IMO

CLASS 12

SAMPLE PAPER

SECTION I : LOGICAL REASONING

1. If the numbers from 1 to 45 which are exactly divisible by 3 are arranged in descending order, which would come at the ninth place from the right end ?

(A) 18 **(B)** 21 **(C)** 24 **(D)** 27

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2. In a certain code language, 'dom pul ta' means 'bring hot food', 'pul tir sop' means 'food is good' and 'tak da sop' means 'good bright boy'. Which of the following means 'hot' in that language ?

(A) dom **(B)** pul **(C)** ta **(D)** Cannot be determined

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3. If the positions corresponding to the multiples of 5 in the English alphabet are replaced by symbols and that of multiples of 7 by digits, how many letters will be left ?

(A) 15 **(B)** 17 **(C)** 18 **(D)** 21

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4. Rohit walked 25 metres towards South. Then he turned to his left and walked 20 metres. He then turned to his left and walked 25 metres. He again turned to his right and walked 15 metres. At what distance is he from the starting point and in which direction ?

(A) 35 metres East **(B)** 35 metres North **(C)** 40 metres East **(D)** 60 metres East

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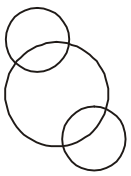
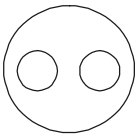
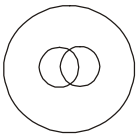
5. Which one of the given Venn diagram correctly illustrate relationship among the following : "Factory, Machinery, Product" ?

(A)  **(B)**  **(C)**  **(D)** None of these

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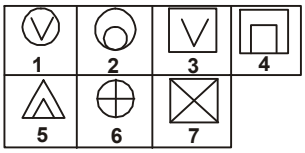
6. In the given figure set, group the figures into three classes using each figure only once.

Figure Set



(A) 1, 2, 6; 3, 4, 7; 5 **(B)** 1, 3; 2, 6; 4, 5, 7 **(C)** 1, 2, 6, 7; 3; 4, 5 **(D)** 1, 3; 2, 4, 5; 6, 7

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7. The position of how many letters in the word BRAKES remains unchanged when they are arranged in alphabetical order ?

(A) One **(B)** Two **(C)** Three **(D)** More than three

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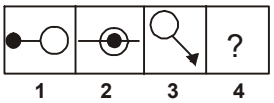
8. In the given question, figures 1, 2, 3 and 4 constitute the Problem Set. There is a definite relationship between figures 1 and 2. Establish a similar relationship between figures 3 and 4 by selecting a suitable figure from the options that would replace the question mark (?) in Fig. (4).

Problem Set



(A)  **(B)**  **(C)**  **(D)** 

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9. Consider the following series :
A B C D ..... X Y Z | Y X .... BA | BCD .... YZ | YX .... CBA | BC .... YZ ...
Which letter occupies the 1000th position in the above series ?

(A) B **(B)** C **(C)** X **(D)** Y

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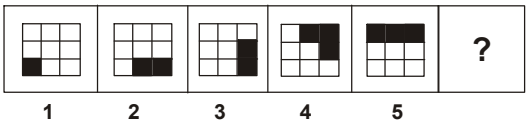
10. The given question consists of five figures marked 1, 2, 3, 4 and 5 called the Problem Figures. Select the figure from amongst the options, which will continue the same series as established by the five Problem Figures.

Problem Figures



(A)  **(B)**  **(C)**  **(D)** 

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11. If 453945 stands for DECIDE, then 8978 stands for ____.

(A) BHEE **(B)** CDEH **(C)** GHEE **(D)** HIGH

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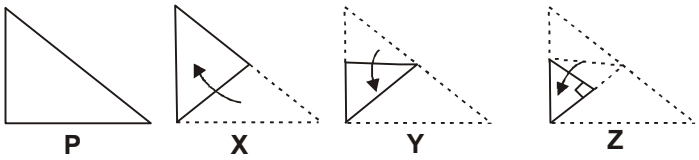
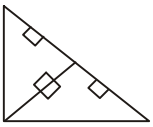
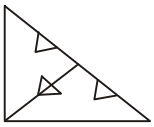
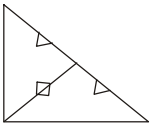
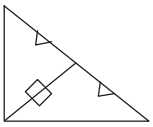
12. The given question consists of a set of four figures P, X, Y and Z showing a sequence of folding of a piece of paper. Fig. (Z) shows the manner in which the folded paper has been cut. Choose a figure which would most closely resemble the unfolded form of Fig. (Z).



