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Unified International Mathematics Olympiad

UNIFIED INTERNATIONAL MATHEMATICS OLYMPIAD (UPDATED)

CLASS - 8

Question Paper Code : 4O119

KEY

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A	D	A	C	B	A	D	D	C	C
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A	A	C	A	B	C	D	D	C	B
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
C	B	D	D	A	B	D	A	D	C
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
A,B,C	B,C,D	A,B,C,D	A,B,C	B,C,D	C	B	B	C	B
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EXPLANATIONS

MATHEMATICS

01. (A) Given $\sqrt{l^2+b^2+h^2}=27\text{cm}$

$\Rightarrow \sqrt{l^2+(10\text{cm})^2+(10\text{cm})^2}=27\text{cm}$

squaring on both sides

$l^2 + 100\text{cm}^2 + 100\text{cm}^2 = 729\text{cm}^2$

$\therefore l^2 = 529\text{cm}^2 = (23\text{cm})^2$

$\therefore l = 23\text{cm}$

02. (D) Area of shaded region = Area of quadrant

$$= \frac{\cancel{90^\circ}^{1}}{\cancel{360^\circ}\,\cancel{4}\,_{2_1}} \times \frac{\cancel{22}^{11}}{\cancel{7}\,1} \times \cancel{42}^{6^3} \times 42\ \text{cm}^2$$

$= 1386\ \text{cm}^2$

Area of unshaded region = Area of rectangle – Area of shaded region

$= 42\ (42 + 21)\ \text{cm}^2 - 1386\text{cm}^2$

$= 1260\ \text{cm}^2$

03. (A) Given $a^3 = 6a^2$

$\Rightarrow$ a = 6 units.

04. (C) $\frac{\left(21x^2+\sqrt{5}x-10\right)}{3x+\sqrt{5}} = \frac{21x^2+7\sqrt{5}x-6\sqrt{5}x-10}{3x+\sqrt{5}}$

$= \frac{7x(3x+\sqrt{5})-2\sqrt{5}(3x+\sqrt{5})}{(3x+\sqrt{5})}$

$= \frac{\cancel{(3x+\sqrt{5})}(7x-2\sqrt{5})}{\cancel{(3x+\sqrt{5})}}$

$= (7x-2\sqrt{5})$

05. (B) Curved surface area of cylinder = 264 cm²

$\Rightarrow 2\pi rh = 264 \Rightarrow \pi rh = 132$

Volume of cylinder = 462 cm³

$\Rightarrow \pi r^2 h = 462 \Rightarrow \pi rh \times r = 462$

$\Rightarrow 132 \times r = 462$ (Using (i))

$\Rightarrow r = \frac{462}{132} = 3.5\text{cm}$

$\therefore$ Diameter of cylinder

= 2 × r = 2 × 3.5 = 7 cm

06. (A) Length of each side of the field

$= \sqrt{80\frac{244}{729}} = \sqrt{\frac{58564}{729}}$

$= \frac{242}{27} = 8.96\,\text{m}$

07. (D) Given $\left(\frac{1}{x}\right)^2 = \frac{1}{2.25} \times \frac{1}{6.25}$

$x^2 = (1.5)^2 \times (2.5)^2$

$x^2 = (1.5 \times 2.5)^2$

$x^2 = (3.75)^2 \Rightarrow x = 3.75$

08. (D) LHS = 8×4^{2026}

$= 2^3 \times (2^2)^{2026}$

$= 2^3 \times 2^{4052} = 2^{4055}$

09. (C) $(6x+7)(2x+3) = (4x+5)(3x+2)$

$12x^2 + 18x + 14x + 21$

$= 12x^2 + 8x + 15x + 10$

$9x = -11 \Rightarrow x = -\frac{11}{9}$

10. (C) Let cost price be ₹ 100. Then M.P. is ₹ 130. After discount of $6\frac{1}{4}\%$ the S.P. is

$₹130\left(\frac{93.75}{100}\right)$

= ₹121.875

$\text{Gain\%} = \frac{\text{S.P.} - \text{C.P.}}{\text{C.P.}} \times 100\ \%$

$\Rightarrow \text{Gain\%} = \frac{121.875 - 100}{100} \times 100\%$

= 21.875 %

11. (A) $25920 = 2^6 \times 3^4 \times 5$

25920 is to be divided by 3 × 5

i.e., 15 to make a perfect cube

12. (A) SP of first cycle = Rs. 1188

Profit = 30%

$\therefore \frac{\text{CP}(100+\text{P})}{100} = \text{SP}$

$\frac{\text{CP}(100+10)}{100} = \text{Rs.}1188$

$\text{CP} \times \frac{11}{10} = \text{Rs. } 1188$

$\therefore$ CP of first cycle (CP_1)

