MIZORAM PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POSTS OF
HIGH SCHOOL TEACHER (MATHEMATICS)
UNDER SCHOOL EDUCATION DEPARTMENT, SEPTEMBER, 2017

TECHNICAL PAPER-II

Time Allowed : 3 hours Full Marks : 150

Attempt all questions.

All questions carry equal marks of 2 each.

1. Two persons start walking in the same direction at 5km/h and 4 km/h respectively. In how many hours will they be 30 kms apart?

(a) 10 hours (b) 20 hours

(c) 30 hours (d) 40 hours

2. A man runs 200 metres in 24 seconds. What is his speed?

(a) 30 km/h (b) 35 km/h

(c) 40 km/h (d) 45 km/h

3. Two train stations X and Y are 390 kms apart. A train starts from X at 10 a.m. and travels towards Y at 65 km/h. Another train starts from Y at 11 a.m. and travels towards X at 35 km/h. At what time do they meet?

(a) 2:00 p.m. (b) 2:05 p.m.

(c) 2:15 p.m. (d) 2:25 p.m.

4. A boat covers a distance of 30 km in $2\frac{1}{2}$ hours running downstream. It covers the same distance upon returning in $3\frac{3}{4}$ hours. What is the speed of the boat in still waters?

(a) 5 km/h (b) 10 km/h

(c) 20 km/h (d) 25 km/h

5. If the length and width of a rectangular garden are each increased by 20%, then what would be the percent increase in the area of the garden?

(a) 20% (b) 32%

(c) 38% (d) 44%

6. How many iron rods each of length 7 m and diameter 2 cm can be made out of 0.88 cubic metre of iron?

(a) 100 (b) 200

(c) 300 (d) 400

7. If the volume and the surface area of a sphere are the same, then its radius is

(a) 3 units (b) 7 units

(c) 8 units (d) 13 units

8. On what day of the week in 2002 did 6th June fall?

(a) Monday (b) Tuesday

(c) Wednesday (d) Thursday

9. At what time between 3 and 4 o'clock will the hands of a clock be together?

(a) $16\frac{4}{11}$ minutes past 3 (b) $16\frac{9}{31}$ minutes past 3

(c) $17\frac{4}{11}$ minutes past 3 (d) $17\frac{9}{31}$ minutes past 3

10. If the simple interest for 6 years be equal to 30% of the principal, in how many years will it be equal to the principal?

(a) 20 years (b) 27 years

(c) 33 years (d) 40 years

11. The value of a machine depreciates every year at the rate of 10% on its value at the beginning of that year. If the present value of the machine is Rs. 7290, what was its worth 3 years ago?

(a) Rs. 7,000 (b) Rs. 10,000

(c) Rs. 12,000 (d) Rs. 15,000

12. A man buys Rs. 50 shares in a company which pays 10% dividend. If the man gets 12.5% on his investment, at what price did he buy the shares?

(a) Rs. 25 (b) Rs. 37

(c) Rs. 40 (d) Rs. 50

13. In a race of 600 m, athlete A can beat athlete B by 60 m and in a race of 500 m, athlete B can beat athlete C by 50 m. By how many metres will A beat C in a race of 400 m?

(a) 53 m (b) 69 m

(c) 76 m (d) 87 m

Directions (for Q. 14 & Q. 15) Study the following table carefully and answer questions 14 & 15 given below

Number of working days of various companies

Companies / Years	A	B	C	D	E
2010	298	296	322	323	301
2011	310	300	323	322	298
2012	310	311	312	310	308
2013	311	310	311	312	310
2014	299	309	311	323	322
2015	298	310	310	313	321

14. What is the average number of working days of all the companies in the year 2011?

(a) $210\frac{3}{5}$ (b) $305\frac{2}{5}$

(c) $310\frac{1}{5}$ (d) $315\frac{4}{5}$

15. What is the respective ratio of the non-working days of company B to company E in the year 2015?

(a) 7:2 (b) 7:4

(c) 5:2 (d) 5:4

16. Find the missing term in the series 1, 4, 27, 16, ?, 36, 343

(a) 25 (b) 64

(c) 125 (d) 625

17. If 3 is subtracted from the middle digit of each of the following numbers and then the positions of the digits are reversed, which of the following will be the last digit of the last number after they are arranged in descending order?

