# SECTION I : LOGICAL REASONING

1. Which of the marked figures is embedded in the given fig. (X) ?

   (A) r

   (B) s

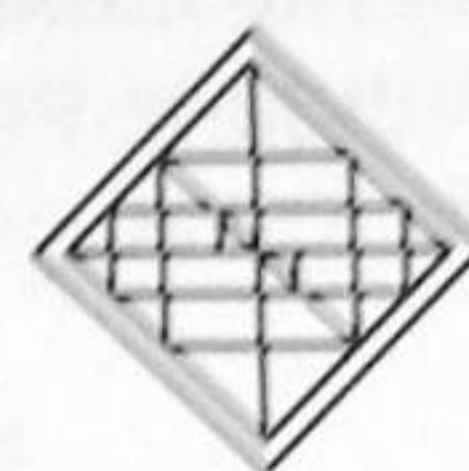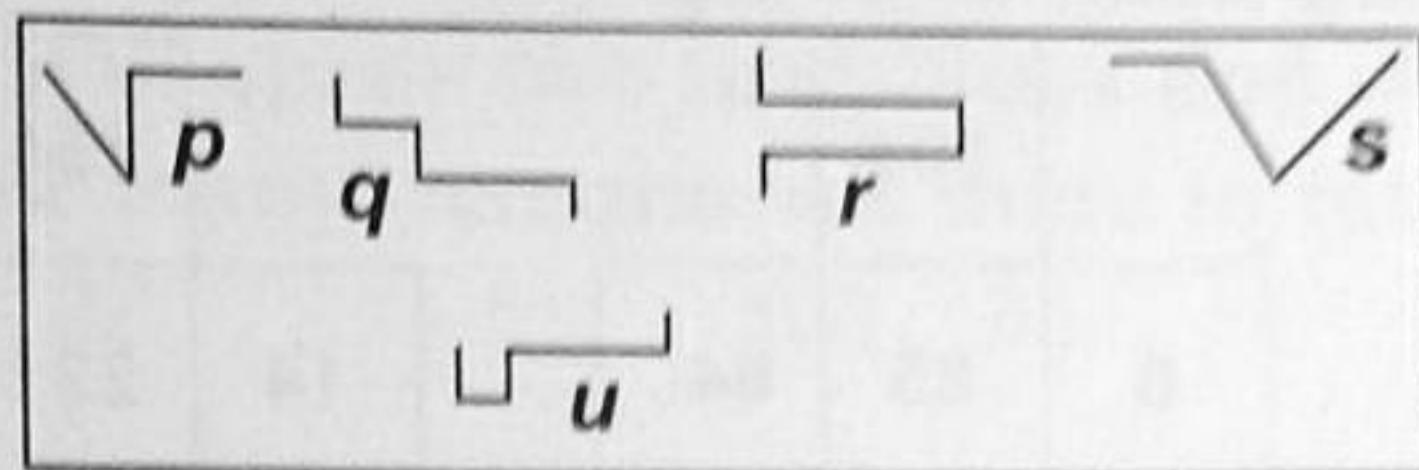   (C) p

   (D) All of these



Fig. (X)

2. A tailor had a number of shirt pieces to cut from a roll of fabric. He cut each roll of equal length into 10 pieces. He cut at the rate of 45 cuts a minute. How many rolls would be cut in 24 minutes?

   (A) 32 rolls      (B) 54 rolls      (C) 108 rolls      (D) 120 rolls

3. In an examination, six subjects were available for candidate of which only three had to be offered under the following conditions.
   One who offered A had to offer B also and vice versa.
   One who offered A could not offer E.
   One who offered C or D could not offer F.
   How many combinations were permitted ?

   (A) 4      (B) 5      (C) 6      (D) 7

4. If −means ÷, + means ×, ÷ means −, × means +, then which of the following equations is correct?

   (A) $52 \div 4 + 5 \times 8 - 2 = 36$

   (B) $43 \times 7 \div 5 + 4 - 8 = 25$

   (C) $36 \times 4 - 12 + 5 \div 3 = 420$

   (D) $36 - 12 \times 6 \div 3 + 4 = 60$

5. How many such numbers are there in the arrangement each of which is immediately preceded by a symbol but not immediately followed by a letter?

