JEE Main 2020 Paper 2A (B.Arch) Sep 1 Shift 1 Question Paper

Conducted by the National Testing Agency (NTA)

Time Allowed: 3 Hours **B.Arch** **Maximum Marks: 400**

General Instructions

(i) This is **Paper 2A (B.Arch)** of **JEE (Main) 2020**, conducted by the National Testing Agency on **1 Sep 2020**.

(ii) The paper contains **77 questions**; attempt **77** as specified in the section table. The maximum score is **400 marks**.

(iii) Multiple choice questions have four options. Select one answer. Each correct answer carries **4 marks**; an incorrect answer carries **−1 mark**.

(iv) Numerical value questions carry **4 marks** for a correct answer and **0 marks** for an incorrect answer. Unanswered questions carry **0 marks**.

(v) The Drawing section contains **two questions of 50 marks each**. Follow the alternatives and instructions printed within each question.

(vi) All questions are compulsory.

Section	Questions	To attempt	Marks
Mathematics	25	25	100
Aptitude Test	50	50	200
Drawing	2	2	100

Mathematics

1. 4 marks

Let a function, $f : \mathbf{R} \to \mathbf{R}$ be defined by

$f(x) = 1 + x|x|$ and let $\text{sgn}(x) = \begin{cases} 1, \text{if } x \geq 0 \\ -1, \text{if } x < 0 \end{cases}$

Then :

(1) f is not invertible

(2) $f^{-1}(x) = \text{sgn}(x-1)\sqrt{|x-1|}$

(3) $f^{-1}(x) = \sqrt{|x-1|}$

(4) $f^{-1}(x) = \text{sgn}(x)\sqrt{|x-1|}$

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2. 4 marks

Let α be a common root of the equations, $x^2 - x - 12 = 0$ and $\lambda x^2 + 10x + 3 = 0$ (where λ is an integer). If β is the other root of the second equation, then the ordered pair (λ, β) is equal to :

(1) $\left(-3, \frac{1}{3}\right)$

(2) $\left(-3, -\frac{1}{3}\right)$

(3) $\left(3, \frac{1}{3}\right)$

(4) $\left(3, -\frac{1}{3}\right)$

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3. 4 marks

If $z = -1 + i\sqrt{2}$, then which one of the following is **not** true ?

(1) $\text{Re}(z^4) + \text{Re}(z^3) = -2$

(2) $\text{Im}(z^4) + \text{Im}(z^3) = 5\sqrt{2}$

(3) $\text{Im}(z^4) - \text{Re}(z^3) = 4\sqrt{2} - 5$

(4) $\text{Re}(z^4) - \text{Im}(z^3) = \sqrt{2} - 7$

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4. 4 marks

For $\theta\epsilon(0, \pi/2)$, $\theta\epsilon(\pi, 2\pi)$ and $\beta\epsilon\mathbf{R}$, the value of the determinant

$$\begin{vmatrix} \cos 2\alpha & \cos(\alpha+\theta) & -\sin(\alpha+\theta) \\ \sin\alpha & \sin\theta & \cos\theta \\ \beta\cos\alpha & -\cos\theta & \sin\theta \end{vmatrix} :$$

(1) is independent of α.

(2) is independent of β.

(3) is independent of θ.

(4) depends on all α, β and θ.

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5. 4 marks

Let $A = \begin{pmatrix} \alpha & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{pmatrix}$, $\alpha\epsilon\mathbf{R}$ and $B = [b_{ij}]_{3\times 3}$ such that $AB = rI$, $r \neq 0$ in $\mathbf{R}$. If $b_{32} = -\frac{3}{2}r$ and $|adjB| = r^5$, then $|adj(AB)|$ equals :

(1) 4^{12}

(2) 2^{12}

(3) 2^6

(4) 4^8

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6. 4 marks

Let a_1, a_2, a_3, a_4 and a_5 be in A.P. with the common difference greater than 2. If $\sum_{i=1}^{5} a_i = 30$ and $a_1 \cdot a_2 \cdot a_3 \cdot a_4 \cdot a_5 = 3840$, then $a_1 \cdot a_5$ is equal to :

