MADE EASY

ESE 2023
Preliminary Examination

Detailed Solutions

General Studies
& Engineering Aptitude
(Paper-I)

Set
A

Exam held on 19-02-2023

General Studies and Engineering Aptitude Paper
Analysis of ESE 2023 Preliminary Examination

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UPSC ESE Prelims 2023 Paper-1
General Studies and Engineering Aptitude
by MADE EASY Faculties

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1. Which one of the following scientists called entropy time arrow?
(a) Thomas Young
(b) Arthur Eddington
(c) Max Planck
(d) Thompson

Ans. **(b)**

2. Consider the following statements:
Energy balances are fundamental for energy planning, since they allow analysing aspects such as:
1. distribution of final energy consumption per end-use sector.
2. storage and refinement of each fuel or group of energies in the matrix.
3. self-sufficiency in energy, foreign dependence and foreign trade.
4. efficiency in processes for transforming primary energy into secondary.
Which of the above statements is/are NOT correct?
(a) 2 only
(b) 1 and 2 only
(c) 1, 2 and 3 only
(d) 4 only

Ans. **(c)**
- The energy balance is an assessment of the relation between the energy consumption of the product and the energy production.
- It helps us to understand how products are transformed into one another, highlight the various relationships among these products, and show how all energy types are ultimately used.
- The energy balance presents all the data in a common energy unit.

3. Which one of the following is NOT an advantage of energy efficiency?
(a) The cost of energy economy is usually smaller than that of its generation
(b) Security of supply increases and resources which are finite are saved
(c) There are micro and macro-economic gains associated with an increase in productivity and in industrial competitivity
(d) The access to energy services is decreased

Ans. **(d)**

4. The British economist Nicholas Stern gave the most impressive analysis in the year 2006 on
(a) Ozone layer depletion
(b) Renewable energy sources
(c) Climate change
(d) Deforestation

Ans. **(c)**

5. Consider the following factors determining the evolution of energy intensity:
1. dematerialization.
2. fuel use intensity
3. recycling
Which of the above factors is/are correct?
(a) 1, 2 and 3   (b) 2 and 3 only
(c) 1 and 3 only   (d) 3 only

Ans. **(a)**

End of Solution

6. Surface rocks on Earth are cool, but below the surface the temperature increases with depth. This is called
(a) the geothermal gradient   (b) the homogeneous accretion
(c) the pangaea   (d) the mesocrates

Ans. **(a)**

End of Solution

7. Which one of the following is NOT correct?
(a) The formation of a mountain chain by the compression of crustal rocks is known as an orogeny
(b) Rock between the two extremes is called mesocratic
(c) Sediments are deposited in horizontal layers called clay plates
(d) Particles deposited as sediments are changed into rock by the pressure of later deposits at low temperature is called diagenesis

Ans. **(c)**

End of Solution

8. Consider the following statements for hammock activities:
1. It derives its name because it spans over a segment of a project.
2. The hammock activity duration is determined after the network plan is not drawn.
3. The hammock activities are frequently used to identify the use of fixed resources or costs over a segment of the project.
4. The maximum amount of time an independent activity must be delayed to begin or end.
Which of the above statements are correct?
(a) 2 and 3 only   (b) 1 and 3 only
(c) 1 and 4 only   (d) 2 and 4 only

Ans. **(b)**
- A hammock or summary activity is used to gather together a number of sub-activities into one master activity.
- Hammock activities show the included subactivities.
- Hammock activities are frequently used to identify the use of fixed resources or costs over a segment of project.

End of Solution

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9. Consider the following strategies for mitigating risk under risk response development:
1. Reduce the likelihood that the event will occur.
2. Reduce the impact that the adverse event would have on the project.
3. Analyze the project to identify sources of risk.
4. Assess risks in terms of severity of impact.
Which of the above strategies are correct?
(a) 1 and 2 only
(b) 3 and 4 only
(c) 1 and 4 only
(d) 2 and 3 only

Ans. **(a)**
As per Krause, 2014, Mitigating risk involves two basic strategies : reducing the likelihood that the event will occur and/or reducing the impact that the adverse event would have on the project.
- The risk response plan development process considers risk transfer, reduction, avoidance and other mitigation tools to develop a risk response plan to ensure that the appropriate risk warning tools are in place, to handle risk efficiency.
- Proper risk management will attempt to reduce the probability of an event occuring and/or the magnitude of its impact as well as increase the probability of project success.

End of Solution

10. Consider the following statements:
The strategy is to assign extra time at critical moments in the project, buffers are added to:
1. activities with no risk.
2. merge activities that are prone to delays due to one or more preceding activities being late.
3. non-critical activities to reduce the likelihood that they will create another critical path.
4. activities that require scarce resources to ensure that the resources are available when needed.
Which of the above statements are correct?
(a) 1, 2 and 3 only
(b) 1, 2 and 4 only
(c) 2, 3 and 4 only
(d) 1, 3 and 4 only

Ans. **(c)**
A buffer is extra time added to plan/schedule so that a task can be done and delays can be considered. The critical chain method has three different types of buffers, as:
1. **Resource Buffer :** It is inserted just before a critical chain activity where a critical resource is required. It is used to remind the project team that a resource is needed and to finish up prior activities.
2. **Feeding Buffer :** It is inserted as a safety margin in the non-critical chain of a network schedule. It is placed where the path feeds back into the critical chain path.
3. **Project Buffer :** It is the summation of all the internal buffers added to each project task or activity.

End of Solution

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11. Which one of the following does NOT always yield an optimal schedule, however it is capable of yielding a "good" schedule for very complex networks having many types of resources?

(a) Algorithm (b) Optimum
(c) Backhoes (d) Heuristics

Ans. (d)

Heuristics do not always yield an optimal schedule, but they are very capable of yielding a "good" schedule for very complex networks with many types of resources. Since, each project is unique, it is good to test several set of heuristics on a network to determine the priority allocation rules that minimize project delay.

End of Solution

12. According to CCPM, using 50/50 estimates will discourage Parkinson's law, the student syndrome, and self-protection from coming into play because there is less "free time" available. What does the abbreviation CCPM stand for?

(a) Control – Chain Project Management
(b) Creating – Chain Project Management
(c) Computer – Control Project Management
(d) Critical – Chain Project Management

Ans. (d)

CCPM stands for critical-chain project management. The CCPM aims to eliminate project schedule delays due to uncertainties, overestimating task duration, etc.

End of Solution

13. According to project cost-duration graph, any reduction in project duration means a reduction in

(a) direct costs (b) indirect costs
(c) total costs (d) optimum costs

Ans. (b)
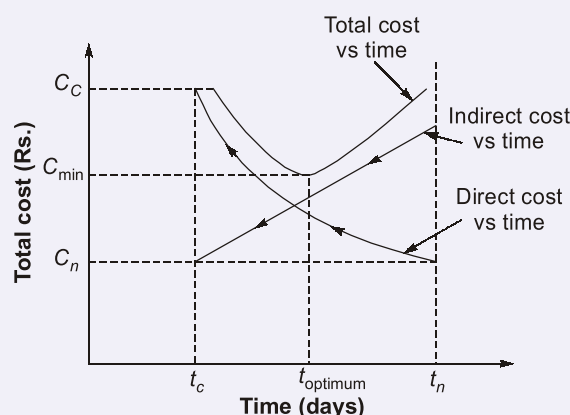
Total cost = Indirect cost + Direct cost
Any reduction in project duration, reduces the indirect cost but increases the direct cost.

End of Solution

14. When a pair of one cation and one anion are absent from an ionic crystal, then the defect is called
 (a) Schottky's defect
 (b) Frenkel's defect
 (c) Cross-slip defect
 (d) Stacking defect

Ans. (a)
When a pair of one cation and one anion are absent from an ionic crystal, then the defect is called Schottky's defect.

15. The diffusion coefficient for copper in aluminium at 500°C and 600°C are 4.8×10^{-14} m^2/s and 5.3×10^{-3} m^2/s respectively What is the approximate time at 500°C that will produce the same diffusion result (in terms of concentration of copper at some specific point in aluminium) as 10 h heat treatment at 600°C?
 (a) 110.4 h
 (b) 152.4 h
 (c) 210.4 h
 (d) 252.4 h

Ans. (a)
The diffusion equation for given case is

$$\frac{x^2}{Dt} = \text{Constant}$$

where $D = $ Diffusion coefficient
$t = $ Time
$x = $ Diffusion depth

Given that the composition in both diffusion situations will be equal at the same position (i.e., x is also a constant)
So, $Dt = $ Constant (at both temperatures)

$$D_{500}t_{500} = D_{600}t_{600}$$

$$\Rightarrow \qquad t_{500} = \frac{D_{600}t_{600}}{D_{500}}$$

$$= \frac{5.3 \times 10^{-3} \times \frac{m^2}{s} \times 10h}{4.8 \times 10^{-14}\frac{m^2}{s}}$$

$$= 1.104 \times 10^{12} \text{ h}$$

Note : There is error in question, D at 600°C should be equal to 5.3×10^{-13} m^2/s, then

$$t_{500} = \frac{5.3 \times 10^{-13} \times 10}{4.8 \times 10^{-14}}$$

$$t_{500} = 110.4 \text{ h}$$

So, option (a) is correct.

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16. A relatively large plate of a glass is subjected to a tensile stress of 40 MPa. If the specific surface energy and modulus of elasticity for this glass are 0.3 J/m^2 and 69 GPa, respectively, what is approximate maximum length of a surface flaw that is possible without fracture?

(a) 6.2 μm
(b) 8.2 μm
(c) 10.2 μm
(d) 12.2 μm

Ans. **(b)**

Stress (σ) requied for crack propagation in '*a*' brittle material is described by the expression.

$$\sigma = \left(\frac{2E\gamma_s}{\pi a} \right)^{1/2}$$

$E \rightarrow$ Modulus of elasticity
$\gamma_s \rightarrow$ Specific surface energy
$a \rightarrow$ Length of a surface flow

Rearrangement of this expression such that a is dependent variable, and realizing that σ = 40 MPa, γ_s = 0.3 J/m^2, E = 69 GPa leads to

$$a = \frac{2E\gamma_s}{\pi\sigma^2} = \frac{2 \times \left(69 \times 10^9\right)(0.3)}{\pi \times \left(40 \times 10^6\right)^2}$$

$$= 8.2 \times 10^{-6} \text{ m} = 8.2 \text{ μm}$$

End of Solution

17. A piece of copper originally 305 mm long is pulled in tension with a stress of 276 MPa. If the deformation is entirely elastic, what is the resultant elongation approximately?

(a) 3.3 mm
(b) 0.33 mm
(c) 0.77 mm
(d) 7.7 mm

Ans. **(c)**

Since deformation is entirely elastic.