   ↑ 9 B Q = $ 2 5 R J ∂ L 3 @ Y M E 6 8 ★ ÷ D F 4 β H 7 ©

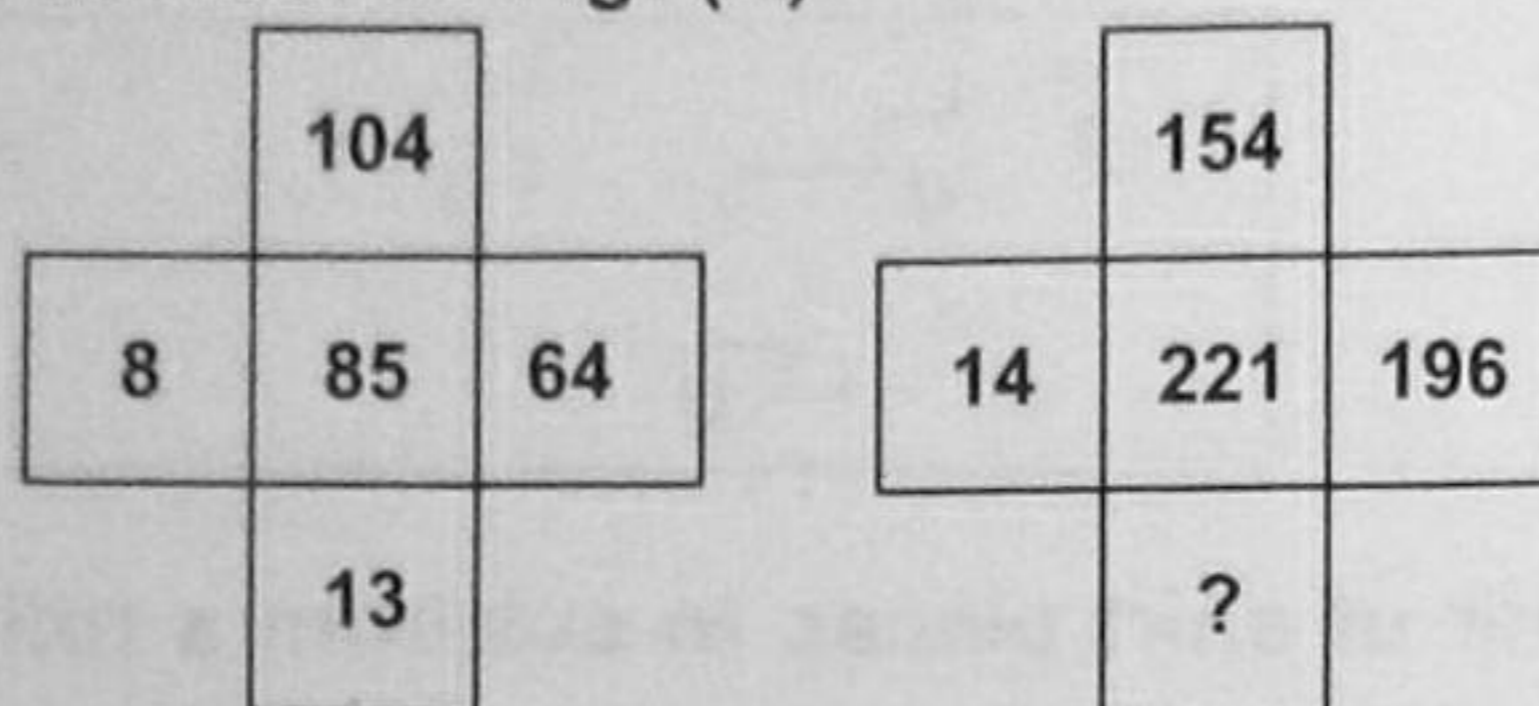   (A) Nil      (B) One      (C) Two      (D) Three

6. Find out which of the letter series follows the given rule : "Number of letters skipped in between adjacent letters in the series decreases by one each time."

   (A) BGKNPR      (B) CINRTU      (C) EJNQST      (D) LQUXAP

7. A, B, C and D are four friends who do not mind exchanging items. A had two chessboards each costing ₹ 500 and a record player. C originally had a cycle and a walkman. Each cricket bat costs ₹ 700. Both D and C got a cricket bat from B. A gave his record player costing ₹ 2000 to B. C got a camera costing ₹ 1500 from D. The cycle C had costs ₹ 1000 and the walkman costs ₹ 700. B had three cricket bats at the beginning and D had two cameras total cost of which is ₹ 5000. A gave one of his chessboards to C and took C's cycle. C gave his walkman to D. Who did not have a cricket bat at the end of exchange of items?

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

8. The numbers have been arranged according to the pattern shown in the given sample figure. Find the missing number in Fig. (X).