(1) 82

(2) -128

(3) 128

(4) -82

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7. 4 marks

Let the functions f and g be defined as $f(x)=2\cos|x-2|+3|x|\sin|x|$ and $g(x)=x^5+x$. If S be the set of points where the function $(fog)(x)$ is not differentiable, then S is equal to :

(1) $\{1\}$

(2) $\{0\}$

(3) $\{0, 1\}$

(4) ϕ (an empty set)

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8. 4 marks

Let f be a twice differentiable function on **R** such that $f(0)=4$ and the function, $g(x)=\frac{1}{2}f^2(x)+3x^3-5$ is monotonically increasing in **R**. Then $f(1)$ **cannot** be :

(1) $2\sqrt{3}$

(2) $3\sqrt{2}$

(3) 4

(4) $2\sqrt{2}$

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9. 4 marks

Let $f(x)=(2x^2-9x+11)\cdot e^x,\ -\infty<x<\infty$. Then f has :

(1) a local maxima at $x=\frac{1}{2}$ and a local minima at $x=2$.

(2) a local minima at $x=\frac{1}{2}$ and a local maxima at $x=2$.

(3) neither a local maxima nor a local minima at $x=\frac{1}{2}$.

(4) neither a local maxima nor a local minima at $x=2$.

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10. 4 marks

If for $x > 0$,

$$\int \frac{e^{\sqrt{x}} \sin\left(\frac{\pi}{4} + \sqrt{x}\right)}{\sqrt{x}} dx = e^{\sqrt{x}} \cdot f(x) + C,$$

where C is a constant of integration, then $f(x)$ is equal to :

(1) $\frac{3}{\sqrt{2}} \cos\sqrt{x}$

(2) $\frac{2\sqrt{2}}{3} \sin\sqrt{x}$

(3) $\sqrt{2} \sin\sqrt{x}$

(4) $\sqrt{2} \cos\sqrt{x}$

11. 4 marks

If $y(x) = \int_{\pi^2/16}^{x^2} \frac{\sin x \sin\sqrt{\theta}}{1 + \cos^2\sqrt{\theta}} d\theta$, then

$y'\left(\frac{\pi}{4}\right)$ is equal to :

(1) $\frac{\pi}{3\sqrt{2}}$

(2) $\frac{\pi}{12}$

(3) $\frac{\pi}{6}$

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

12. 4 marks

The area (in sq. units) of the region $\{(x, y) \in \mathbf{R}^2 : 2|x| + |y| \leq 2 \text{ and } x + y \geq 1\}$ is :

(1) $\frac{1}{3}$

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

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

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

13. 4 marks

Let ABC be a triangle such that the vertex A has coordinates $(-3, 1)$. If the equation of the median through B be $2x+y-3=0$ and the equation of the bisector of angle C be $7x-4y-1=0$, then the equation of the line BC is :

(1) $15x+y=50$

(2) $4x-y=7$

(3) $18x-y=49$

(4) $7x-3y=6$

14. 4 marks

If the ellipse centered at the origin has a focus at $(0, 3)$ and the corresponding directrix is $y=9$, then which one of the following is not true for this ellipse ?

(1) Length of its minor axis is $6\sqrt{2}$

(2) Length of its latus rectum is $4\sqrt{3}$

(3) Point $\left(\sqrt{6}, 2\sqrt{3}\right)$ lies on it

(4) Point $\left(\sqrt{6}, -3\sqrt{2}\right)$ lies on it

15. 4 marks

If a hyperbola has length of its transverse axis $=\sqrt{2}$ and it has the same foci as that of the ellipse, $4x^2+3y^2=24$, then this hyperbola also passes through the point whose coordinates are :

(1) $\left(2\sqrt{3}, \frac{3}{\sqrt{2}}\right)$

(2) $\left(2\sqrt{3}, \frac{3}{2}\right)$

(3) $\left(\frac{1}{\sqrt{6}}, 1\right)$

(4) $\left(\frac{1}{\sqrt{6}}, \frac{\sqrt{2}}{3}\right)$

16. 4 marks

Let P be the point of intersection of the plane, $4x-6y+14z=57$ with the line joining the points A(2, 3, 5) and B(1, −1, 4). If $BP=\lambda AP$, then the value of λ is :

