JEE Main 2024 Paper 2A (B.Arch) Jan 24 Single sitting 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) 2024**, conducted by the National Testing Agency on **24 Jan 2024**.

(ii) The paper contains **82 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 **−1 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) In Mathematics Section B, attempt **any five of the ten** numerical value questions.

Section	Questions	To attempt	Marks
Mathematics Section A	20	20	80
Mathematics Section B	10	5	20
Aptitude Test	50	50	200
Drawing	2	2	100

Mathematics Section A

1. 4 marks

The domain of the function $f(x)=\sqrt{4-x^2}+\sqrt{2+x}$ is $[a, b]$, then a^2+3b^2 is equal to

(1) 4
(2) 8
(3) 12
(4) 16

2. 4 marks

Let $\mathbb{R}$ denote the set of real numbers, $\mathbb{Z}$ the set of integers and W the set of Non-negative integers, and define a map

(i) $f_1 : \mathbb{Z} \to \mathbb{Z}$ by $f_1(x) = x^3$. Then f_1 is one-one and not onto.

(ii) $f_2 : \mathbb{R} \to \mathbb{R}$ by $f_2(x) = x^3$. Then f_2 is one-one and onto.

(iii) $f_3 : \mathbb{Z} \to W$ by $f_3(x) = |x|$. Then f_3 is not one-one but is onto.

(iv) $f_4 : \mathbb{Z} \to \mathbb{Z}$ by $f_4(x) = x^2$. Then f_4 is neither one-one nor onto.

Then which of the following options is correct?

(1) (i), (iii), (iv) are true but (ii) is false
(2) All are true
(3) (ii), (iii) and (iv) are true but (i) is false
(4) (i), (ii) and (iv) are true but (iii) is false

3. 4 marks

If $\frac{\sqrt{5+12i}+\sqrt{5-12i}}{\sqrt{5+12i}-\sqrt{5-12i}}=a+bi$, then $a-b$ is :

(1) $\frac{5}{6}$
(2) $-\frac{5}{12}$
(3) $\frac{3}{2}$
(4) $\frac{5}{12}$

4. 4 marks

Let A be a 3×3 matrix such that $adj(A)=\begin{bmatrix}25 & 0 & 100\\ 0 & 4 & 3\\ 0 & 100 & 100\end{bmatrix}$, then determinant of A is

(1) 25 (2) 50

(3) 100 (4) 1000

5. 4 marks

The total number of times the digit 3 will be written when listing integers from 1 to 1000 is

(1) 297 (2) 243

(3) 273 (4) 300

6. 4 marks

The coefficient of x^{24} in $(1+x^2)^{12}(1+x^{12})(1+x^{24})$ is

(1) ${}^{12}C_6+3$ (2) ${}^{12}C_6$

(3) ${}^{12}C_6+1$ (4) ${}^{12}C_6+2$

7. 4 marks

Sum to n terms of the series $\log_e a+\log_e\left(\frac{a^2}{b}\right)+\log_e\left(\frac{a^3}{b^2}\right)+\log_e\left(\frac{a^4}{b^3}\right)+\ldots\ldots\ldots$ is

(1) $\frac{n}{2}\left[(n+1)\log_e\left(\frac{a}{b}\right)-\log_e ab\right]$ (2) $\frac{n}{2}\left[n\log_e\left(\frac{a}{b}\right)-\log_e ab\right]$

(3) $\frac{n}{2}\left[\log_e\left(\frac{a}{b}\right)+n\log_e ab\right]$ (4) $\frac{n}{2}\left[n\log_e\left(\frac{a}{b}\right)+\log_e ab\right]$

8. 4 marks

If the sum of first 10 terms and first 26 terms of an A.P. are 190 and 1326 respectively, then find the sum of its first 50 terms.

(1) 4900 (2) 4924

(3) 4950 (4) 4980

9. 4 marks

If $\lim_{x\to 1}\frac{x^5-1}{x-1}=\lim_{x\to k}\frac{x^3-k^3}{x^2-k^2}$, then k is equal to

(1) $\frac{5}{3}$ (2) $\frac{7}{3}$

(3) $\frac{8}{3}$ (4) $\frac{10}{3}$

10. 4 marks

Let $f:[0,\pi]\to\mathbb{R}$ be a function defined by $f(x)=\begin{cases} x+\sqrt{2}a\sin x, & 0\le x<\frac{\pi}{4} \\ 2x\cot x+b, & \frac{\pi}{4}\le x\le\frac{\pi}{2} \\ a\cos 2x-b\sin x, & \frac{\pi}{2}<x\le\pi \end{cases}$.