|   | 104 |   |
|---|-----|---|
| 8 | 85  | 64 |
|   | 13  |   |

Sample Figure

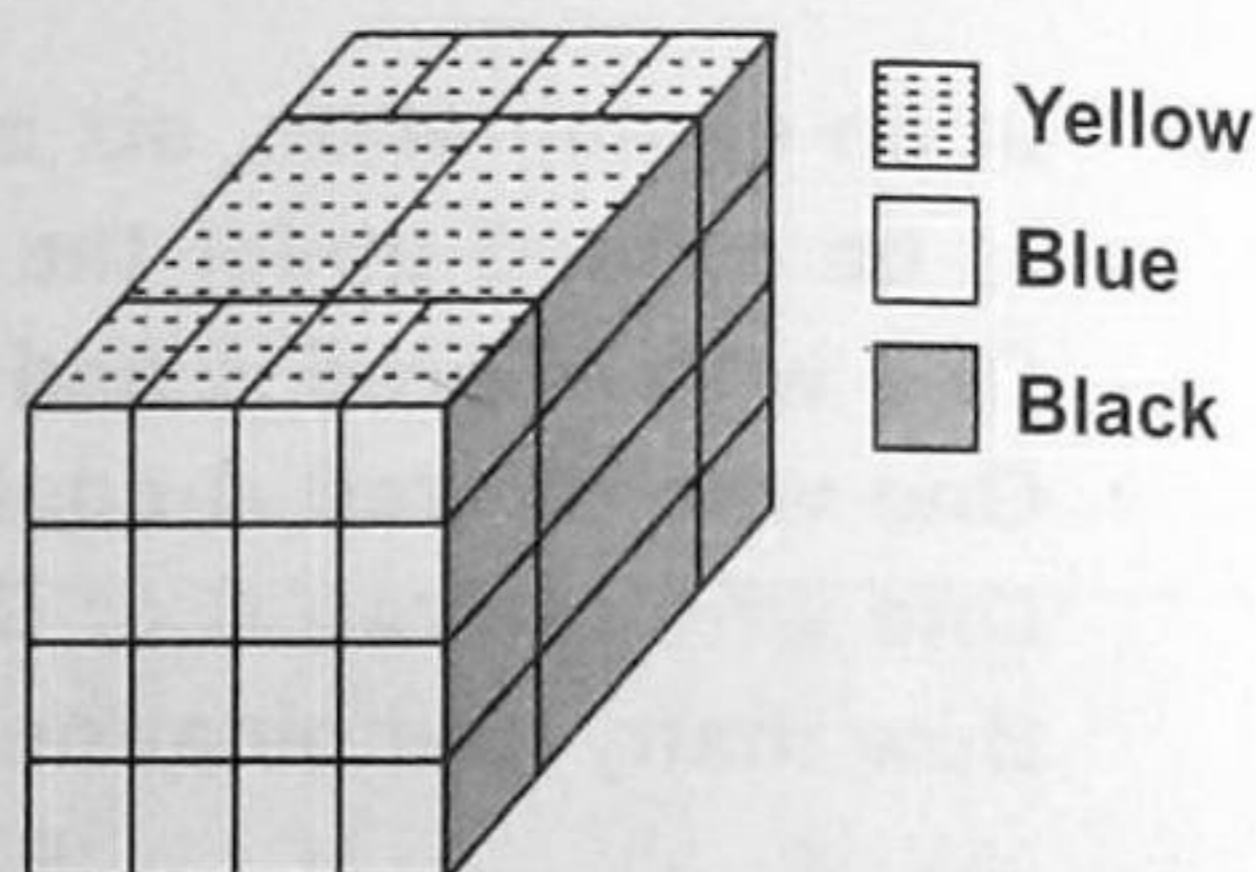|    | 154 |     |
|----|-----|-----|
| 14 | 221 | 196 |
|    | ?   |     |

Fig. (X)

(A) 11  (B) 13  (C) 15  (D) 17

9. A solid cube has been painted yellow, blue and black on pairs of opposite faces. The cube is then cut into 36 smaller cubes such that 32 cubes are of the same size while 4 others are of bigger size. Also no face of any of the bigger cubes is painted blue.
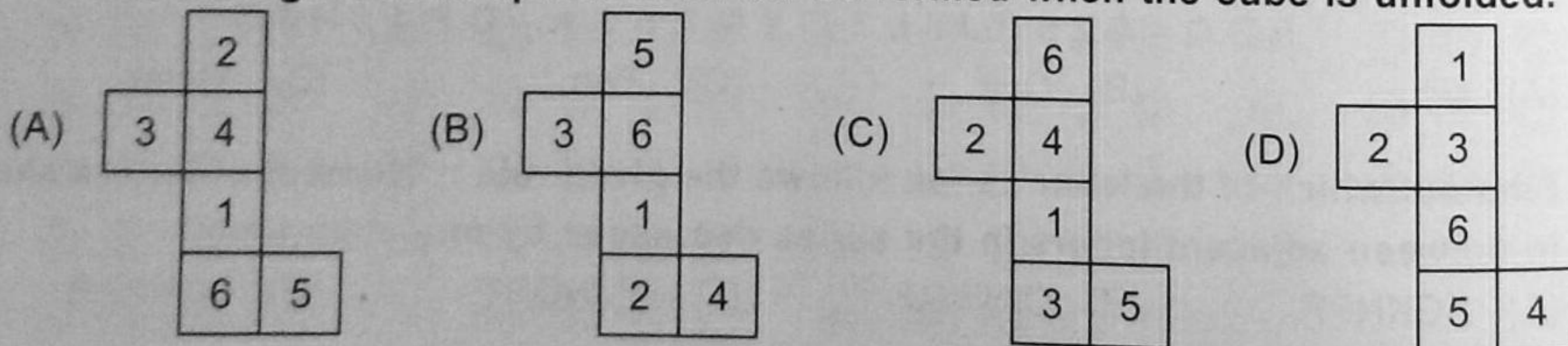How many cubes have at least one face painted blue?

(A) 0
(C) 16
(B) 8
(D) 32

Yellow
Blue
Black

10. The six faces of a cube have been marked with numbers 1, 2, 3, 4, 5 and 6 respectively. This cube is rolled down three times. The three positions are given in the figures below.