So, $\sigma = \epsilon E$

where σ → stress; ϵ → strain; E → Modulus of elasticity

$\Rightarrow \qquad \sigma = \frac{\Delta l}{l_o} E$

$\Rightarrow \qquad \Delta l = \frac{\sigma l_o}{E} = \frac{(276 \text{ MPa}) \times (305 \text{ mm})}{110 \times 10^3 \text{ MPa}}$ (For Cu, E = 110 GPa)

$\Delta l = 0.756$ mm

$\Delta l \simeq 0.77$ mm

where $\Delta l \rightarrow$ elongation; $l_o \rightarrow$ original length

End of Solution

18. What is the approximate value of ductility (%EL) of a cylindrical copper rod if it is cold worked such that the diameter is reduced from 15.2 mm to 12.2 mm? (Take the tensile strength from the curve for copper as 340 MPa).

(a) 7%   (b) 3.56%

(c) 70%   (d) 35.6%

Ans. (a)

Percentage cold work (%CW) is defined as

$$\%CW = \left(\frac{A_o - A_d}{A_o}\right) \times 100$$

$$= \frac{\pi\left(\frac{15.2}{2}\right)^2 - \pi\left(\frac{12.2}{2}\right)^2}{\pi\left(\frac{15.2}{2}\right)^2} \times 100 = 35.6\%$$

For copper, ductility (%EL) versus % CW curve is given as
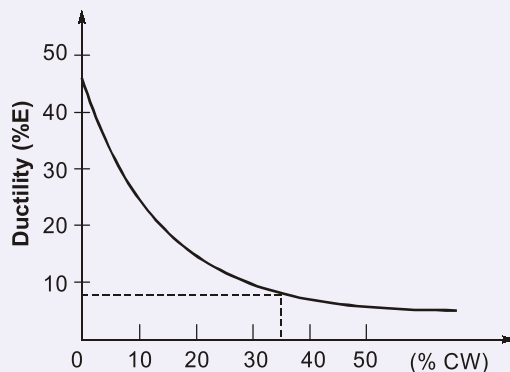
End of Solution

19. The density of α – Fe is 7.87×10^3 kg/m^3. Atomic weight of Fe is 55.8. If α – Fe crystallises in BCC space lattice, what is the lattice constant approximately? (Take Avogadro's number (N) = 6.02×10^{26}/kg/mole and number of atoms per unit cell is 2)

(a) 0.666 Å   (b) 1.766 Å

(c) 2.866 Å   (d) 3.966 Å

Ans. (c)

Density of α-Fe = 7.87×10^3 kg/m^3

Atomic weight of Fe = 55.8

Avogadro's number, N_A = 6.02×10^{26} kg/mole

Number of atoms per unit cell

= 2

$$\rho = \frac{nA}{V_C N_A}$$

where, ρ = density

n = No. of atoms per unit cell

V_C = Volume of unit cell

A = Atomic weight

N_A = Avogadro's number

$\Rightarrow \qquad V_C = \dfrac{nA}{\rho N_A} = \dfrac{2 \times 55.8}{7.87 \times 10^3 \times 6.02 \times 10^{26}}$ m^3

$\Rightarrow \qquad V_C = 2.355 \times 10^{-29} = a^3$

(a = lattice constant or edge length of cubic unit cell)

$\Rightarrow \qquad a = 2.866 \times 10^{-10}$ m

$\Rightarrow \qquad a = 2.866$ Å

End of Solution

20. Which one of the following statements is related to frequency hopping spread spectrum?
(a) It is a spread spectrum technique which allows for the coexistance of multiple networks in the same area by separating different networks using different hopping sequences.
(b) It is a spread spectrum technique which allows for the coexistence of multiple networks in the different area by separating different networks using different hopping sequences.
(c) It is a spread spectrum technique which does not allow for the coexistence of multiple networks in the same area by separating same networks using different hopping sequences.
(d) It is a spread spectrum technique which allows for the coexistence of single network in the different area by separating different networks using same hopping sequence.

Ans. **(a)**
Frequency hopping : Keep changing from one frequency to another to avoid eaves dropping.
Spread spectrum means co-existence of multiple network in the same area by separating different network using different hopping sequence.

End of Solution

21. Which one of the statements is NOT relevant to quantum computing?
(a) Quantum computing is that much more powerful functions may be computed using qubits and quantum gates.
(b) Quantum operations are well adapted to describe discrete state changes, that is, transformations between an initial state and final state, without explicit reference to the passage of time.
(c) Quantum computation does not support entanglement and measurements of a quantum computer's registers can yield only a small, discrete set of values.
(d) Quantum computing is the use of quantum phenomena such as superposition and entanglement to perform the computation.

Ans. **(c)**

End of Solution

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22. A device which exhibits irregular or unpredictable response times is called
(a) Asynchronous   (b) Synchronous
(c) Sharable   (d) Non-sharable

Ans. **(a)**

End of Solution

23. Which one of the following tables is used by operating system to keep the track of many I/O requests at the same time?
(a) File allocation table   (b) Device – status table
(c) Memory – status table   (d) Interrupt driven table

Ans. **(b)**
Device status table contain entry for each I/O device indicating its type, address and state.

End of Solution

24. A stream of a video image that is one-quarter the size of a standard TV image; that is, it has a resolution of 352 by 240 pixels. If each pixel is represented by 24 bits of information, as would be the case for 24-bit color, then what is the approximate size of each frame?
(a) 247.5 KB   (b) 352.5 KB
(c) 417.5 KB   (d) 532.5 KB

Ans. **(a)**

$$\frac{352 \times 240 \times 24}{8000} \approx 247.5 \text{ kB}$$

End of Solution

25. What is the approximate effective throughput, if user wants to fetch a 1-MB file across a 1-Gbps network with a round-trip time of 100 ms?
(a) 50.1 Mbps   (b) 74.1 Mbps
(c) 84.1 Mbps   (d) 90.1 Mbps

Ans. **(b)**

Throughput = data size/(t.t + 2p.t)
2 × p.t = RTT = 100 millisec
Transmission time = data size/BW = 8 M bits/1000 Mbps = 8 millisec
Throughput = 8 × 1 Mbits/(8 + 100) millisec = 8000/108
= 74.07 Mbps

End of Solution

26. In a network, a transcontinental channel with a one-way latency of 50 ms and a bandwidth of 45 Mbps is able to hold how many bits that fit in the pipe approximately?

(a) 2.25×10^6 bits

(b) 1.25×10^6 bits

(c) 50.00×10^6 bits

(d) 45.00×10^6 bits

Ans. (a)

$$1 \text{ sec} = 45 \times 10^6 \text{ bits}$$
$$50 \text{ ms} = 45 \times 10^6 \times 50 \times 10^{-3} \text{ bits}$$
$$= 2.25 \times 10^6 \text{ bits}$$

End of Solution

27. Consider the following statements for significance of prominence in the Internet architecture:

1. Programmers are free to define new channel abstractions or applications that run on top of any of the existing protocols.
2. It defines a common method for exchanging packets among a wide collection of networks.
3. It allows someone to propose a new protocol to be included in the architecture.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans. (d)

End of Solution

28. Consider the following statements regarding the failure in the network:

1. Bit errors typically occur because outside forces, such as lightning strikes, power surges, and microwave ovens, interfere with the transmission of data.
2. One of the main difficulties in dealing with lost packets is distinguishing between a packet that is indeed lost and one that is merely late in arriving at the destination.
3. The failure can be caused by software that crashes, a power failure, or a reckless backhoe operator.

Which of the above statement(s) is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

Ans. (d)

End of Solution

29. Which one of the following statements is NOT correct regarding human values?
- (a) Values mean an in-built mechanism which distinguishes the right from the wrong.
- (b) Values provide us with a unique, personal and moral template that we use subconsciously to assess and judge the intensions and actions of others and ourselves.
- (c) Values serve the process of 'becoming' in the sense of transformation of the level of consciousness to purer, higher levels.
- (d) Values are essentially objective while skills are subjective.

Ans. **(d)**

End of Solution

30. Consider the following objectives of the study on professional ethics :
1. Forming consistent viewpoints based on facts.
2. Searching beyond obvious the alternative responses to issues and being receptive to creative solutions
3. Comprehending, assessing different views.
Which of the above objective(s) is/are correct?
- (a) 2 and 3 only
- (b) 1, 2 and 3
- (c) 2 only
- (d) 1 and 3 only

Ans. **(a)**

End of Solution

31. Which one of the following statements is NOT correct?
- (a) Notions or beliefs about manners, tastes, customs and towards laws are few examples of morality.
- (b) Morality is more general and prescriptive based on customs and traditions; whereas ethics is specific and descriptive.
- (c) Morality thrusts on judgement and punishment, in the name of God or by laws; whereas ethics, thrust is on influence, education, training through codes, guidelines and correction.
- (d) Morality is more concerned with the results of wrong action, when done; whereas ethics is with the results of a right action, when not done.

Ans. **(a)**

End of Solution

32. The 'work ethics' is aimed at NOT ensuring which of the following?
- (a) The economy and productivity.
- (b) Safety and privacy.
- (c) Consumption and distribution.
- (d) Health and hygiene.

Ans. **(c)**

End of Solution

33. Which one of the following is NOT included under the categories of civic virtues as indispensable for a self-governing administration?
(a) Self-reflection
(b) Self-restraint
(c) Self-reliance
(d) Self-assertion

Ans. **(d)**

End of Solution

34. Spirituality is promoted in the work-place by adhering to the following activities:
1. Verbally respect the individuals as humans and recognize their values in all decisions and actions.
2. Support causes outside the business.
3. Do unto others as you would have them do unto you.
4. Realization of the self-potential through meditative acts.
Which of the above activities are correct?
(a) 2, 3 and 4 only
(b) 1, 2, 3 and 4
(c) 2 and 3 only
(d) 1, 2 and 3 only

Ans. **(d)**

End of Solution

35. The normative sense of engineering ethics does NOT include:
(a) Knowing moral values, finding accurate solutions to moral problems and justifying moral Judgements in engineering practices.
(b) Generating alternate courses of action to resolve the dilemma.
(c) Study of decisions, policies, and values that are morally desirable in the engineering practice and research.
(d) Using codes of ethics and standard and applying them in their transactions by engineers.

Ans. **(b)**

End of Solution

36. Which one of the following characteristic features distinguishes Carol Gilligan's theory from Kohlberg's theory with regard to the moral development.
(a) Transactional approach
(b) Logic and rule centric
(c) More of caring
(d) Justice

Ans. **(c)**

End of Solution

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37. Which one of the following theorists and philosophers in NOT associated with the 'Duty Ethics' ?

(a) Immanuel Kant
(b) John Locke
(c) John Rawl
(d) C.W.D. Ross

Ans. (b)

End of Solution

38. Consider the following non-reliability performance measures of automobile industry related objects:

1. Fuel efficiency (km/l)
2. Economic efficiency (cost/km/kg)
3. Quality of ride
4. Emissions (ppm)

Which of the above performance measures are correct?

(a) 1, 3 and 4 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

Ans. (a)

End of Solution

39. Match the following:

List-I (Severity of failure)	List-II (Impact of failure)
P. Catastrophic	1. Less than minor injury or system damage
Q. Critical	2. Minor injury or minor system damage
R. Marginal	3. Result in death or total system loss
S. Negligible	4. Result in severe injury or major system damage

Select the correct pair using the code given below:

	P	Q	R	S
(a)	3	4	2	1
(b)	4	3	1	2
(c)	2	1	3	4
(d)	1	2	4	3

Ans. (a)

End of Solution

40. Consider the following statements for the multi-state characterization (infinite number of states) with $K = \infty$.

