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UIMO
Unified International Mathematics Olympiad

UNIFIED INTERNATIONAL MATHEMATICS OLYMPIAD

CLASS - 7
Question Paper Code : 4O109

KEY

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C	D	C	B	D	C	D	D	B	A

SOLUTIONS

MATHEMATICS - 1

01. (A) Use BODMAS rule & simplify

$\underline{124 \times 4} - 3 + \underline{118 \div 2}$

$\downarrow \qquad\qquad \downarrow$

$= 496 - 3 + 59$

$= 493 + 59 = 552$

02. (A) Here jumping downwards is taken as positive and jumping upwards is taken as negative

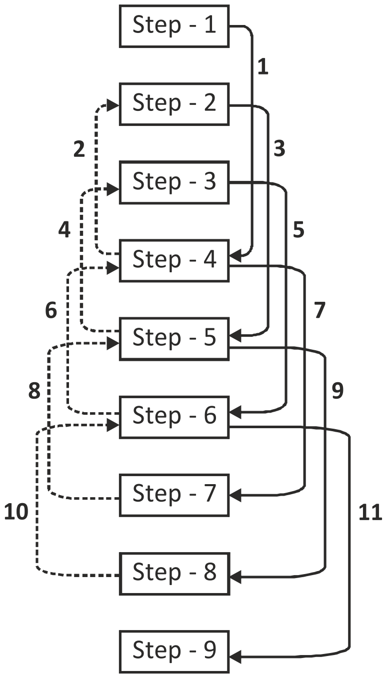
Also given that the monkey is sitting on the first step

$1 + (+3) + (-2) + (+3) + (-2) + (+3) + (-2) + (+3) + (-2) + (+3)+(-2) + (+3)$

$= 1+3-2+3-2+3-2+3-2+3-2+3$

is 11 steps

(or)



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

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

$=1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{4}{\left(\frac{5}{3}\right)}}}$

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

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

04. (A) The sum of weights of 10 apples before the error was detected is 520 g. Increase in the weight after the correction is 10 g per apple $\Rightarrow$ for 10 apples, = 10 × 10 g = 100 g

$\therefore$ Correct sum of weight of apples

= (520 + 100) g = 620 g

Hence, correct average weight

$= \frac{620}{10}$ = 62 g

05. (A) Required probability $= \frac{1}{6}$

06. (D) Given $\frac{3p+2}{5} - \frac{4p-3}{7} + \frac{p-1}{35} = 4$

Multiplying by 35, we have

7(3p + 2) –5(4p – 3) + (p – 1) = 140

$\Rightarrow$ 21p + 14 – 20p + 15 + p – 1 = 140

$\Rightarrow$ 2p + 28 = 140 $\Rightarrow$ 2p = 112

$\therefore$ p = 56

07. (C) Let the first prize be Rs. x

$\therefore$ Second prize = Rs. $\frac{3}{4}x$

Third prize = Rs. $\frac{1}{2} \times \frac{3x}{4}$ = Rs. $\frac{3x}{8}$

$\therefore$ Rs. $\left(x + \frac{3x}{4} + \frac{3x}{8}\right)$ = Rs. 2250

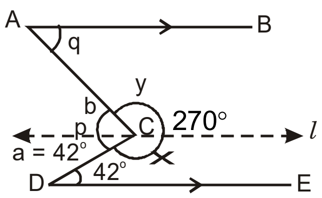
$\Rightarrow$ Rs. $\frac{17x}{8}$ = Rs. 2550

$\Rightarrow$ x = Rs. 1200

08. (A) Clearly p = 360° – 270° = 90°

(Angles at a point)

Through C, draw a line l parallel to AB and DE



$\therefore$ 42° + x = 180° and q + y = 180°

$\Rightarrow$ x = 180° – 42° = 180°

$\therefore$ y = 270° – 138° = 132°

$\therefore$ q = 180° – 132° = 48°

Alternate Method:

p = 90°, p = a + b = 90°

a = 42° (Since l || DE, alternate angles)

$\Rightarrow$ b = 90° – 42° = 48°

q = b = 48° (Alternate angles)