589 362 554 371 442

(a) 1 (b) 2

(c) 3 (d) 4

18. In the numbers from 100 to 1000, how many times does digit 1 comes at the ten's place?

(a) 10 (b) 30

(c) 90 (d) 120

19. Which one of the four interchanges in signs and numbers would make the equation 3+5-2=0 correct?

(a) + and -, 2 and 5 (b) + and -, 0 and 3

(c) + and =, 2 and 5 (d) + and -, 3 and 5

20. Arrange the following in a meaningful order, from particular to general

1. Family 2. Community 3. Member 4. Locality 5. Country

(a) 3,1,2,4,5 (b) 1,2,3,4,5

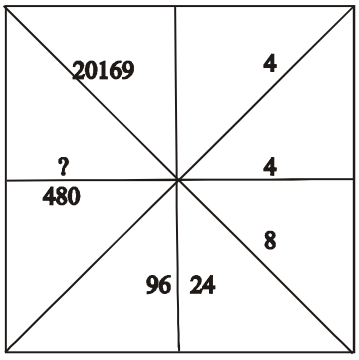
(c) 3,5,4,1,2 (d) 1,2,4,2,3

21. A man has Rs. 480 in the denominations of one-rupee notes, five-rupee notes and ten-rupee notes. The number of notes of each denomination is equal. What is the total number of notes that he has?

(a) 30 (b) 45

(c) 60 (d) 90

22. Find the missing character



(a) 1920 (b) 2400

(c) 2880 (d) 3360

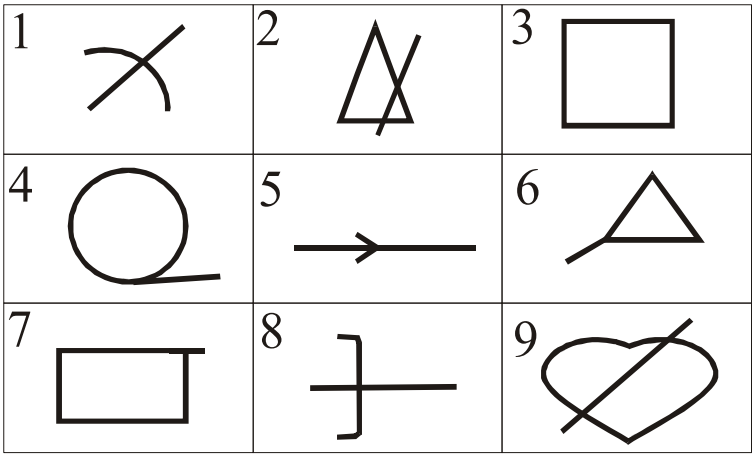
23. In the following statement, two statements are given followed by four conclusions numbered I,II,III and IV. You have to take the given statement to be true even if it seem to be at variance from the commonly known facts and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

Statements: All aeroplanes are trains.
Some trains are chairs.

Conclusions: I. Some aeroplanes are chairs
II. Some chairs are aeroplanes
III. Some chairs are trains
IV. Some trains are aeroplanes