1. $X(t)$ is non-decreasing.
2. $X(t)$ is continuous-time stochastic process.
3. Higher value of $X(t)$ implies greater degradation and the item failure time.

Which of the above statements are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans. (b)

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41. Six sigma gives a precision of
(a) 99.9997%   (b) 98.4599%
(c) 97.7333%   (d) 96.2799%

Ans. **(a)**

<div align="right">*End of Solution*</div>

42. Consider the following statements with reference to six-sigma:
1. It is a methodology for structured, process oriented and systematic quality improvement.
2. It provides a systematic approach for quality and process in improvement, rather than being just a collection of tools.
3. It is a rigorous, data-driven, decision-making approach to analyse the root causes of problems.
Which of the above statements are correct?
(a) 1 and 3 only   (b) 2 and 3 only
(c) 1 and 2 only   (d) 1, 2 and 3

Ans. **(d)**

<div align="right">*End of Solution*</div>

43. As sigma level increases,
(a) cost of poor quality and customer satisfaction both go up
(b) cost of poor quality goes up and customer satisfaction goes down
(c) cost of poor quality goes down and customer satisfaction goes up
(d) cost of poor quality and customer satisfaction both go down

Ans. **(c)**

<div align="right">*End of Solution*</div>

44. Consider the following statements regarding the design for six-sigma:
1. The concept of six-sigma originated at Motorola.
2. The goal is to arrive at 3.4 defects per million opportunities.
3. Sigma is used to compare expected outcomes versus failures in population.
Which of the above statements are correct?
(a) 1 and 2 only   (b) 2 and 3 only
(c) 1 and 3 only   (d) 1, 2 and 3

Ans. **(a)**

<div align="right">*End of Solution*</div>

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45. In a plain scale, if 1.5 inches = 1 foot and it can measure upto 4 feet, what is the representative factor of the scale?

(a) $\dfrac{1}{8}$

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

(c) $\dfrac{1}{1.5}$

(d) $\dfrac{2}{1.5}$

Ans. **(a)**
- 1.5 inches length on drawing is represented by actual length of 12 inches.
- Conceptually representative fraction of a drawing indicates the ratio by which linear distance in drawing are changed compared to actual length.
- The formula for R.F. is

$$\text{R.F.} = \frac{\text{distance between points A and B on drawing}}{\text{actual distance between the points A and B}}$$

$$= \frac{1.5}{12} = \frac{1}{8}$$

Hence the correct answer is (a).

<div align="right">**End of Solution**</div>

46. Which one of the following is used when components of same shape but different dimensions are to be manufactured?
(a) Drawing for installation
(b) Tabular drawing
(c) Schematic assembly drawing
(d) Patent drawing

Ans. **(b)**
Tabular drawings are used for parts that have different dimension but same shape. When several parts that differ only a few dimensions are required, only one drawing with a table of sizes is made. In other words, a series of objects having like features but varying in dimensions may be represented by one drawing as shown in figure. Letters are substituted for dimensions value on the drawing, and the varying dimensions are given in the tabular form.
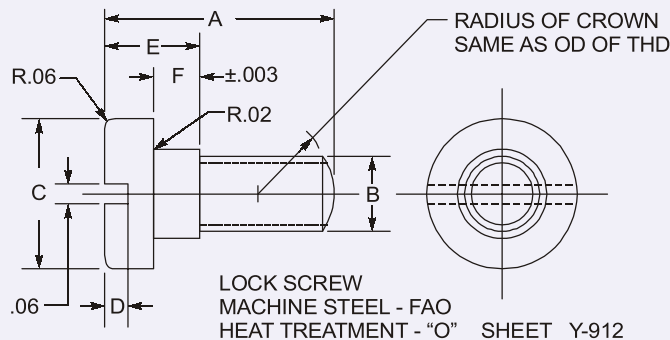
DETAILS	A	B	C	D	E	F	UNC THD	STOCK	LBS
1	.62	.38	.62	.06	.25	.135	.312 – 18	⌀.75	.09
2	.88	.38	.62	.09	.38	.197	.312 – 18	⌀.75	.12
3	1.00	.44	.75	.12	.38	.197	.375 – 16	⌀.875	.19
4	1.25	.50	.88	.12	.50	.260	.437 – 14	⌀.1	.30
5	1.50	.56	1.00	.16	.62	.323	.5 – 13	⌀1.125	.46

End of Solution

47. Which one of the following lines is used to represent the outlines of adjacent parts or alternative and extreme positions of movable parts?

(a) Continuous thick line
(b) Continuous thin line
(c) Chain thin double-dashed line
(d) Dashed thin line

Ans. **(c)**

As per IS SP 46 2003 long dashed double dotted narrow line i.e., narrow line of type 5 is used for showing
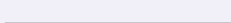
1. Alternative and extreme positions of movable parts
2. Centroidal line
3. Outlines of adjacent parts

Best matching answer is (c) chain thin double dashed line

In IS SP 46 2003 word narrow line means thin line & word wide line means thick line & word extra wide line mean extra thick line. The thickness of narrow line, wide line & extra wide line are in the ratio 1:2:4

Table below gives information about application of lines type mentioned in answer options given for the question as per IS SP46 2003

No.	Description and representation	Application
1.2	Continuous wide line _____	1. Visible outlines of parts in cut and section when hatching is used. 2. Boundaries of different materials in view, cut and section (alternatively see 01.1.1). 3. Visible outlines of parts in view (alternatively see 1.1.11). 4. Simplified representation of doors, windows, stairs, fittings (alternatively see 01.1.12). 5. Modular grid lines, second stage (if necessary other colour, then outlines). 6. Arrow lines for making of views, cuts and sections. 7. Proposed contours on landscape drawings.
0.1.1	Continuous narrow line _____	1. Boundaries of different materials in view, cut and section. 2. Hatching. 3. Diagonals of indication of openings, holes and recesses. 4. Arrow lines in stairs, ramps and sloping areas. 5. Modular grid lines, first stage (if necessary, other colour then outlines). 6. Short centrelines. 7. Extension lines. 8. Dimension lines and their terminators. 9. Leader lines.

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		10. Existing contours on landscape drawings. 11. Visible outlines of parts in view (alternatively see 01.2.3). 12. Simplified representation of doors, windows, stairs, fittings etc. (alternatively see .1.2.4). 13. Framing of details
05.1	Long dashed double dotted narrow line ————··————··————··————	1. Alternative and extreme position of movable parts 2. Centroidal line 3. Outlines of adjacent parts
02.1	Dashed narrow lines —— ————— ————— ————— ————— ——	1. Existing contours on landscape drawings 2. Subdivisions of plant bed/ grass 3. hidden outlines (alternatively see 02.2.1).

End of Solution

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48. If a line is inclined to the H.P. and parallel to the V.P., then it has
(a) No trace
(b) Only V.T. but no H.T.
(c) Both H.T. and V.T.
(d) Only H.T. but no V.T.

Ans. **(d)**
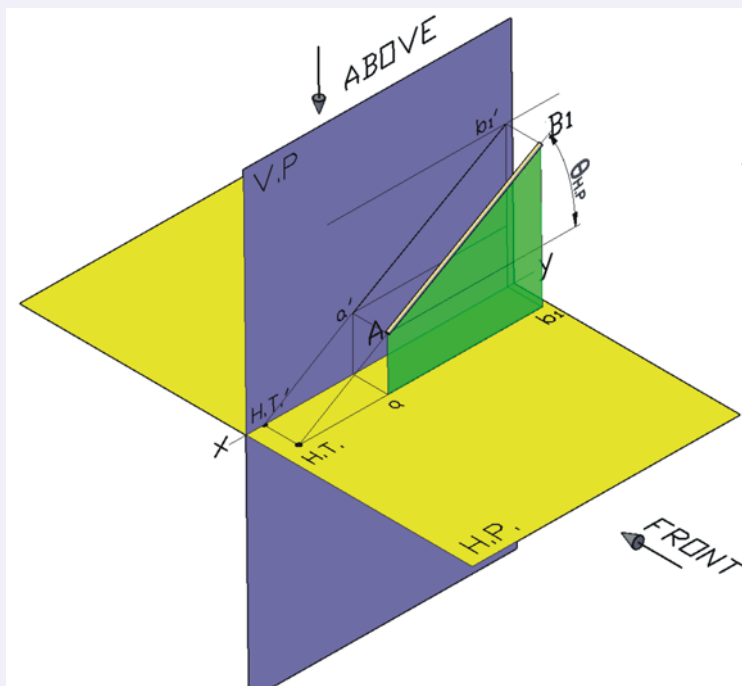
In pictorial diagram shown you can see a straight line AB1 parallel to V.P. and inclined to H.P. Since line is inclined to H.P. on extension it intersects H.P. and has horizontal trace. Since line is parallel to V.P. it will never intersect V.P. and therefore it will have no vertical trace.

Hence correct answer is (d) only H.T. but no V.T.

End of Solution

49. A triangular prism, base 40 mm side and axis 50 mm long is resting on one of its bases on the H.P. with a vertical face perpendicular to the V.P. What is the front vies of the prism?
(a) a triangle
(b) a rectangle
(c) combination of two rectangles
(d) combination of triangle and rectangle

Ans. **(b)**
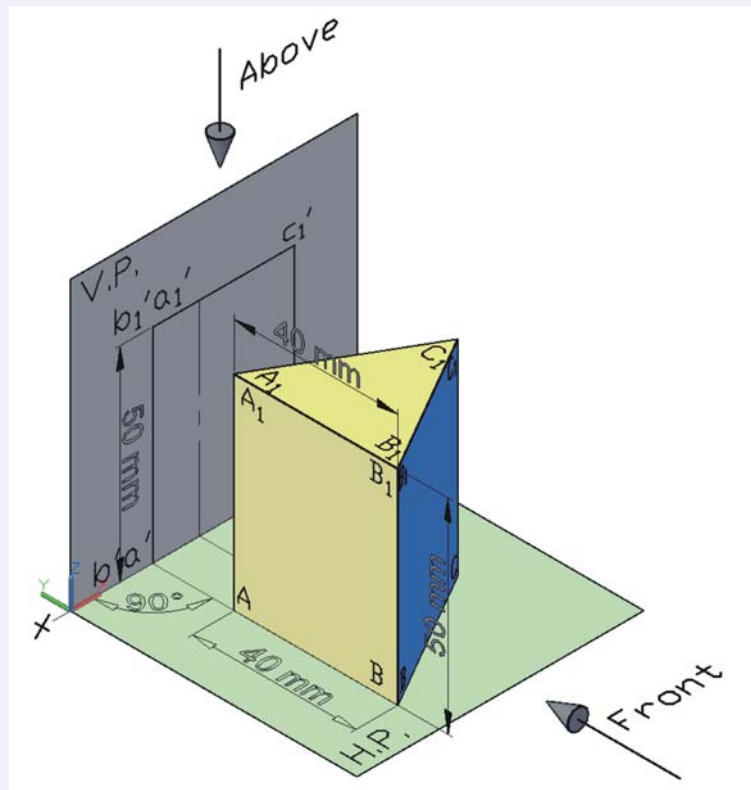
In pictorial diagram shown you can see a right triangular prism of edge of base 40 mm and height 50 mm. The prism is having its base ABC in H.P. and vertical face A1B1BA is perpendicular to V.P.. You can observe that when you look at the prism from front direction you see the rectangle B1C1CB. Hence front view of the prism is a rectangle.