If f is continuous for $0\le x\le\pi$, then a^2+140b^2 is equal to

(1) 0 (2) π^2

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

11. 4 marks

$\int\frac{dx}{\sin^2 x\cos^2 x}$ is equal to

(1) $\tan x+\cot x+c$ (2) $(\tan x+\cot x)^2+c$

(3) $\tan x-\cot x+c$ (4) $2(\sec x\tan x-\operatorname{cosec} x\cot x)+c$

12. 4 marks

The solution of differential equation $\left(x+2y^3\right)\frac{dy}{dx}=y$ is

(1) $x=y^2+c$ (2) $y=x^2+c$

(3) $x=y\,(y^2+c)$ (4) $y=x\,(x^2+c)$

13. 4 marks

The point diametrically opposite to the point $(-1, 1)$ on the circle $x^2+y^2-x-4y+1=0$ is

(1) $(-2, 5)$ (2) $(2, -5)$

(3) $(0, 3)$ (4) $(2, 3)$

14. 4 marks

The vertices of a triangle OAB are $(0, 0)$, $(a, 0)$ and $(0, b)$ respectively. The distance between its orthocentre and circumcentre is

(1) $(a+b)$

(2) $(a-b)$

(3) $\frac{1}{2}\sqrt{a^2+b^2}$

(4) $\frac{1}{2}\sqrt{a^2-b^2}$

15. 4 marks

The shortest distance between the lines $\vec{r}=\left(\hat{i}+2\hat{j}+3\hat{k}\right)+\lambda\left(\hat{i}-3\hat{j}+2\hat{k}\right)$ and $\vec{r}=\left(4\hat{i}+5\hat{j}+6\hat{k}\right)+\mu\left(2\hat{i}+3\hat{j}+\hat{k}\right)$ is :

(1) $\frac{1}{19}$ units

(2) $\sqrt{19}$ units

(3) $\frac{3}{\sqrt{19}}$ units

(4) $\frac{1}{\sqrt{19}}$ units

16. 4 marks

The projection vector of $\vec{a}=\hat{i}-3\hat{j}-3\hat{k}$ on $\vec{b}=3\hat{i}-4\hat{j}$ is

(1) $\frac{9}{5}\hat{i}-\frac{12}{5}\hat{j}$

(2) $\frac{3}{\sqrt{19}}\hat{i}-\frac{4}{\sqrt{19}}\hat{j}$

(3) $\frac{12}{5}\hat{i}-\frac{36}{5}\hat{j}-\frac{36}{5}\hat{k}$

(4) $9\hat{i}-12\hat{j}$

17. 4 marks

Given $\left|\vec{a}\right|=\left|\vec{b}\right|=1$ and $\left|\vec{a}+\vec{b}\right|=\sqrt{3}$. If $\vec{c}$ is a vector such that $\vec{c}-\vec{a}-2\vec{b}=3\left(\vec{a}\times\vec{b}\right)$, then $\vec{c}\cdot\vec{b}$ is equal to

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

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

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

(4) $\frac{5}{2}$

18. 4 marks

If A and B are two events such that $P(A\cup B)=\frac{5}{8}$ and $P(A'\cup B')=\frac{3}{4}$, then $P(A')+P(B')=$

(1) $\frac{1}{8}$

(2) $\frac{3}{8}$

(3) $\frac{9}{8}$

(4) $\frac{11}{8}$

19. 4 marks

The value of $\sec 15^\circ - \sqrt{3}\,\text{cosec}\,15^\circ$ is

(1) $4\sqrt{2}$

(2) $3\sqrt{3}$

(3) $-3\sqrt{3}$

(4) $-4\sqrt{2}$

20. 4 marks

$\cot^{-1}7 + \cot^{-1}8 + \cot^{-1}5 =$

(1) $\cot^{-1}2$

(2) $\cot^{-1}10$

(3) $\cot^{-1}6$

(4) $\cot^{-1}4$

Mathematics Section B

21. Numerical value · 4 marks

Let α and β be the roots of the equation $x^2 - 6x - 2 = 0$, with $\alpha > \beta$. If $a_n = \alpha^n - \beta^n$ for $n \geq 1$, then the value of $\frac{a_{10} - 2a_8}{3a_9}$ is equal to_____

