CODE
Z

QUESTIONS & SOLUTIONS OF AIEEE 2011

PART-I, PAPER-2 (MATHEMATICS & APTITUDE TEST)

Date : 01-05-2011 | **Duration : 3 Hours** | **Max. Marks : 390**

IMPORTANT INSTRUCTIONS

1. Immediately fill the particulars on this page of the Test Booklet with Blue / Black Ball Point Pen. Use of pencil is strictly prohibited.

2. This Test Booklet consists of three parts - Part-I, Part-II and Part-III. Part-I has 30 objective type questions of Mathematics consisting of FOUR (4) marks for each correct response. Mark your answers for these questions in the appropriate space against the number corresponding in the appropriate space against the number corresponding to the question in the Answer Sheet placed inside this Test Booklet. Use Blue/Black Ball Point Pen only for writing particulars/marking responses on Side-1 and Side-2 of the Answer Sheet. Part-III consists of 2 questions carrying 70 marks which are to be attempted on a separate Drawing Sheet which is also placed inside this Test Booklet. Marks allotted to each question are written against each question. Use colour pencil or crayons only on the Drawing Sheet. Do not use water colours. For each incorrect response in Part-I and Part-II, one-fourth (¼) of the total marks allotted to the question would be deducted from the total score. No deduction from the total score, however, will be made if no response is indicated for an item in the Answer Sheet.

3. There is only one correct response for each question in Part-I and Part-II. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 2 above.

4. The test is of 3 hours duration. The maximum marks are 390.

5. On completion of the test, the candidates must hand over the Answer Sheet of Mathematics and Aptitude Test-Part-I & II and the Drawing Sheet of Aptitude Test-Part-III to the Invigilator in the Room/Hall. Candidates are allowed to take away with them the Test Booklet of Aptitude Test-Part-I & II.

6. The CODE for this Booklet is **Z**. Make sure that the CODE printed on **Side-2** of the Answer Sheet and on the Drawing Sheet (Part-III) is the same as that on this booklet. Also tally the serial Number of the Test Booklet, Answer Sheet and Drawing Sheet and ensure that they are same. In case of discrepancy in Code or serial Number, the candidate should immediately report the matter to the Invigilator for replacement of the Test Booklet, Answer Sheet and the Drawing Sheet.

Name of the Candiate (in Capital letters) : ______________________________

Roll Number : in figures : | | | | | | | | | in words : ______________________

Examination Centre Number : | | | | | | |

Name of Examination Centre (in Capital letters) : ______________________

Candidate's Signature : ________________ Invigilator's Signature : ________________

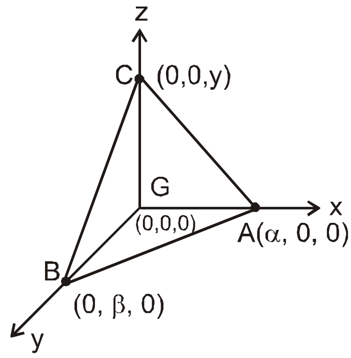
PART-I (MATHEMATICS)

1. If a plane meets the coordinate axes at A, B and C and ΔABC has centroid at the point $G\left(\frac{a}{2},\frac{b}{2},\frac{c}{2}\right)$, then the equation of the plane is -

(1) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=\frac{1}{3}$ (2) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=\frac{3}{2}$ (3) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=\frac{2}{3}$ (4) $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=\frac{1}{2}$

Sol. **(2)**

Centriod $\frac{\alpha+0+0}{3}=\frac{a}{2}$



Similarly $\beta = \frac{3b}{2}$

$\gamma = \frac{3c}{2}$

Equation of plane is -

$\frac{x}{\alpha}+\frac{y}{\beta}+\frac{z}{c} = 1$

$\frac{x}{a}+\frac{y}{b}+\frac{z}{c} = \frac{3}{2}$

2. The latus rectum of the conic section $9x^2+4y^2-36 = 0$ is : -

(1) 9 (2) 1/9 (3) 3/8 (4) 8/3

Sol. **(4)**

$9x^2+4y^2=36$

$\frac{x^2}{4}+\frac{y^2}{9} = 1$

$a^2 = 4 \quad b^2 = 9$

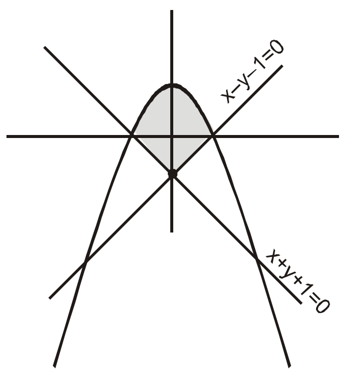
length of locus rectum is $\frac{2a^2}{b} = \frac{2(4)}{3} = \frac{8}{3}$

3. The area of the region bounded by the curves $y = 1 - x^2$, $x + y + 1 = 0$ and $x - y - 1 = 0$ is -

(1) 3 (2) 10/3 (3) 7/3 (4) 8/3

Sol. **(3)**

Required Area



$= 2\int_0^1 (1-x^2)\,dx + 2\left(\frac{1}{2}\times1\times1\right)$

$= 2\left(x-\frac{x^3}{3}\right)_0^1 + 1$

$= 2\left(1-\frac{1}{3}\right) + 1 = \frac{4}{3} + 1 = \frac{7}{3}$

4. $\tan9° - \tan27° - \tan63° + \tan81°$ is equal to :

(1) –1 (2) 4 (3) 0 (4) 1

Sol. **(2)**

$\tan9° - \tan27° - \cot27° + \cot9°$

$= \left(\frac{\sin9°}{\cos9°}+\frac{\cos9°}{\sin9°}\right)-\left(\frac{\sin27°}{\cos27°}+\frac{\cos27°}{\sin27°}\right)$

$$= \frac{2}{2\sin 9^\circ \cos 9^\circ} - \frac{2}{2\sin 27^\circ \cos 27^\circ}$$

$$= \frac{2}{\sin 18} - \frac{2}{\sin 54}$$

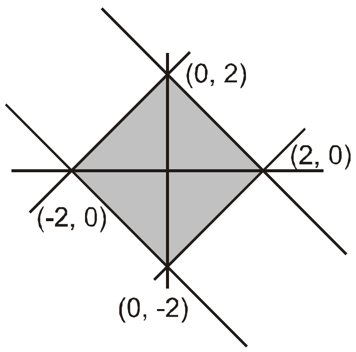
$$= \frac{2}{\left(\frac{\sqrt{5}-1}{4}\right)} - \frac{2}{\left(\frac{\sqrt{5}+1}{4}\right)}$$

$$= 8\left(\frac{1}{5-1}(\sqrt{5}+1)\right) - \frac{1}{5-1}(\sqrt{5}-1)$$

$= 2\ (2) = 4$ **Ans.**

5. **Statement - 1 :** The equation $|x| + |y| = 2$ represents a parallelogram.
Statement - 2 : Lines $x + y = 2$ and $x + y = -2$ are parallel. Also lines $x - y = 2$ and $-x + y = 2$ are parallel.
(1) Statement - 1 is true, Statement - 2 is false.
(2) Statement - 1 is false, Statement - 2 is true.
(3) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is correct explanation for Statement - 1.
(4) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is ***not*** a correct explanation for Statement - 1.