$= \frac{\text{Rs.}1188 \times 10}{11} = \text{Rs.}1080$

SP of second cycle = Rs. 1188

$\therefore \frac{\text{CP}(100-l)}{100} = \text{Rs.}1188$

$\frac{\text{CP}(100-10)}{100} = \text{Rs.}1188$

$\text{CP} \times \frac{70}{100} = 1188$

$\text{CP} = 1188 \times \frac{10}{9} = \text{Rs.}1320$

Total SP = Rs. 1080 + Rs. 1320 = Rs. 2400

Total CP = 2 × Rs. 1188 = Rs. 2376

Total less = 2400 – 2376 = 24

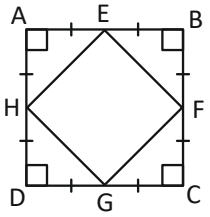
Total loss % = $\frac{24}{2400} \times 100 = 1\%$

13. (C) $x^2+4+\frac{1}{x^2-4}=\frac{x^4-16+1}{x^2-4}$

$=\frac{x^4-15}{x^2-4}$

14. (A) $\Delta AEH \simeq \Delta BEF$ [$\because$ SAS Congruency]

$\therefore$ EH = EF [$\because$ CPCT]



Similarly we can prove

EF = FG = GH and EG = HF

[$\because$ side of a square]

$\therefore$ EFGH is a square

15. (B) Let the height of the building be x metres. Less the length of shadow, less is the height.

$\therefore$ 40.25 : 28.75 : : 17.5 : x

$\Rightarrow$ 40.25 × x = 28.75 × 17.5

$\Rightarrow x = \frac{28.75 \times 17.5}{40.25} \Rightarrow x$ = 12.5 m

16. (C) Given $a^2 = 9x^2 - 24x + 16$

$= (3x)^2 - 2(3x)(4) + 4^2$

$= (3x - 4)^2$

$\therefore$ a = $(3x - 4)$ units

Perimeter = 4a = $4(3x - 4)$ units

= $(12x - 16)$ units

17. (D) $\sqrt{1^3+2^3+3^3+4^3+5^3+6^3}$

$=\sqrt{1+8+27+16+125+216}$

$=\sqrt{441}$ = 21

18. (D) Given $\sqrt[3]{x+3}=24$

Cubing on both sides

$\left(\sqrt[3]{x+3}\right)^3=24^3$

x + 3 = 13824

x = 13824 − 3 = 13821

19. (C) Maximum area grazed by houses

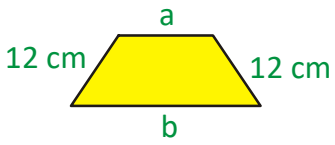
$= \frac{x}{360^\circ}\times\pi r^2+\frac{4}{360^\circ}.\pi r^2+\frac{z}{360^\circ}\pi r^2$

$=\frac{\pi r^2}{360^\circ}[x+y+z]$

$=\frac{\frac{22}{7}\times 7\times 7cm^2}{360^\circ}\times 180^\circ$

= 77 m^2

20. (B) Given a + 12 cm + 12 cm + b = 52 cm



a + b = 52 cm − 24 cm = 28 cm

Given h = 8 cm

Area of trapezium $=\frac{1}{2}h(a+b)$

$=\frac{1}{2}\times 8cm\times 28cm$ = 112 cm^2

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

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

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

22. (B) It is in inverse proporsion

$\therefore x_1y_1 = x_2y_2$

700 × 54 = (700 + 200) × y_2

$y_2 = \frac{700\times 54}{900}$ = 42 days.