(A)  **(B)**  **(C)**  **(D)** 

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13. Pointing to Kapil, Shilpa said, "His mother's brother is the father of my son Ashish". How is Kapil related to Shilpa?

(A) Sister-in-law **(B)** Nephew **(C)** Niece **(D)** Aunt

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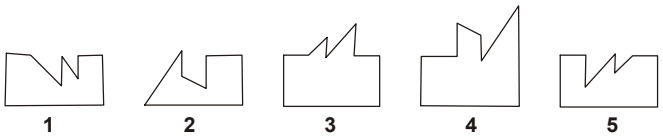
14. In the following question, five figures marked 1, 2, 3, 4, and 5 are given. From these five figures, we can get two pairs of figures such that each pair forms a complete square. You have to select the odd figure which does not fit into any of the other figures to form a complete square.



(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

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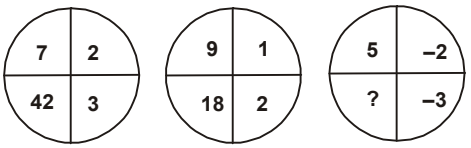
15. In the following question, a set of figures carrying certain characters is given. Assuming that the characters in each set follow a similar pattern, find the missing character.



(A) – 30 **(B)** 13 **(C)** 18 **(D)** 30

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16. In the following question, find out which of the figures (A), (B), (C) and (D) is a rearrangement of the parts of the given Fig. (X).

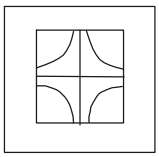
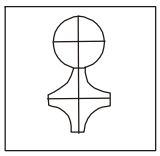
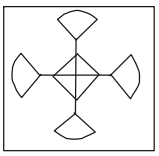
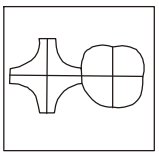
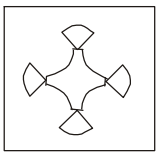


Fig. (X)

(A)  **(B)**  **(C)**  **(D)** 

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17. The given question contains four Problem Figures marked as 1, 2, 3 and 4. Select a figure from amongst the options which will continue the series established by the four Problem Figures.

Problem Figures

(A)  **(B)**  **(C)**  **(D)** 

DIRECTION (18-20) : $\times$ stands for 'greater than'; © stands for 'not less than' ; $\div$ stands for 'not equal to''; ϕ stands for 'equal to'; + stands for 'not greater than'; Δ stands for 'less than'.
Using these symbols, choose the correct alternative in each of the following questions.

18. If a © b × c, it implies that

(A) a © b ϕ c **(B)** a Δ b © c **(C)** a © c + b **(D)** c × b × a

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19. If a × b Δ c, it follows that

(A) c + b © a **(B)** a © b + c **(C)** b © a × c **(D)** a ϕ c Δ b

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20. If a Δ b Δ c, it does not imply that

(A) a × c × b **(B)** a Δ c × b **(C)** c × b × a **(D)** b × a Δ c

SECTION II : MATHEMATICAL REASONING

21. Let A, B and C be three mutually independent events. Consider the two statements S_1 and S_2.
S_1 : A and $B \cup C$ are independent.
S_2 : A and $B \cap C$ are independent.
Then

(A) Both S_1 and S_2 are true **(B)** Only S_1 is true
(C) Only S_2 is true **(D)** Neither S_1 nor S_2 is true

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22. The equations to a pair of opposite sides of parallelogram are $x^2 - 5x + 6 = 0$ and $y^2 - 6y + 5 = 0$. **The equation to its diagonals are ___.**

(A) $x + 4y = 13$ and $y = 4x - 7$ **(B)** $4x + y = 13$ and $4y = x - 7$
(C) $4x + y = 13$ and $y = 4x - 7$ **(D)** $y - 4x = 13$ and $y + 4x = 7$

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23. If ω ($\neq 1$) is a cube root of unity, then $\begin{vmatrix} 1 & 1+i+\omega^2 & \omega^2 \\ 1-i & -1 & \omega^2-1 \\ -i & -i+\omega-1 & -1 \end{vmatrix} =$

(A) 0 (B) 1 (C) i (D) ω

24. If $f(x) = A \sin\left(\frac{\pi x}{2}\right) + B$, $f'\left(\frac{1}{2}\right) = \sqrt{2}$ and $\int_0^1 f(x)\,dx = \frac{2A}{\pi}$, then the constants A and B, respectively are ____.