22. Numerical value · 4 marks

If α, β, γ are the angles of a triangle, then the value of the determinant $\begin{vmatrix} \cot\alpha & \cot\beta & \cot\gamma \\ 1 & 1 & 1 \\ \sin^2\alpha & \sin^2\beta & \sin^2\gamma \end{vmatrix}$ is equal to_____

23. Numerical value · 4 marks

If r^{th} term in the expansion of $\left(\sqrt[3]{\frac{a}{\sqrt{b}}} + \sqrt{\frac{b}{\sqrt[3]{a}}}\right)^{21}$ contains equal powers of a and b, then value of r is_____

24. Numerical value · 4 marks

If $y = \tan^{-1}\left(\frac{3x}{1+54x^2}\right) + \tan^{-1}\left(\frac{3x}{1+18x^2}\right)$, then $\frac{dy}{dx}$ at $x = 0$ is_____

25. Numerical value · 4 marks

The value of $\int_1^5 f(x)dx$, where $f(x) = |x-1| + |x-2| + |x-3|$ is_____

26. Numerical value · 4 marks

Let $y = y(x)$ be the solution of differential equation $\sin x\frac{dy}{dx} + y\cos x = 4x$. If $y\left(\frac{\pi}{2}\right) = 0$ and $y\left(-\frac{\pi}{6}\right) = \frac{\alpha}{\beta}\pi^2$, where α and β are co-prime numbers, then value of $(\alpha + \beta)$ is_____

27. Numerical value · 4 marks

Let L denote the line in the xy-plane with x and y intercepts as 2 and 1 respectively. If the image of the point $(-1, -3)$ in this line is $\left(\frac{\alpha}{5}, \frac{\beta}{5}\right)$, then $\alpha + \beta$ is equal to_____

28. Numerical value · 4 marks

The length of projection of the line segment joining the points $(1, 0, -1)$ and $(-1, 2, 2)$ on the plane $x + 3y - 5z = 6$ is d, then find $70d^2$_____

29. Numerical value · 4 marks

There are two bags. The first bag contains 3 white and 4 red balls and the second bag contains 4 white and 3 red balls. Two balls are drawn at random from the first bag and are put into the second bag without noticing their colours. Then two balls are drawn from the second bag. If the probability that one ball is white and the other is red is $\frac{x}{y}$, where $\frac{x}{y}$ is in the simplest form, then value of $(2x - y)$ is_____

30. Numerical value · 4 marks

In a ΔABC, $\angle A = \frac{\pi}{2}$. If $\tan\frac{B}{2}$ and $\tan\frac{C}{2}$ are the roots of $2x^2 - bx - c = 0$, then what is the value of $(b - c)^3$_____?

collegedunia

31. 4 marks

Saturation level of colors represents

(1) Distribution
(2) Darkness
(3) Brilliance
(4) Warmth

32. 4 marks

Which of the following is a shell structure?

(1) Millenium dome
(2) Stansted airport
(3) Bank of China tower
(4) Louvre, Museum

33. 4 marks

Identify the building material represented in the given figure



(1) Tile
(2) Paving Block
(3) Wooden Plank
(4) Granite

34. 4 marks

Before plastering, the surface has to be :

(1) Cemented
(2) Polished
(3) Smooth
(4) Rough

35. 4 marks

Who designed the 'Sydney Opera House'?

(1) Jorn Utzon
(2) Jan Gehl
(3) Bjarke Ingels
(4) Henning Lorsen

36. 4 marks

The design elements which are associated with the sense of touch

(1) Pattern, Shape, Form
(2) Texture, Shape, Form
(3) Shape, Pattern, Texture
(4) Form, Pattern, Texture

37. 4 marks

The First World Environment Day was held in which year?

(1) 1973
(2) 1976
(3) 1978
(4) 1970

38. 4 marks

Elephanta Caves are dedicated to which God?

(1) Budha
(2) Tirthankar Mahavir
(3) Shiva
(4) Vishnu

39. 4 marks

Which one of the following is not a city type?

(1) Garden City
(2) Linear City
(3) Radiant City
(4) Stack City

40. 4 marks

A gigantic chariot with elaborately carved stone wheels, pillars and walls are the characteristics of :

(1) Konark Sun temple
(2) Golden temple
(3) Meenakshi temple
(4) Dilwara temple

41. 4 marks

Who built the Moti Masjid in Red Fort at Delhi?

