CAT 2004 Nov 21

Question Paper with Solutions

Conducted by the Indian Institutes of Management (IIMs)



Maximum Marks: 150

General Instructions

(i) This is the Common Admission Test (CAT) 2004 question paper, held on 21 November 2004.

(ii) The paper has 123 questions. Maximum marks: 150.

(iii) The marks for each question are indicated against it.

(iv) Some questions are based on a passage or table; read the given material carefully and answer the questions that follow.

Questions (150 marks)

Questions 1–4. Directions for the following four questions: Answer the questions on the basis of the information given below.

The Dean's office recently scanned student results into the central computer system. When their character reading software cannot read something, it leaves the space blank. The scanner output read as follows:

In the grading system, A, B, C, D, and F grades fetch 6, 4, 3, 2, and 0 grade points respectively. The Grade Point Average (GPA) is the arithmetic mean of the grade points obtained in the five subjects. For example Nisha's GPA is (6 + 2 + 4 + 6 + 0) / 5 = 3.6. Some additional facts are also known about the students' grades. These are

(i) Vipul obtained the same grade in Marketing as Aparna obtained in Finance and Strategy.

(ii) Fazal obtained the same grade in Strategy as Utkarsh did in Marketing.

(iii) Tara received the same grade in exactly three courses.

Name	Finance	Marketing	Statistics	Strategy	Operations	GPA
Aparna		B	F			1.4
Bikas	D	D	F	F		
Chandra		D	A	F	F	2.4
Deepak	A	B		D	D	3.2
Fazal	D	F		B	D	2.4
Gowri	C	C	A		B	3.8
Hari		B	A		D	2.8
Ismet			B		A	
Jagdeep	A	A	B		C	3.8
Kunal	F		A	F	F	1.8
Leena	B	A		B	F	3.2
Manab			A	B	B	
Nisha	A	D	B	A	F	3.6
Osman	C		B	B	A	4.6
Preeti	F	D		D		3.2
Rahul	A	C	A		F	4.2
Sameer		C	F	B		
Tara	B					2.4
Utkarsh			F	C	A	3.0
Vipul	A		C	C	F	2.4

1. What grade did Preeti obtain in Statistics? [1 mark]

(A) A

(B) B

(C) C

(D) D

Correct Answer: (A) A

Solution:

Concept:

- Grade points: $A = 6,\ B = 4,\ C = 3,\ D = 2,\ F = 0$.
- GPA $= \dfrac{\text{sum of the five grade points}}{5}$, so the sum of a student's five grade points is $5 \times$ GPA.
- A blank in the table is an unreadable entry; if a row has blanks, the known grades and the printed

GPA fix the sum of the missing grade points.

Step 1: Read Preeti's row Preeti's printed entries are Finance $= F$, Marketing $= D$, Strategy $= D$; Statistics and Operations are blank. Her GPA is 3.2.

Step 2: Find the total grade points Total grade points $= 5 \times 3.2 = 16$.

Known grade points: $F + D + D = 0 + 2 + 2 = 4$.

So the two missing subjects (Statistics and Operations) together carry $16 - 4 = 12$ points.

Step 3: Split the 12 points between the two subjects The largest grade point is 6 (grade A). Two grades summing to 12 are possible only as $6+6$, since any other grade is at most 4 and $4+6 = 10 < 12$.

Hence both Statistics and Operations are A. Preeti's grade in Statistics is A.

Step 4: Rule out the other grades If Statistics were any grade below A, the two missing subjects could give at most $4 + 6 = 10$ points, which cannot reach 12.

Step 5: Conclusion Preeti obtained grade A in Statistics. Hence, the correct option is (A).

Quick Tip to Solve: Convert GPA to a total (GPA $\times 5$) first; when the leftover is the maximum possible for the blanks (here 12 from two grades), every blank must be A.

2. In operations, Tara could have received the same grade as [1 mark]

(A) Ismet

(B) Hari

(C) Jagdeep

(D) Manab

Correct Answer: (D) Manab

Solution:

Concept:

- Grade points: $A = 6,\ B = 4,\ C = 3,\ D = 2,\ F = 0$; sum of the five grade points $= 5 \times$ GPA.
- Condition (iii): Tara received the same grade in exactly three of her five courses.

Step 1: Use Tara's data Tara's only readable grade is Finance $= B$ (4 points) and her GPA is 2.4. The total of her five grade points is $5 \times 2.4 = 12$, so her other four subjects give $12 - 4 = 8$ points.

Step 2: Find the grade repeated three times Let the repeated grade (exactly three courses) be x and let the remaining course(s) carry the other grades.

If x is not B, then Finance is the odd one and the other four courses must contain three x's plus one more grade y: $3x + y = 8$. Trying the grade points $6, 4, 3, 2, 0$ for x: $x = 2$ gives $y = 2$, which makes four D's (not exactly three); $x = 0$ gives $y = 8$, impossible; larger values exceed 8. So x cannot be a non-B grade.

Hence the three equal grades are B's: Finance plus two other B's. These contribute $4 \times 3 = 12$ points, so the remaining two courses carry 0 points: both are F. Tara's pattern is B, B, B, F, F, in some order.

Step 3: Check Operations against the options Tara's Operations grade must be B or F. Compare the options: Ismet $= A$, Hari $= D$, Jagdeep $= C$, Manab $= B$.

Only Manab's Operations grade, B, is one that Tara could have received.