(A) $\frac{\pi}{2}$ and $\frac{\pi}{2}$ (B) $\frac{2}{\pi}$ and $\frac{3}{\pi}$ (C) 0 and $-\frac{4}{\pi}$ (D) $\frac{4}{\pi}$ and 0

25. If A, B and C are three non-coplanar vectors, then $(A + B + C).((A + B) \times (A + C))$ equals

(A) 0 (B) $[A\ B\ C]$ (C) $2[A\ B\ C]$ (D) $-[A\ B\ C]$

26. Which of the following expressions is not true ?

(A) $\lim_{x \to \pi/2^+} \tan x = \infty$ (B) $\lim_{x \to \pi/2^-} \tan x = \infty$

(C) $\lim_{x \to \pi/2} \tan x = \infty$ (D) $\lim_{x \to \pi/2^+} \tan x$ does not exist

27. The domain of the function $\sqrt{\log(x^2 - 6x + 6)}$ is ____.

(A) $(-\infty, \infty)$ (B) $(-\infty, 3 - \sqrt{3}) \cup (3 + \sqrt{3}, \infty)$

(C) $(-\infty, 1] \cup [5, \infty)$ (D) $[0, \infty)$

28. Let u, v and w be vectors such that $u + v + w = \vec{0}$. If $|u| = 3$, $|v| = 4$ and $|w| = 5$, then the value of $u.v + v.w + w.u$ is ____.

(A) 47 (B) – 25 (C) 0 (D) 25

29. If p and q are the roots of $x^2 + px + q = 0$, then _____.

(A) $p = 1$ (B) $p = 1$ or 0 (C) $p = -2$ (D) $p = -2$ or 0

30. Three of the six vertices of a regular hexagon are chosen at random. The probability that the triangle with these three vertices is equilateral, equals ___.

(A) $\frac{1}{2}$ (B) $\frac{1}{5}$ (C) $\frac{1}{10}$ (D) $\frac{1}{20}$

31. Which one of the following curves cuts the parabola $y^2 = 4ax$ at right angles ?

(A) $x^2 + y^2 = a^2$ (B) $y = e^{-x/2a}$ (C) $y = ax$ (D) $x^2 = 4ay$

32. If the lengths of the sides of triangle are 3, 5 and 7, then the largest angle of the triangle is ___.

(A) $\frac{\pi}{2}$ (B) $\frac{5\pi}{6}$ (C) $\frac{2\pi}{3}$ (D) $\frac{3\pi}{4}$

33. The number of points of intersection of the two curves $y = 2 \sin x$ and $y = 5x^2 + 2x + 3$ is ___.

(A) 0 (B) 1 (C) 2 (D) ∞

34. If ω ($\neq 1$) is a cube root of unity and $(1 + \omega)^7 = \alpha + \beta\omega$, then α and β respectively are ____.

(A) 0, 1 (B) 1, 1 (C) 1, 0 (D) –1, 1

35. Let $0 < P(A) < 1$, $0 < P(B) < 1$ and $P(A \cup B) = P(A) + P(B) - P(A)P(B)$. Then

(A) $P(B/A) = P(B) - P(A)$ **(B)** $P(A' \cup B') = P(A') + P(B')$

(C) $P(A \cup B') = P(A)\,P(B)$ **(D)** $P(A / B) = P(A)$

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36. If $\lim\limits_{x \to 0} \dfrac{\sin px}{\tan 3x} = 4$, then value of p is ___.

(A) 6 **(B)** 9 **(C)** 12 **(D)** 4

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37. If $\sqrt{x} + \sqrt{y} = 1$, then $\dfrac{dy}{dx}$ at $\left(\dfrac{1}{4}, \dfrac{1}{4}\right)$ is ___.