(1) Shah Jahan
(2) Aurangzeb
(3) Qutub-Ud-Din Aibak
(4) Akbar

42. 4 marks

Spray painting is used to :

(1) Get a textured pain
(2) Reach high areas
(3) Apply paint without touching surface
(4) Apply large amount of paint

43. 4 marks

An escalator looks like which one of the following?

(1) Ladder
(2) Stair case
(3) Ramp
(4) Lift

44. 4 marks

Concrete is a mixture of

(1) Cement + Sand + Water
(2) Cement + Coarse Aggregate + Fine Aggregate + Water
(3) Cement + Water + Brick Bat
(4) Cement + Sand + Water + Brick Bat

45. 4 marks

What type of tile are suitable for air - conditioned rooms and gymnasium?

(1) Cork Tile
(2) Ceramic Tile
(3) Concrete Tile
(4) Wooden Tile

46. 4 marks

Famous Tassel House was designed by

(1) Victor Horta
(2) Gerrit Rietvelt
(3) Mies Van der Rohe
(4) Frank Lloyd Wright

47. 4 marks

Who is the Author of "Toward an Architecture"?

(1) Frank Ching
(2) Le Corbusier
(3) Kevin A. Lynch
(4) Frank Wright

48. 4 marks

Hiroshima Peace Memorial Museum in Japan was designed by :

(1) I. M. Pie
(2) Tadao Ando
(3) Kenzo Tange
(4) Kisho Kurokawa

49. 4 marks

Which of the following is not a principle of Design?

(1) Emphasis
(2) Focal Point
(3) Unity
(4) Rhythm

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50. 4 marks

Which of the following software is not used by architects

(1) Staad. Pro
(2) 3D Max
(3) Revit
(4) Sketch Up

51. 4 marks

Who built the Shalimar Bagh, Srinagar?

(1) Bega Begum
(2) Akbar
(3) Shah Jahan
(4) Jahangir

52. 4 marks

Kanpur, Uttar Pradesh is also known as :

(1) The Leather City
(2) Wine Capital of India
(3) The Orange City
(4) City of Nawabs

53. 4 marks

How the load is transfered from the super structure to sub structure?

A. Beam
B. Slab
C. Foundation
D. Earth
E. column

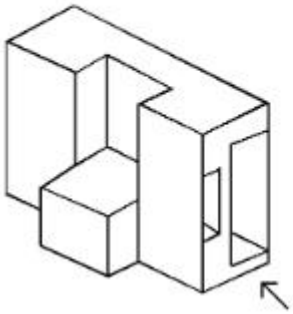
Choose the correct answer from the options given below:

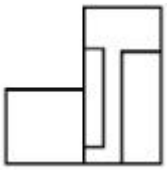
(1) A, B, E, D, C
(2) E, A, C, B, D
(3) A, B, C, D, E
(4) B, A, E, C, D

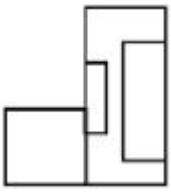
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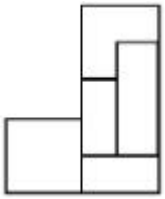
54. 4 marks

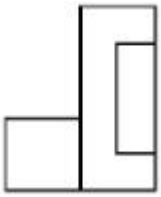
The Question figure shows the 3D view of an object. Identify the correct view, looking in the direction of Arrow, identify the correct view of the object.



(1) 

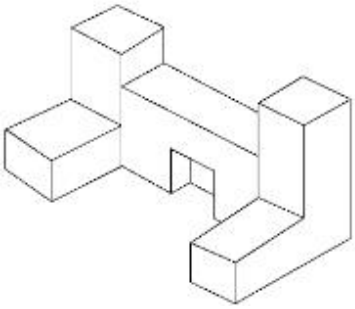
(2) 

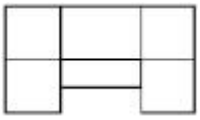
(3) 

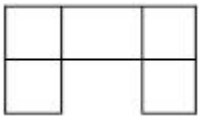
(4) 

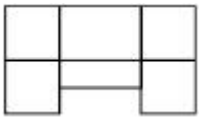
55. 4 marks

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



(1) 

(2) 

(3) 

(4) 