Step 4: Rule out the others Ismet's grade A, Hari's grade D and Jagdeep's grade C are none of B or F, so Tara cannot have matched them.

Step 5: Conclusion In Operations Tara could have received B, the same as Manab. Hence, the correct option is (D).

Quick Tip to Solve: Test the 'exactly three equal' condition against the GPA total: here the only consistent pattern is B, B, B, F, F, so Operations is B or F.

3. In Strategy, Gowri's grade point was higher than that obtained by [1 mark]

(A) Fazal

(B) Hari

(C) Nisha

(D) Rahul

Correct Answer: (B) Hari

Solution:

Concept:

- Grade points: $A = 6,\ B = 4,\ C = 3,\ D = 2,\ F = 0$; the sum of a student's five grade points is $5 \times$ GPA.
- Missing grades are recovered by subtracting the known grade points from this total.

Step 1: Find Gowri's Strategy grade Gowri: Finance C, Marketing C, Statistics A, Operations B; GPA 3.8.

Total $= 5 \times 3.8 = 19$. Known points $= 3 + 3 + 6 + 4 = 16$. So Strategy $= 19 - 16 = 3$, i.e. grade C.

Step 2: Compare with each option in Strategy **Fazal:** Strategy is printed as B (4 points), which is higher than Gowri's 3.

Nisha: Strategy is printed as A (6 points), higher than 3.

Rahul: Finance A, Marketing C, Statistics A, Operations F, GPA 4.2: total 21, known $6+3+6+0 = 15$, so Strategy $= 6$, grade A, higher than 3.

Hari: Marketing B, Statistics A, Operations D, GPA 2.8: total 14, known $4 + 6 + 2 = 12$, so Finance and Strategy together carry 2 points. The only way to split 2 over two grades is $2 + 0$, so Hari's Strategy is D (2) or F (0), either way below Gowri's 3.

Step 3: Conclusion Gowri's Strategy grade point (3) exceeds only Hari's (2 or 0). Hence, the correct option is (B).

Quick Tip to Solve: Recover each option's Strategy grade from GPA; the one with a lower value is the answer. Hari's two blanks must be D and F, so he is below C either way.

4. What grade did Utkarsh obtain in Finance? [1 mark]

(A) B

(B) C

(C) D

(D) F

Correct Answer: (C) D

Solution:

Concept:

- Grade points: $A = 6,\ B = 4,\ C = 3,\ D = 2,\ F = 0$; sum of five grade points $= 5 \times$ GPA.
- Additional facts (i) and (ii) of the passage link blank entries of different students.

Step 1: Use fact (ii) Fazal's grade in Strategy is printed as B. Fact (ii) says Utkarsh's Marketing grade equals Fazal's Strategy grade, so Utkarsh's Marketing is B (4 points).

Step 2: Use Utkarsh's GPA Utkarsh: Statistics F (0), Strategy C (3), Operations A (6); GPA 3.0, so the total is $5 \times 3.0 = 15$.

Finance and Marketing together $= 15 - (0 + 3 + 6) = 6$.

With Marketing $= 4$, Finance $= 6 - 4 = 2$, i.e. grade D.

Step 3: Check consistency Utkarsh's grade points: $2 + 4 + 0 + 3 + 6 = 15$, giving GPA 3.0, as printed.

Step 4: Conclusion Utkarsh obtained D in Finance. Hence, the correct option is (C). The other options fail: B would make the total 17, C would make it 16, and F would make it 13.

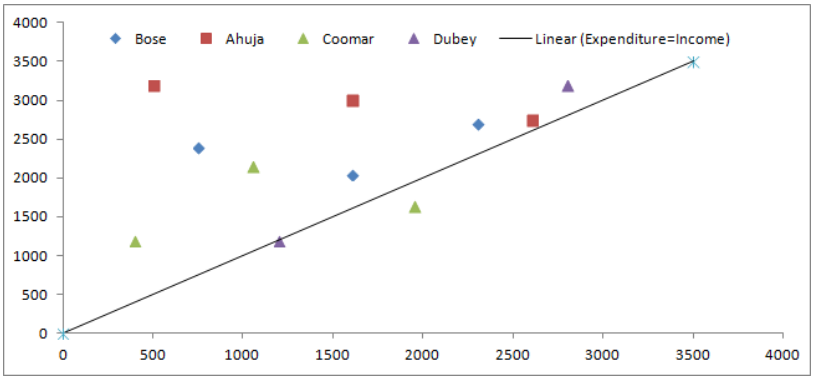
Quick Tip to Solve: Use the equality fact first (Utkarsh's Marketing = Fazal's Strategy = B), then the GPA total gives the single remaining blank.

Questions 5–8. Directions for the following four questions: Answer the questions on the basis of the information given below.

The data points in the figure below represent monthly income and expenditure data of individual members of the Ahuja family, the Bose family, the Coomar family, and the Dubey family.

The X axis represents Expenditure and the Y axis represents the Income of the individual members.

For these questions, savings is defined as Savings = Income - Expenditure



5. Which family has the lowest average income? [1 mark]

(A) Ahuja

(B) Bose

(C) Coomar

(D) Dubey

Correct Answer: (C) Coomar

Solution:

Concept:

- Each point is (Expenditure, Income) of one family member: X-coordinate = expenditure, Y-coordinate = income.
- Average income of a family = mean of the Y-values of its points.