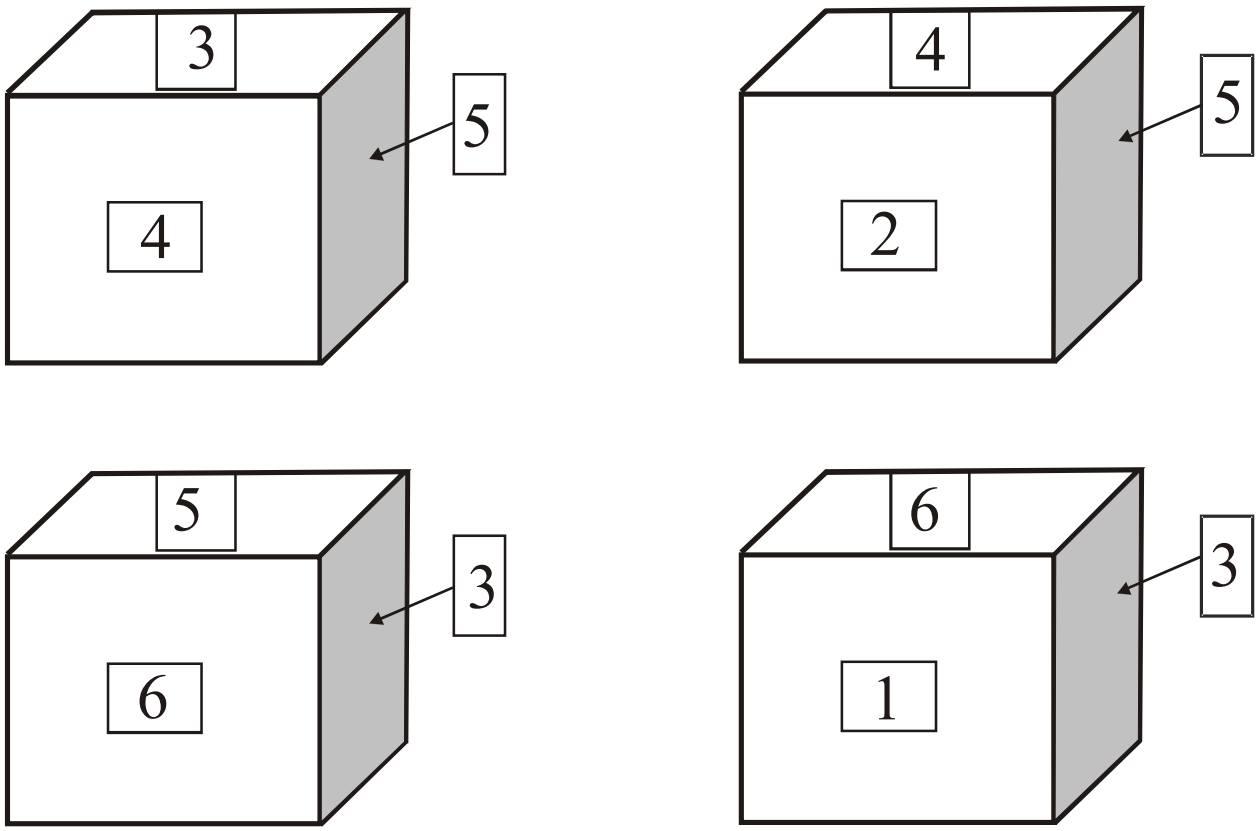
(a) None follows
(b) Only I and II follows
(c) Only II and III follow
(d) Only III and IV follow

24. Group the given figures into three classes using each of the figures only once.



(a) 3,4,8 ; 1,6,7 ; 2,5,9
(b) 3,4,7 ; 2,5,8 ; 1,6,9
(c) 1,5,8 ; 4,6,7 ; 2,3,9
(d) 1,2,3 ; 4,5,6 ; 7,8,9

25. Shown below are four different positions of the same dice. What is the number on the face opposite the face showing 6?