6 2 4   1 2 3   5 3 6
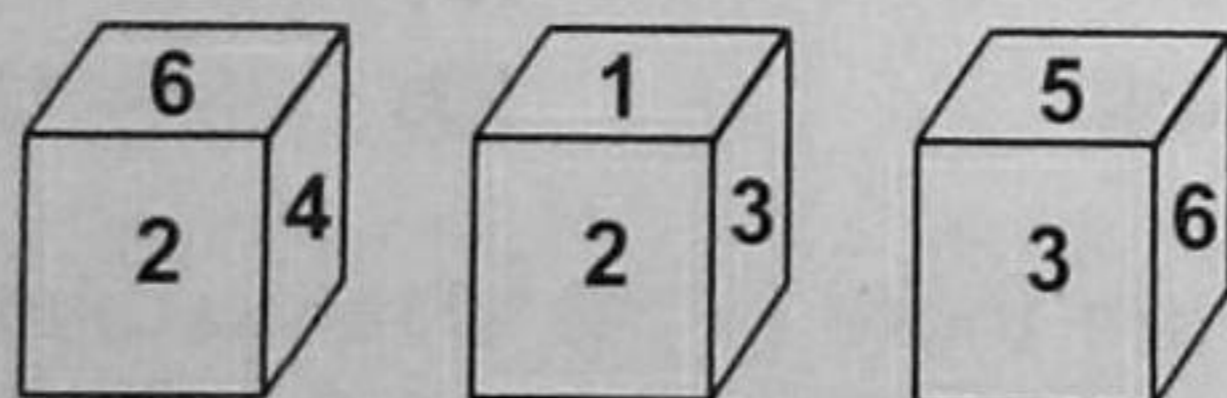
Choose the figure from options that will be formed when the cube is unfolded.

(A)
|   | 2 |   |
|---|---|---|
| 3 | 4 |   |
|   | 1 |   |
|   | 6 | 5 |

(B)
|   | 5 |   |
|---|---|---|
| 3 | 6 |   |
|   | 1 |   |
|   | 2 | 4 |

(C)
|   | 6 |   |
|---|---|---|
| 2 | 4 |   |
|   | 1 |   |
|   | 3 | 5 |

(D)
|   | 1 |   |
|---|---|---|
| 2 | 3 |   |
|   | 6 |   |
|   | 5 | 4 |

11. The sheet of paper shown in the figure (X) is folded to form a box. Choose a box/boxes that is/are similar to the box that will be formed.



Fig. (X)    (a)    (b)    (c)    (d)
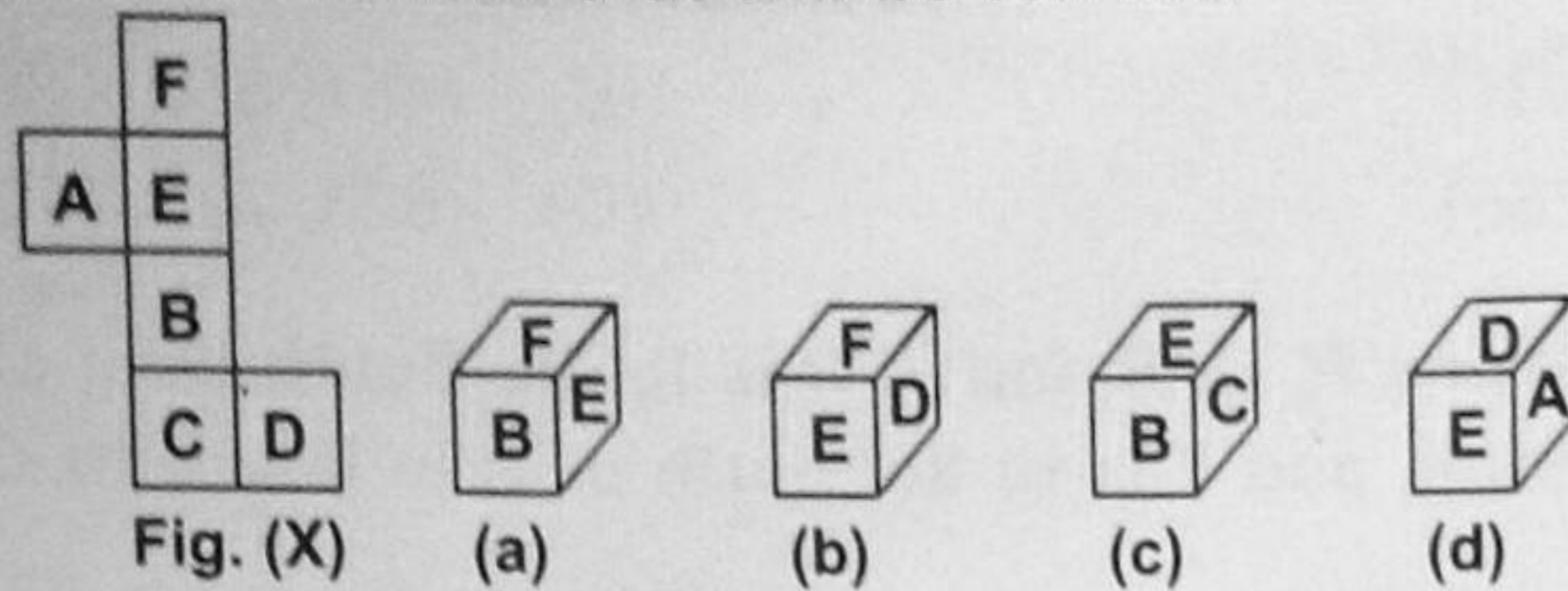
(A) a only              (B) b only              (C) a and c only        (D) a, b, c and d

12. In a group of persons travelling in a bus, 7 persons can speak French, 14 can speak Spanish and 6 can speak English. In that group, none can speak any other language. If 2 persons in the group can speak two languages and one person can speak all the three languages, then how many persons are there in the group?

(A) 21              (B) 22              (C) 23              (D) 24

13. The following question consists of a set of three figures 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 from the given options which would most closely resemble the unfolded form of Fig. (Z).