09. (B) Let the required number be x. Then,

$$\frac{-13}{6} + x = -5 \Rightarrow x = -5 - \left(\frac{-13}{6}\right)$$

$$= \frac{-5}{1} + \frac{13}{6} \qquad \left[\because -\left(\frac{-13}{6}\right) = \frac{13}{6}\right]$$

$$= \frac{-30+13}{6} = \frac{-17}{6}$$

$\therefore$ Required difference $= \frac{-13}{6} - \left(\frac{-17}{6}\right)$

$$= \frac{-13+17}{6} = \frac{4}{6} = \frac{2}{3}$$

10. (A) B = A + 20% of A

$$= A + \frac{20}{100} A$$

$$B = \frac{5A+A}{5} = \frac{6A}{5}$$

$$C = B - 50\% \text{ of } B = \frac{6A}{5} - \frac{50}{100} \times \frac{6A}{5}$$

$$C = \frac{6A-3A}{5} = \frac{3A}{5}$$

$$= \frac{3}{5} \times \frac{20}{20} A$$

$$C = \frac{60}{100} A = 60\% \ A$$

11. (A) Let the profit % be x

Given $\frac{3}{4}$ of CP $\frac{(100+x)}{100} = \text{CP} \frac{(100-10)}{100}$

$$\Rightarrow \frac{3}{4} \times \text{CP} \times \frac{(100+x)}{100} = \text{CP} \times \frac{90}{100}$$

$$100 + x = \text{CP} \times \frac{90}{100} \times 100 \times \frac{4}{3} \times \frac{1}{\text{CP}}$$

$100 + x = 120$

$x = 120 - 100$

$x = 20\%$

12. (D) Consider a right ΔABC in which $\angle B = 90^\circ$

BC = 12 cm and AC = 13 cm

Now, $AB^2 + BC^2 = AC^2$

(By Pythagoras theorem)

$\Rightarrow$ $AB^2 = (AC^2 - BC^2)$

$\Rightarrow$ $AB^2 = 169 - 144 = 25$

$\Rightarrow$ AB = 5 cm

$\Rightarrow$ AB = 5 cm

$\therefore$ Area of triangle ABC = $\left(\frac{1}{2} \times BC \times AB\right) cm^2$

$$= \left(\frac{1}{2} \times 12 \times 5\right) cm^2 = 30 \ cm^2$$

13. (B) In Δ ABC, $\angle A + \angle B + \angle C = 180^\circ$

$\angle A + 3\angle A + 104^\circ = 180^\circ$

$4\angle A = 76^\circ$

$\angle A = \frac{76^\circ}{4} = 19^\circ$

$\angle B = 3\angle A = 57^\circ$

14. (D) We have $\frac{x^3 + y^3 + z^3 - 3xyz}{x^2 + y^2 + z^2 - xy - yz - zx}$

$$= \frac{(1)^3 + (2)^3 + (-1)^3 - 3(1)(2)(-1)}{(1)^2 + (2)^2 + (-1)^2 - (1)(2) - (2)(-1) - (-1)(1)}$$

$$= \frac{1+8-1+6}{1+4+1-2+2+1} = \frac{14}{7} = 2$$

15. (C) Total S.I = Rs. 275

Let x be the sum borrowed at 7% rate.

So, $\frac{(2500 - x) \times 5 \times 2}{100} + \frac{x \times 7 \times 2}{100} = 275$

$\Rightarrow$ x = Rs. 625

16. (A) $99^3 - 3 \times 99^2 \times 100 + 3 \times 99 \times 100^2 - 100^3$

= 9,70,299 – 29,40,300 + 29,70,000 – 10,00,000

= 9,70,299 + 29,70,000 – 29,40,300 – 10,00,000

= 39,40,299 – 39,49,300

= –1

17. (C) Given $\angle AOB + \angle BOC + \angle COD = 180°$

[$\because$ straight angle]

$11x + 12x + 13x = 180°$

$36x = 180°$

$$x = \frac{180°}{36} = 5°$$

$\therefore$ $\angle AOC = 11x + 12x = 23x = 23 \times 5° = 115°$

18. (C) $\frac{-5}{16} = -0.3125$

$\frac{-13}{24} = -0.546$

$\frac{-3}{4} = -0.75$

$\frac{-7}{12} = -0.58.$

$\therefore \frac{-3}{4}$ is the smallest rational number

19. (C) $2^{2025} - 2^{2024} - 2^{2023} + 2^{2022} = K \times 2^{2022}$

$\Rightarrow$ $2^{2022} \times 2^3 - 2^{2022} - 2^2 - 2^{2022} \times 2^1 + 2^{2022} \times 1 = K \times 2^{2022}$