(1) $\frac{1}{9}$

(2) 9

(3) $\frac{1}{3}$

(4) 3

17. 4 marks

A six faced biased dice is so loaded that in any of its toss getting any of even scores is equally likely and the probability of getting an even score is three times the probability of getting an odd score. This dice is tossed repeatedly until a six is obtained. If X denotes the number of tosses required, then $P(X<4)$ is :

(1) $\frac{19}{3^3}$

(2) $\frac{37}{4^3}$

(3) $\frac{61}{4^3}$

(4) $\frac{397}{(12)^3}$

18. 4 marks

If $2\sin x-\cos 2x=1$, then :

(1) $\cos^4 x-\cos^2 x=3-\sqrt{5}$

(2) $2(\cos^4 x-\cos^2 x)=-1$

(3) $\sin^4 x-\sin^2 x=2-\sqrt{5}$

(4) $2(\sin^4 x-\sin^2 x)=1$

19. 4 marks

Let $\vec{a}, \vec{b}, \vec{c}$ be any three non-coplanar vectors. If the points $A\left(-2\vec{a}+3\vec{b}+5\vec{c}\right)$, $B\left(\vec{a}+2\vec{b}+3\vec{c}\right)$ and $C\left(7\vec{a}-\lambda\vec{c}\right)$ are collinear, then λ is equal to :

(1) 1 (2) -1

(3) 2 (4) -2

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20. 4 marks

Which one of the following is a tautology ?

(1) $\sim(p \to q) \to q$ (2) $\sim(p \to q) \leftrightarrow \sim q$

(3) $\sim(p \to q) \leftrightarrow p$ (4) $\sim(p \to q) \to p$

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21. Numerical value · 4 marks

If the sum of all possible 4 digit numbers formed using digits 1, 2, 3, 4 without repetition, is 1111k, then k is equal to _____.

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22. Numerical value · 4 marks

If $x=\text{cosec}\theta-\sin\theta$ and $y=\text{cosec}^5\theta-\sin^5\theta$, $0<\theta<\frac{\pi}{2}$, then $\left(x^2+4\right)\left(\frac{dy}{dx}\right)^2-25y^2$ is equal to _____.

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23. Numerical value · 4 marks

Let the function $f : \mathbf{N} \to \mathbf{R}$ satisfy $f(x+y) = f(x) \cdot f(y)$ for all $x, y \in \mathbf{N}$ and $f(1) = 2$.

If $\sum_{k=1}^{50} f(4 + k) = \lambda(2^{\beta} - 1)$, then $\lambda + \beta$ is equal to _____.

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24. Numerical value · 4 marks

Let the circle, $(x-a)^2 + (y-b)^2 = 8$ and the parabola, $y^2 = 4x$ have a common tangent at the point P(1, 2). If C is the centre of the circle and S is the focus of the parabola, then the area (in sq. units) of ΔCPS is equal to _____.

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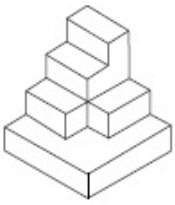
25. Numerical value · 4 marks

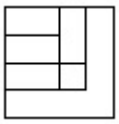
If $y = y(x)$ is a solution of the differential equation, $x\frac{dy}{dx} = y(2 - 3xy)$, $x > 0$ with $y(1) = 1$, then $y\left(\frac{1}{4}\right)$ is equal to _____.

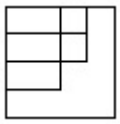
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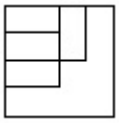
26. 4 marks

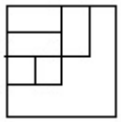
The 3 - D figure shows the view of an object. Identify the correct top view from amongst the answer figures.