Fig. (X)        Fig. (Y)        Fig. (Z)

(A)          (B)          (C)          (D)
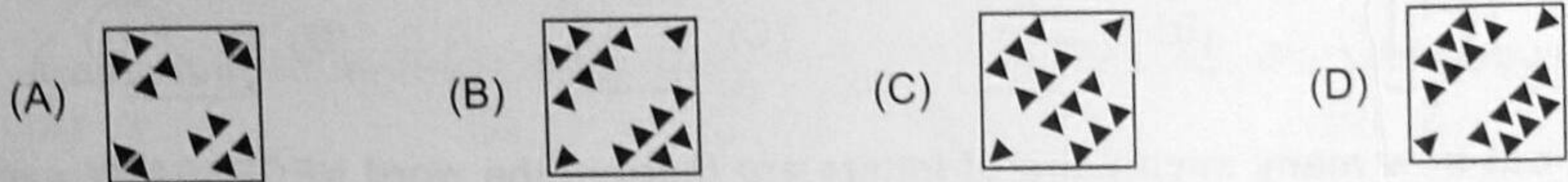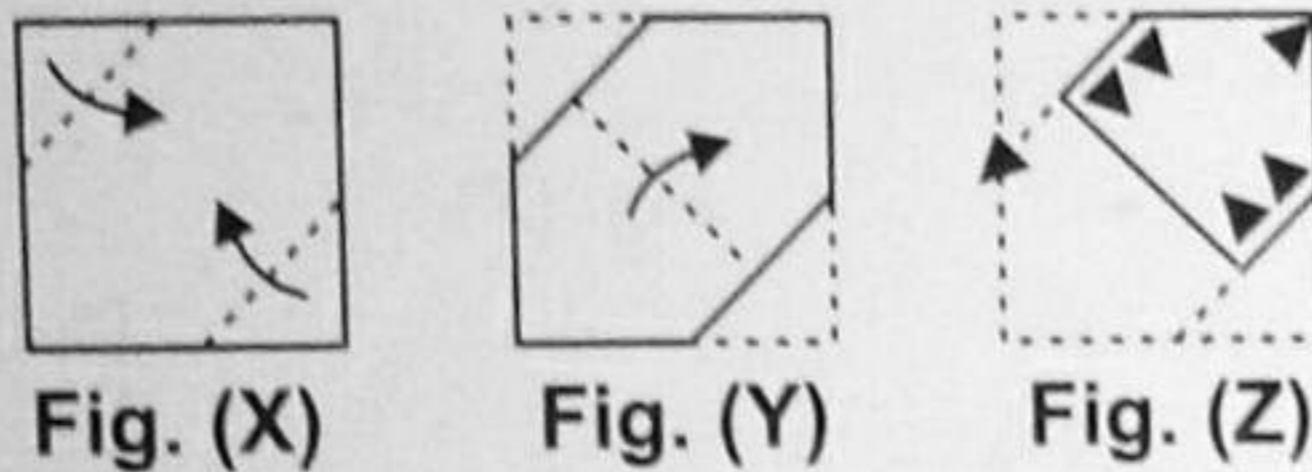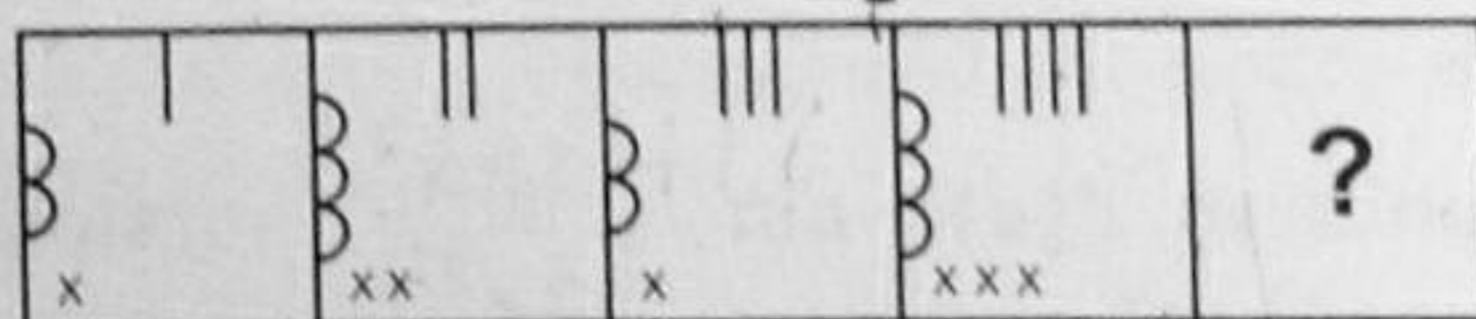
14. The relationship among the three words in the question can best be represented by one of the four diagrams given below. Choose the correct answer.

Nitrogen, Ice, Air

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

15. Select a figure from the options which will continue the series established by the four problem figures.

Problem Figures



?

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

16. Choose a set of numbers from the options that is similar to the given set.

(223, 324, 425)

(A) (225, 326, 437)

(B) (451, 552, 636)

(C) (554, 655, 756)

(D) (623, 723, 823)

17. There are four towns $P$, $Q$, $R$ and $T$. $Q$ is to the South-west of $P$, $R$ is to the east of $Q$ and South-east of $P$, and $T$ is to the north of $R$ in line with $QP$. In which direction of $P$ is $T$ located?