56. 4 marks

Identify the mirror image of the given word with respect to X-X



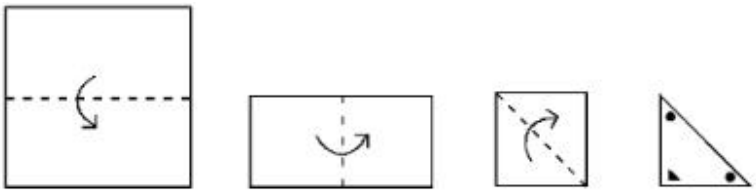
(1) MOUSE

(2) MOUSE

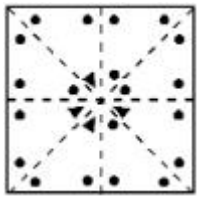
(3) MOUSE

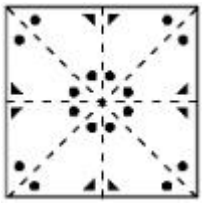
(4) MOUSE

57. 4 marks



When the paper is folded in a given pattern and it is cut at the end. Identify which pattern is formed when the paper is unfold.

(1) 

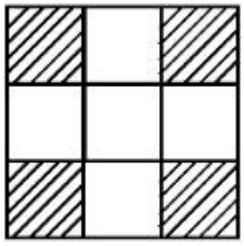
(2) 

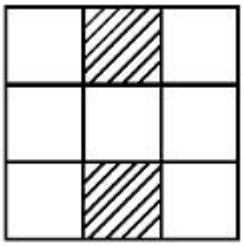
(3) 

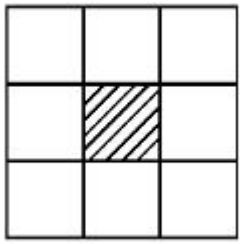
(4) 

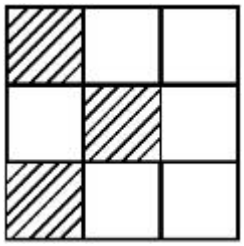
58. 4 marks

Identify the figure which is odd from rest of the figures.

(1) 

(2) 

(3) 

(4) 

59. 4 marks

Given below are two statements :
Statement I : Stone masonary is classified into two parts - Random rubble and ashlar masonary.
Statement II : Random Rubble masonary, each stone is cut to uniform size and shape with all sides rectangular so that stones gives perfect joints.
In the light of the above statements, choose the ***correct*** answer from the options given below :

(1) Both Statement I and Statement II are true
(2) Both Statement I and Statement II are false
(3) Statement I is true but Statement II is false
(4) Statement I is false but Statement II is true

60. 4 marks

Identify the type of Garden by understanding the elements used in the given picture:



(1) Roman Garden
(2) Japanese Garden
(3) French Garden
(4) Chinese Garden

61. 4 marks

Match List I with List II

LIST I		LIST II	
A.	Rila Monastery	I.	Egypt
B.	Moha Bodhi Temple	II.	Bulgaria
C.	Wadi al Hitan	III.	Malta
D.	Valletta	IV.	India

Choose the correct answer from the options given below:

(1) A-IV, B-III ,C-I ,D-II

(2) A-II, B-IV ,C-I ,D-III

(3) A-IV, B-I ,C-II ,D-III

(4) A-II, B-IV ,C-III ,D-I

62. 4 marks

Identify the name of the monument :



(1) The Pantheon

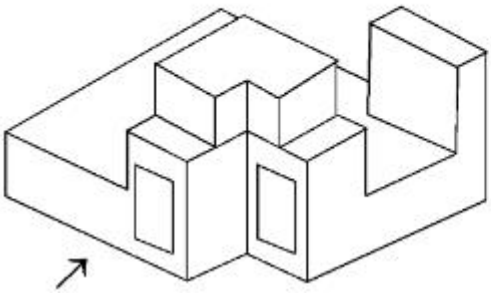
(2) The Cathedral of Pisa

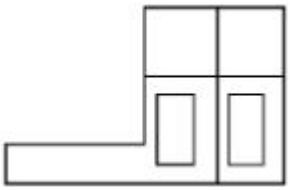
(3) The Parthenon

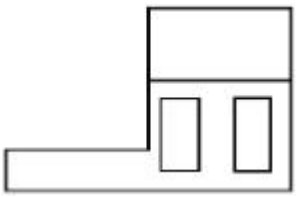
(4) Great Temple of Karnak

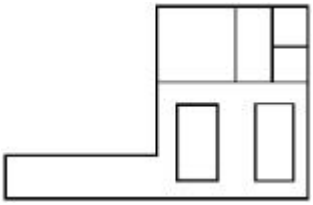
63. 4 marks

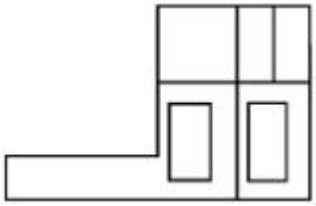
The question figure shows the 3D view of an object. Identify the correct view, looking in the direction of Arrow :