(a) 1 (b) 2
(c) 3 (d) 4

26. Let A and B be two non-empty sets such that $A \cap B' = \Phi$, where B' denotes the complement of B, then

(a) $A = A \cup B$ (b) $A = A \cap B$
(c) $B = A \cup B$ (d) $B = A \cap B$

27. $(1+i)^4\left(1+\frac{1}{i}\right)^4 =$

(a) 4 (b) 8
(c) 16 (d) 20

28. If $\frac{2}{|x-3|} > 5$ where x is a real number, then

(a) $5 < x < \frac{17}{3}$ (b) $5 > x > \frac{17}{3}$

(c) $3 < x < \frac{17}{5}$ (d) $3 > x > \frac{17}{5}$

29. In polar form, $-2i =$

(a) $2\left[cos\left(\frac{\pi}{2}\right)+isin\left(\frac{\pi}{2}\right)\right]$

(b) $2\left[cos\left(\frac{-\pi}{2}\right)+isin\left(\frac{-\pi}{2}\right)\right]$

(c) $2\left[cos\pi+isin\pi\right]$

(d) $2\left[cos\left(-\pi\right)+isin\left(-\pi\right)\right]$

30. The roots of the equation are $x^3 = 1$ are

(a) $1,-1,0$

(b) $1,1+i\sqrt{3},1-i\sqrt{3}$

(c) $1,\frac{1+i\sqrt{3}}{2},\frac{-1-i\sqrt{3}}{2}$

(d) $1,\frac{-1+i\sqrt{3}}{2},\frac{-1-i\sqrt{3}}{2}$

31. If the inclination of the line joining the points $(x, -3)$ and $(2,5)$ is $135°$, then $x =$

(a) 7

(b) 10

(c) 16

(d) 45

32. The eccentricity of the ellipse $\frac{x^2}{144}+\frac{y^2}{128}=1$ is

(a) $\frac{1}{2}$

(b) $\frac{3}{2}$

(c) $\frac{1}{4}$

(d) $\frac{3}{4}$

33. $sin105° + cos105° =$

(a) 0

(b) $\frac{1}{\sqrt{2}}$

(c) $\frac{1}{2}$

(d) 1

34. The general solution of the equation $tan3x = -1$ is

(a) $x=\frac{n\pi}{2}+\frac{\pi}{3}$, where n is a natural number

(b) $x=\frac{n\pi}{2}-\frac{\pi}{4}$, where n is a natural number

(c) $x=\frac{n\pi}{3}-\frac{\pi}{4}$, where n is a natural number

(d) $x=\frac{n\pi}{3}+\frac{\pi}{4}$, where n is a natural number

35. If three numbers are in Arithmetic Progression such that their sum is 27 and their product is 648. Then the numbers are

(a) 3,6,9 (b) 2,9,18

(c) 4,6,12 (d) 6,9,12

36. A company produces and installs solar panels on residential and commercial buildings. In the first year, the company produced and installed the solar panels on the total area of 100,000 square feet. In the next year, the company covered the area 20% more than in the first year. In the third year, the company covered the area 20% more than in the second year, and so on. The total area covered by the company in 10 years is

(a) 2595868 square feet (b) 2590000 square feet

(c) 3595868 square feet (d) 4590000 square feet

37. $7^{\frac{1}{2}} \times 7^{\frac{1}{4}} \times 7^{\frac{1}{8}} \ldots \infty =$

(a) 1 (b) 7

(c) 100 (d) ∞

38. The 7^{th} term of the series 12,6,4,3,… is

(a) 1 (b) –4

(c) $\frac{1}{7}$ (d) $\frac{12}{7}$

39. If the AM between a and b is twice their GM, then $\frac{a}{b} =$

(a) $2 \pm 4\sqrt{3}$ (b) $3 \pm 7\sqrt{3}$

(c) $4 \pm 7\sqrt{3}$ (d) $7 \pm 4\sqrt{3}$

40. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

(a) 2200 (b) 4520

(c) 25200 (d) 32200

41. The determinant $\Delta = \begin{vmatrix} cos(\alpha+\beta) & -sin(\alpha+\beta) & cos2\beta \\ sin\alpha & cos\alpha & sin\beta \\ -cos\alpha & sin\alpha & cos\beta \end{vmatrix}$ is independent of