Sol. **(4)**



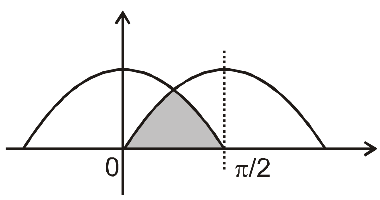
$|x| + |y| = 2$
represent parallelogram
lines $x + y = 2$, $x + y = -2$ are parallel also lines $x - y = 2$, $-x + y = 2$ are also parallel

6. $\int_0^{\pi/2} \min(\sin x, \cos x)\, dx$, equal to :

(1) $2 + \sqrt{2}$ (2) $2\sqrt{2}$ (3) $\sqrt{2}$ (4) $2 - \sqrt{2}$

Sol. **(4)**

$$\int_0^{\pi/4} \sin x\, dx + \int_{\pi/4}^{\pi/2} \cos x\, dx$$



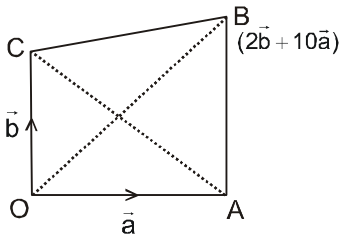
$$= (-\cos x)_0^{\pi/2} + (\sin x)_{\pi/4}^{\pi/2}$$

$$= \left(-\frac{1}{\sqrt{2}} + 1\right) + \left(1 - \frac{1}{\sqrt{2}}\right) = 2 - \frac{2}{\sqrt{2}} = 2 - \sqrt{2}$$

7. Let $\overrightarrow{OA} = \vec{a}$, $\overrightarrow{OB} = 2\vec{b}+10\vec{a}$ and $\overrightarrow{OC} = \vec{b}$ where O is the origin. If p is the area of the quadrilateral OABC and q is the area of the parallelogram with OA and OC as adjacent sides then p is equal to -

(1) 6 – p (2) q^6 (3) 6q (4) q/6

Sol. **(3)**



Area of parallelogram with OA and OC as adjacent sides = $\left|\overrightarrow{OA} \times \overrightarrow{OC}\right|$

q = $\left|\vec{a}\times\vec{b}\right|$

Area of quadrilateral OABC is

= Area (ΔOAB) + Area of (ΔOBC)

= $\left|\frac{1}{2}(\overrightarrow{OA}\times\overrightarrow{OB}) + \frac{1}{2}(\overrightarrow{OB}\times\overrightarrow{OC})\right|$

= $\frac{1}{2}\left|\vec{a}\times(2\vec{b}+10\vec{a})\right| + \frac{1}{2}\left|(2\vec{b}+10\vec{a})\right|\times\vec{b}$

= $\left|\vec{a}\times\vec{b}\right| + 5\left|\vec{a}\times\vec{b}\right|$

p = $6\left|\vec{a}\times\vec{b}\right|$

p = 6q

8. If $x_1, x_2, x_3, \ldots, x_{13}$ are in A.P. then the value of $\begin{vmatrix} e^{x_1} & e^{x_4} & e^{x_7} \\ e^{x_4} & e^{x_7} & e^{x_{10}} \\ e^{x_7} & e^{x_{10}} & e^{x_{13}} \end{vmatrix}$ is -

(1) 9 (2) 27 (3) 0 (4) 1

Sol. **(3)**

$x_1, x_2, x_3, \ldots, x_{13}$ are in A.P.

$\Rightarrow$ $x_1 = a$

$x_2 = a + d$

$x_3 = a + 2d$

$x_{13} = a + 12$

Now

$$\begin{vmatrix} e^{x_1} & e^{x_4} & e^{x_7} \\ e^{x_4} & e^{x_7} & e^{x_{10}} \\ e^{x_7} & e^{x_{10}} & e^{x_{13}} \end{vmatrix} = \begin{vmatrix} e^{a} & e^{a+3d} & e^{a+6d} \\ e^{a+3d} & e^{a+6d} & e^{a+9d} \\ e^{a+6d} & e^{a+9d} & e^{a+12d} \end{vmatrix}$$

$$= e^a \cdot e^a \cdot e^a \begin{vmatrix} 1 & e^{3d} & e^{6d} \\ e^{3d} & e^{6d} & e^{9d} \\ e^{6d} & e^{9d} & e^{12d} \end{vmatrix}$$

(multiply c_2 by e^{3d} then c_2 and c_3 are identical we get zero)

= 0

9. The value of α and β such that $\lim\limits_{x\to\infty}\left[\dfrac{x^2+1}{x+1}-\alpha x-2\beta\right]=\dfrac{3}{2}$ are :

(1) $\alpha = 1$, $\beta = -3/4$ (2) $\alpha = -1$, $\beta = 3/4$ (3) $\alpha = 1$, $\beta = -5/4$ (4) $\alpha = -1$, $\beta = 5/4$

Sol. **(3)**

$$\lim_{x\to\infty}\left(\frac{(x^2+1)-\alpha x(x+1)-2\beta(x+1)}{x+1}\right)=\frac{3}{2}$$

$$\Rightarrow \lim_{x\to\infty}\left(\frac{(1-\alpha)x^2+(-\alpha-2\beta)x+(1-2\beta)}{x+1}\right)=\frac{3}{2}$$

