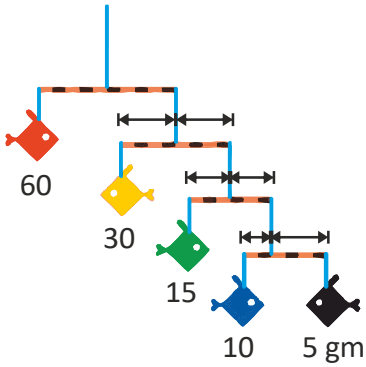
d1 = distance 1 ; d2 = distance 2

f = (w × d1) ÷ d2

Calculation : f = (50 × 1) ÷ d2

= 25 kgs

47. (A) P and S

48. (C) 

49. (A) It is impossible to tell conclusively that Sravanthi is faster than Saritha.

50. (C) All school vans are 3 wheeler or 4 wheels, and motor vehicles are different.

The End