(a) α (b) β

(c) Both α and β (d) Trigonometric functions

42. If A and B are symmetric matrices of order n, then $A+B$ is

(a) Hermitian (b) Skew-Hermitian

(c) Symmetric (d) Skew-symmetric

43. If $A = \left[a_{ij} \right]_{n \times n}$ be a scalar matrix, then trace of A is equal to

(a) $na_{ij},\ i, j = 1, 2, \ldots, n$ (b) $(n+1)a_{ij},\ i, j = 1, 2, \ldots, n$

(c) na_{11} (d) $(n+1)a_{11}$

44. A square matrix A is idempotent if

(a) $A^2 = A^t$, where A^t is the transpose of A (b) $A = A^t$

(c) $A = -A^t$ (d) $A = A^2$

45. For what values of λ and μ does the system of equations $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ have infinitely many solutions?

(a) $\lambda = 3$ *and* $\mu = 10$ (b) $\lambda = 3$ *and* $\mu = 7$

(c) $\lambda = 2$ *and* $\mu = 7$ (d) $\lambda = 2$ *and* $\mu = 10$

46. Which of the following operations is not binary?

(a) Ordinary subtraction on the set of positive integers

(b) Ordinary addition on the set of positive integers

(c) Ordinary multiplication on the set of all integers

(d) Ordinary subtraction on the set of all integers

47. If the sum of two roots of the equation $x^3 - 5x^2 - 16x + p = 0$, then the value of p is

(a) 10 (b) 50

(c) 80 (d) 90

48. If α, β, γ are roots of the equation $x^3 - 2x^2 + 7 = 0$, then $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma} =$

(a) 0 (b) 1

(c) -1 (d) 3

49. The equation whose roots are double the roots of the equation $x^4 - 6x^3 + 5x^2 - 6x + 1 = 0$ is

(a) $x^4 + 12x^3 - 20x^2 - x + 1 = 0$ (b) $x^4 - 12x^3 + 20x^2 - 48x + 16 = 0$

(c) $x^4 + 12x^2 - 8x + 16 = 0$ (d) $x^4 - 12x^3 + 10x^2 + 16 = 0$

50. The remainder when $x^5 - 3x^4 + 4x^2 + x + 4 = 0$ is divided by $(x+1)(x+2)$ is

(a) $\frac{1}{3}(x+4)$ (b) $\frac{1}{3}(x-6)$

(c) $\frac{1}{3}(x+16)$ (d) $\frac{1}{3}(x-16)$

51. Solution set of the inequality is $x > 0$ is

(a) Half plane on the right of Y-axis excluding the points on the Y-axis

(b) Half plane on the right of Y-axis including the points on the Y-axis

(c) Half plane on the left of X-axis excluding the points on the Y-axis

(d) Half plane on the right of X-axis excluding the points on the X-axis

52. Which of the following sets is convex?

(a) $\{(x, y) : x^2 + y^2 > 6\}$ (b) $\{(x, y) : 2x^2 + 3y^2 \le 6\}$

(c) $\{(x, y) : 4 \le x^2 + y^2 \le 9\}$ (d) $\{(x, y) : x^2 + 3y^2 \ge 4\}$

53. Objective function of a LPP is

(a) A function to be optimized

(b) A constant

(c) A relation between the variables

(d) A constraint to which the LPP is subjected to

54. The maximum value of $f = 4x + 3y$ subject to the constraints $x \geq 0, y \geq 0, 2x + 3y \leq 18, x + y \geq 10$ is

(a) 10 (b) 25

(c) 40 (d) No optimum value

55. A variable added to the left side of a less than or equal to constraint to convert the constraint into an equality is called a/an

(a) Slack variable (b) Surplus variable

(c) Artificial variable (d) Byproduct variable

56. The order and degree of the differential equation $x\left(\frac{dy}{dx}\right) - \frac{5}{\left(\frac{dy}{dx}\right)} = y$ is respectively