Limit will be exist

$\Rightarrow 1-\alpha=0$ and $-\alpha-2\beta=\dfrac{3}{2}$

$\alpha = 1$, $2\beta = -1-\dfrac{3}{2}$

$\beta = -\dfrac{5}{4}$

10. The function $f(x) = xe^{-x}$ has :

(1) a maximum at $x = -1$ (2) neither maximum nor minimum at $x = 1$

(3) a minimum at $x = 1$ (4) a maximum at $x = 1$

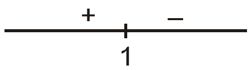
Sol. **(3)**

$f(x) = xe^{-x}$

$f'(x) = 1.e^{-x} - xe^{-x}$

$= e^{-x}(1-x) = -(x-1)e^{-x}$

for maxima and minima

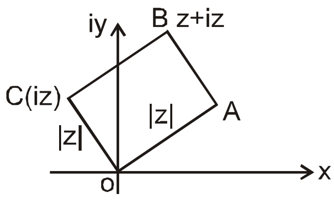


at x = 1 , it has minimum value

11. Area of a triangle with vertices given by z, iz, z + iz, where z is any complex number is :

(1) $2\,|z|^2$ (2) 0 (3) $\dfrac{1}{2}|z|^2$ (4) $|z|^2$

Sol. **(4)**

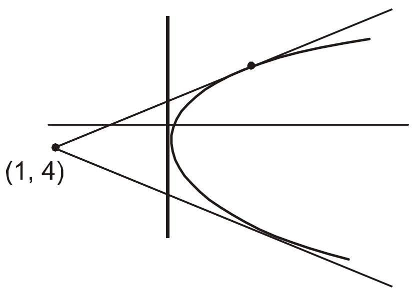


Area of Rectangle OABC is = $|z| \,.\, |z| = |z|^2$

12. The acute angle between the tangents drawn from the point (1, 4) to the parabola $y^2 = 4x$ is :

(1) $\pi/4$ (2) $\pi/6$ (3) $\pi/2$ (4) $\pi/3$

Sol. **(4)**



Parabola $y^2 = 4x$

tangent equation $y = mx + \frac{1}{m}$

pass (1, 4)

$4 = m + \frac{1}{m}$

$m^2 - 4m + 1 = 0$

$m_1 + m_2 = 4$

$m_1 m_2 = 1$

Angle between tangents

$$\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right| = \left|\frac{\sqrt{(4)^2 - 4(1)}}{1+1}\right|$$

$$\Rightarrow \tan\theta = \left(\frac{2\sqrt{3}}{2}\right) = \sqrt{3}$$

$\Rightarrow \theta = \pi/3$

13. A committee consisting of at least three members is to be formed from a group of 6 boys and 6 girls such that it always has a boy and a gir. The number of ways to form such committee is -

(1) $2^{11} - 2^7 - 35$ (2) $2^{12} - 2^7 - 13$ (3) $2^{11} - 2^6 - 35$ (4) $2^{12} - 2^7 - 35$

Sol. **(4)**

Number of ways to select atleast three passons

= Total – no selection – 1 person selected – 2 person selected

$= 2^{12} - 1 - 12 - {}^{12}C_2$

$= 2^{12} - 79$

Required ways $= 2^{12} - 79 - [{}^6C_3 + {}^6C_3 + {}^6C_4 + {}^6C_4 + {}^6C_5 + {}^6C_6]$

$= 2^{12} - 79 - (2^7 - 44)$

$= 2^{12} - 2^7 - 35$

14. If $f(x) = \begin{cases} 1 - x^2, & x \le -1 \\ 2x + 2, & x > -1 \end{cases}$ then the derivative of f(x) at x = –1 is -

(1) 3 (2) 2 (3) 0 (4) $\frac{1}{2}$

Sol. **(2)**

$$f(x) = \begin{cases} 1 - x^2, & x \le -1 \\ 2x + 2, & x > -1 \end{cases}$$

at x = – 1 , it is continuous

$$f'(x) = \begin{cases} -2x, & x = -1 \\ 2, & x > -1 \end{cases}$$

$\Rightarrow f'(x) = 2$ **Ans.**

15. Shortest distance between z-axis and the line $\frac{x-2}{3} = \frac{y-5}{2} = \frac{z+1}{-5}$ is -

(1) $\frac{11}{\sqrt{13}}$ (2) $\frac{1}{\sqrt{13}}$ (3) $\frac{11}{13}$ (4) $\frac{\sqrt{11}}{13}$

Sol. **(1)**

Equation of z-axis $\frac{x-0}{0} = \frac{y-0}{0} = \frac{z-0}{1}$

$\vec{b} = \hat{k}$

and line $\frac{x-2}{3} = \frac{y-5}{2} = \frac{z+1}{-5}$

$\vec{d} = 3\hat{i} + 2\hat{j} - 5\hat{k}$

$\vec{b} \times \vec{d} = 3\hat{j} - 2\hat{i}$

$$\text{S.D} = \left|\frac{(\vec{c}-\vec{a}).(\vec{b}\times\vec{d})}{|\vec{b}\times\vec{d}|}\right| = \left|\frac{(2\hat{i}+5\hat{j}-\hat{k}).(-2\hat{i}+3\hat{j})}{\sqrt{3}}\right| = \frac{11}{\sqrt{13}}$$

16. **Statement - 1 :** ~ (A $\Leftrightarrow$~B) is equivalent to A $\Leftrightarrow$ B .
Statement - 2 : A v (~(A^~B)) a tautology.
(1) Statement - 1 is true, Statement - 2 is false.
(2) Statement - 1 is false, Statement - 2 is true.
(3) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is a correct explanation for Statement - 1.
(4) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is ***not*** a correct explanation for Statement - 1.

Sol. **(4)**
Statement - 1 :

A	B	~B	A $\leftrightarrow$ B	A $\leftrightarrow$ ~ B	~ (A $\leftrightarrow$ B)
T	F	T	F	T	F
F	T	F	F	T	F
T	T	F	T	F	T
F	F	T	T	F	T

so statement - 1 is true
Statement -2
A v (~(A^ ~B))
A v (~A v B)
= (A v ~ A) v B
= t v B
= t
Statement (2) is true.

17. **Statement - 1 :** The function f(x) = $x^2 e^{-x^2}$ sin | x | is even.
Statement - 2 : Product of two odd functions is an even function.
(1) Statement - 1 is true, Statement - 2 is false.
(2) Statement - 1 is false, Statement - 2 is true.
(3) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is a correct explanation for Statement - 1.
(4) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is ***not*** a correct explanation for Statement - 1.