$\Rightarrow$ $2^{2022}(2^3 - 2^2 - 2 + 1) = k \times 2^{2022}$

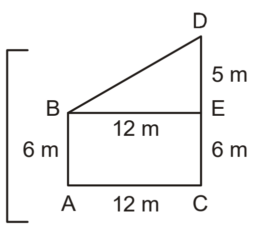
$2^{2022}(8 - 4 - 2 + 1) = k \times 2^{2022}$

$$k = \frac{\cancel{2^{2022}} \times 3}{\cancel{2^{2022}}}$$

k = 3

20. (C) AB = 6 m, CD = 11 m, AC = 12 m

Now, DE = (CD – CE) = (11 – 6) m = 5 m



In ΔBED,

$BD^2 = BE^2 + DE^2$

$= (12)^2 + (5)^2$

$= 144 + 25 = 169$

$\therefore$ BD = 13 m

$\therefore$ Answer is option (C)

21. (D) Given $\angle AOD + \angle DOB = 180°$

$2x + 3x = 180°$

$x = 36°$

Given $\angle DOB = 3x$

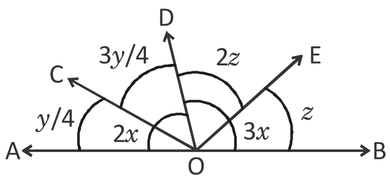
$\Rightarrow \angle DOG + \angle EOB = 3x$

$2z + z = 3x$

$3z = 3x$

$\therefore$ $z = x$

$\therefore$ $x = z = 36°$



Given $\angle AOD = 2x$

$\Rightarrow \angle AOC + \angle COD = 2x.$

$$\frac{y}{4} + \frac{3y}{4} = 2x$$

$y = 2x$

$$\therefore \angle COE = \angle COD + \angle DOE = \frac{3y}{4} + 2z = \frac{3}{4}(2x) + 2x$$

$$= \frac{3x}{2} + 2x = \frac{7x}{2}$$

$$= \frac{7 \times 36°}{2} = 126°$$

22. (C) Given AB = BD

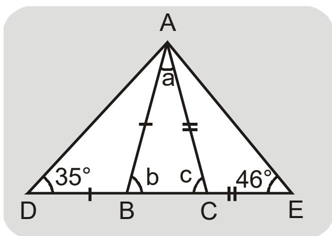
$\Rightarrow \angle BAD = \angle BDA = 35°$

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

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

Also given AC = CE

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



Using exterior angle property,

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

= 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 $\angle c = 92°$

23. (D) Let 'x' be the other number.Let 'x' be the other number $x \times \frac{-4}{3} = \frac{-9}{16}$

$\Rightarrow x = \frac{-9/16}{-4/3} = \frac{-9}{16} \times \frac{-3}{4} = \frac{27}{64}$

24. (B) a + b – c = a + b – c + c – c

= a + b + c – 2c

= 2s – 2c

= 2(s – c)

25. (B) Let the sum be P

Let the number of times it gets multiplied be x

T = 10 years

R = 20% p.a

We know that, $A = P\left(1 + \frac{TR}{100}\right)$

$\Rightarrow xP = P\left(1 + \frac{10 \times 20}{100}\right)$

$\Rightarrow xP = 3P$

$\Rightarrow x = 3$

26. (C) LHS = $\frac{a^2}{2} - \frac{b^3}{3} + \frac{c^3}{4} + \frac{2a^2}{3} - \frac{3b^3}{4} + \frac{4c^3}{5}$

$+ a^2 - b^3 - c^3$

$= \left(\frac{a^2}{2} + \frac{2a^2}{3} + a^2\right) + \left(-\frac{b^3}{3} - \frac{3b^3}{4} - b^3\right)$

$+ \left(\frac{c^3}{4} + \frac{4c^3}{5} - c^3\right)$

$= \left(\frac{3a^2 + 4a^2 + 6a^2}{6}\right) + \left(\frac{-4b^3 - 9b^3 - 12b^3}{12}\right)$