Step 1: Read the Y-values (incomes) from the graph Approximate incomes (Y-coordinates):

Ahuja (squares): $3180,\ 3000,\ 2740$.

Bose (diamonds): $2380,\ 2030,\ 2690$.

Coomar (green triangles): $1180,\ 2140,\ 1620$.

Dubey (purple triangles): $1180,\ 3180$.

Step 2: Compute the averages

$$\begin{aligned}\text{Ahuja} &\approx \tfrac{3180+3000+2740}{3} \approx 2970,\\ \text{Bose} &\approx \tfrac{2380+2030+2690}{3} \approx 2370,\\ \text{Coomar} &\approx \tfrac{1180+2140+1620}{3} \approx 1650,\\ \text{Dubey} &\approx \tfrac{1180+3180}{2} \approx 2180.\end{aligned}$$

Step 3: Conclusion The lowest average income, about 1650, belongs to the Coomar family. Hence, the correct option is (C). Ahuja, Bose and Dubey all exceed 2100.

Quick Tip to Solve: For income only look at heights of points: Coomar has two low points (about 1200 and 1600), which pulls its mean below every other family's.

6. Which family has the highest average expenditure? [1 mark]

(A) Ahuja

(B) Bose

(C) Coomar

(D) Dubey

Correct Answer: (D) Dubey

Solution:

Concept:

- Each point is (Expenditure, Income); the X-coordinate gives expenditure.

- Average expenditure of a family = mean of the X-values of its points.

Step 1: Read the X-values (expenditures) Approximate expenditures (X-coordinates):

Ahuja: $500,\ 1600,\ 2600$.

Bose: $750,\ 1600,\ 2300$.

Coomar: $400,\ 1050,\ 1950$.

Dubey: $1200,\ 2800$.

Step 2: Compute the averages

$$\begin{aligned}\text{Ahuja} &\approx \tfrac{500+1600+2600}{3} \approx 1570,\\ \text{Bose} &\approx \tfrac{750+1600+2300}{3} \approx 1550,\\ \text{Coomar} &\approx \tfrac{400+1050+1950}{3} \approx 1130,\\ \text{Dubey} &\approx \tfrac{1200+2800}{2} = 2000.\end{aligned}$$

Step 3: Conclusion The highest average expenditure, about 2000, belongs to the Dubey family. Hence, the correct option is (D). The others lie between 1100 and 1600.

Quick Tip to Solve: Only the horizontal positions matter here. Dubey has just two members, one of them far right (about 2800), so its mean is clearly the largest.

7. Which family has the lowest average savings? [1 mark]

(A) Ahuja

(B) Bose

(C) Coomar

(D) Dubey

Correct Answer: (D) Dubey

Solution:

Concept:

- Savings = Income − Expenditure = (Y-value) − (X-value). A point above the line Expenditure = Income saves money; a point below it dissaves.
- Average savings of a family = mean of the individual savings.

Step 1: Savings of each member Using (Expenditure, Income) readings:

Ahuja: $(500, 3180) \to 2680$; $(1600, 3000) \to 1400$; $(2600, 2740) \to 140$.

Bose: $(750, 2380) \to 1630$; $(1600, 2030) \to 430$; $(2300, 2690) \to 390$.

Coomar: $(400, 1180) \to 780$; $(1050, 2140) \to 1090$; $(1950, 1620) \to -330$.

Dubey: $(1200, 1180) \to \approx 0$ (on the line); $(2800, 3180) \to 380$.

Step 2: Average savings

$$\text{Ahuja} \approx \frac{2680+1400+140}{3} \approx 1410,$$
$$\text{Bose} \approx \frac{1630+430+390}{3} \approx 820,$$
$$\text{Coomar} \approx \frac{780+1090-330}{3} \approx 510,$$
$$\text{Dubey} \approx \frac{0+380}{2} \approx 190.$$

Step 3: Conclusion The lowest average savings, about 190, is that of the Dubey family. Hence, the correct option is (D).

Quick Tip to Solve: Savings is the vertical distance of a point from the line Income = Expenditure. Dubey's two points are on or just above the line, so its average is smallest.

8. The highest amount of savings accrues to a member of which family? [1 mark]

(A) Ahuja

(B) Bose

(C) Coomar

(D) Dubey

Correct Answer: (A) Ahuja

Solution:

Concept:

- Savings = Income − Expenditure, i.e. the vertical gap between a point and the line Income = Expenditure.
- The highest savings of a single member is the point farthest above that line.

Step 1: Find the largest vertical gap for each family **Ahuja:** the point $(500, 3180)$ gives savings ≈ 2680; the others give 1400 and 140.

Bose: best point $(750, 2380)$ gives ≈ 1630.

Coomar: best point $(1050, 2140)$ gives ≈ 1090.

Dubey: best point $(2800, 3180)$ gives ≈ 380.

Step 2: Compare $2680 > 1630 > 1090 > 380$. The largest single savings figure, about 2680, occurs for an Ahuja member with a low expenditure and a high income.

Step 3: Conclusion The highest amount of savings accrues to a member of the Ahuja family. Hence, the correct option is (A).

Quick Tip to Solve: Look for the point with the largest height minus its horizontal position, i.e. farthest above the diagonal: the top-left point (500, 3180) is Ahuja's.

Questions 9–12. Directions for the following four questions: Answer the questions on the basis of the information given below.