Sol. **(3)**
Statement - 1 : $f(x) = x^2 e^{-x^2} \sin|x|$

$f(-x) = (-x)^2 e^{-x^2} \sin|x|$

$f(-x) = x^2 e^{-x^2} \sin|x| = f(x)$

even function , statement-1 is true.
Statement - 2 : let f(x) and g(x) are two odd functions and f(x) = f'(x) g(x)
h(–x) = f(–x) g(–x)
h(–x) = f(x) g(x) = f(x)

Statement - 2 is also true. but it does not explain statement - 1

18. If the mean and standard deviation of 20 observations $X_1, X_2, X_3, ..., X_{20}$ are 50 and 10 respectively, then $\sum_{i=1}^{20} X_i^2$ is equal to :

(1) 2600 (2) 2510 (3) 50200 (4) 52000

Sol. **(4)**

$X = 50$

S.D. = 10

$(S.D.)^2 = 100$

$$100 = \frac{\sum X_i^2}{90} - (\overline{X})^2$$

$$\frac{\sum X_i^2}{20} - 2500 = 100$$

$$\sum X_i^2 = 52000$$

19. If the sum of the coefficients in the expansion of $(x+y)^n$ is 2048, then the greatest coefficient in the expansion is :

(1) $^{12}C_6$ (2) $^{10}C_6$ (3) $^{11}C_6$ (4) $^{11}C_7$

Sol. **(3)**

$(x+y)^n = nC_0x^n + nC_1x^{n-1}y^1 + ... + nC_0y^n$

put x = y = 1

$2^n = C_0 + C_1 + C_2 + ... + C_n = 2048$

$2^n = 2^{11} \Rightarrow n = 11$

greatest coeff. in the expansion of $(x+y)^{11}$ is

$^{11}C_0$

20. Let $f : R \rightarrow R$ be defined as $f(x) = \int_0^1 \frac{x^2 + t^2}{2 - t}\,dt$. Then the curve y = f(x) is -

(1) a hyperbola (2) an ellipse (3) a straight line (4) a parabola

Sol. **(4)**

$$f(x) = \int_0^1 \frac{x^2 + t^2}{2 - t}\,dt.$$

$$= \int_0^1 \left(\frac{x^2}{2-t} + \frac{t^2 - 4}{2-t} + \frac{4}{2-t}\right)dt$$

$$= -x^2\,[\ell n(2-t)]_0^1 - \left(\frac{t^2}{2} + 2t\right)_0^1 - [4\ell n(2-t)]_0^1$$

$$= -x^2\,(\ell n2) - \frac{5}{2} + 4\ell n2$$

$$f(x) = x^2 \ln 2 - \frac{5}{2} + 4\ell n2 = y$$

This is equaiton of parabola

21. Let p, q, r be real numbers such that $p + q + r \neq 0$. The system of linear equations

$x + 2y - 3z = p$

$2x + 6y - 11z = q$

$x - 2y + 7z = r$

has at least one solution if :

(1) $5p + 2q - r = 0$ (2) $5p - 2q - r = 0$ (3) $5p + 2q + r = 0$ (4) $5p - 2q + r = 0$

Sol. **(2)**

$x + 2y - 3z = p$

$2x + 6y - 11z = q$

$x - 2y + 7z = r$

$$D = \begin{vmatrix} 1 & 2 & -3 \\ 2 & 6 & -11 \\ 1 & -2 & 7 \end{vmatrix}$$

$= 1(42 – 22) – 2(14+11) –3 (–4–6)$
$= 20 – 50 + 30 = 0$

$$D_1 = \begin{vmatrix} p & 2 & -3 \\ q & 6 & -11 \\ r & -2 & 7 \end{vmatrix} \qquad = p(20) – 2(7q + 11r) – 3(–2q – 6r)$$

$= 20p – 14q – 22r + 6q + 18r$
$= 20p – 8q – 4r = 4(5p – 2q – r)$

If $D_1 = 0$, then there are infinite solutions which confirm at least one solution.
$\therefore\ 5p – 2q – r = 0$

22. The equation of a curve is given by $y = f(x)$. where $f''(x)$ is a continuous function. The tangents at points (1, f(1), (2, f(2)) and (3, f(3)) make angles $\frac{\pi}{6}$, $\frac{\pi}{3}$ and $\frac{\pi}{4}$ respectively with the positive x-axis. Then

$\int_2^3 f'(x)\,f''(x)dx + \int_1^3 f''(x)\,dx$ is :

(1) 0 (2) 1 (3*) $-\frac{1}{\sqrt{3}}$ (4) $\frac{1}{\sqrt{3}}$

Sol. **(3)**

$\int_2^3 f'(x)\,f''(x)dx$ .... (I_1) + $\int_1^3 f''(x)\,dx$ .... (I_2)

$I_1 = f'(x)^2 \Big|_2^3 - \int_2^3 f'(x)\,f''(x)dx$

$I_1 = (f'(3))^2 - (f'(2))^2 - I_1$

$2I_1 = 1^2 - (\sqrt{3})^2 = -2$

$I_1 = -1$

$I_2 = f'(x)\,|_1^3 = f'(3) - f'(1)$

$I_2 = 1 - \frac{1}{\sqrt{3}}$

$I_1 + I_2 = -1 + 1 - \frac{1}{\sqrt{3}} = -\frac{1}{\sqrt{3}}$

23. Consider the folowing relations
R_1 = { (x , y) : x, y are integers and x = ay or y = ax for some integer a }
R_2 = {(x, y) : x, y are integers and ax + by = 1 for some integers a, b}
Then

(1) R_2 is an equivalence relation but R_1 is not
(2) R_1, R_2 are not equivalence relations.
(3) R_1, R_2 are equivalence relations.
(4) R_1 is an equivalence relation but R_2 is not

Sol. **(2)**
Relation R_1 :
(i) x = ax for a = 1 $\therefore$ reflexive
(ii) x = ay

$\Rightarrow y = \frac{1}{a}x \Rightarrow$ a may not be integer

$\therefore$ not symmetric

so R_1 is not equivalance

Relation R_2 : $ax + ax = 1 \Rightarrow 2ax = 1$

$ax = \frac{1}{2}$ not possible so R2 is not reflexive so not equivalance

24. If $x^2 - 3x + 2$ is factor of $x^4 - ax^2 + b = 0$, then the equation whose roots are a and b is :

(1) $x^2 + 9x - 20 = 0$ (2) $x^2 + 9x + 20 = 0$ (3) $x^2 - 9x - 20 = 0$ (4) $x^2 - 9x + 20 = 0$

Sol. **(4)**

$x^2 - 3x + 2$ is factor of $x^4 - ax^2 + b = 0$

but $f(x) = x^4 - ax^2 + b$

$x^2 - 3x + 2$ is a factor of f(x)

$\therefore f(1) = 0$

$\Rightarrow 1 - a + b = 0 \Rightarrow a - b = 1$ .... (i)

also $f(2) = 0$

$16 - 4a + b = 0 \Rightarrow 4a - b = 16$ .... (ii)

(ii) – (i)

$3a = 15$

$a = 5$

$b = 4$

$\therefore x^2 - 9x + 20$ is the desived equaiton

25. If P(A) = 0.4 , P(B') = 0.6 and $P(A \cap B) = 0.15$, then the value of $P(A|A' \cup B')$ is

(1) $\frac{10}{17}$ (2) $\frac{1}{17}$ (3) $\frac{4}{17}$ (4) $\frac{5}{17}$

Sol. **(4)**

P(A) = 0.4 = P(A') = 0.6

$$P(A/A' \cup B') = \frac{P(A \cup (A' \cap B'))}{P(A' \cup B')}$$

$$= \frac{P(A) - P(A \cap B)}{1 - P(A \cap B)} = \frac{.4 - .15}{1 - .15} = \frac{.25}{.85} = \frac{5}{17}$$

26. **Statement - 1 :** If $f(x) = e^{(x-1)(x-3)}$, then Rolle's theorem is applicable to f(x) in the interval [1, 3]

Statement - 2 : Mean value theorem is applicable to $f(x) = e^{(x-1)(x-3)}$ in the interval [1, 4]

(1) Statement - 1 is true, Statement - 2 is false.