(A) South-east

(B) North

(C) North-east

(D) East

18. Consider the following series :

A B C D.....X Y Z | Y X ......B A | B C D......Y Z | Y X......C B A | B C......Y Z....

Which letter occupies the 1000$^{th}$ position in the above series ?

(A) B

(B) C

(C) X

(D) Y

19. Select the correct option which satisfies the same conditions of placement of dots as in Fig. (X).
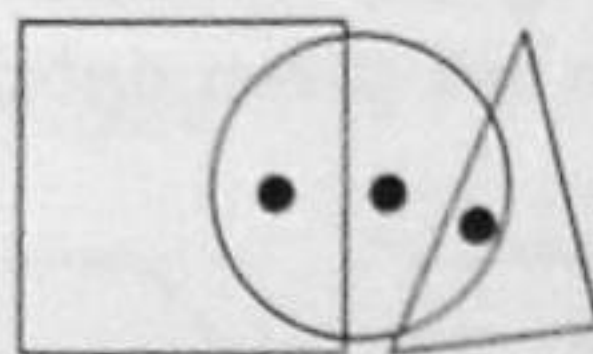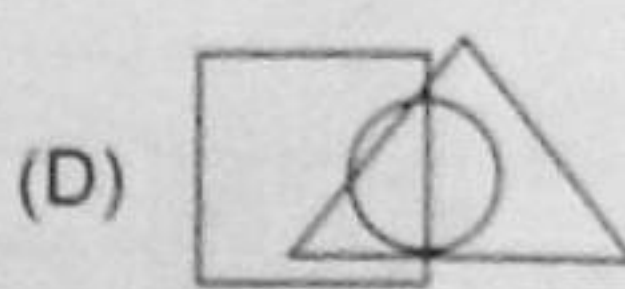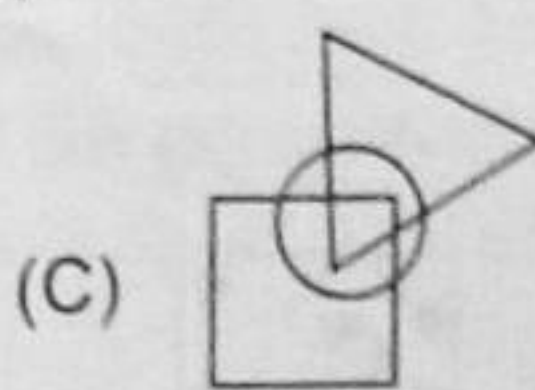


Fig. (X)



(A)

(B)

(C)

(D)
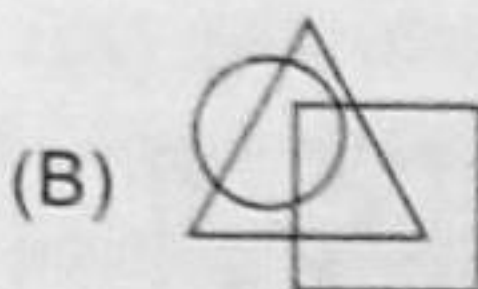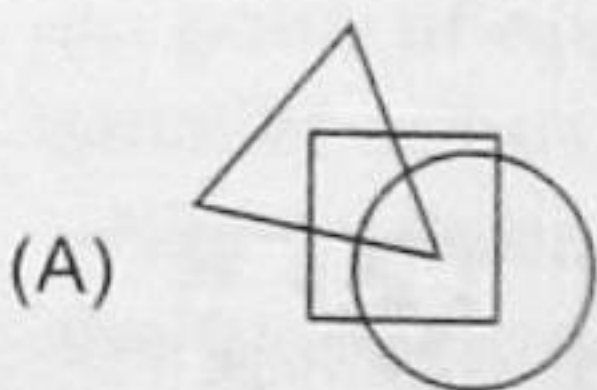
20. Find out how many such pairs of letters are there in the word NECESSARY each of which has as many letters between them in the word as in the English alphabets.

(A) Nil

(B) One

(C) Two

(D) Three

## SECTION II : MATHEMATICAL REASONING

21. If $y = \sin(\log_e x)$, then $x^2 \dfrac{d^2y}{dx^2} + x \dfrac{dy}{dx} =$

(A) $\sin(\log_e x)$

(B) $\cos(\log_e x)$

(C) $y^2$

(D) $-y$

22. The domain of the function, $f(x) = \sin^{-1}\left(\dfrac{1+x^3}{2x^{3/2}}\right) + \sqrt{\sin(\sin x)} + \log_{(3\{x\}+1)}(x^2 + 1)$, where $\{.\}$ represents fractional part function, is _____.