(1) 

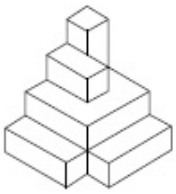
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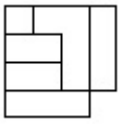
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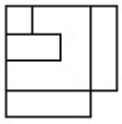
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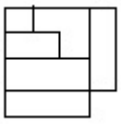
27. 4 marks

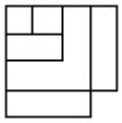
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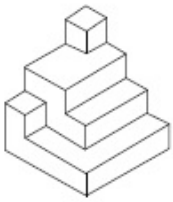
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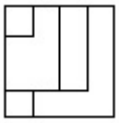
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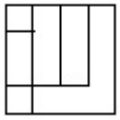
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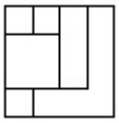
28. 4 marks

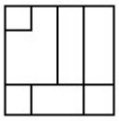
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(1) 

(2) 

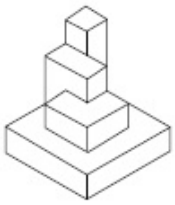
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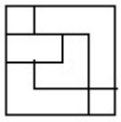
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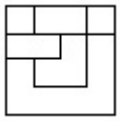
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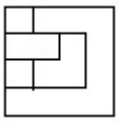
29. 4 marks

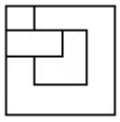
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(2) 

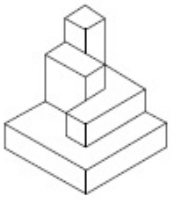
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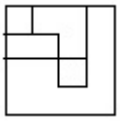
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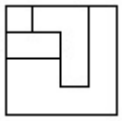
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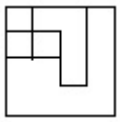
30. 4 marks

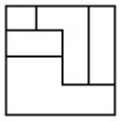
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(1) 

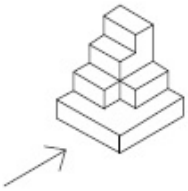
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(4) 

31. 4 marks

The 3 – D figure shows the view of an object. Identify the correct view in the direction of the arrow, from amongst the answer figures.



(1) 

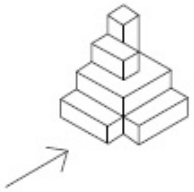
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32. 4 marks

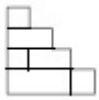
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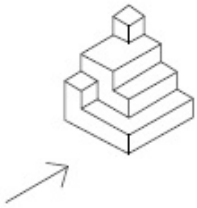
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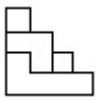
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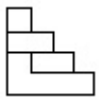
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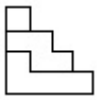
33. 4 marks

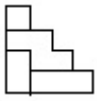
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(1) 

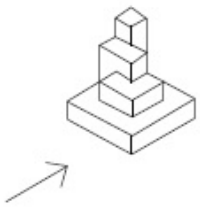
(2) 

(3) 

(4) 

34. 4 marks

The 3 – D figure shows the view of an object. Identify the correct view in the direction of the arrow, from amongst the answer figures.



(1) 

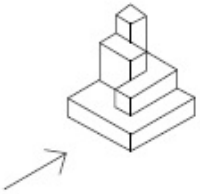
(2) 

(3) 

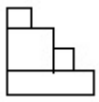
(4) 

35. 4 marks

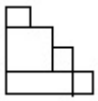
The 3 – D figure shows the view of an object. Identify the correct view in the direction of the arrow, from amongst the answer figures.



(1) 

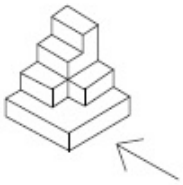
(2) 

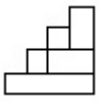
(3) 

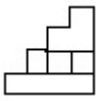
(4) 

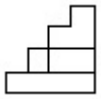
36. 4 marks

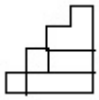
The 3 - D figure shows the view of an object. Identify the correct view in the direction of the arrow, from amongst the answer figures.



(1) 

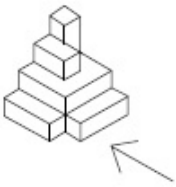
(2) 

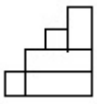
(3) 

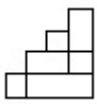
(4) 

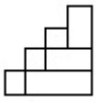
37. 4 marks

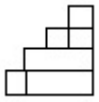
The 3 - D figure shows the view of an object. Identify the correct view in the direction of the arrow, from amongst the answer figures.