(2) Statement - 1 is false, Statement - 2 is true.

(3) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is correct explanation for Statement - 1.

(4) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is ***not*** a correct explanation for Statement - 1.

Sol. **(4)**

$f(x) = e^{(x-1)(x-3)}$ is continuous and differentiable $\forall x \in R$.

so mean value theorem is applicable.

Also f(1) = f(3). So rolle's theorem is also applicable.

27. If a and b are such that $a \sin\theta = b\cos\theta$ for $0 \le \theta < \pi/4$, then $\sqrt{\frac{a-b}{a+b}} + \sqrt{\frac{a+b}{a-b}}$ equals :

(1) $\frac{2\sin\theta}{\sqrt{\cos 2\theta}}$ (2) $\frac{2}{\sqrt{\cos 2\theta}}$ (3) $2\cos\theta$ (4*) $\frac{2\cos\theta}{\sqrt{\cos 2\theta}}$

Sol. **(4)**

$$\sqrt{\frac{a-b}{a+b}} + \sqrt{\frac{a+b}{a-b}} = \frac{2a}{\sqrt{a^2 - b^2}} = \frac{2}{\sqrt{1 - \frac{b^2}{a^2}}}$$

$$= \frac{2}{\sqrt{1 - \tan^2\theta}} = \frac{2\cos\theta}{\sqrt{\cos 2\theta}}$$

28. If y(x) is a solution of the differential equation $\frac{dy}{dx} + 3y = 2$, then $\lim_{x\to\infty} y(x)$ is equal to -

(1*) $\frac{2}{3}$ (2) 1 (3) 0 (4) $\frac{3}{2}$

Sol. **(1)**

$$\frac{dy}{dx} + 3y = 2 \Rightarrow \int \frac{dy}{2-3y} = \int dx$$

$$\Rightarrow \frac{-\ell n(2-3y)}{3} = x + c$$

$$\Rightarrow \ell n(2-3y) = -3x - c$$

$$\Rightarrow 2 - 3y = e^{-3x} . e^{-c} \quad \Rightarrow y = \frac{2 - e^{-3x} . e^{-c}}{3}$$

$$\lim_{x\to\infty} y = \lim_{x\to\infty} \frac{2 - e^{-3x} . e^{-c}}{3} = \frac{2}{3}$$

29. Let A and B be two 2 × 2 matrices.

Statement - 1 : A(adj A) = | A | I_2

Statement - 2 : adj(AB) = (adj A) (adj B)

(1) Statement - 1 is true, Statement - 2 is false.

(2) Statement - 1 is false, Statement - 2 is true.

(3) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is correct explanation for Statement - 1.

(4) Statement - 1 is true, Statement - 2 is true ; Statement - 2 is ***not*** a correct explanation for Statement - 1.

Sol. **(1)**

adj(AB) = (adj B) (adj A)

so statement 2 is false

30. The equation of a circle of area 22π square units for which each of the two lines 2x + y = 2 and x – y = –5 is diameter is :

(1) $x^2 + y^2 + 2x + 8y - 5 = 0$ (2) $x^2 + y^2 - 2x + 8y - 5 = 0$

(3) $x^2 + y^2 - 2x - 8y - 5 = 0$ (4) $x^2 + y^2 + 2x - 8y - 5 = 0$

Sol. **(4)**

$\pi r^2 = 22\pi \Rightarrow r^2 = 22$

solving 2x + y = 2 and x – y = – 5

we get centre of circle as (–1, 4)

So equation of circle is $(x + 1)^2 + (y - 4)^2 = 22$

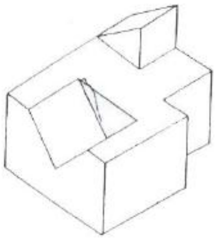
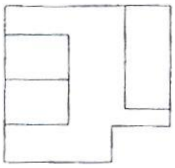
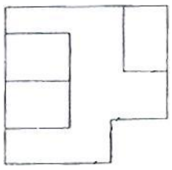
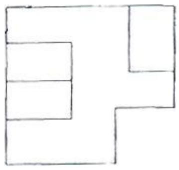
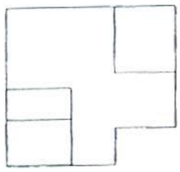
$\Rightarrow x^2 + y^2 + 2x - 8y - 5 = 0$

PART-II (APTITUDE)

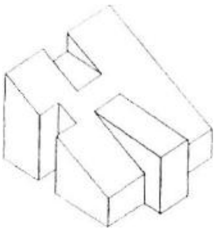
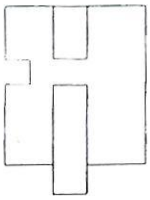
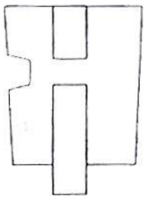
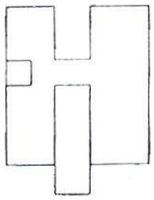
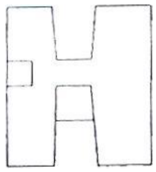
Directions (For Q.31 to 35)

The 3-D problem figure shows the veiw of an object. Identify its correct top view from amongst the answer figures.