End of Solution

50. Consider the following points while drawing the isometric view of any solid:
1. The isometric view should be drawn according to the given views and in such a way that maximum possible details are visible.
2. At every point for the corner of a solid, at least three lines for the edges must converge. Of these, at least two must be for visible edges.
3. Two lines (for visible edges) will never cross each other.
Which of the above statements are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans. **(d)**

End of Solution

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51. Which one of the following methods is used when the non-isometric lines or their ends lie in isometric planes?
(a) Co-ordinate method
(b) Box method
(c) Offset method
(d) Visual-ray method

Ans. **(b)**
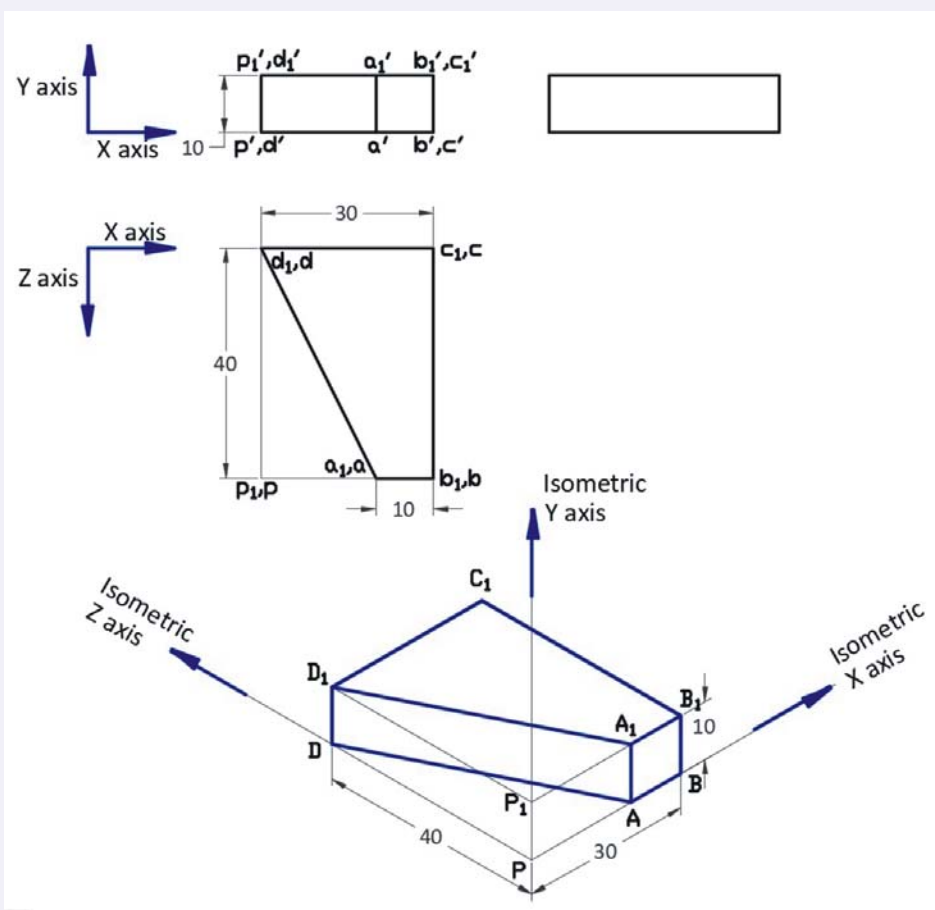
In above drawing AD is a non-isometric line lying in Isometric plane XZ. A_1D_1 is also a non-isometric line lying in Isometric plane parallel to XZ plane and 10 mm above it. To draw the non-isometric lines AD and A_1D_1 lying in isometric planes you enclose the solid in a box with upper rectangle $P_1B_1C_1D_1$ &lower rectangle PBCD. You can draw the isometric view of box easily because all its lines of box are along one of the 3-dimensional axis i.e. X axis or Y axis or Z axis. Point A1 is located on isometric line P1B1 and joined to D1 to obtain the non-isometric line A1D1.Point A is located on isometric line PB and joined to D to obtain the non-isometric line AD.

End of Solution

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52. If $X_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, X_2 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ and $X_3 = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$ are the eigenvectors of the matrix $A = \begin{bmatrix} 2 & 1 & -1 \\ 3 & 2 & -3 \\ 3 & 1 & -2 \end{bmatrix}$,

then $A^5 =$

(a) $\begin{bmatrix} 32 & 31 & -31 \\ 33 & 32 & -33 \\ 33 & 31 & -32 \end{bmatrix}$

(b) $\begin{bmatrix} 32 & 31 & -33 \\ 33 & 32 & -31 \\ 33 & 31 & -32 \end{bmatrix}$

(c) $\begin{bmatrix} 32 & 31 & -32 \\ 33 & 32 & -33 \\ 33 & 31 & -31 \end{bmatrix}$

(d) $\begin{bmatrix} 32 & 33 & -31 \\ 33 & 32 & -33 \\ 33 & 31 & 32 \end{bmatrix}$

Ans. **(a)**

Using $\qquad AX_1 = \lambda_1 X_1 \implies \lambda_1 = 2$

and $\qquad AX_2 = \lambda_2 X_2 \implies \lambda_2 = 1$

and $\qquad AX_3 = \lambda_3 X_3 \implies \lambda_3 = -1$

∴ By diagonalization

$$D = P^{-1}AP$$

$$D = \begin{bmatrix} 1 & 1 & -1 \\ 0 & -1 & 1 \\ -1 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 & 1 & -1 \\ 3 & 2 & -3 \\ 3 & 1 & -2 \end{bmatrix} \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

$$D = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

By diagonalization

$$D = P^{-1}AP$$

$$A^5 = PD^5P^{-1}$$

$$= \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 2^5 & 0 & 0 \\ 0 & 1^5 & 0 \\ 0 & 0 & (-1)^5 \end{bmatrix} \begin{bmatrix} 1 & 1 & -1 \\ 0 & -1 & 1 \\ -1 & 0 & 1 \end{bmatrix}$$

$$A^5 = \begin{bmatrix} 32 & 1 & 0 \\ 32 & 0 & -1 \\ 32 & 1 & -1 \end{bmatrix} \begin{bmatrix} 1 & 1 & -1 \\ 0 & -1 & 1 \\ -1 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 32 & 31 & -31 \\ 33 & 32 & -33 \\ 33 & 31 & -32 \end{bmatrix}$$

End of Solution

53. The equation for the ellipsoid of inertia of a solid body is

$$P(x) \equiv 4x_1^2 + 4x_2^2 + x_3^2 - 2x_1x_2.$$

What is the standard from in terms of a new orthogonal set of axes $O\{y_1, y_2, y_3\}$?

(a) $y_1^2 - 3y_2^2 + 3y_3^3$

(b) $y_1^2 + 5y_2^2 + 3y_3^2$

(c) $y_1^2 - 5y_2^2 + 3y_3^2$

(d) $y_1^2 - 5y_2^2 - 3y_3^2$

Ans. **(b)**

Given quadratic form,

$$P(x) = 4x_1^2 + 4x_2^2 + x_3^2 - 2x_1x_2$$

Symmetric matrix, $A = \begin{bmatrix} 4 & -1 & 0 \\ -1 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Eigen values of A are $\lambda = 1, 3, 5$

Orthogonal form of given quadratic form is given by $y^T D y$

$$y^T D y = \begin{bmatrix} y_1 & y_2 & y_3 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 3 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$$

$$= y_1^2 + 5y_2^2 + 3y_3^2$$

End of Solution

54. What is the general solution of a homogeneous differential equation with the characteristic equation?

$$\lambda^3(\lambda + 4)^2 (\lambda^2 + 2\lambda + 5)^2 = 0$$

(a) $y(x) = c_1 + c_2 x + c_3 x^2 + c_4 e^{-4x} + c_5 x e^{4x} + e^x \{c_6 \cos 2x + c_7 \sin 2x + c_8 x \cos 2x + c_9 x \sin 2x\}$

(b) $y(x) = c_1 + c_2 x + c_3 x^2 + c_4 e^{-4x} + c_5 x e^{-4x} + e^{-x} \{c_6 \cos 2x + c_7 \sin 2x\} + e^x \{c_8 x \cos 2x + c_9 x \sin 2x\}$

(c) $y(x) = c_1 + c_2 x + c_3 x^2 + c_4 e^{-4x} + c_5 x e^{4x} + e^x \{c_6 \cos 2x + c_7 \sin 2x\} + e^{-x} \{c_8 x \cos 2x + c_9 x \sin 2x\}$

(d) $y(x) = c_1 + c_2 x + c_3 x^2 + c_4 e^{-4x} + c_5 x e^{-4x} + e^{-x} \{c_6 \cos 2x + c_7 \sin 2x + c_8 x \cos 2x + c_9 x \sin 2x\}$

Ans. **(d)**

Roots of characteristics equations are

$$\lambda = 0 \text{ (3 times)}$$
$$\lambda = -4 \text{ (2 times)}$$
$$\lambda = -1 \pm i2 \text{ (2 times)}$$

∴ General solution of D.E is $y = y_{CF}$

$$y_{CF} = c_1 + c_2 x + c_3 x^2 + c_4 e^{-4x} + c_5 x e^{-4x} + e^{-x} (c_6 \cos 2x + c_7 \sin 2x) + x e^{-x}(c_8 \cos 2x + c_9 \sin 2x)$$

End of Solution

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55. What is the initial value if $\dfrac{d^2y}{dx^2} + 4\dfrac{dy}{dx} + 3y = e^{-x}$, with $y(0) = 2, \left(\dfrac{dy}{dx}\right)_{x=0} = 1$?

(a) $y(x) = \left(\dfrac{13}{4} + \dfrac{1}{2}x\right)e^{-x} - \dfrac{5}{4}e^{-3x}$

(b) $y(x) = \left(\dfrac{13}{4} + \dfrac{1}{2}x\right)e^{-3x} - \dfrac{5}{4}e^{-x}$

(c) $y(x) = \left(\dfrac{13}{4} + \dfrac{1}{2}x\right)e^{-x} + \dfrac{5}{4}e^{-3x}$

(d) $y(x) = \left(\dfrac{13}{4} - \dfrac{1}{2}x\right)e^{-x} - \dfrac{5}{4}e^{-3x}$

Ans. **(a)**

$y'' + 4y' + 3y = e^{-x}$ with $y(0) = 2$, $y'(0) = 1$

It is non-homogeneous LDE with constant coefficients.