(1) 

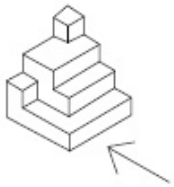
(2) 

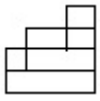
(3) 

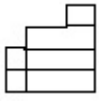
(4) 

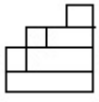
38. 4 marks

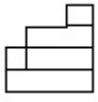
The 3 - D figure shows the view of an object. Identify the correct view in the direction of the arrow, from amongst the answer figures.



(1) 

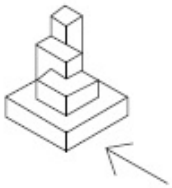
(2) 

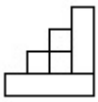
(3) 

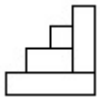
(4) 

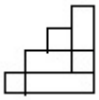
39. 4 marks

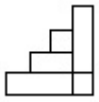
The 3 - D figure shows the view of an object. Identify the correct view in the direction of the arrow, from amongst the answer figures.



(1) 

(2) 

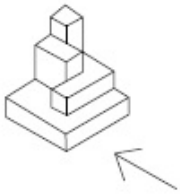
(3) 

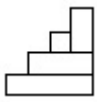
(4) 

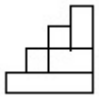
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40. 4 marks

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



(1) 

(2) 

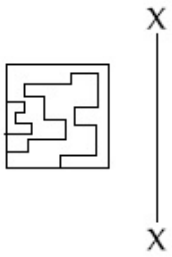
(3) 

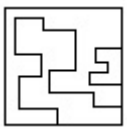
(4) 

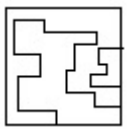
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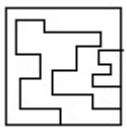
41. 4 marks

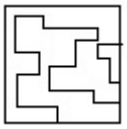
Which one of the answer figures is the correct mirror image of the problem figure with respect to X – X ?



(1) 

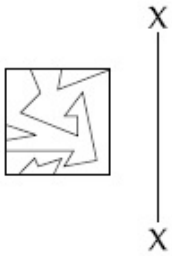
(2) 

(3) 

(4) 

42. 4 marks

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



(1) 

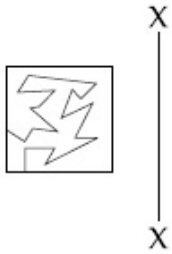
(2) 

(3) 

(4) 

43. 4 marks

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



(1) 

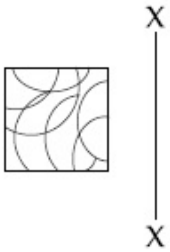
(2) 

(3) 

(4) 

44. 4 marks

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



(1) 

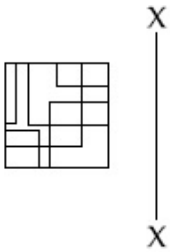
(2) 

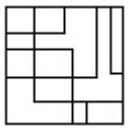
(3) 

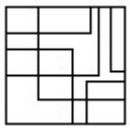
(4) 

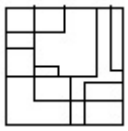
45. 4 marks

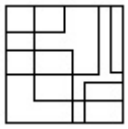
Which one of the answer figures is the correct mirror image of the problem figure with respect to X – X ?



(1) 

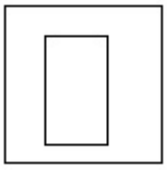
(2) 

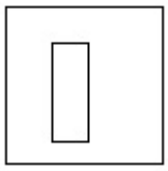
(3) 

(4) 

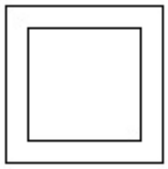
46. 4 marks

Find the odd figure out of the problem figures given below.

(1) 

(2) 

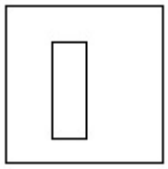
(3) 

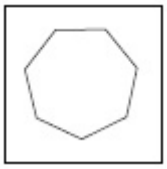
(4) 

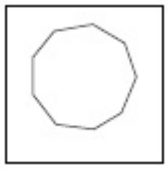
47. 4 marks

Find the odd figure out of the problem figures given below.