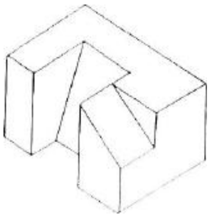
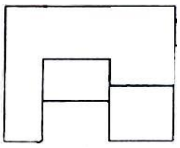
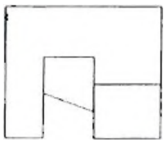
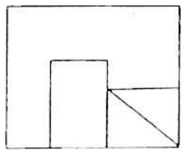
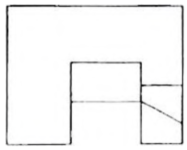
Problem **Answer Figures**

31.  (1)  (2)  (3)  (4) 

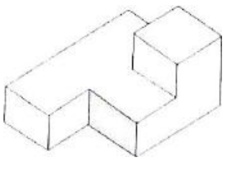
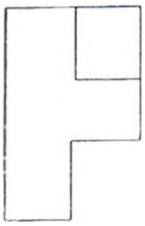
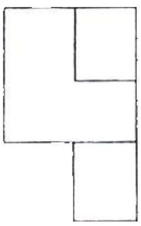
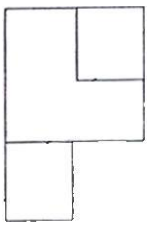
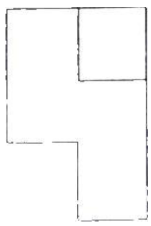
Ans. 2

32.  (1)  (2)  (3)  (4) 

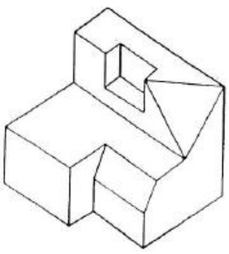
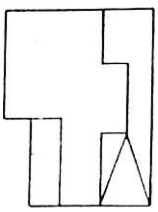
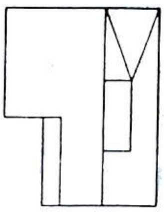
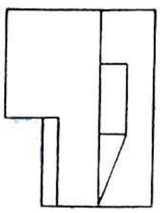
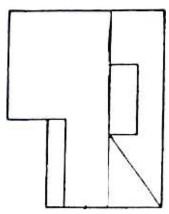
Ans. 1

33.  (1)  (2)  (3)  (4) 

Ans. 1

34.  (1)  (2)  (3)  (4) 

Ans. 1

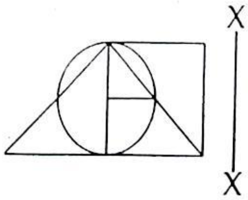
35.  (1)  (2)  (3)  (4) 

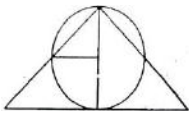
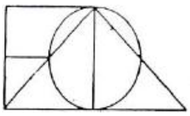
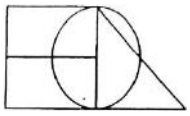
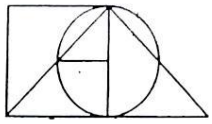
Ans. 4

Directions (For Q.36 to 38)

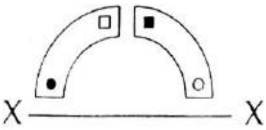
Which one of the answer figures is the correct mirror image of the problem figure with respect to X – X?

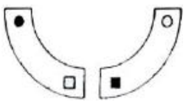
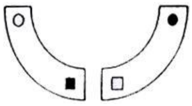
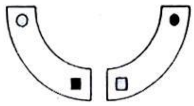
Problem **Answer Figures**

36. 

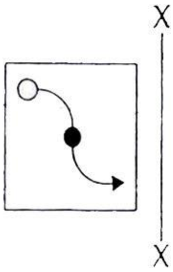
(1)  (2)  (3)  (4) 

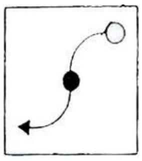
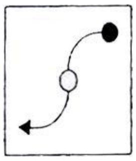
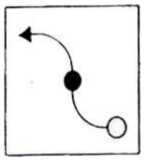
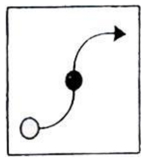
Ans. **4**

37. 

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

Ans. **1**

38. 

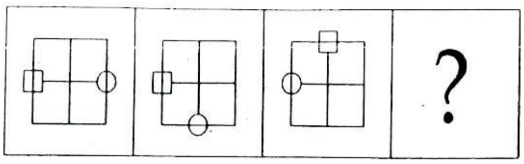
(1)  (2)  (3)  (4) 

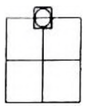
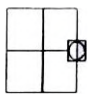
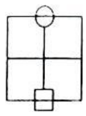
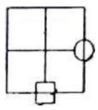
Ans. **1**

Directions (For Q.39 to 41)

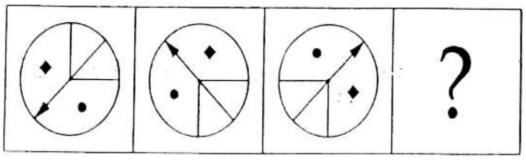
Which one of the answer figures will complete the sequence of the three problem figures?

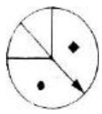
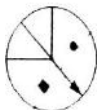
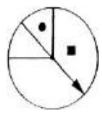
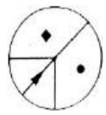
Problem **Answer Figures**

39. 

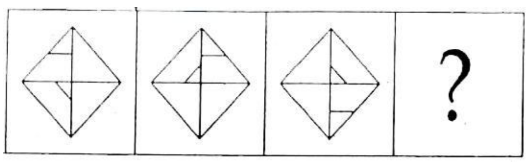
(1)  (2)  (3)  (4) 

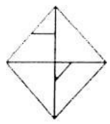
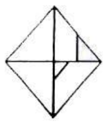
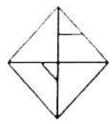
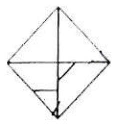
Ans. **1**

40. 

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

Ans. **2**

41. 

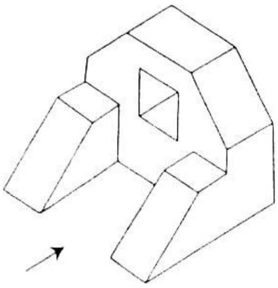
(1)  (2)  (3)  (4) 

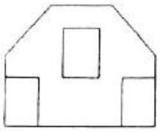
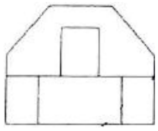
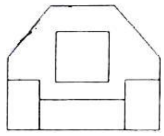
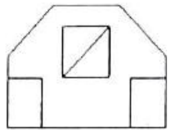
Ans. **4**

Directions (For Q.42 to 48)

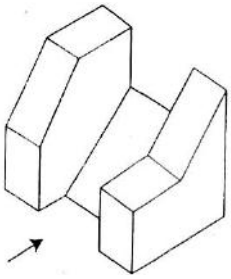
The 3-D problem figure shows the veiw of an object. Identify its correct front view, from amongst the answer figures, looking in the direction of arrow.

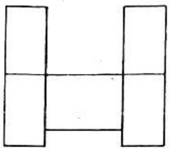
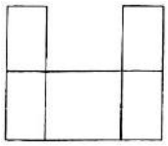
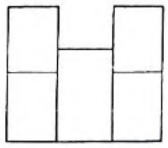
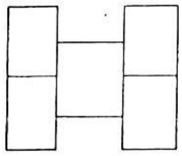
Problem **Answer Figures**

42. 