(A) $\{1\}$

(B) $R - \{1, -1\}$

(C) $x > 3, x \notin 1$

(D) None of these

23. If $f(x) = \begin{cases} \dfrac{\sqrt{1+px} - \sqrt{1-px}}{x}, & -1 \le x < 0 \\ \dfrac{2x+1}{x-2}, & 0 \le x < 1 \end{cases}$ is continuous in the interval $[-1, 1]$, then $p$ equals

(A) $-1$

(B) $-\dfrac{1}{2}$

(C) $\dfrac{1}{2}$

(D) $1$

24. The smallest positive root of the equation, $\tan x - x = 0$ lies in

(A) $\left(0, \dfrac{\pi}{2}\right)$

(B) $\left(\dfrac{\pi}{2}, \pi\right)$

(C) $\left(\pi, \dfrac{3\pi}{2}\right)$

(D) $\left(\dfrac{3\pi}{2}, 2\pi\right)$

25. If $A$ is a square matrix of order $n \times n$ and $k$ is a scalar, then adj $(kA)$ is equal to

(A) $k$ adj$A$

(B) $k^n$ adj$A$

(C) $k^{n-1}$ adj$A$

(D) $k^{n+1}$ adj$A$

26. Let $A$, $B$, $C$ be three events. If the probability of occurring exactly one event out of $A$ and $B$ is $1 - a$, out of $B$ and $C$ is $1 - 2a$, out of $C$ and $A$ is $1 - a$ and that of occurring three events simultaneously is $a^2$, then the probability that at least one out of $A$, $B$, $C$ will occur is

(A) $1/2$

(B) Greater than $1/2$

(C) Less than $1/2$

(D) Greater than $3/4$

27. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ are linearly dependent vectors and $|\vec{c}| = \sqrt{3}$, then

(A) $\alpha = 1, \beta = -1$

(B) $\alpha = 1, \beta = \pm 1$

(C) $\alpha = -1, \beta = \pm 1$

(D) $\alpha = \pm 1, \beta = 1$

28. Area bounded by the curve $y^2 = 16x$ and line $y = mx$ is $2/3$, then $m$ is equal to

(A) $3$

(B) $4$

(C) $1$

(D) $2$

29. A box contains 6 nails and 10 nuts. Half of the nails and half of the nuts are rusted. If one item is chosen at random, the probability that it is rusted or is a nail is

(A) $\dfrac{3}{16}$

(B) $\dfrac{5}{16}$

(C) $\dfrac{11}{16}$

(D) $\dfrac{14}{16}$

30. $\int x\{f(x^2)g''(x^2) - f''(x^2)g(x^2)\}\, dx$ is equal to

(A) $f(x^2)g'(x^2) - g(x^2)f'(x^2) + c$

(B) $\dfrac{1}{2}\{f(x^2)g'(x^2)f'(x^2)\} + c$

(C) $\dfrac{1}{2}\{f(x^2)g'(x^2) - g(x^2)f'(x^2)\} + c$

(D) $f(x^2)g(x^2)f'(x^2) + c$

31. The length of the perpendicular from the origin to the plane passing through the point $\vec{a}$ and containing the line $\vec{r} = \vec{b} + \lambda\vec{c}$, is _____.

(A) $\dfrac{[\vec{a}\vec{b}\vec{c}]}{|\vec{a}\times\vec{b} + \vec{b}\times\vec{c} + \vec{c}\times\vec{a}|}$

(B) $\dfrac{[\vec{a}\vec{b}\vec{c}]}{|\vec{a}\times\vec{b} + \vec{b}\times\vec{c}|}$

(C) $\dfrac{[\vec{a}\vec{b}\vec{c}]}{|\vec{b}\times\vec{c} + \vec{c}\times\vec{a}|}$

(D) $\dfrac{[\vec{a}\vec{b}\vec{c}]}{|\vec{c}\times\vec{a} + \vec{a}\times\vec{b}|}$

32. If $\cos^{-1} p + \cos^{-1} q + \cos^{-1} r = \pi$, then $p^2 + q^2 + r^2 + 2pqr$ is equal to

(A) 3       (B) 1       (C) 2       (D) −1

33. For any four points $P$, $Q$, $R$ and $S$; $|\overrightarrow{PQ} \times \overrightarrow{RS} - \overrightarrow{QR} \times \overrightarrow{PS} + \overrightarrow{RP} \times \overrightarrow{QS}|$ is equal to 4 times the area of the triangle _____.

(A) PQR       (B) QSR       (C) PRS       (D) PQS

34. One hundred identical coins, each with probability $p$ of showing up heads, are tossed. If $0 < p < 1$ and the probability of heads showing on 50 coins is equal to that of heads showing on 51 coins, then the value of $p$ is

(A) $\dfrac{1}{2}$       (B) $\dfrac{49}{101}$       (C) $\dfrac{50}{101}$       (D) $\dfrac{51}{101}$

35. If $A$ and $B$ are independent events such that $P(A) > 0$, $P(B) > 0$, then

(A) $A$ and $B$ are mutually exclusive

(B) $A$ and $\bar{B}$ are dependent

(C) $\bar{A}$ and $B$ are dependent

(D) $P(A/B) + P(\bar{A}/B) = 1$

36. The slope of the tangent to the curve $\tan y = \dfrac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}$ at $x = \dfrac{1}{2}$ is

(A) $\dfrac{1}{\sqrt{3}}$       (B) $\sqrt{3}$       (C) 1       (D) $\dfrac{1}{2}$

37. Let $f(x) = \displaystyle\int \dfrac{x^2 dx}{(1+x^2)(1+\sqrt{1+x^2})}$ and $f(0) = 0$, then $f(1)$ is

(A) $\log(1+\sqrt{2})$

(B) $\log(1+\sqrt{2}) - \dfrac{\pi}{4}$

(C) $\log(1+\sqrt{2}) + \dfrac{\pi}{4}$

(D) $\log(\sqrt{2} - 1)$

38. Let $\dfrac{d}{dx} F(x) = \left(\dfrac{e^{\sin x}}{x}\right)$, $x > 0$. If $\displaystyle\int_1^4 \dfrac{3}{x} e^{\sin x^3} dx = F(k) - F(1)$, then one of the possible values of $k$ is _____.