∴ Gen solution is $y = y_{CF} + y_I$

Obtain y_{CF} : Given by $f(m) = m^2 + 4m + 3 = 0$

$\Rightarrow$ $m = -1, -3$

∴ $y_{CF} = C_1 e^{-x} + C_2 e^{-3x}$

Obtain y_{PI} : $y_{PI} = \dfrac{Q(x)}{f(D)} = \dfrac{e^{-x}}{D^2 + 4D + 3}$

$= x\dfrac{e^{-x}}{2D + 4} = \dfrac{x}{2}e^{-x}$

∴ $y = y_{CF} + y_{PI}$

$= C_1 e^{-x} + C_2 e^{-3x} + \dfrac{x}{2}e^{-x}$

$y' = -C_1 e^{-x} - 3C_2 e^{-3x} + \dfrac{e^{-x}}{2} - \dfrac{x}{2}e^{-x}$

Put, $x = 0$, $y = 2$

$2 = C_1 + C_2$

Put, $x = 0$, $y' = 1$

$1 = -C_1 - 3C_2 + \dfrac{1}{2}$

Solving, $C_1 + C_2 = 2 \Rightarrow C_2 = 2 - C_1$

$C_1 + 3 (2 - C_1) = -\dfrac{1}{2}$

$\Rightarrow$ $2C_1 = \dfrac{13}{2} \Rightarrow C_1 = \dfrac{13}{4}$

$C_2 = 2 - \dfrac{13}{4} = \dfrac{-5}{4}$

∴ $y = \dfrac{13}{4}e^{-x} - \dfrac{5}{4}e^{-3x} + \dfrac{x}{2}e^{-x}$

End of Solution

56. If $\mathcal{L}\{(f(t))\} = \dfrac{e^{-3s}(1-2s)}{2s^2 - s + 1}$, then $\mathcal{L}\{(f(3t))\} =$

(a) $\dfrac{e^{-s}(-3-2s)}{2s^2 - 3s + 9}$

(b) $\dfrac{e^{-s}(3+2s)}{2s^2 - 3s + 9}$

(c) $\dfrac{e^{-s}(3-s)}{2s^2 - 3s + 9}$

(d) $\dfrac{e^{-s}(3-2s)}{2s^2 - 3s + 9}$

Ans. (d)

Given: $L\{f(t)\} = \dfrac{e^{-3s}(1-2s)}{2s^2 - s + 1} = F(s)$

By Change of scale,

$$L\{f(at)\} = \frac{1}{3}\left[\frac{e^{-s}\left(1 - \dfrac{2}{3}s\right)}{2\left(\dfrac{s^2}{3}\right) - \dfrac{s}{3} + 1}\right]$$

$$= \frac{e^{-s}(3-2s)}{2s^2 - 3s + 9}$$

End of Solution

57. What is the solution of the equation $\dfrac{d^2 y}{dt^2} + y(t) = \displaystyle\int_0^t \sin\tau\, y(t-\pi)\,d\tau$, subject to the initial

conditions $y(0) = 1$ and $\left(\dfrac{dy}{dt}\right)_{t=0} = 0$?

(a) $y(t) = \dfrac{1}{2}\left(1 - \cos\sqrt{2}t\right)$, for $t > 0$

(b) $y(t) = \dfrac{1}{2}\left(1 + \cos\sqrt{2}t\right)$, for $t > 0$

(c) $y(t) = \dfrac{1}{2}\left(-1 - \cos\sqrt{2}t\right)$, for $t > 0$

(d) $y(t) = -\dfrac{1}{2}\left(1 - \cos\sqrt{2}t\right)$, for $t > 0$

Ans. (b)

By varifying boundary conditions and D.E with given options

We get $\quad y(t) = \dfrac{1}{2}(1 + \cos\sqrt{2}\,t), t > 0$

End of Solution

58. The nth coefficient of a series is given by $a_n = \dfrac{1.5.9.13...(4n+1)}{2^n}$. What is the expression a_n in terms of the gamma function?

(a) $a_n = 2^{n+2}\dfrac{\Gamma\left(n+\dfrac{5}{4}\right)}{\Gamma\left(\dfrac{1}{4}\right)}$

(b) $a_n = 2^{n+1}\dfrac{\Gamma\left(n+\dfrac{5}{4}\right)}{\Gamma\left(\dfrac{1}{4}\right)}$

(c) $a_n = 2^n\dfrac{\Gamma\left(n+\dfrac{5}{4}\right)}{\Gamma\left(\dfrac{1}{4}\right)}$

(d) $a_n = 2^{n+3}\dfrac{\Gamma\left(n+\dfrac{5}{4}\right)}{\Gamma\left(\dfrac{1}{4}\right)}$

Ans. **(a)**

$$a_n = \frac{1}{1}\cdot\frac{5}{2}\cdot\frac{9}{2}\cdot\frac{13}{2}....\frac{4n+1}{2}$$

$$a_0 = \frac{1}{1}, a_1 = \frac{1}{1}\cdot\frac{5}{2}, \ \ a_2 = \frac{1}{1}\cdot\frac{5}{2}\cdot\frac{9}{2}....$$

Verifying with each options

we get
$$a_n = 2^{n+2}\frac{\Gamma\left(n+\dfrac{5}{4}\right)}{\Gamma\left(\dfrac{1}{4}\right)}$$

End of Solution

59. Fourier series representation of $f(x) = x + 1$ for $-1 \le x \le 1$ is

(a) $f(x) = 1-\dfrac{2}{\pi}\displaystyle\sum_{n=1}^{\infty}\dfrac{(-1)^{n+1}}{n}\sin n\pi x$

(b) $f(x) = -1-\dfrac{2}{\pi}\displaystyle\sum_{n=1}^{\infty}\dfrac{(-1)^{n+1}}{n}\sin n\pi x$

(c) $f(x) = 1+\dfrac{2}{\pi}\displaystyle\sum_{n=1}^{\infty}\dfrac{(-1)^{n+1}}{n}\sin n\pi x$

(d) $f(x) = -1+\dfrac{2}{\pi}\displaystyle\sum_{n=1}^{\infty}\dfrac{(-1)^{n+1}}{n}\sin n\pi x$

Ans. **(c)**
Fourier series of $f(x) = x + 1$, $-1 \le x \le 1$ is given by

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos\frac{n\pi x}{l} + \sum_{n=1}^{\infty} b_n \sin\frac{n\pi x}{l} \qquad ...(1)$$

given $l = 1$

$$a_0 = \frac{1}{l}\int_{-l}^{l} f(x)dx = \frac{1}{1}\int_{-1}^{1}(x+1)dx = 0 + (x)_{-1}^{1} = 2$$

$$a_n = \frac{1}{l}\int_{-l}^{l} f(x)\cos\frac{n\pi x}{l} = \frac{1}{1}\int_{-1}^{1}(1+x)\cos\frac{n\pi x}{1}dx$$

$$= \left(\frac{\sin \frac{n\pi x}{1}}{n\pi} \right)_{-1}^{1}$$

$$= 0$$

$$b_n = \frac{1}{l} \int_{-l}^{l} f(x) \sin \frac{n\pi x}{l} dx$$

$$= \frac{1}{1} \int_{-1}^{1} (1+x) \sin(n\pi x) dx$$

$$= 0 + \frac{2}{1} \int_{0}^{1} x \sin \frac{n\pi x}{1} dx$$

$$b_n = 2 \left[x \left(\frac{-\cos n\pi x}{n\pi} \right) - \left(\frac{-\sin n\pi x}{n^2 \pi^2} \right) \right]_{0}^{1}$$

$$= \frac{2}{n\pi} \left[(-1)^{n+1} + 0 \right]$$

$\therefore$ Fourier series of $f(x)$ is

$$f(x) = 1 + \sum_{n=1}^{\infty} \frac{2}{n\pi} (-1)^{n+1} \sin n\pi x$$

End of Solution

60. Let $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a, \end{cases}$ and $g(x) = \begin{cases} 1, & 0 < x < a \\ 0, & \text{otherwise}, \end{cases}$ then the Fourier transform of

$3f(x) - 2g(x)$ is

(a) $\sqrt{\dfrac{2}{\pi}} \left\{ \dfrac{3\sin\omega a}{\omega} + \left(\dfrac{1 - e^{i\omega a}}{i\omega} \right) \right\}$

(b) $\sqrt{\dfrac{2}{\pi}} \left\{ \dfrac{3\sin\omega a}{\omega} - \left(\dfrac{1 + e^{-i\omega a}}{i\omega} \right) \right\}$

(c) $\sqrt{\dfrac{2}{\pi}} \left\{ \dfrac{-3\sin\omega a}{\omega} - \left(\dfrac{1 - e^{-i\omega a}}{i\omega} \right) \right\}$

(d) $\sqrt{\dfrac{2}{\pi}} \left\{ \dfrac{3\sin\omega a}{\omega} - \left(\dfrac{1 - e^{-i\omega a}}{i\omega} \right) \right\}$

Ans. **(d)**

$$f/\{3f(x) - 2g(x)\} = \sqrt{\frac{1}{2\pi}} \left[\int_{-\infty}^{\infty} e^{-i\omega n} (3f(x)) dx - \int_{-\infty}^{\infty} e^{-i\omega n} (2g(x)) dx \right]$$

$$= \sqrt{\frac{1}{2\pi}} \left[3 \int_{-a}^{a} e^{-iWx} (1) dx - 2 \int_{0}^{a} e^{-iWx} (1) dx \right]$$

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$$= \sqrt{\frac{1}{2\pi}} \left[3 \left(\frac{e^{-i\omega x}}{-i\omega} \right)_{-a}^{a} - 2 \left(\frac{e^{-i\omega x}}{-i\omega} \right)_{0}^{a} \right]$$

$$= \sqrt{\frac{1}{2\pi}} \left[-\frac{3}{\omega} \left(\frac{e^{-i\omega a} - e^{-i\omega a}}{i} \right) + \frac{2}{i\omega} \left(e^{-i\omega a} - 1 \right) \right]$$

$$= \sqrt{\frac{1}{2\pi}} \left[+\frac{3}{\omega} (2 \sin\omega) + \frac{2}{i\omega} \left(e^{-i\omega a} - 1 \right) \right]$$

$$= \sqrt{\frac{2}{\pi}} \left[+\frac{3 \sin\omega a}{\omega} - \left(\frac{1 - e^{-i\omega a}}{i\omega} \right) \right]$$

End of Solution

61. For what values of a and b is the vector field $F = (x + z)i + a(y + z)j + b(x + y)k$ a conservative field?

(a) $a = b = 1$
(b) $a = b = -1$
(c) $a = 1, b = -1$
(d) $a = -1, b = 1$

Ans. **(a)**

$$\vec{F} = (x+z)\hat{i} + a(y+z)\hat{j} + b(x+y)\hat{k}$$

$$\text{Curl } \vec{F} = \vec{\nabla} \times \vec{F} = \begin{bmatrix} \hat{i} & \hat{j} & \hat{k} \\ \dfrac{\partial}{\partial x} & \dfrac{\partial}{\partial y} & \dfrac{\partial}{\partial z} \\ x+z & ay+az & bx+by \end{bmatrix}$$

$$= \hat{i}(b-a) - \hat{j}(b-1) + \hat{k}(0-0)$$

$$= (b-a)\hat{i} + (1-b)\hat{j} + 0\hat{k}$$

For conservative field Curl $\vec{F} = 0$

$$(b-a)\hat{i} + (1-b)\hat{j} + 0\hat{k} = 0\hat{i} + 0\hat{j} + 0\hat{k}$$

$\Rightarrow b = a$ and $b = 1$. So, $a = b = 1$
Hence, Answer is (a).