(1) 

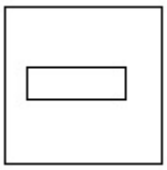
(2) 

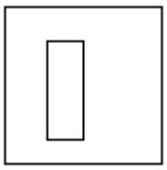
(3) 

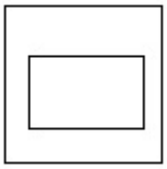
(4) 

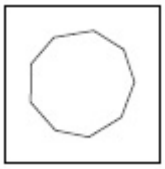
48. 4 marks

Find the odd figure out of the problem figures given below.

(1) 

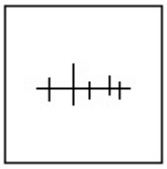
(2) 

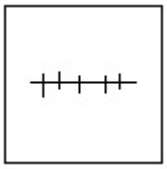
(3) 

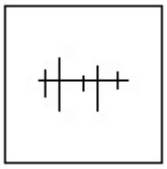
(4) 

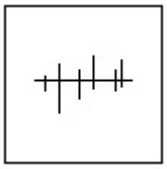
49. 4 marks

Find the odd figure out of the problem figures given below.

(1) 

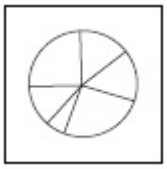
(2) 

(3) 

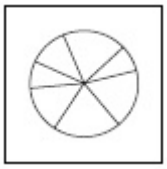
(4) 

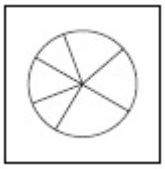
50. 4 marks

Find the odd figure out of the problem figures given below.

(1) 

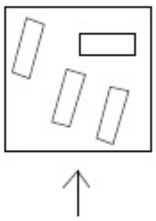
(2) 

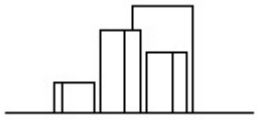
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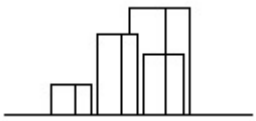
(4) 

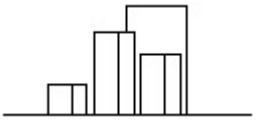
51. 4 marks

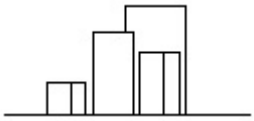
The problem figure shows the top view of objects. Looking in the direction of the arrow, identify the correct elevation, from amongst the answer figures.



(1) 

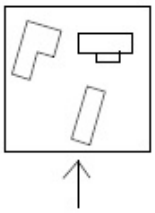
(2) 

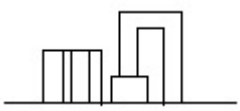
(3) 

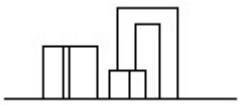
(4) 

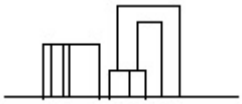
52. 4 marks

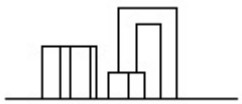
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(1) 

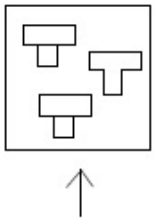
(2) 

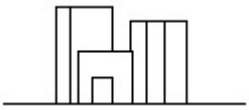
(3) 

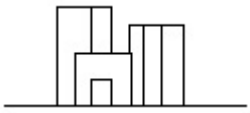
(4) 

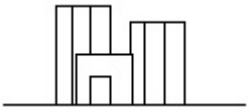
53. 4 marks

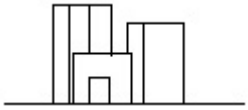
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(1) 

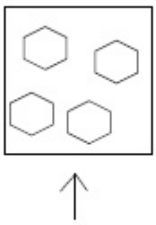
(2) 

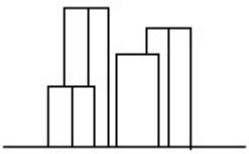
(3) 

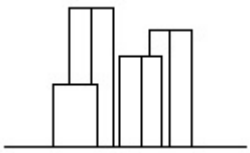
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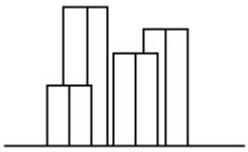
54. 4 marks