$+ \left(\frac{5c^3 + 16c^3 - 20c^3}{20}\right)$

$= \frac{13a^2}{6} - \frac{25b^3}{12} + \frac{c^3}{20}$

27. (C) $LHS = -\frac{3}{10} - \frac{9}{10} + \frac{7}{15} - \frac{13}{15} + \frac{3}{20} - \frac{13}{20}$

$= \frac{-3-9}{10} + \frac{7-13}{15} + \frac{3-13}{20}$

$= \frac{-12}{10} - \frac{6}{15} - \frac{10}{20}$

$= -\frac{6}{5} - \frac{2}{5} - \frac{1}{2}$

$= \frac{-12-4-5}{10} = \frac{-21}{10}$

28. (A) Area of shaded part = Area of PQRS – area of ABCD

= $(95^2 - 91^2)$ sq m

= (9025 – 8281) sq m

= 744 sq m

29. (B) Option (A) : $\frac{-67,860}{468} = -145$

Option (B) : $\frac{-60,088}{518} = -116$

Option (C) : $\frac{-70,040}{515} = -136$

Option (D) : $\frac{-65,125}{521} = -125$

– 116 > – 125 > – 136 > – 145

30. (B) Let the height be x cm.

Then, the base = $2x$ cm.

$\therefore$ Area of the parallelogram = (Base × height)

= $(2x \times x)$ cm² = $(2x^2)$ cm².

But, area of the parallelogram = 648 cm²

$\therefore$ $2x^2 = 648 \Rightarrow x^2 = 324 \Rightarrow x = 18$

Hence, the base of the parallelogram is 2 × 18 = 36 cm

MATHEMATICS - 2

31. (B, C) The lines AB and EF intersect at G.

$\therefore \angle ECG = \angle AGF$

(Vertically opposite angles)

$\Rightarrow \angle AGF = 65°$

Since AB||CD

$\angle GHD = \angle AGH = \angle AGF$

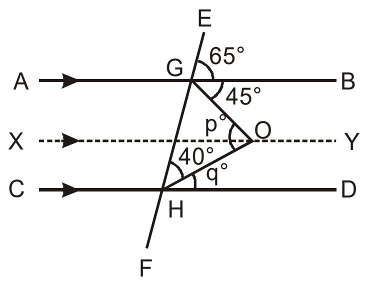
$\Rightarrow \angle GHD = 65°$

(Since $\angle AGH = 65°$)

$\Rightarrow \angle GHO + \angle OHD = 65°$

$\Rightarrow 40° + q° = 65°$

$\Rightarrow q° = 65° - 40° = 25°$



Draw a line XY through 'O' parallel to AB and CD.

Since XY || AB, $\angle XOG = \angle BGO$

$\Rightarrow \angle XOG = 45°$ ($\because$ Alternate angles) and XY || CD $\Rightarrow \angle XOH = \angle OHD$

$\Rightarrow \angle XOH = 25°$

But $p° = \angle XOG + \angle XOH$

$\Rightarrow p = 45° + 25° = 70°$

$\therefore$ p = 70° & q = 25°

32. (A,B,D)

Option (A) $(0.1)^3 = 0.001$

$(0.1)^2 = 0.01$

$\therefore (0.1)^3 < (0.1)^2$

$\therefore$ Option 'A' is correct.

Option (B) $4^{1026} = (2^2)^{1026}$

$= 2^{2 \times 1026}$

$= 2^{2052}$

$\therefore 2^{2024} < 2^{2052}$

Option 'B' is correct

Option (C) i = 1

$1^{2025} = 1$

$\therefore i < 1^{2025}$ is false

Option (D) $9^{50} = (3^2)^{50} = 3^{100}$

$3^{123} > 9^{50}$

Hence Option 'D' is correct.