(a) 1 and 2 (b) 2 and 2

(c) 2 and 3 (d) 1 and 3

57. Which of the following is a solution to the differential equation

$$\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0$$

(a) $y = c_1e^x + c_2e^{-x}$, where c_1 and c_2 are constants

(b) $y = c_1e^{2x} + c_2e^{-2x}$, where c_1 and c_2 are constants

(c) $y = c_1e^x + c_2e^{-2x}$, where c_1 and c_2 are constants

(d) $y = c_1e^{2x} + c_2e^{-x}$, where c_1 and c_2 are constants

58. The differential equation of the family of all ellipses having foci on the x-axis and center at the origin is given by

(a) $x\frac{d^2y}{dx^2} + y\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ (b) $y\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$

(c) $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ (d) $\frac{d^2y}{dx^2} + xy\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$

59. The general solution of the differential equation $(x-y)dy=(x+y)dx$ is

(a) $tan^{-1}\left(\frac{y}{x}\right)=c\sqrt{x^2+y^2}$ (b) $e^{tan^{-1}\left(\frac{y}{x}\right)}=c\sqrt{x^2+y^2}$

(c) $tan^{-1}\left(\frac{y}{x}\right)=e^{c\sqrt{x^2+y^2}}$ (d) $e^{tan^{-1}\left(\frac{y}{x}\right)}=tan^{-1}\left(\frac{y}{x}\right)+c\sqrt{x^2+y^2}$

60. The differential equation of the family of circles $x^2+y^2+2gx+2fy+c=0$ is

(a) $\left\{\left(1-\left(\frac{dy}{dx}\right)^2\right)\right\}\frac{d^3y}{dx^3}+\left(\frac{d^2y}{dx^2}\right)^2=0$ (b) $\left\{\left(1+\left(\frac{dy}{dx}\right)^2\right)\right\}\frac{d^3y}{dx^3}-3\frac{dy}{dx}\left(\frac{d^2y}{dx^2}\right)^2=0$

(c) $\left\{\left(1-\left(\frac{dy}{dx}\right)^2\right)\right\}\frac{d^3y}{dx^3}-3\frac{dy}{dx}=0$ (d) $\left\{\left(1+\frac{dy}{dx}\right)\right\}\frac{d^3y}{dx^3}-\frac{dy}{dx}\left(\frac{d^2y}{dx^2}\right)^2=0$

61. 1.If $\vec{p}=\frac{\vec{b}\times\vec{c}}{\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right]},\vec{q}=\frac{\vec{c}\times\vec{a}}{\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right]},\vec{r}=\frac{\vec{a}\times\vec{b}}{\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right]}$, where $\vec{a},\vec{b},\vec{c}$ are non-coplanar vectors, then $\left(\vec{a}+\vec{b}+\vec{c}\right)\cdot\left(\vec{p}+\vec{q}+\vec{r}\right)=$

(a) 0 (b) 1

(c) 2 (d) 3

62. If $\vec{a},\vec{b},\vec{c}$ are vectors such that $\vec{c}=\vec{a}+\vec{b}$ and $\vec{a}\perp\vec{b}$,then

(a) $ab=c^2$ (b) $a^2=b^2c^2$

(c) $a^2+b^2=c^2$ (d) $a^2-b^2=c^2$

63. If A,B,C,D are any four points in space, then $\overrightarrow{AB}\times\overrightarrow{CD}+\overrightarrow{BC}\times\overrightarrow{AD}+\overrightarrow{CA}\times\overrightarrow{BD}=$

(a) 2(area of triangle ABC) (b) 4(area of triangle ABC)

(c) 2(area of parallelogram $ABCD$) (d) 4(area of parallelogram $ABCD$)