Prof. Singh has been tracking the number of visitors to his homepage? His service provider has provided him with the following data on the country of origin of the visitors and the university they belong to.

Number of Visitors			
	Day		
Country	1	2	3
Canada	2	0	0
Netherlands	1	1	0
India	1	2	0
UK	2	0	2
USA	1	0	1

Number of Visitors			
	Day		
University	1	2	3
University 1	1	0	0
University 2	2	0	0
University 3	0	1	0
University 4	0	0	2
University 5	1	0	0
University 6	1	0	1
University 7	2	0	0
University 8	0	2	0

9. To which country does University 5 belong? [1 mark]

(A) India or Netherlands but not USA

(B) India or USA but not Netherlands

(C) Netherlands or USA but not India

(D) India or USA but not UK

Correct Answer: (A) India or Netherlands but not USA

Solution:

Concept:

- Each university belongs to exactly one country, so on each day the visitors of a country are the sum of the visitors of its universities for that day.
- Match the day-wise columns of the country table with those of the university table.

Step 1: Day-wise data Country table (day 1, 2, 3): Canada $(2, 0, 0)$; Netherlands $(1, 1, 0)$; India $(1, 2, 0)$; UK $(2, 0, 2)$; USA $(1, 0, 1)$.

University table: U1 $(1, 0, 0)$; U2 $(2, 0, 0)$; U3 $(0, 1, 0)$; U4 $(0, 0, 2)$; U5 $(1, 0, 0)$; U6 $(1, 0, 1)$; U7 $(2, 0, 0)$; U8 $(0, 2, 0)$.

Step 2: Use day 2 On day 2 only U3 (1) and U8 (2) have visitors, and only the Netherlands (1) and India (2) have visitors. U8 has 2 visitors, so it must be India; U3 must be the Netherlands.

India's and the Netherlands' remaining day-1 visitor (1 each) must come from universities with the pattern $(1, 0, 0)$: U1 and U5. (U6 is excluded because it has a day-3 visitor and neither country has one.) So U1 and U5 are India and the Netherlands in some order.

Step 3: Check the other countries U6 $(1, 0, 1)$ alone matches the USA $(1, 0, 1)$. The UK $(2, 0, 2)$ is U4 together with one of U2/U7, and Canada $(2, 0, 0)$ is the other of U2/U7. So U5 cannot be the USA, the UK or Canada.

Step 4: Test the options Options (B), (C) and (D) all allow the USA, which is impossible for University 5 because the USA is U6; option (D) also mentions the UK, which U5 cannot be. Only (A) is consistent.

Step 5: Conclusion University 5 belongs to India or the Netherlands, but not the USA. Hence, the correct option is (A).

Quick Tip to Solve: Start with the day having the fewest entries (day 2): a university with 2 visitors on day 2 can only be India, which then forces U1 and U5 to be India and the Netherlands.

10. University 1 can belong to [1 mark]

(A) UK

(B) Canada

(C) Netherlands

(D) USA

Correct Answer: (C) Netherlands

Solution:

Concept:

- Each university belongs to one country, and its day-wise visitors add up to that country's day-wise visitors.
- Use the day with the fewest entries (day 2) to fix some universities, then reason with the rest.

Step 1: Fix U3 and U8 Day 2 has visitors only from the Netherlands (1) and India (2), and only from U3 (1) and U8 (2). Hence U8 = India and U3 = Netherlands.

Step 2: Place U1 University 1 has the pattern $(1, 0, 0)$. The remaining day-1 visitor of India and of the Netherlands each needs a university with pattern $(1, 0, 0)$: these are U1 and U5, one for each country. So U1 is India or the Netherlands.

Canada $(2, 0, 0)$, the UK $(2, 0, 2)$ and the USA $(1, 0, 1)$ are made up of U2, U4, U6, U7 as: Canada = U2 or U7, UK = U4 + the other of U2/U7, USA = U6. U1 cannot fill any of these.

Step 3: Compare with the options UK, Canada and USA are impossible for U1; the Netherlands is possible.

Step 4: Conclusion University 1 can belong to the Netherlands. Hence, the correct option is (C).

Quick Tip to Solve: Universities with a single day-1 visitor and nothing else (U1, U5) can only complete India or the Netherlands, since those countries have lone day-1 visitors.

11. Which among the listed countries can possibly host three of the eight listed universities? [1 mark]

(A) None

(B) Only UK

(C) Only India

(D) Both India and UK

Correct Answer: (A) None

Solution:

Concept:

- Each university belongs to one country; a country's day-wise visitors are the sums of its universities' day-wise visitors.
- Count how many universities each country can have in a consistent assignment.

Step 1: Recall the forced assignment From day 2: U8 = India and U3 = Netherlands. U1 and U5 are India and the Netherlands (one each). Hence India = {U8, one of U1/U5} and the Netherlands = {U3, the other of U1/U5}: two universities each.

Step 2: Remaining countries U6 $(1, 0, 1)$ is the USA (one university). The UK $(2, 0, 2)$ needs the day-3 visitors of U4 $(0, 0, 2)$ and day-1 visitors of U2 or U7: two universities. Canada $(2, 0, 0)$ is the other of U2/U7: one university.

Step 3: Total check $2 + 2 + 2 + 1 + 1 = 8$ universities, accounting for all eight. No country can host three universities: the eight universities are already fully distributed as 2, 2, 2, 1, 1, so no country gets a third.