End of Solution

62. Let S be the surface of the paraboloid of revolution $z = 1 - x^2 - y^2$ with the domain of definition $x^2 + y^2 \le 1$, and let Γ be the boundary of the paraboloid.

Given: $F = x^3i + (x + y - z) j + yzk$.

What is the value of $\iint\limits_{s} \text{curl}\, F \cdot dS$?

(a) 2π (b) π

(c) $\dfrac{\pi}{2}$ (d) π^2

Ans. **(b)**

When $x^2 + y^2 = 1$, $z = 1 - x^2 - y^2 = 1 - 1 = 0$

i.e., Boundary curve is $x^2 + y^2 = 1$ and $z = 0$.

Let $x = \cos t,\ y = \sin t,\ 0 \le t \le 2\pi$ then

$$r(t) = (\cos t)\hat{i} + (\sin t)\hat{j} \Rightarrow r'(t) = -(\sin t)\hat{i} + (\cos t)\hat{j}$$

Again $\vec{F} = x^3\hat{i} + (x + y - z)\hat{j} + (yz)\hat{k}$

$$= (\cos^3 t)\hat{i} + (\cos t + \sin t - 0)\hat{j} + (0)\hat{k}$$

So, $\vec{F}(r(t)) \cdot r'(t) = -\sin t \cos^3 t + \cos^2 t + \cos t \sin t + 0$

So, by Stoke's theorem

$$\iint\limits_{S}(\text{Curl}\ \vec{f} \cdot d\vec{s}) = \int\limits_{C}(\vec{F}(r(t)) \cdot r'(t))dt \approx \int\limits_{C}\vec{F} \cdot d\vec{r}$$

$$= \int\limits_{t=0}^{2\pi}(-\sin t\cos^3 t + \cos^2 t + \cos t \sin t)dt$$

$$= \left(\frac{\cos^4 t}{4}\right)_0^{2\pi} + \left(\frac{t}{2} + \frac{\sin 2t}{4}\right)_0^{2\pi} + \left(\frac{\sin^2 t}{2}\right)_0^{2\pi}$$

$$= 0 + \left(\frac{2\pi - 0}{2}\right) + 0 + 0 = \pi$$

Hence, correct option is (b).

End of Solution

63. The fixed point iterative scheme for determing $\sqrt{2}$ is

(a) $x_{n+1} = \dfrac{1}{2}\left(x_n - \dfrac{2}{x_n}\right)$ (b) $x_{n+1} = \dfrac{1}{2}\left(-x_n + \dfrac{2}{x_n}\right)$

(c) $x_{n+1} = -\dfrac{1}{2}\left(x_n + \dfrac{2}{x_n}\right)$ (d) $x_{n+1} = \dfrac{1}{2}\left(x_n + \dfrac{2}{x_n}\right)$

Ans. **(d)**

Let $x^2 = 2 \Rightarrow x = \dfrac{2}{x}$ so let $f(x) = \dfrac{2}{x}$

To find square root of 2, let's start with $x_o = 1$ i.e.

$$x_1 = f(x_o) = \frac{2}{1} = 2$$

Now, for $x_1 = 2$, $x_2 = f(x_1) = \dfrac{2}{2} = 1 \approx x_o$ i.e. we stuck in a loop $b/x\ x_o$ and x_2 so we will redefine $f(x)$ using average damping technique i.e.

$$f(x) = \frac{\dfrac{2}{x} + x}{2} = \text{Average of } \left(\frac{2}{x}\right) \text{ and } x$$

$$f(x) = \frac{1}{2}\left(x + \frac{2}{x}\right) \text{ which will converge hence Answer is (d).}$$

End of Solution

---

64. The Gauss-Seidel iterative method for the system of equations :

$$-\frac{1}{4}x_2 - \frac{1}{4}x_3 + x_4 = \frac{1}{4}, \qquad -\frac{1}{4}x_1 + x_3 - \frac{1}{4}x_4 = \frac{1}{4},$$

$$x_1 - \frac{1}{4}x_2 - \frac{1}{4}x_3 = \frac{1}{2} \qquad -\frac{1}{4}x_1 + x_2 - \frac{1}{4}x_4 = \frac{1}{2} \text{ is}$$

(a) $x_1^{(n+1)} = 0.5 - 0.25x_2^{(n)} + 0.25x_3^{(n)},$

$x_1^{(n+1)} = 0.5 + 0.25x_1^{(n+1)} + 0.25x_4^{(n)},$

$x_3^{(n+1)} = 0.25 + 0.25x_1^{(n+1)} + 0.25x_4^{(n)},$

$x_4^{(n+1)} = 0.25 - 0.25x_2^{(n+1)} + 0.25x_3^{(n+1)}$

(b) $x_1^{(n+1)} = 0.5 + 0.25x_2^{(n)} + 0.25x_3^{(n)},$

$x_2^{(n+1)} = 0.5 + 0.25x_1^{(n+1)} + 0.25x_4^{(n)},$

$x_3^{(n+1)} = 0.25 + 0.25x_1^{(n+1)} + 0.25x_4^{(n)},$

$x_4^{(n+1)} = 0.25 + 0.25x_2^{(n+1)} + 0.25x_3^{(n+1)}$

(c) $x_1^{(n+1)} = 0.5 + 0.25x_2^{(n)} + 0.25x_3^{(n)},$

$x_2^{(n+1)} = 0.5 + 0.25x_1^{(n+1)} - 0.25x_4^{(n)},$

$x_3^{(n+1)} = 0.25 + 0.25x_1^{(n+1)} - 0.25x_4^{(n)},$

$x_4^{(n+1)} = 0.25 + 0.25x_2^{(n+1)} + 0.25x_3^{(n+1)}$

(d) $x_1^{(n+1)} = 0.5 + 0.25x_2^{(n)} + 0.25x_3^{(n)},$

$x_2^{(n+1)} = 0.5 - 0.25x_1^{(n+1)} + 0.25x_4^{(n)},$

$x_3^{(n+1)} = 0.25 + 0.25x_1^{(n+1)} + 0.25x_4^{(n)},$

$x_4^{(n+1)} = 0.25 + 0.25x_2^{(n+1)} + 0.25x_3^{(n+1)}$

Ans. **(b)**

Given equations are :

$-x_2 - x_3 + 4x_4 = 1$

$-x_1 + 4x_3 - x_4 = 1$

$4x_1 - x_2 - x_3 = 2$

$-x_1 + 4x_2 - x_4 = 2$

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It is not diagonally dominant system so using E-operation, we get

$$4x_1 - x_2 - x_3 = 2$$
$$-x_1 + 4x_2 - x_4 = 2$$
$$-x_1 + 4x_3 - x_4 = 1$$
$$-x_2 - x_3 + 4x_4 = 1$$

Now it is diagonally dominant so we can use Gaus-seidal method as follows

$$x'_1 = \frac{1}{4}(2 + x_2 + x_3) = 0.5 + 0.25x^0_2 + 0.25x^0_3$$

$$x'_2 = \frac{1}{4}(2 + x_1 + x_4) = 0.5 + 0.25x'_1 + 0.25x^0_4$$

$$x'_3 = \frac{1}{4}(1 + x_1 + x_4) = 0.25 + 0.25x'_2 + 0.25x^0_4$$

$$x^1_4 = \frac{1}{4}(1 + x_2 + x_3) = 0.25 + 0.25x'_3 + 0.25x'_3$$

where $(x^0_1, x^0_2, x^0_3, x^0_4)$ is the initial assumption and (x'_1, x'_2, x'_3, x'_4) is the 1st iteration. Proceeding in the same manner, option (b) is the right answer.

End of Solution

65. What is the missing figure in the following table?

x	1	2	3	4	5
$y = f(x)$	2	5	7	–	32

(a) 10 (b) 13
(c) 14 (d) 17

Ans. (c)

Forward difference table is

x	$f(x)$	$\Delta f(x)$	$\Delta^2 f(x)$	$\Delta^3 f(x)$	$\Delta^4 f(x)$
1	2				
2	5	3	–1		
3	7	2	$\alpha - 9$	$\alpha - 8$	$56 - 4\alpha$
4	α	$\alpha - 7$	$39 - 2\alpha$	$48 - 3\alpha$	
5	32	$32 - \alpha$			

$\because$ Four values of y are given so we can assume $f(x)$ as polynomial of degree 3 and in that situation 4th order differences will be zero.

i.e., $\Delta^4 f(x) = 0$ $\Rightarrow$ $56 - 4\alpha = 0$ $\Rightarrow$ $\alpha = 14$

Hence, correct option is (c).

End of Solution

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66. What is $f'(0.2)$ from the following tabular data?

x	0.0	0.2	0.4	0.6	0.8	1.0
$y(x)$	1.00	1.16	3.56	13.96	41.96	101.00

(a) 4.2   (b) 2.2

(c) 5.2   (d) 3.2

Ans. **(d)**

Forward difference table is

x	$f(x)$	$\Delta f(x)$	$\Delta^2 f(x)$	$\Delta^3 f(x)$	$\Delta^4 f(x)$	$\Delta^5 f(x)$
0	1	0.16				
0.2	1.16	2.40	2.24			
0.4	3.56	10.40	8.00	5.76		
0.6	13.96	28.00	17.60	9.60	3.84	0
0.8	41.96	59.04	31.04	13.44	3.84	
1.0	101.00					

Here $h = 0.2$

              $a = 0$

then $u = \dfrac{x-a}{h} = \dfrac{x}{0.2}$

So, at $x = 0.2$

            $u = \dfrac{0.2}{0.2} = 1$

Newton forward differnce formula is

$$f(x) = f(a) + u\Delta f(a) + \frac{a(u-1)}{2!}\Delta^2 f(a) + \frac{u(u-1)(u-2)}{3!}\Delta^3 f(a)$$

$$+ \frac{u(u-1)(u-2)(u-3)}{4!}\Delta^4 f(a) + \ldots\ldots\ldots$$

So, $f'(x) = \dfrac{1}{h}\left[\Delta f(a) + \left(\dfrac{2u-1}{2}\right)\Delta^2 f(a) + \left(\dfrac{3u^2 - 6u + 2}{6}\right)\Delta^3 f(a)\right]$

$$+ \left(\frac{4u^3 - 18u^2 + 22u - 6}{24}\right)\Delta^4 f(a) + \ldots\ldots\ldots$$

Putting $x = 0.1$, $a = 0$, $u = 1$ we get,

           $f'(0.2) = \ldots\ldots\ldots = 3.2$

End of Solution

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67. Of the five boys A, B, C, D and E two are good, one is poor and two are average in studies. Two of them study in post-graduate classes and three in under graduate classes. One comes from a rich family two from middle class families and two from poor families. One of them is interested in music, two in acting and one in sports. Of those studying in under graduate classes, two are average and one is poor in studies. Of the two boys interested in acting, one is a post-graduate student. The one who is interested in music comes from a middle class family. Both of the boys interested in acting are not industrious, good in studies come from middle class families, are average in studies and one of them is interested in acting. The boy interested in sports comes from a poor family, while the one interested in music in industrious. E is industrious, good in studies comes from a poor family and is not interested in acting, music or sports. Cis poor in studies in spite of being industrious. A comes from a rich family, is not industrious but good in studies. B is industrious and comes from a middle class family. Name the boy who is not industrious and is average in studies.