64. The points on the line $x+y=4$ that lie at a unit distance from the line $4x+3y=10$ are

(a) $(1,1)$ and $(-7,7)$ (b) $(3,3)$ and $(7,11)$

(c) $(1,1)$ and $(-7,11)$ (d) $(3,1)$ and $(-7,11)$

65. The foci of a hyperbola coincide with the foci of the ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$. If the eccentricity of the hyperbola is 2, then the equation of the hyperbola is

(a) $x^2-y^2=9$ (b) $x^2+y^2=12$

(c) $3x^2-y^2=12$ (d) $3x^2+9y^2=25$

Direction for Questions 66 - 67: Choose the correct alternative that will continue the same pattern and replace the question mark in the given series:

66. 6, 13, 25, 51, ?, 203

(a) 98 (b) 99

(c) 100 (d) 101

67. 22, 24, ?, 36, 52, 84

(a) 26 (b) 28

(c) 30 (d) 33

68. Arrange the words given below in a meaningful sequence:

1. Town 2. District 3. House 4. Street 5. Room

(a) 5, 3, 4, 2, 1 (b) 5, 3, 4, 1, 2

(c) 5, 1, 4, 2, 3 (d) 5, 4, 3, 2, 1

Direction for Question 69: Pick up the one which is most nearly the same in meaning as the word printed in bold and can replaces it without altering the meaning of the sentence:

69. Lack of occupation is not necessary revealed by **manifest** idleness.

(a) easily perceived (b) easily acquired

(c) easily infected (d) easily deflected

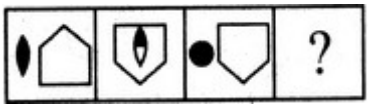
Dircetion for Question 70: Below is given alternative to the underlined and italicized part which may improve the sentence. Choose the correct alternative:

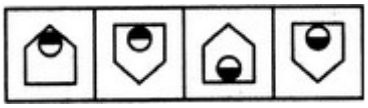
70. Will you kindly <u>*open*</u> the knot?

(a) loose (b) break

(c) untie (d) No improvement

71. Select a suitable figure from the Answer Figures that would replace the question mark (**?**)



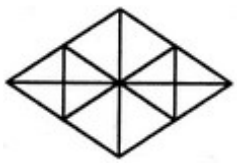


(1) (2) (3) (4)

(a) 1 (b) 2

(c) 3 (d) 4

72. Find the number of triangles in the given figure.



(a) 16 (b) 22

(c) 28 (d) 32

73. Three bus tickets from A to B and two tickets from A to C cost Rs. 77, but two bus tickets from A to B and three tickets from A to C cost Rs. 73. What are the fares for B and C from A?

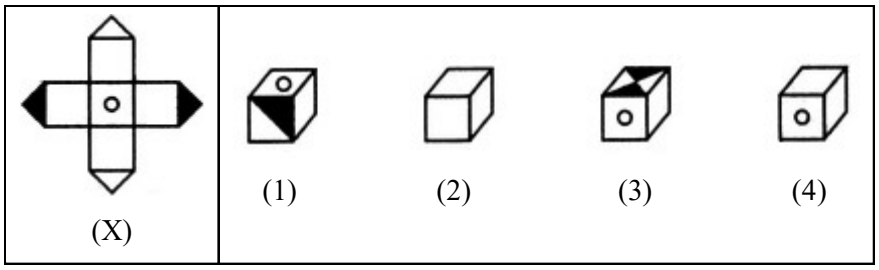
(a) Rs. 4, Rs. 23
(b) Rs. 13, Rs. 17
(c) Rs. 15, Rs. 14
(d) Rs. 17, Rs. 13

74. Which one will replace the question mark **(?)**

5	4	7	=	8
6	9	5	=	10
3	7	4	=	?

(a) 7
(b) 8
(c) 9
(d) 10

75. Choose the box that is similar to the box formed from the given sheet of paper (X).



(a) 1
(b) 2
(c) 3
(d) 4

* * * * * * *