Step 4: Test the options The UK and India each host exactly two universities, so the options naming the UK, India, or both fail.

Step 5: Conclusion No country can host three of the eight universities. Hence, the correct option is (A).

Quick Tip to Solve: Once the assignments are forced, add up university counts per country: 2, 2, 2, 1, 1 - nobody reaches three.

12. Visitors from how many universities from UK visited Prof. Singh's homepage in the three days?

[1 mark]

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: (B) 2

Solution:

Concept:

- The UK's day-wise visitors $(2, 0, 2)$ must be the sum of the day-wise visitors of the UK universities, and each university belongs to exactly one country.

Step 1: List universities with UK-compatible visits The UK has visitors only on days 1 and 3. Universities active on day 3 are U4 $(0, 0, 2)$ and U6 $(1, 0, 1)$.

U6 cannot be a UK university: U6 would add $(1, 0, 1)$ and the UK's remaining $(1, 0, 1)$ would need another university with exactly that pattern, which does not exist. So U6 is the USA's $(1, 0, 1)$.

Hence the UK's two day-3 visitors come from U4 alone.

Step 2: Complete the day-1 visitors The UK also needs 2 visitors on day 1. A university with pattern $(2, 0, 0)$ provides this exactly: U2 or U7. (Two $(1, 0, 0)$ universities, U1 and U5, are needed for India and the Netherlands.)

So the UK consists of U4 and one of U2/U7: two universities.

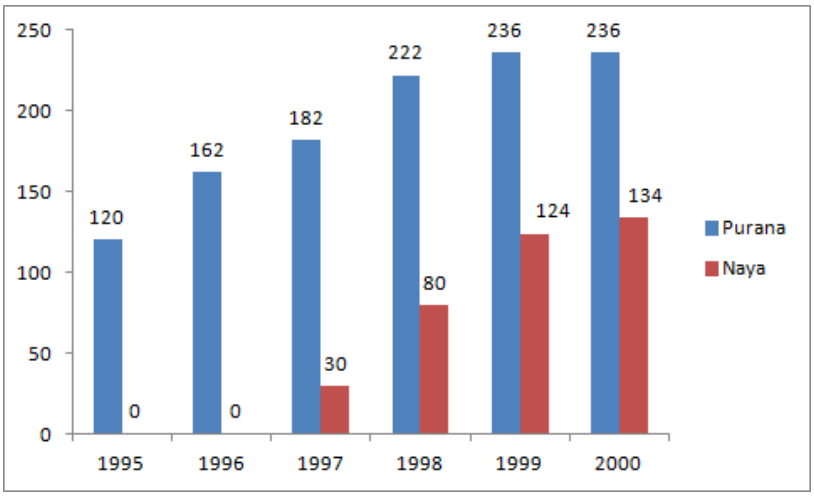
Step 3: Conclusion Two universities from the UK visited Prof. Singh's homepage. Hence, the correct

option is (B).

Quick Tip to Solve: Match the UK's 2 visitors on day 3 to the single university with 2 on that day (U4), and its 2 on day 1 to one $(2, 0, 0)$ university: $1 + 1 = 2$ universities.

Questions 13–16. Directions for the following four questions: Answer the questions on the basis of the information given below.

Purana and Naya are two brands of kitchen mixer-grinders available in the local market. Purana is an old brand that was introduced in 1990, while Naya was introduced in 1997. For both these brands, 20% of the mixer-grinders bought in a particular year are disposed off as junk exactly two years later. It is knows that 10 Purana mixer-grinders were disposed off in 1997. The following figures show the number of Purana and Naya mixer-grinders in operation from 1995 to 2000, as at the end of the year.



13. How many Naya mixer-grinders were purchased in 1999? [1 mark]

(A) 44

(B) 50

(C) 55

(D) 64

Correct Answer: (B) 50

Solution:

Concept:

- Stock balance: (number in operation at end of a year) = (number in operation at end of the previous year) + (purchases in the year) − (disposals in the year).
- Disposal rule: 20% of the units bought in a year are disposed off exactly two years later, so disposals in year t equal $0.2\times$ purchases in year $t-2$.

Step 1: Read the Naya bars of the chart Naya was introduced in 1997, so the units in operation at the end of each year are: 1997: 30, 1998: 80, 1999: 124, 2000: 134. Since the brand started in 1997, the 30 units in operation at the end of 1997 are exactly the purchases of 1997.

Step 2: Find the disposals in 1999 Disposals in 1999 come from the purchases of 1997 (two years earlier):

$$0.2 \times 30 = 6 \text{ units.}$$

No Naya unit could have been disposed off in 1997 or 1998, because nothing was bought before 1997.

Step 3: Apply the stock balance for 1999 Let x be the Naya purchases in 1999. Then

$$124 = 80 + x - 6 \;\Rightarrow\; x = 124 - 80 + 6 = 50.$$

Check: $80 + 50 - 6 = 124$. The other options give $80 + 44 - 6 = 118$, $80 + 55 - 6 = 129$ and $80 + 64 - 6 = 138$, none of which equals 124.

Step 4: Conclusion Naya mixer-grinders purchased in 1999 $= 50$. Hence, the correct option is (B).

Quick Tip to Solve: Always add back the disposals: purchases = change in stock + units junked that year (here $44 + 6 = 50$); forgetting the 6 gives the trap answer 44.