(1) 

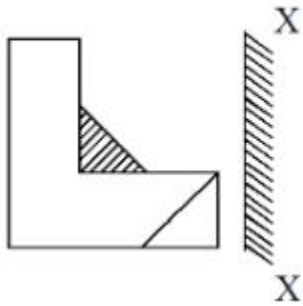
(2) 

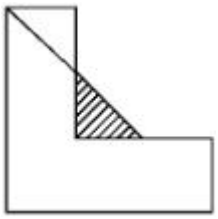
(3) 

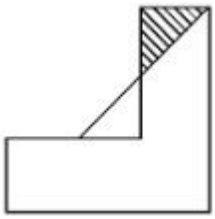
(4) 

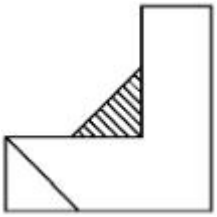
64. 4 marks

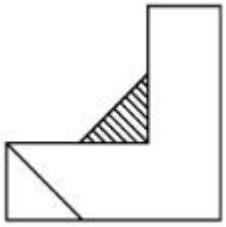
Identify the correct mirror image of the given figure along X-axis.



(1) 

(2) 

(3) 

(4) 

65. 4 marks

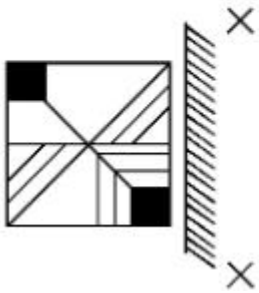
Identify the Mirror image of given word

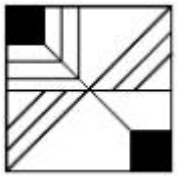
ARCHITECTURE

(1) ARCHITƎCTURƎ
(2) ƎRUTCƎTIHCRA
(3) ƎRUTCETIHCRA
(4) ƎRUTCETIHCRA

66. 4 marks

Identify the true mirror image of the figure amongst the answer figures with respect to X-X



(1) 

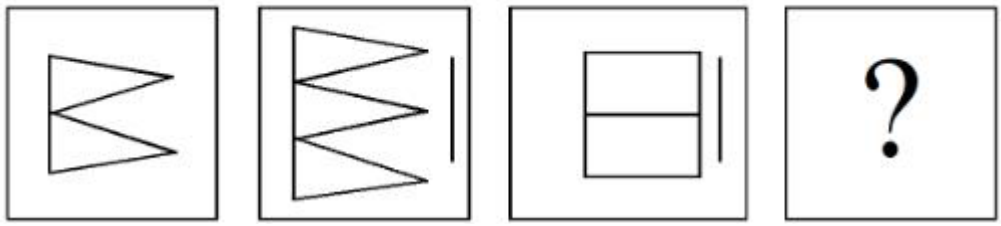
(2) 

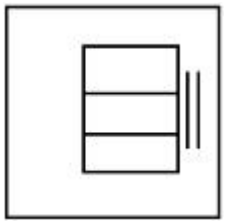
(3) 

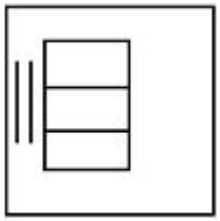
(4) 

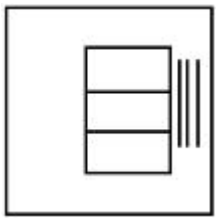
67. 4 marks

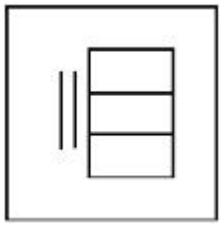
Identify the correct figure to complete the sequence :



(1) 

(2) 

(3) 

(4) 

68. 4 marks

Complete the number series

10, 30, 68, 130, ____, 350

(1) 222
(2) 192
(3) 220
(4) 216

69. 4 marks

In a clock, the time is 11:35 AM. The clock is so placed that its hour hand is facing North-West. In which direction will be minute hand facing?