(A) 15       (B) 16       (C) 63       (D) 64

39. Eight different letters of an alphabet are given. Words of four letters from these are formed. The number of such words with at least one letter repeated is

(A) $\dbinom{8}{4} - {}^8P_4$       (B) $8^4 + \dbinom{8}{4}$       (C) $8^4 - {}^8P_4$       (D) $8^4 - \dbinom{8}{4}$

40. What is function $f$ satisfying the identity, $f(x) + f\left(\dfrac{x-1}{x}\right) = 1 + x$, $\forall\, x \in R - \{0,1\}$ ?

(A) $\dfrac{x^3 - x^2 - 1}{x(x-1)}$       (B) $\dfrac{x^3 - x + 1}{x(x+1)}$       (C) $\dfrac{x^2 - x^3 + 1}{x(x-1)}$       (D) $\dfrac{x^3 + x^2 + 1}{x(x-1)}$

41. The income of Raj on the $n^{th}$ day is ₹ $(n^2 + 2)$ and the expenditure of Raj on the $n^{th}$ day is ₹ $(2n + 1)$. In how many days his total savings will be ₹ 1240?

(A) 10  (B) 12  (C) 15  (D) 16

42. Dev and Tukku can do a piece of work in 45 and 40 days respectively. They began the work together, but Dev leaves after some days and Tukku finished the remaining work in 23 days. After how many days did Dev leave ?

(A) 7 days  (B) 8 days  (C) 9 days  (D) 11 days

43. The table gives the population, '$p$' in a region of the country as a function of the years '$t$' since 2003.

| $t$ | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| $p$ | 42,500 | 43,000 | 43,500 | 44,000 |

Which equation represents this data algebraically ?

(A) $p = 42,500 + 1,000t$
(B) $p = 42,000 + 500t$
(C) $p = 42,500 + 500t$
(D) $p = 40,000 + 1,500t$

44. Two trains running in opposite directions cross a man standing on the platform in 27 seconds and 17 seconds respectively and they cross each other in 23 seconds. The ratio of their speeds is

(A) $1 : 3$  (B) $3 : 2$  (C) $3 : 4$  (D) $2 : 5$

45. An object released from rest at a position 20 m above the ground is governed by the following equation: $g = 9.81$ m/s$^2$, $v_o = 0$, $y_o = 0$. How long does it take the falling object to reach the ground ?

(A) 2.02 sec

(B) 2.5 sec

(C) 5 sec

(D) 6 sec
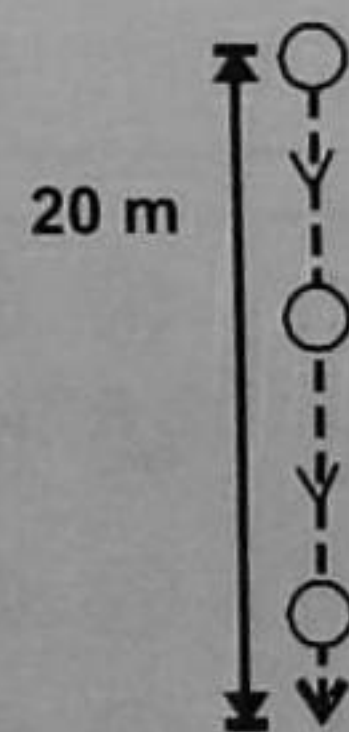


46. There are ten subjects in the school day at St. Vincent's High School, but the sixth standard students have only 5 periods in a day. In how many ways can we form a time-table for the day for the sixth standard students?

(A) $5^{10}$  (B) $10^5$  (C) 252  (D) 30,240

47. A salesman used the inequality $4(2 - x) \geq 20$ in analyzing his inventory. Choose the best description of the graph that represents the solution of $4(2 - x) \geq 20$.

(A) All values to the right of −3 on the number line satisfy $4(2 - x) \geq 20$

(B) All values to the right of −3 (including −3) on the number line satisfy $4(2 - x) \geq 20$

(C) All values to the left of − 3 on the number line satisfy $4(2 - x) \geq 20$

(D) All values to the left of − 3 (including −3) on the number line satisfy $4(2 - x) \geq 20$

48. A vessel is filled with liquid, 3 parts of which are water and 5 parts syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup?

(A) $\dfrac{1}{3}$

(B) $\dfrac{1}{4}$

(C) $\dfrac{1}{5}$

(D) $\dfrac{1}{7}$

49. Kamal and Monica appeared for an interview for two vacancies. The probability of Kamal's selection is 1/3 and that of Monica's selection is 1/5. Find the probability that only one of them will be selected.

(A) $\dfrac{2}{5}$

(B) $\dfrac{1}{5}$

(C) $\dfrac{5}{9}$

(D) $\dfrac{2}{3}$

50. Entry fee in an exhibition was ₹ 1. Later, this was reduced by 25% which increased the sale by 20%. The percentage increase in the number of visitors is _____ .

(A) 54

(B) 57

(C) 60

(D) 66