14. How many Naya mixer-grinders were disposed off by the end of 2000? [1 mark]

(A) 10

(B) 16

(C) 22

(D) Cannot be determined from the data

Correct Answer: (B) 16

Solution:

Concept:

- Stock balance: (in operation at year end) = (previous year-end stock) + (purchases) − (disposals).
- Disposal rule: 20% of a year's purchases are junked exactly two years later, so disposals in year t are $0.2\times$ purchases in year $t - 2$.

Step 1: Find the Naya purchases of 1997 and 1998 Naya was introduced in 1997, so purchases in 1997 $= 30$ (the stock at the end of 1997). In 1998 nothing is yet due for disposal, so purchases in 1998 $= 80 - 30 = 50$.

Step 2: Find the disposals up to 2000 Disposals in 1999 $= 0.2 \times 30 = 6$ (from the 1997 purchases). Disposals in 2000 $= 0.2 \times 50 = 10$ (from the 1998 purchases). Units bought in 1999 or 2000 cannot be junked by the end of 2000, since the two-year gap has not passed.

Step 3: Total disposed by the end of 2000

$$6 + 10 = 16.$$

This is determined fully by the data, so option (D) is not applicable, and 10 and 22 do not match the working.

Step 4: Conclusion Naya mixer-grinders disposed off by the end of 2000 $= 16$. Hence, the correct

option is (B).

Quick Tip to Solve: Naya starts in 1997, so only the 1997 and 1998 purchases (30 and 50) can have been junked by 2000: $0.2(30 + 50) = 16$.

15. How many Purana mixer-grinders were disposed off in 2000? [1 mark]

(A) 0

(B) 5

(C) 6

(D) Cannot be determined from the data

Correct Answer: (D) Cannot be determined from the data

Solution:

Concept:

- Stock balance: (year-end stock) = (previous stock) + (purchases) − (disposals), with disposals in year t equal to $0.2 \times P_{t-2}$, where P_t is the purchases in year t.
- Disposals of Purana in 2000 $= 0.2\,P_{1998}$, so the question reduces to whether P_{1998} can be found.

Step 1: Recover the earlier Purana purchases Disposals in 1997 $= 0.2\,P_{1995} = 10$, so $P_{1995} = 50$. For 1997: $182 = 162 + P_{1997} - 10$, so $P_{1997} = 30$.

Step 2: Express P_{1998} For 1998: $222 = 182 + P_{1998} - 0.2\,P_{1996}$, so

$$P_{1998} = 40 + 0.2\,P_{1996}.$$

Disposals in 2000 $= 0.2\,P_{1998}$, so we need P_{1996}.

Step 3: Check whether P_{1996} is known For 1996: $162 = 120 + P_{1996} - 0.2\,P_{1994}$, so $P_{1996} = 42 + 0.2\,P_{1994}$. The purchases of 1994 (and the earlier ones from 1990) are not given: the 1995 stock 120 only fixes a combination of them. Hence P_{1996}, P_{1998} and the 2000 disposals $0.2P_{1998}$ cannot be fixed from the data. Even the smallest case $P_{1994} = 0$ gives about 9.7 units, and a larger P_{1994} gives more, so the options 0, 5 and 6 are all impossible and the exact value is not fixed by the data.

Step 4: Conclusion The number of Purana units disposed off in 2000 depends on earlier purchases that are not given, so it cannot be determined. Hence, the correct option is (D).

Quick Tip to Solve: Disposals in year t depend on purchases two years earlier; if the chain of purchases needed runs back to years with no data (here 1994), answer "cannot be determined".

16. How many Purana mixer-grinders were purchased in 1999? [1 mark]

(A) 20

(B) 23

(C) 50

(D) Cannot be determined from the data

Correct Answer: (A) 20

Solution:

Concept:

- Stock balance: (year-end stock) = (previous stock) + (purchases) − (disposals).
- Disposal rule: disposals in year t equal $0.2\times$ purchases in year $t-2$; the given fact is that 10 Purana units were disposed off in 1997.

Step 1: Find the purchases of 1995 from the given disposal Disposals in 1997 come from the 1995 purchases: $0.2\,P_{1995} = 10$, so $P_{1995} = 50$.

Step 2: Find the purchases of 1997 Stock in 1997 is 182 and in 1996 is 162:

$$182 = 162 + P_{1997} - 10 \;\Rightarrow\; P_{1997} = 30.$$

Step 3: Find the purchases of 1999 Disposals in 1999 $= 0.2 \times P_{1997} = 0.2 \times 30 = 6$. Stock in 1998 is 222 and in 1999 is 236:

$$236 = 222 + P_{1999} - 6 \;\Rightarrow\; P_{1999} = 20.$$

Only P_{1995} and P_{1997} were needed, and both are fixed by the data, so the answer is determinable.

Step 4: Conclusion Purana mixer-grinders purchased in 1999 $= 20$. Hence, the correct option is (A).

Quick Tip to Solve: The 1999 disposals depend only on 1997 purchases, and the given fact (10 junked in 1997) fixes the chain $P_{1995} \to P_{1997} \to P_{1999}$. Compare with q15, where the chain breaks.

Questions 17–20. Directions for the following four questions: Answer the questions on the basis of the information given below.

A study was conduced to ascertain the relative importance that employees in five different countries assigned to five different traits in their Chief Executive Officers. The traits were compassion (C), decisiveness (D), negotiation skills (N), public visibility (P), and vision (V). The level of dissimilarity between two countries is the maximum difference in the ranks allotted by the two countries to any of the five traits. The following table indicates the rank order of the five traits for each country.