33. (A,B,C,D)

Area of a rectangle = 16×9 cm^2 = 144 cm^2

Area of a square = 12cm × 12cm = 144 cm^2

Area of u triangle $= \frac{1}{2} \times 36 \times 8\text{cm}^2$ = 144 cm^2

Area of a square = $\frac{1}{2} \times d^2 = \frac{1}{2} \times \left(12\sqrt{2}\right)^2$

$= \frac{1}{2} \times 12 \times 12 \times 2$ cm^2 = 144 cm^2

34. (A, B, C, D)

Option 'A' : 4 cm + 1.5 cm = 5.5 cm > 5 cm

Option 'B' : 4 cm + 5 cm = 9 cm > 8 cm

Option 'C' : 4 cm + 4 cm = 8 cm > 5 cm

Option 'D' : 4 cm + 5 cm = 9 cm > 5 cm

35. (A, B, D)

$\frac{-4}{9} = -0.444$ and $\frac{-7}{17} = -0.41$

$\frac{-6}{17} = -0.35$ does n't lie between –0.44 and –0.411

$\frac{-9}{20} = -0.45$ does n't lies between –0.44 and –0.411

$\frac{-135}{311} = -0.434$

lies between –0.44 and –0.411

$\frac{-2}{5} = -0.4$ does not lie between –0.44 and –0.41

REASONING

36. (D) FIT = 6 + 9 + 20 = 35

MIT = 13 + 9 + 20 = 42

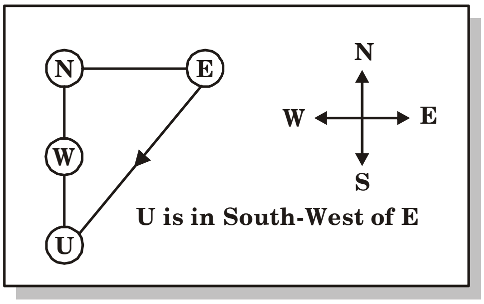
37. (D) Except option (D) remaining all prime numbers.

38. (B) In the given pattern alternates between adding letters at the beginning and the end of the word follwoing this logic, adding "P" to the beginning of "leter" completes the sequence.

39. (C) 2, 5, 3, 1, 4

40. (D) 2 × 5 – 6 + 2 = 6

41. (C)



42. (D) 3 + 6 = 9 (Right to left)

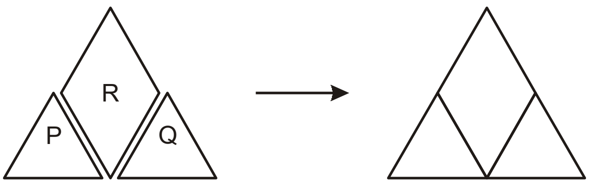
Now 9th from the right (i.e., 9th from left in original) is I which is given in option (D).

43. (C) 6 8 5 3 4 9

A M O E B A

Hence the answer is option (C).

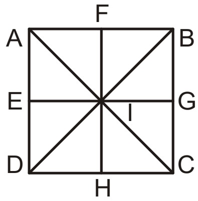
44. (B)



Hence the correct option is (B)

i.e., P Q R

45. (D)



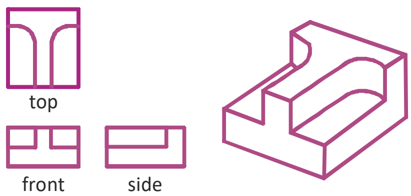
There are 16 triangles in the given figure.

1. AFI	2. BFI	3. BGI	4. CGI
5. CHI	6. DHI	7. DEI	8. AEI
9. ABI	10. BCI	11. CDI	
12. ADI	13. ABC	14. BCD	
15. CDA	16. ABD		

CRITICAL THINKING

46. (C) The shortest person is S from the given information, R is the third tallest and S is shorter than both T and Q, making S the shortest among all

47. (D)



48. (D) Area 2, 3, 4 rep healthy people

Area 5, 3, 4 rep old person

Area 2, 4 rep men

Therefore Area 2 represent healthy men but not old person.

49. (B) The digit 0 appears 5 times in the page numbers (10, 20, 30, 40, 50)

The digit 8 appears 6 times in the page numbers (8, 18, 28, 38, 48, 58)

50. (A) The assertion is true because no life exists on the moon due to its lack of an atmophere. The reason is also correct, as the moons atmosphere is too thin to support life, unlike earth's atmosphere, which is essential for sustaining life.

∴ Both Assertion and Reason are true and Reason is correct explantion of Assertion.