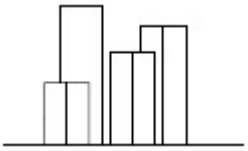
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(1) 

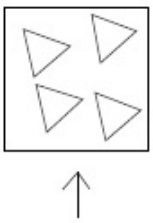
(2) 

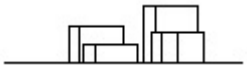
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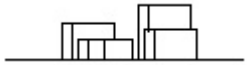
(4) 

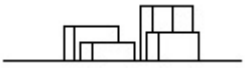
55. 4 marks

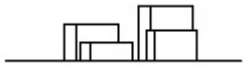
The problem figure shows the top view of objects. Looking in the direction of the arrow, identify the correct elevation, from amongst the answer figures.



(1) 

(2) 

(3) 

(4) 

56. 4 marks

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



(1) 

(2) 

(3) 

(4) 

57. 4 marks

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



(1) 

(2) 

(3) 

(4) 

58. 4 marks

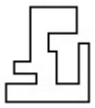
Which one of the answer figure will complete the sequence of the three problem figures ?



(1) 

(2) 

(3) 

(4) 

59. 4 marks

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



(1) 

(2) 

(3) 

(4) 

60. 4 marks

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



(1) 

(2) 

(3) 

(4) 

61. 4 marks

10 Downing Street is the residence of which one of the following ?

(1) President of America
(2) Prime Minister of England
(3) President of France
(4) President of Sri Lanka

62. 4 marks

In the Northern Hemisphere the winter sun sets in which one of the following directions ?

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

63. 4 marks

The famous Badrinath temple is located in which one of the following States ?

(1) Kerala
(2) Tamil Nadu
(3) Assam
(4) Uttarakhand

64. 4 marks

What is the thickness of a one brick thick wall ?

(1) 4.5″
(2) 9″
(3) 13.5″
(4) 12″

65. 4 marks

Why is the depth of a beam normally more than its width ?

(1) Horizontal Force
(2) Momentum
(3) Moment of Inertia
(4) Balance

66. 4 marks

Where is the famous Notre Dame Cathedral which caught fire recently located ?

(1) Paris
(2) Hague
(3) Venice
(4) Rome

67. 4 marks

The concept of CharBagh garden found in which one of the following garden concepts ?

(1) Christian
(2) Chinese
(3) Islamic
(4) Zen

68. 4 marks

Where is the Bara Imambara located ?

(1) Kolkata
(2) Mumbai
(3) Hyderabad
(4) Lucknow

69. 4 marks

Which one of the colors reflects the maximum light ?

(1) Red
(2) Green
(3) White
(4) Black

70. 4 marks

Which one of the following colors denotes equality ?

(1) White
(2) Blue
(3) Indigo
(4) Red

71. 4 marks

Which one of the following describes the texture of a hand made brick ?

(1) Smooth
(2) Glossy
(3) Rough
(4) Silky

72. 4 marks

What are shafts used for in buildings ?

(1) Beauty
(2) Concealing pipes
(3) Structural strength
(4) Stability

73. 4 marks

Which one of the following is the most suitable material for toilet floors ?

(1) Polished granite
(2) Non skid tiles
(3) Wood
(4) Carpet

74. 4 marks

Who amongst the following designed Indian Institute of Management ?

(1) Charles Correa
(2) B.V. Doshi
(3) Louis Kahn
(4) A.P. Kanvinde

75. 4 marks

Who amongst the following designed The Falling Waters ?

(1) Frank Ghery
(2) Zaha Hadid
(3) Norman Foster
(4) Frank Lloyd Wright

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Drawing

76. 50 marks

In the space provided for the answer of this question, draw an aesthetic composition appropriate to this space using only rectangles. There is no restriction to numbers, sizes, placement and directions of these shapes. Color this composition so that it becomes visually exciting.

77. 50 marks

Draw from imagination a highway on which cars and trucks are moving in both directions.

OR

Draw from imagination an interior of cinema hall.

OR

Draw from memory your best teachers face.