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

70. 4 marks

Match List I with List II

LIST I		LIST II	
A.	Brick	I.	Dampness Prevention
B.	Arch	II.	Bevelled closer
C.	Lintel	III.	Openings
D.	Cavity wall	IV.	Span

Choose the correct answer from the options given below:

(1) A-IV, B-II, C-I, D-III
(2) A-II, B-I, C-III, D-IV
(3) A-III, B-I, C-II, D-IV
(4) A-II, B-IV, C-III, D-I

71. 4 marks

Match List I with List II

LIST I (Buildings)		LIST II (Architects)	
A.	Habital 67	I.	F. L. Wright
B.	Falling Water	II.	Moshe Safdi
C.	Gherkin Tower	III.	Louis Kahn
D.	Fisher House	IV.	Norman Foster

Choose the correct answer from the options given below:

(1) A-II, B-I, C-IV, D-III
(2) A-IV, B-II, C-III, D-I
(3) A-IV, B-I, C-II, D-III
(4) A-I, B-III, C-IV, D-II

72. 4 marks

Identify the famous building in the given picture :



(1) Mysore Palace
(2) Khalsa Heritage Complex
(3) Hotel Taj Mahal Palace
(4) Victoria Memorial

collegedunia

73. 4 marks

'LEED' stands for :

(1) Leadership in Energy and Environmental Design

(2) Leadership in Environmental and Energy Design

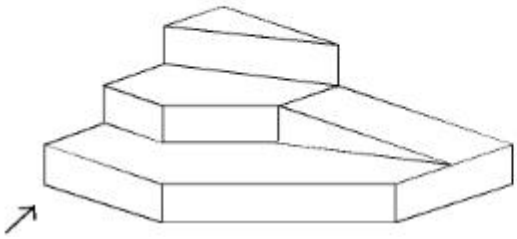
(3) Leadership in Energy Efficient Design

(4) Leadership in Environmental Energy Design

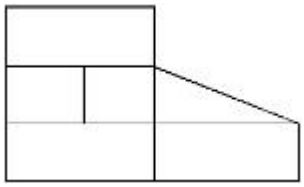
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74. 4 marks

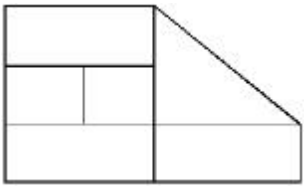
From the given 3D view of an object, identify the most appropriate elevation looking in the direction of the given arrow :



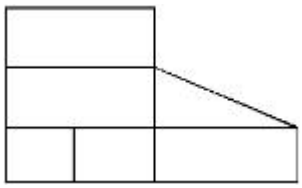
(1)



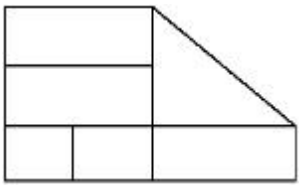
(2)



(3)

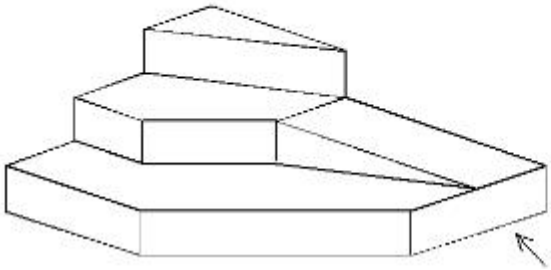


(4)

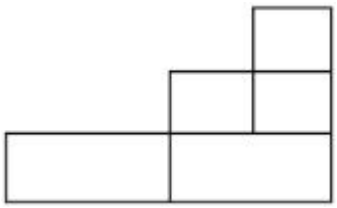


75. 4 marks

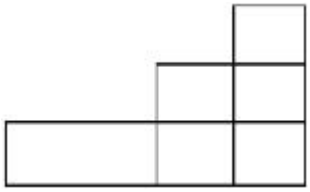
From the given 3D view of an object, identify the most appropriate elevation looking in the direction of the given arrow.