(a) A
(b) B
(c) C
(d) D

Ans. **(d)**

Forward difference table is

A = Rich, E = Poor

A, E = good in studies and C = poor in studies

B, D - Average in studies

B, D, C - middle class family

A, E in PG

A, D - Interested in acting

B, D - middle class family

D - Music

C - Sports

B, C, E - Industrious

A and D - Not industrious

So, D is average in studies and NOT industrious.

End of Solution

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68. At an electric Data Processing Unit five out of the eight program sets, P, Q, R, S, T, U, V and W are to be operated daily. On any one day except for the first day of the month only three of the program sets must be the ones that were operated on the previous day. The program operating must also satisfy the following conditions:

1. If program P is to be operated on a day, V cannot be operated on that day.
2. If Q is to be operated on a day, T must be one of the programs to be operated after Q.
3. If R is to be operated on a day, V must be one of the programs to be operated after R.
4. The last program to be operated on any day must be either S or U.

If the program sets R and W are to be operated on the first day which of the following could be the other programs on that day?

(a) Q, V, S
(b) Q, T, V
(c) T, S, V
(d) T, S, V

Ans. (d)

(PV) not together on any day.

$(\overrightarrow{R\ V})$ as V after R

Last S or U

$(\overrightarrow{Q\ T})$ Q followed by T

T, S, V only correct (d).

End of Solution

69. Read the following information carefully and answer the question give below it:

1. Eight doctors *P, Q, R, S, T, U, V* and *W* visit charitable dispensary every day except on a holiday i.e., Monday.
2. Each doctor visits for one hour from Tuesday to Sunday except Saturday. The timings are 9 A.M. to 1 P.M. and 2 P.M. to 6 P.M., 1 P.M. to 2 P.M. is lunch break.
3. On Saturday it is opened only in the morning i.e. 9 A.M. to 1 P.M. and each doctor visits for only half an hour.
4. No other doctor visits the dispensary, before doctor *Q* and after *U*.
5. Doctor *W* comes immediately after the lunch break is followed by *R*.
6. *S* comes in the same order as *P* in the afternoon session.

If the lunch break and subsequent visiting hours are reduced by 15 minutes at what time doctor *U* is expected to attend the dispensary?

(a) 3.15 P.M.
(b) 4 P.M.
(c) 4.15 P.M.
(d) 4.45 P.M.

Ans. **(b)**

B = 4 PM

Q visit first and 4 visit last

After break there are foru people W, R, P, U and total tiem reduced by 15 minute for break and 15 mins each for Dr.'s visiting after break total reduction of 75 min.

6 PM – 75 min = 4 : 45 PM

So, U came @ 4 : 00 - 4 : 45

As break is from 1 to 2 reduced by 15 mins.

So, break only from   1 to 1:45

           Next   1:45 to 2:30

           Next   2:30 to 3:15

           Next   3:15 to 4:00

           Next   4:00 to 4:45

U attended from 4 to 4:45

So, he bagan @ 4 PM = B

U is expected to attend from 4 to 4:45.

End of Solution

70. Study the following information carefully and answer the question given below it:

1. *P, Q, R, S, T* and *U* are six members in a family in which there are two married couples.
2. *T*, a teacher, is married to the doctor who is mother or *R* and *U*.
3. *Q*, the lawyer, is married to *P*.
4. *P* has one sone and one grandson.
5. Of the two married ladies on is housewife.
6. There is one student and one male engineer in the family.

How is *R* related to *U*?
(a) Brother only   (b) Sister only
(c) Brother or Sister   (d) Mother

Ans. **(c)**

End of Solution

71. Read the following information carefully and answer the question that follow:

1. Madhu and Shobha are good in Dramatics and Computer Science.
2. Anjali and Madhu are good in Computer Science and Physics.
3. Anjali, Poonam and Nisha are good in physics and History.
4. Nisha and Anjali are good in Physics and Mathematics.
5. Poonam and Shobha are good in History and Dramatics.

Who is good in History, Physics, Computer Science and Mathematics?
(a) Poonam   (b) Nisha
(c) Madhu   (d) Anjali

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Ans. **(d)**

Following table can be plotted

	Dramatics	C.S.	Physics	History	Maths
Madhu	✓	✓	✓		
Shobha	✓	✓		✓	
Anjali		✓	✓	✓	✓
Poonam	✓		✓	✓	
Nisha			✓	✓	✓

Only Anjali good in History, Physics, C.S. and Maths.

End of Solution

72. The question given below the three statements followed by three conclusions numbered I, II and III. You have to take the given statements to be true even if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

Statements:

All lions are tigers

All tigers are leopards

Some leopards are wolves

Conclusions:

I.   No elephant is lion.

II. Some wolves are lions.

III. Some leopards are lions.

(a) Only I follows   (b) Only II follows

(c) Only III follows   (d) Only I and III follows

Ans. **(c)**

(i) No mention of elephent

(ii) May or may not

(iii) Always follows
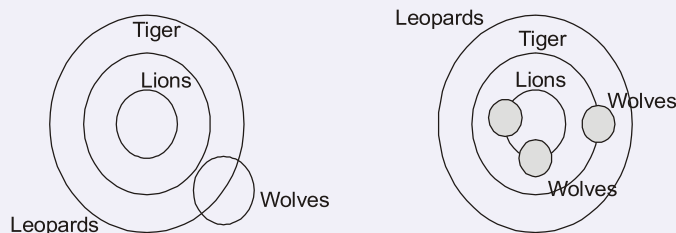
End of Solution

73. Rohith went 15 km to the west from his house, then he turned left and walked 20 km. He then turned east and walked 25 km and finally turning left covered 20 km. How far is he from his house?

(a) 5 km   (b) 10 km

(c) 40 km   (d) 80 km

Ans. **(b)**

$25 - 15 = 10$
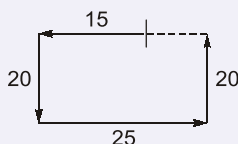
74. Cryptic language is popular since ages, mostly in the field of espionage and sending classified messages. If 'I LOVE YOU' is coded as 7, then how would you code 'GO TO HELL' in the same language?

(a) 1   (b) 4

(c) 3   (d) 5

Ans. **(b)**

```
 I   L   O   V   E    Y   O   U
 9  12  15  22  5    25  15  21   =   124    =  7
                              1 + 2 + 4 =
```

```
 7  15  20  15    8  5  12  12
 G   O   T   O    H  E  L  L   = 94 = 13
                          = 4
```

75. What letter should replace the question mark?

(a) Z   (b) Y

(c) X   (d) W

Ans. **(c)**

$24 = X$
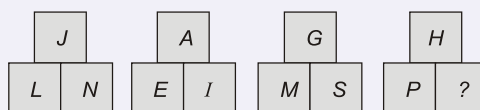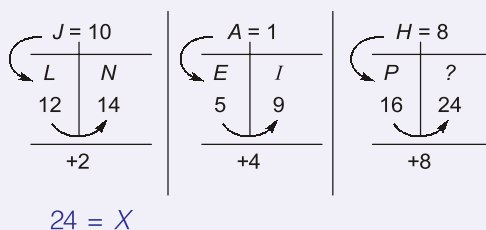
76. In the first two circles, the number inside the circle is written according to a particular relation. What is the number inside the third circle which follows the same relation as that of the first two circles?

Circle 1: 8 (top), 27 (bottom left), 125 (bottom right)
Circle 2: 10 (top), 64 (bottom left), 216 (bottom right)
Circle 3: ? (top), 343 (bottom left), 216 (bottom right)

(a) 12   (b) 13
(c) 9   (d) 14

Ans. **(b)**

$$
\begin{array}{c|c}
\multicolumn{2}{c}{8} \\
27 & 125 \\
\downarrow & \downarrow \\
3^3 & 5^3 \\
\multicolumn{2}{c}{3 + 5 = 8}
\end{array}
\qquad
\begin{array}{c|c}
\multicolumn{2}{c}{10} \\
64 & 216 \\
\downarrow & \downarrow \\
4^3 & 6^3 \\
\multicolumn{2}{c}{4 + 6 = 10}
\end{array}
\qquad
\begin{array}{c|c}
\multicolumn{2}{c}{13 = ?} \\
343 & 216 \\
\downarrow & \downarrow \\
7^3 & 6^3 \\
\multicolumn{2}{c}{7 + 6 = 13}
\end{array}
$$
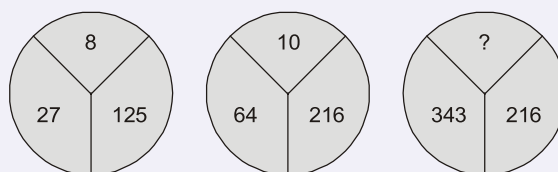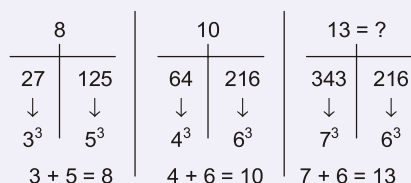
77. Deepthi is playing a treasure hunt game. At the first stage, Deepthi needs to choose a five-digit code to unlock the vault which contains the treasure. She gets the following codes to choose from

15342   26540   35415
23105   15320   13402
35047   71024   28305

The following clues are given to her to help her to find the code
P.   The code number is not an even number.
Q.   The product of the first two digits is odd.
R.   The sum of the first four digits is 12.
S.   The code number is not a multiple of 5.

If Deepthi had the option of selecting only one clue, which of the four clues will give her the best chance of finding out the five digit code?
(a) S   (b) R
(c) Q   (d) P

Ans. **(b)**

As 3504
$R \rightarrow$ first four digits
$3504 = 3 + 5 + 0 + 4 = 12$
Only one number (code) 35047 satisfies it

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78. Suppose you enter an elevator at a certain floor. Then the elevator moves up 5 floors, down 3 floors, and up 2 floors. If you are then at the 8th floor, on what floor did you first enter the elevator?

(a) 8   (b) 7

(c) 6   (d) 9

Ans. **(*)**

$$x + 5 - 3 + 2 = 8$$
$$x = 4$$

∗ No option matched

79. A number series is given with one term missing. Choose the correct alternative from options.

0.5, 0.55, 0.65, 0.8, ?