	Country				
Rank	India	China	Japan	Malaysia	Thailand
1	C	N	D	V	V
2	P	C	N	D	C
3	N	P	C	P	N
4	V	D	V	C	P
5	D	V	P	N	D

17. Which of the following pairs of countries are most dissimilar? [1 mark]

(A) China and Japan

(B) India and China

(C) Malaysia and Japan

(D) Thailand and Japan

Correct Answer: (D) Thailand and Japan

Solution:

Concept:

- Dissimilarity of two countries = the maximum, over the five traits, of the absolute difference between the ranks the two countries give to that trait.
- First convert the table to a rank for each trait in each country, then compare country pairs trait by trait.

Step 1: Rank of each trait in each country Reading the table (C, D, N, P, V):

Country	C	D	N	P	V
India	1	5	3	2	4
China	2	4	1	3	5
Japan	3	1	2	5	4
Malaysia	4	2	5	3	1
Thailand	2	5	3	4	1

Step 2: Dissimilarity of the pairs in the options China–Japan: differences $1, 3, 1, 2, 1$, so level 3. India–China: differences $1, 1, 2, 1, 1$, so level 2. Malaysia–Japan: differences $1, 1, 3, 2, 3$, so level 3. Thailand–Japan: differences $1, 4, 1, 1, 3$, so level 4.

Step 3: Compare The largest level among the four pairs is 4, for Thailand and Japan (it comes from decisiveness, ranked 5th by Thailand and 1st by Japan). The pairs in (A) and (C) have level 3 and the pair in (B) has level 2.

Step 4: Conclusion Thailand and Japan are the most dissimilar pair among the options, with level 4. Hence, the correct option is (D).

Quick Tip to Solve: Look for a trait ranked 1 by one country and 5 by another: that gives difference 4 (the maximum possible) at once, as D is for Thailand and Japan.

18. Which of the following countries is least dissimilar to India? [1 mark]

(A) China

(B) Japan

(C) Malaysia

(D) Thailand

Correct Answer: (A) China

Solution:

Concept:

- Dissimilarity of two countries $=$ the maximum absolute difference in the ranks given to any of the five traits.
- The country least dissimilar to India is the one with the smallest such maximum.

Step 1: Ranks of the traits (C, D, N, P, V) India: $1, 5, 3, 2, 4$; China: $2, 4, 1, 3, 5$; Japan: $3, 1, 2, 5, 4$; Malaysia: $4, 2, 5, 3, 1$; Thailand: $2, 5, 3, 4, 1$.

Step 2: Dissimilarity of each option with India China: differences $1, 1, 2, 1, 1$, so level 2. Japan: differences $2, 4, 1, 3, 0$, so level 4. Malaysia: differences $3, 3, 2, 1, 3$, so level 3. Thailand: differences $1, 0, 0, 2, 3$, so level 3.

Step 3: Pick the smallest The levels are $2, 4, 3, 3$ for China, Japan, Malaysia and Thailand, so China, with level 2, is the least dissimilar to India. Japan is the most dissimilar, and Malaysia and Thailand tie at 3.

Step 4: Conclusion China is least dissimilar to India (level 2). Hence, the correct option is (A).

Quick Tip to Solve: Compute the largest rank gap for each country against India; the smallest of these maxima wins. China's gaps never exceed 2.

19. Which amongst the following countries is most dissimilar to India? [1 mark]

(A) China

(B) Japan

(C) Malaysia

(D) Thailand

Correct Answer: (B) Japan

Solution:

Concept:

- Dissimilarity of two countries = the maximum absolute difference in the ranks given to any of the five traits.
- The country most dissimilar to India has the largest such maximum.

Step 1: Ranks of the traits (C, D, N, P, V) India: $1, 5, 3, 2, 4$; China: $2, 4, 1, 3, 5$; Japan: $3, 1, 2, 5, 4$; Malaysia: $4, 2, 5, 3, 1$; Thailand: $2, 5, 3, 4, 1$.

Step 2: Dissimilarity of each option with India China: differences $1, 1, 2, 1, 1$, so level 2. Japan: differences $2, 4, 1, 3, 0$, so level 4 (decisiveness: India 5th, Japan 1st). Malaysia: differences $3, 3, 2, 1, 3$, so level 3. Thailand: differences $1, 0, 0, 2, 3$, so level 3.

Step 3: Pick the largest The largest level is 4, for Japan. A level of 4 is the largest possible with five ranks, and no other country reaches it against India.

Step 4: Conclusion Japan is the most dissimilar to India (level 4). Hence, the correct option is (B).

Quick Tip to Solve: A rank gap of 4 (1st versus 5th) cannot be beaten. India ranks D 5th and Japan ranks it 1st, so Japan wins immediately.

20. Three of the following four pairs of countries have identical levels of dissimilarity. Which pair is the odd one out? [1 mark]

(A) Malaysia and China

(B) China and Thailand

(C) Thailand and Japan

(D) Japan and Malaysia

Correct Answer: (D) Japan and Malaysia

Solution:

Concept:

- Dissimilarity of two countries = the maximum absolute difference in their ranks over the five traits.
- Compute the level for all four pairs and pick the one that differs from the other three.