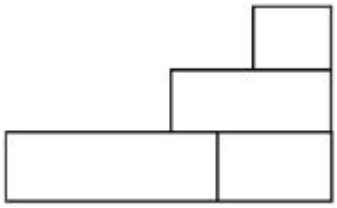
(1)



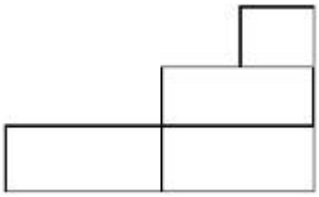
(2)



(3)

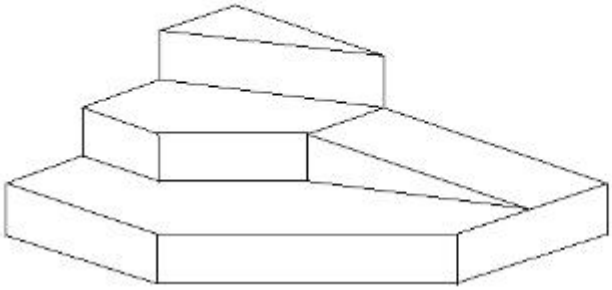


(4)

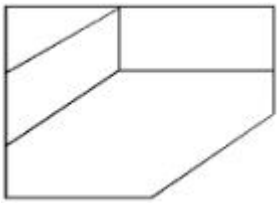


76. 4 marks

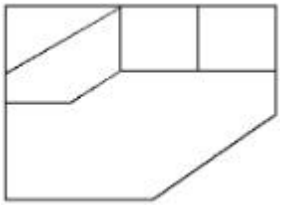
Choose the correct top view of the given 3D image from the options.



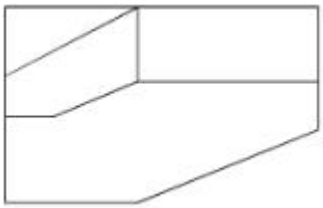
(1)



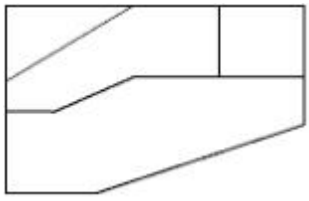
(2)



(3)

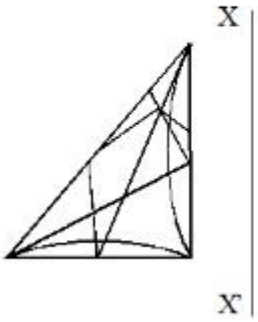


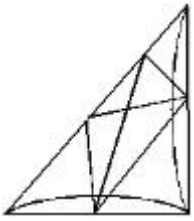
(4)

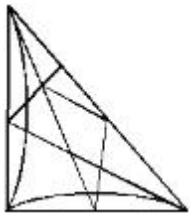


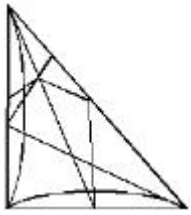
77. 4 marks

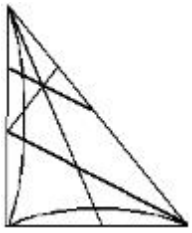
Identify the True mirror image of the figure amongst the answer figures with respect to X-X.



(1) 

(2) 

(3) 

(4) 

78. 4 marks

Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A : Green buildings have a lower life cycle cost than conventional buildings.

Reason R : Green buildings require less maintenance and have lower energy and water consumption.

In the light of the above statements, choose the ***most appropriate*** answer from the options given below :

(1) Both **A** and **R** are correct and **R** is the correct explanation of **A**

(2) Both **A** and **R** are correct but **R** is NOT the correct explanation of **A**

(3) **A** is correct but **R** is not correct

(4) **A** is not correct but **R** is correct

79. 4 marks

Match List I with List II

LIST I		LIST II	
A.	Tower Bridge	I.	
B.	Torii	II.	
C.	Stonehenge	III.	
D.	Petronas Tower	IV.	

Choose the correct answer from the options given below:

(1) A-III, B-II, C-IV, D-I

(2) A-IV, B-III, C-I, D-II

(3) A-III, B-II, C-I, D-IV

(4) A-IV, B-I, C-II, D-III

80. 4 marks

Identify the building material primarily used for cladding in Lotus Temple :



(1) Dolomite

(2) Lime

(3) Marble

(4) Granite

Drawing

81. 50 marks

Draw a proportionate Sketch of the image given below in detail. Sketch this using Black and White Medium only.



82. 50 marks

Combine Musical Instruments like Guitar, Microphone (mic), Drums, Tabla, Keyboard, etc. into a 3D Abstract Sculpture, using different colors to represent various Texture and Instruments. You can scale each object to any size of your choice. Apply the effect of light and shadow on your Sculpture.

OR

Considering yourself as one of the spectators, draw a beautiful sketch of a Football stadium where a match is going on.