(A) $\dfrac{1}{2}$ **(B)** 1 **(C)** –1 **(D)** 2

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38. The function $f(x) = x + \dfrac{4}{x}$ has ____.

(A) Local maxima at $x = 2$ and local minima at $x = -2$

(B) Local minima at $x = 2$, and local maxima at $x = -2$

(C) Absolute maxima at $x = 2$ and absolute minima at $x = -2$

(D) Absolute minima at $x = 2$ and absolute maxima at $x = -2$

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39. $\displaystyle\int_{-1}^{1} \frac{\sin x - x^2}{3 - |x|} dx =$

(A) 0 **(B)** $2\displaystyle\int_0^1 \frac{\sin x}{3 - |x|} dx$ **(C)** $\displaystyle\int_0^1 \frac{-2x^2}{3 - |x|} dx$ **(D)** $2\displaystyle\int_0^1 \frac{\sin x - x^2}{3 - |x|} dx$

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40. If a, b and c are in A.P. then the value of $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix}$ is ____.

(A) 3 **(B)** – 3 **(C)** 0 **(D)** None of these

SECTION III : EVERYDAY MATHEMATICS

41. A student gets 4 marks for a correct answer and 1 mark is deducted for a wrong answer. If she has done 80 questions in all and she has got only 240 marks. The correct answers she has attempted is

(A) 40 **(B)** 60 **(C)** 64 **(D)** Can't be determined

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42. A student has to obtain 33% of the total marks to pass. He got 125 marks and failed by 40 marks. The maximum marks are ____.

(A) 300 **(B)** 500 **(C)** 800 **(D)** 1000

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43. Out of a total of 120 musicians in a club, 5% can play all the three instruments – guitar, violin and flute. It so happens that the number of musicians who can play any two and only two of the above instruments is 30. The number of musicians who can play the guitar alone is 40. What is the total number of those who can play violin alone or flute alone?

(A) 30 **(B)** 38 **(C)** 44 **(D)** 45

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44. **Priyansh and his wife Priya appear in an interview for two vacancies at the same post. The probability of Priyansh's selection is $\frac{1}{7}$ and that of his wife Priya's selection is $\frac{1}{5}$. What is the probability that atleast one of them will be selected ?**

(A) $\frac{11}{35}$ **(B)** $\frac{1}{35}$ **(C)** $\frac{24}{35}$ **(D)** $\frac{2}{7}$

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45. **Each family in a locality has at most two adults, and no family has fewer than 3 children. Considering all the families together, there are more adults than boys, more boys than girls, and more girls than families. Then the minimum possible number of families in the locality is _____.**

(A) 4 **(B)** 5 **(C)** 2 **(D)** 3

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46. **A test has 50 questions. A student scores 1 mark for a correct answer, $-\frac{1}{3}$ for a wrong answer, and $-\frac{1}{6}$ for not attempting a question. If the net score of a student is 32, the number of questions answered wrongly by that student cannot be less than _____.**

(A) 6 **(B)** 12 **(C)** 3 **(D)** 9

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47. **A train 240 m long passed a pole in 24 seconds. How long will it take to pass a platform 650 m long?**

(A) 65 secs **(B)** 89 secs **(C)** 100 secs **(D)** 150 secs

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48. **10 men can complete a piece of work in 15 days and 15 women can complete the same work in 12 days. If all the 10 men and 15 women work together, in how many days will the work get completed ?**

(A) 6 **(B)** $6\frac{1}{3}$ **(C)** $6\frac{2}{3}$ **(D)** $7\frac{2}{3}$

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49. **Four men and three women are to be seated for a dinner such that no two women sit together and no two men sit together. Find the number of ways in which this can be arranged.**

(A) 144 **(B)** 72 **(C)** 36 **(D)** None of these

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50. **A ball is dropped from a height of 96 feet and it rebounds $\frac{2}{3}$ of the height it falls. If it continues to fall and rebound. Find the total distance that the ball can travel before coming to rest.**

(A) 240 ft **(B)** 360 ft **(C)** 480 ft **(D)** 290 ft

SPACE FOR ROUGH WORK

ANSWER KEYS

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