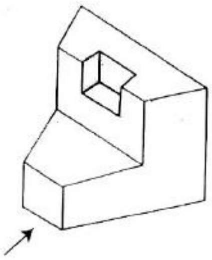
(1)  (2)  (3)  (4) 

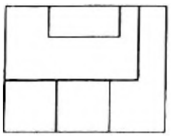
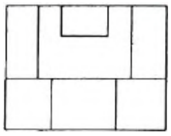
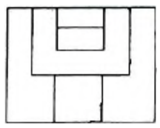
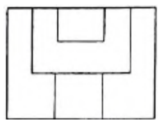
Ans. **1**

43. 

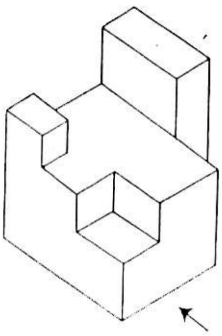
(1)  (2)  (3)  (4) 

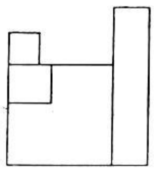
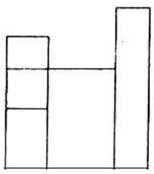
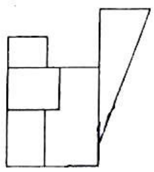
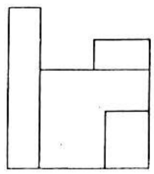
Ans. **3**

44. 

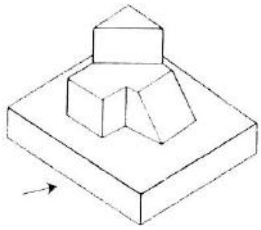
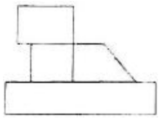
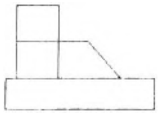
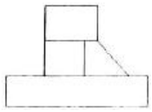
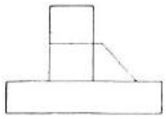
(1)  (2)  (3)  (4) 

Ans. **4**

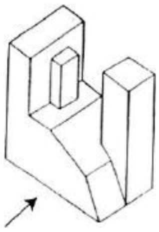
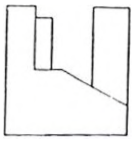
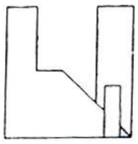
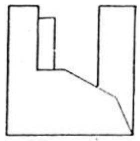
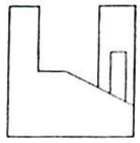
45. 

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

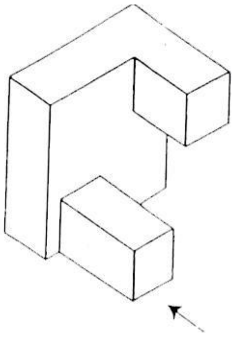
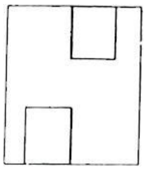
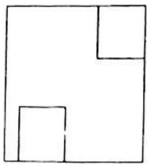
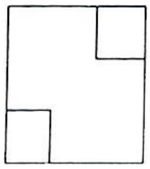
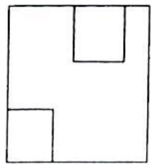
Ans. **1**

46.  (1)  (2)  (3)  (4) 

Ans. **4**

47.  (1)  (2)  (3)  (4) 

Ans. **3**

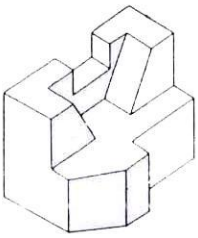
48.  (1)  (2)  (3)  (4) 

Ans. **2**

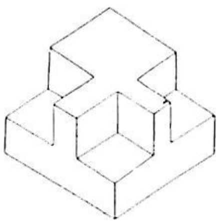
Directions (For Q.49 to 53)

Find out the total number of surfaces of the object given below in the problem figure.

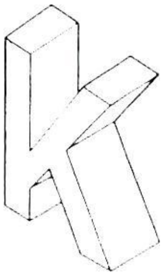
Problem

49.  (1) 18 (2) 20 (3) 17 (4) 19

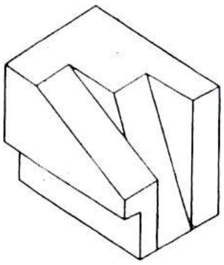
Ans. **4**

50.  (1) 14 (2) 15 (3) 12 (4) 13

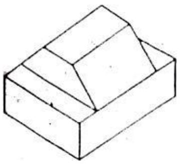
Ans. **2**

51.  (1) 13 (2) 14 (3) 11 (4) 12

Ans. **2**

52.  (1) 15 (2) 16 (3) 14 (4) 12

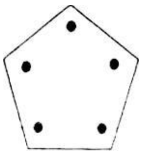
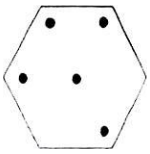
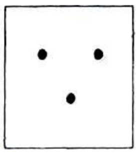
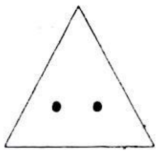
Ans. **4**

53.  (1) 13 (2) 12 (3) 15 (4) 14

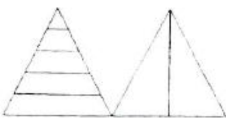
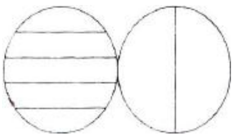
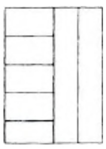
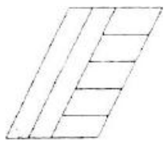
Ans. **2**

Directions (For Q.54 to 55)

Find the odd figures out in the problem figures given below :

54. (1)  (2)  (3)  (4) 

Ans. **1**

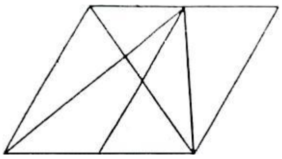
55. (1)  (2)  (3)  (4) 

Ans. **4**

Directions (For Q.56 to 57)

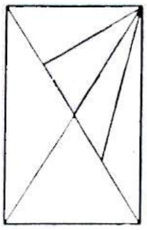
How many total number of triangles are there in the problem figure given below?

Problem Figure

56. 

(1) 18 (2) 17 (3) 14 (4) 16

Ans. 4

57. 