23. (D) $2^3\times 2^{\frac{1}{3}} = 2^{3n}$

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

$3n = \frac{10}{3}$

$n = \frac{10}{3}\times\frac{1}{3}=\frac{10}{9}$

24. (D) Next perfect square after x is

$\left(x+2\sqrt{x}+1\right)$

25. (A) Given $2(l + b) = 98$ cm

$l + b = 49$ cm and $lb = 360$ cm^2

s.o.b.s

$(l + b)^2 = 492$

$l^2 + b^2 + 2lb = 2401$

$l^2 + b^2 + 2\times 360 = 2401$

$l^2 + b^2 = 1681$

Taking square root on both sides

$\sqrt{l^2+b^2} = \sqrt{1681} = 41$ cm

$\therefore$ Diagonal = 41 cm

26. (B) Given $2(l + b) = 40$ cm

$l + b = \frac{40}{2}$ cm

13 cm + b = 20 cm

b = 20 cm – 13 cm = 7 cm

$\therefore$ Volume = lbh

$= 13 \times 7 \times 8$ cm$^3 = 728$ cm^3

27. (D) LCM of 48, 24, 32, 16 & 12 = 96

$\therefore \quad \frac{-19}{48}=\frac{-15}{48}\times\frac{2}{2}=\frac{-38}{96}$

$\frac{-13}{24}=\frac{-13}{24}\times\frac{4}{4}=\frac{-52}{96}$

$\frac{-13}{32}=\frac{-17}{32}\times\frac{2}{3}=\frac{-53}{96}$

$\frac{-9}{16}=\frac{-9}{16}\times\frac{6}{6}=\frac{-54}{96}$

$\frac{-7}{12}=\frac{-7}{12}\times\frac{8}{8}=\frac{-56}{96}$

$\frac{-38}{96}>\frac{51}{96}>\frac{-52}{96}>\frac{-54}{96}$

$>-\frac{56}{96}$

i.e. $\frac{-19}{48}>\frac{-17}{32}>\frac{-13}{24}>\frac{-9}{16}>\frac{-7}{12}$

28. (A) $\sqrt{11^3+12^3-23^3+12\times23\times33}$

$= \sqrt{1331+1728-12167+9108}$

$= \sqrt{12167-12167}$

$= \sqrt{0} = 0$

29. (D) $\frac{1}{x-2}-\frac{2}{x(x-1)(x-2)}$

$= \frac{x(x-1)-2}{x(x-1)(x-2)}$

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

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

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

30. (C) $1 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + ... + 15^2 - 16^2 + 17^2$

$= (1 - 2)(1 + 2) + (3 - 4)(3 + 4) + (5 - 6)(5 + 6) + ... + (15 - 16)(15 + 16) + 17^2$

$= (-1)(1 + 2) + (-1)(3 + 4) + (-1)(5 + 6) + ... + (-1)(15 + 16) + 17^2$

$= -1 \times 136 + 289 = 153$

MATHEMATICS -2

31. (A,B,C) Sum of rational numbers is also a rational number.

Difference of two rational numbers is also a rational number.

Product of two rational numbers is also a rational number.

But divison of a rational and a non zero rational number is also a rational number.

32. (B,C,D)

Except zero all values of 'x' the given equation is true.

33. (A,B,C,D)

$\sqrt{90601} = 301, \sqrt{89401} = 299$

$\sqrt{54756} = 234, \sqrt{39204} = 198$

34. (A,B,C)

$-512 = (-8)^3$, $-1331 = (-11)^3$,

$-343 = (-7)^3$, $-243 = (-3)^5$

35. (B,C,D)

$\sqrt[3]{-27} = -3$ is a rational number

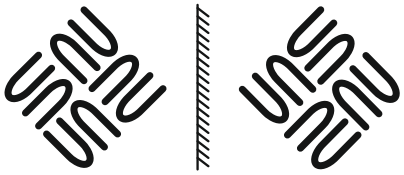
$\sqrt{1} = 1$ is a rational number

$0.232323\ldots\ldots = 0.\overline{23}$ which can be written in $\frac{p}{q}$ form

$\therefore$ 0.232323 .... is also a rational number.

REASONING

36. (C) In a cube, each face has 4 adjacent faces. The face not seen with face 1 must be opposite to it. Since 2, 3, 4, and 5 are adjacent to 1, the only number not adjacent is 6, which is opposite to 1.

37. (B) 

38. (B) $14 \times 2 + 6 \div 2 - 4$

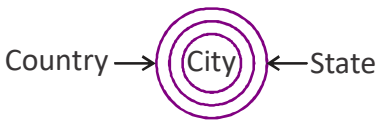
$= 28 + 3 - 4$

$= 31 - 4 = 27$

39. (C) The first, second, third, fourth, fifith and sixth letters of the word respectively moved two, three, four, five, six and seven steps forward to obtain the corresponding letters of the code.

40. (B) Explanation: Here, State comes under Country and City comes under State.

Hence, the diagram will be:



41. Delete

42. (A) Calendars repeat after 6 or 11 years depending on leap year cycle.

2025 - 2031 is 6 years and matches.

43. (D) 

44. (C) In both the pairs, from first to second pair the inner polygon is increased by one side and becomes shaded.

45. (B) 2 =  , 6 = 

CRITICAL THINKING

46. (B) We know from the first two statements that Lily runs fastest. Therefore, the third statement must be false.

47. (D) Nagesh breaks 2 complete strips = 12 squares, so

1 strip = 6 squares.

John breaks 1 complete strip = 9 squares.

This means the chocolate bar originally had 6 squares along one side and 9 along the other, so

Total squares = $6 \times 9 = 54$.

Squares eaten = $12 + 9 = 21$

Squares left = $54 - 21 = 45$

48. (D) Bunny likes only apples, so Bunny must get apples. Esha likes apples and cherries, but apples are already taken by Bunny, so Esha gets cherries. (Other fruits can be shared among the remaining people accordingly.)Therefore, Esha gets the cherries.

49. (B) 

50. Delete