(a) 0.9   (b) 0.95

(c) 0.82   (d) 1

Ans. **(d)**

0.5,   0.55,   0.65,   0.8   1

+0.05   +0.10   +0.15   +0.20
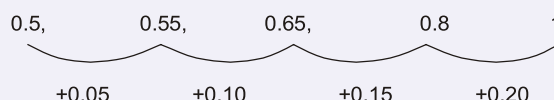
80. The soccer club is putting together a mural using lightly colored transparent paper. This paper then is cut into squares of different sizes that are placed next to each other to make the designs for the mural. Of course, the club wants to save money, so its members are trying to buy the minimum number of sheets of colored paper. Below is one of the designs they are going to use. What is the minimum number of squares they will need to make this design?
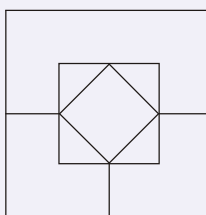
(a) 4   (b) 5

(c) 6   (d) 7

Ans. **(b)**

$P\ Q\ R\ S \rightarrow 1$

$A\ B\ C\ D \rightarrow 2$

$\alpha\ \beta\ \gamma\ \delta \rightarrow 3$

$E\ F\ G\ S \rightarrow 4$

$i\ F\ G\ R \rightarrow 5$
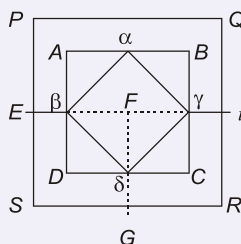
81. What is the correct alternative for the question mark?

2, 3, 8, 63, ?
(a) 1038   (b) 1998
(c) 3008   (d) 3968

Ans. **(d)**

$$2^2 - 1 = 3$$
$$3^2 - 1 = 8$$
$$8^2 - 1 = 63$$
$$63^2 - 1 = 3968$$

Ans. = D = 3968

82. What one of the following is NOT an objective of Mahila Kisan Sashaktikaran Pariyojana (MKSP)?
(a) To create sustainable agricultural livelihood opportunities for women in agriculture.
(b) To ensure food and nutrition security at the household and the community level.
(c) To enable women to have better access to inputs and services of the government and other agencies.
(d) To help women educate the rural folk and improve their living condition.

Ans. **(d)**
Mahila Kisan Sashaktikaran Pariyojana (MKSP):
• Implemented by Department of Agriculture and farmer welfare.
• Atleast 30% of the expenditure incurred for women to bring them into mainstream agriculture.
• Started in 2011
• It seeks to improve the present status of women in agriculture and to enhance the opportunities available to empower her.

83. Consider the following statements regarding the aim of Jal Jeevan Mission to provide every rural household of the country with adequate tap water of prescribed quality on regular basis:
1. It seeks to ensure 'ease of living' which leads to healthier as well as hygienic living conditions in rural areas.
2. It aims to establish water tanks in good numbers with the slogan 'Har Ghar Jal'.
3. By ensuring community participation at village-level, it will help in developing local leadership based no Gandhiji's philosophy of 'Gram Swarajya'.
4. The Mission seeks to achieve its goal by 2024.
Which of the above statements are correct?
(a) 1,3 and 4 only   (b) 1, 2, 3 and 4
(c) 1 and 3 only   (d) 2 and 4 only

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Ans. **(b)**

Jal Jeevan Mission:

Slogan: HAR GHAR JAL

Objective: Safe and adequate drinking water to all household in rural India.

<div align="right">**End of Solution**</div>

84. Which one of the following is NOT correctly matched?
(a) The Last Queen : Chitra Banerjee Divakaruni
(b) Inseparable : Simone de Beauvior
(c) Great Circle : Rumaan Alam
(d) Jungle Nama : Amitav Ghosh

Ans. **(c)**
- **The last Queen:** Chitra Banerjee Divakaruni.
- **Inseparable :** Simone de Beavour.
- **Great Circle :** Maggie Shipsteal.
- **Jungle Nama :** Amitav Ghos.

<div align="right">**End of Solution**</div>

85. What is 'The Pandora Papers'?
(a) It is the document related to the top 100 highest tax payers of the world.
(b) It is the project of investigation which leaked almost 12 million documents that reveals hidden wealth, money laundering by some of the world's rich and powerful.
(c) It is the record of total revenue collected at the world level.
(d) It is the document containing record of the top young talented entrepreneurs under the age 30.

Ans. **(b)**

Pandora papers are a release of nearly 12 million leaked documents that reveal the hidden and sometimes unethical or corrupt dealings of global wealthy and elite including prominent world leaders, politicians, corporate executives, celebrities and billionaires.

<div align="right">**End of Solution**</div>

86. Match the following:

List I	List II
P. V Shanta	1. Film Director
Q. Akhtar Ali	2. Former Davis Cup Coach
R. Anil Dharkar	3. Noted Journalist
S. Sumitra Bhave	4. Renowned Indian Oncologist

Select the correct pair using the code given below:

	P	Q	R	S
(a)	4	2	3	1
(b)	2	4	1	3
(c)	3	1	2	4
(d)	1	3	4	2

Ans. (a)
     V Shanta : Renowned Indian Oncologist
     Akhtar Ali: Former Davis Cup Coach
     Anil Dharkar: Journalist and Writer
     Sumitra Bhave: Film Director

End of Solution

87. Select the State/s and/or UTs of India which have been ranked first as 'Zero Hunger' as per SDG : India Agenda for Development:
    (a) Tamil Nadu and Delhi
    (b) Kerala and Chandigarh
    (c) Gujarat and Delhi
    (d) Goa and Lakshadweep

Ans. (b)
     SDG: State score in zero Hunger quality education and affordable and clean energy.
             Kerala : 75 Points
          Chandigarh : 79 points

End of Solution

88. Which one of the following pairs is NOT correct under women achievers?
    (a) Megha Rajagopalan : Winner of Pulitzer prize in feature writing
    (b) Anvee Bhutani : Indian-origin student elected as the President of Oxford Student Union
    (c) Delisha Davis : 24 year old female heavy vehicle driver carrying hazardous goods.
    (d) Bela M Trivedi : Took oath as the Judge of the Supreme Court of India

Ans. (c)
- **Megha Rajgopalan**: American journalist of Indian descent who works at the New York Times. She won 2021 Pulitzer Prize.
- **Anvee Bhutani**: President of oxford university student union.
- **Delisha Davis**: First Indian woman to drive a fuel tanker.
- **Bela M Trivedi**: Took oaths as the judge of the supreme court of India.

End of Solution

89. Who among the following is India's first Space Tourist?
    (a) Santosh George Kulangara
    (b) Sirisha Bandla
    (c) Raja J V Chari
    (d) Pankaj Lokhani

Ans. (a)
     Santosh George Kulangara was the first Indian space tourist after paying a whopping $ 2,00,000 and booked a seat in Virgin Atlantic. Santosh George is a resident of Kerala.

End of Solution

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90. The Wasseanaar Arrangement is
(a) an elite club of countries which subscribe to arms export controls.
(b) a group of countries concerned with unconventional energy sources in the world.
(c) concerned with the preservation of extinct animal species.
(d) an arrangement which seeks to study recurring cyclone patterns.

Ans. **(a)**
Wassenaar Arrangement on export control for conventional arrows and dual– use goods and Technologies is a multilateral export control region with 42 participating states.

End of Solution

91. Which one of the following is NOT include in the 12 areas of "Doing Business 2020"?
(a) Getting credit (b) Paying taxes
(c) Promoting small scale industries (d) Getting electricity

Ans. **(c)**
12 areas of doing business
1. Starting a business.
2. Dealing with construction permit.
3. Getting electricity.
4. Registering property.
5. Getting credit.
6. Protecting minority investors.
7. Paying taxes.
8. Trading across borders.
9. Inforcing contracts.
10. Resolving insolvency.
11. Employing workers.
12. Contracting with the government.

End of Solution

92. Consider the following economic activities:
1. Public administration
2. Financial services
3. Mining and quarrying
Which of the above economic activities fall under the tertiary sector?
(a) 1 and 3 only (b) 1, 2 and 3
(c) 2 and 3 only (d) 1 and 2 only

Ans. **(d)**

End of Solution

93. IMF raises its projection for economic growth in 2021-22 to
(a) 11.3% (b) 12.5%
(c) 10.2% (d) 8.4%

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Ans. **(d)**
- 6.0%
- 8.7% (projected)

For the world, growth will slow down from 6% in 2021 to 3.2% 2022 and 2.7% in 2023.

<div style="text-align:right">*End of Solution*</div>

94. Consider the following statements:
1. Ford India will stop manufacturing vehicles in India but will retain the engine-making an technology services business as part of restructuring its India operations.
2. Zee Entertainment Enterprises Ltd announces a merger with Sony pictures Networks India.
3. Yashoda Hegde is the new CEO of Coffee Day Enterprises Ltd.

Which of the above statements is/are correct?
(a) 1 and 3 only   (b) 1 only
(c) 1 and 2 only   (d) 2 only

Ans. **(c)**

Malvika Krishna is the new CEO of Coffee Day Enterprises Ltd.

<div style="text-align:right">*End of Solution*</div>

95. Government of India has moved a resolution in UN General Assembly to declare the year 2023 as the International Year of Millets for which of the following reasons?
1. Support will be provided for post-harvest value addition, enhancing domestic consumption.
2. Support will be provided for branding millet products nationally and internationally.

Select the correct answer using the code given below:
(a) 1 only   (b) Neither 1 nor 2
(c) Both 1 and 2   (d) 2 only

Ans. **(b)**
- "Indian Wealth, Millets for Health"
- Millets included in PDS.

<div style="text-align:right">*End of Solution*</div>

96. 'Bahujan Hitaya : Bahujan Sukhaya' is the motto of
(a) Central Board of Film Certification   (b) Indian Railways
(c) Doordarshan   (d) All India Radio

Ans. **(d)**

<div style="text-align:right">*End of Solution*</div>

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Directions : Each of the next Four (04) items consists of two statements, one labelled as the 'Statement (I) and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes :
- (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I).
- (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is **not** the correct explanation of Statement (I).
- (c) Statement (I) is true but Statement (II) is false.
- (d) Statement (I) is false but Statement (II) is true.

97. **Statement (I):** The machine shop produces parts machined from stock material and finishes castings, forgings, etc., requiring machined surfaces.
Statement (II): In machine shops, machining operations remove metal, either to make a smoother and more accurate surface, as by planning, facing, milling, etc. or to produce a surface previously existing, as by drilling, punching, etc.

Ans. **(c)**

End of Solution

98. **Statement (I):** Ozone depletions are mostly harmful to biological systems in a variety of ways.
Statement (II): Ozone depletion in stratosphere leads to the loss of filtering ability of UV light.

Ans. **(b)**

End of Solution

99. **Statement (I):** Alterations in both physico-chemical (abiotic) and biological (biotic) components of the biosphere by mankind resulted in environmental degradation world over.
Statement (II): Major environmental problems are in fact the manifestations of the degraded environments at global level.

Ans. **(a)**

End of Solution

100. **Statement (I):** Ethics involves the discipline of systematic enquiry into moral norms of standards of behavior and their underlying values and justification.
Statement (II): Applied ethics looks into the way in which moral value can be applied to particular areas of concern such as business.

Ans. **(b)**

End of Solution

■■■■

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