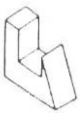
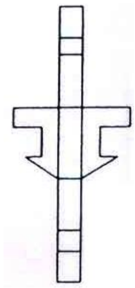
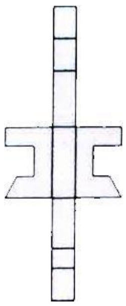
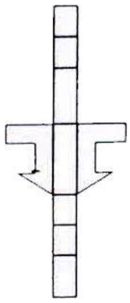
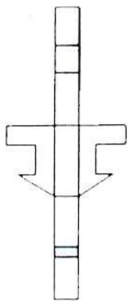
(1) 16 (2) 13 (3) 15 (4) 14

Ans. 3

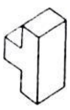
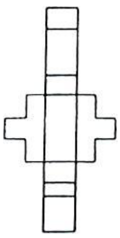
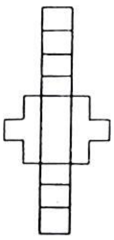
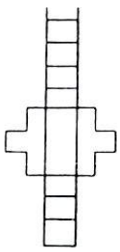
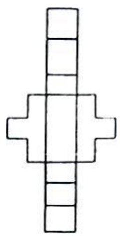
Directions (For Q.58 to 60)

Which one of the answer figures shows the correct view of the 3-D problem figure, after the problem figure is opened up?

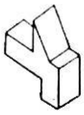
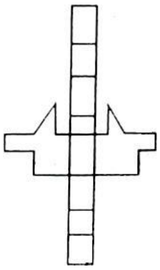
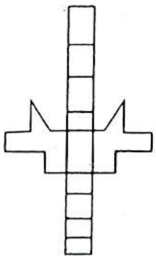
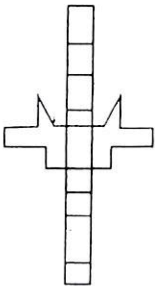
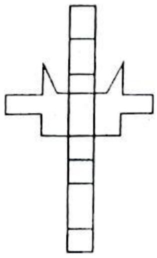
Problem Figure **Answer Figure**

58.  (1)  (2)  (3)  (4) 

Ans. 1

59.  (1)  (2)  (3)  (4) 

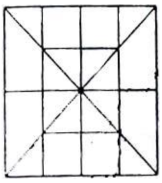
Ans. 2

60.  (1)  (2)  (3)  (4) 

Ans. **3**

Directions (For Q.61)

How many total number of squares are there in the problem figure given below?

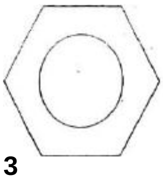
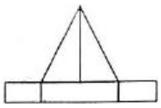
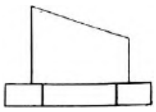
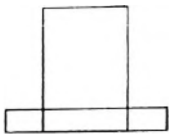
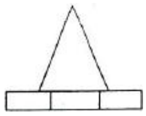
61. 

(1) 19 (2) 20 (3) 13 (4) 16

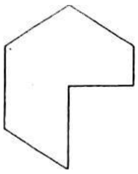
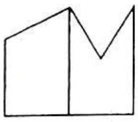
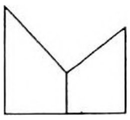
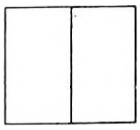
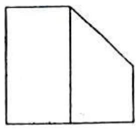
Ans. **4**

Directions (For Q.62 to 63)

The problem figure shows the top view of an object. Identify its correct front view, from amongst the snwer figures.

62.  (1)  (2)  (3)  (4) 

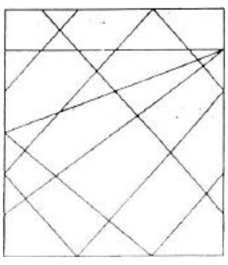
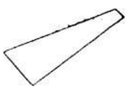
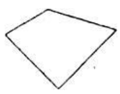
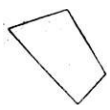
Ans. **3**

63.  (1)  (2)  (3)  (4) 

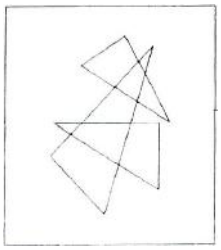
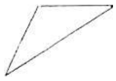
Ans. **3**

Directions (For Q.64 to 65)

One of the following answer figures is hidden in the problem figure, in the same size and direction. Select, which one is correct?

64.  (1)  (2)  (3)  (4) 

Ans. **1**

65.  (1)  (2)  (3)  (4) 

Ans. **2**

66. Who was the architect of Sansad Bhawan, New Delhi?

(1) A.P. Kanvinde (2) Alvar Alto (3) Charles Correa (4) Herbert Baker

Ans. **4**

67. Which one of the following is an Earthquake resistant structure?

(1) Random stone masonary. (2) Mud walls.

(3) RCC framed. (4) Load bearing brick walled.

Ans. **3**

68. What is ‘Green Architecture’ ?

(1) Where maximum green plants are

(2) Where green coloured glass is used.

(3) Where buildings are painted green.

(4) Where building material used have consumed least energy.

Ans. **4**

69. Which structural component can be built without steel reinforcement ?

(1) Domes (2) Folded concrete roof slabs

(3) Concrete beams (4) Flat concrete roof slabs

Ans. **1**

70. In buildings, which parts are responsible for maximum heat Eain?

(1) Windows (2) Chajjas (3) Roofs (4) Walls

Ans. **3**

71. Trees should be planted on which side to protect buildings from heat gain?

(1) West side (2) East side (3) North (4) North-East side

Ans. **1**

72. Cavity walls are best suited against:

(1) Rain (2) Heat (3) Dust (4) Light

Ans. **2**

73. Who amongst the following is an architect ?

(1) Usha Uthup (2) Raj Rewal (3) Ravi Shankar (4) Shanker Mahadevan

Ans. **2**

74. The Dome of influenced by:

(1) Stupa (2) Gurdwara (3) Mosque (4) Temple

Ans. **1**

75. Which one of the following is not a matching set ?

(1) Heat - Insulation

(2) Steel - Mud

(3) Concrete - Beam

(4) Sound - Vibration

Ans. **2**

76. Name the city, where canals are used for transportation channels:

(1) Venice (2) Canberra (3) Tokyo (4) Manhattan

Ans. **1**

77. Tracing paper is:

(1) Opaque (2) Black (3) Transparent (4) Semi-transparent

Ans. **3**

78. New Gugenheium museum is designed by:

(1) LM. Pie (2) Frank O Gehry (3) F.L. Wright (4) Charles Correa

Ans. **2**

79. Horizontal sun shades are required to protect windows on which facade of a building?

(1) North (2) South (3) East (4) West

Ans. **2**

80. Which is not a sound absorbing material?

(1) Ground Glass (2) Jute Bags (3) Thermocol (4) Glass

Ans. **1**