Step 1: Ranks of the traits (C, D, N, P, V) China: $2, 4, 1, 3, 5$; Japan: $3, 1, 2, 5, 4$; Malaysia: $4, 2, 5, 3, 1$; Thailand: $2, 5, 3, 4, 1$.

Step 2: Levels of the four pairs Malaysia–China: differences $2, 2, 4, 0, 4$, so level 4. China–Thailand:

differences $0, 1, 2, 1, 4$, so level 4. Thailand–Japan: differences $1, 4, 1, 1, 3$, so level 4. Japan–Malaysia: differences $1, 1, 3, 2, 3$, so level 3.

Step 3: Identify the odd one Pairs (A), (B) and (C) all have level 4, whereas the pair in (D), Japan and Malaysia, has level 3. The level 4 in the first pair comes from negotiation skills (Malaysia 5th, China 1st) and from vision (China 5th, Malaysia 1st); in the second from vision (China 5th, Thailand 1st); in the third from decisiveness (Thailand 5th, Japan 1st). For Japan and Malaysia no trait has a gap of 4; the largest gap is 3, for negotiation skills and vision.

Step 4: Conclusion Japan and Malaysia is the odd pair out. Hence, the correct option is (D).

Quick Tip to Solve: Hunt for a trait ranked 1 by one country and 5 by the other; three of the pairs have one, and Japan and Malaysia do not (their largest gap is 3).

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21. Zakib spends 30% of his income on his children's education, 20% on recreation and 10% on healthcare. The corresponding percentage for Supriyo are 40%, 25%, and 13%. Who spends more on children's education?

A. Zakib spends more on recreation than Supriyo.

B. Supriyo spends more on healthcare than Zakib. [1 mark]

(A) The question can be answered by using one of the statements alone but not by using the other statement alone.

(B) The question can be answered by using either of the statements alone.

(C) The question can be answered by using both statements together but not by either statement alone.

(D) The question cannot be answered on the basis of the two statements.

Correct Answer: (A) The question can be answered by using one of the statements alone but not by using the other statement alone.

Solution:

Concept:

- Let Zakib's income be Z and Supriyo's be S. Spending on education is $0.30Z$ for Zakib and $0.40S$ for Supriyo, so the question is whether $0.30Z$ is more than $0.40S$, that is, how Z compares with $\frac{4}{3}S$.
- Test each statement alone, then together, and match the result with the four standard options.

Step 1: Test statement A alone Recreation: $0.20Z > 0.25S \Rightarrow Z > 1.25S$. Then $0.30Z > 0.375S$. This can be above or below $0.40S$: for $Z = 1.26S$ education is $0.378S < 0.40S$, but for $Z = 2S$ it is $0.6S > 0.40S$. So A alone is not sufficient.

Step 2: Test statement B alone Healthcare: $0.13S > 0.10Z \Rightarrow Z < 1.3S$. Then Zakib's education spending is $0.30Z < 0.39S < 0.40S$, so Supriyo spends more on education whatever the exact incomes. So B alone is sufficient.

Step 3: Combine and match the option Together, $1.25S < Z < 1.3S$ also gives Supriyo more, but this adds nothing beyond B. The question can be answered from statement B alone but not from statement A alone, which is the first option.

Step 4: Conclusion Statement B alone is sufficient, statement A alone is not. Hence, the correct option is (A).

Quick Tip to Solve: Convert each statement to a bound on Z/S and compare with $4/3 \approx 1.333$ (the break-even ratio): B gives $Z/S < 1.3$, enough; A gives $Z/S > 1.25$, which straddles 1.333.

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22. Four candidates for an award obtain distinct scores in a test. Each of the four casts a vote to choose the winner of the award. The candidate who gets the largest number of votes wins the award. In case of a tie in the voting process, the candidate with the highest score wins the award. Who wins the award?

A. The candidates with top three scores each vote for the top score amongst the other three.

B. The candidate with the lowest score votes for the player with the second highest score. [1 mark]

(A) The question can be answered by using one of the statements alone but not by using the other statement alone.

(B) The question can be answered by using either of the statements alone.

(C) The question can be answered by using both statements together but not by either statement alone.

(D) The question cannot be answered on the basis of the two statements.

Correct Answer: (A) The question can be answered by using one of the statements alone but not by using the other statement alone.

Solution:

Concept:

- Label the candidates $1, 2, 3, 4$ in decreasing order of score. The winner has the most votes, and ties are broken by the higher score.
- Test each statement alone, then together, and match the result with the four standard options.

Step 1: Test statement A alone Candidate 1 votes for the top score among the other three, which is candidate 2. Candidates 2 and 3 each vote for candidate 1 (the top score among the other three). So candidate 1 has 2 votes and candidate 2 has 1 vote so far; candidate 4's vote is unknown. If candidate 4 votes for 1, then 1 has 3 votes. If for 2, then 1 and 2 tie at 2 and the higher score gives 1. If for 3, then 1 has 2 and the rest at most 1. In every case candidate 1 wins, so A alone is sufficient.

Step 2: Test statement B alone Only the lowest candidate's vote is known (for candidate 2). The other three votes are not given, so any of the candidates could win. For instance, if the top three all vote for candidate 3 it wins, and if they all vote for candidate 1 it wins. So B alone is not sufficient.

Step 3: Match the option Statement A alone answers the question (the top scorer wins) but B alone does not, which is the first option.

Step 4: Conclusion A alone is sufficient and B alone is not. Hence, the correct option is (A).

Quick Tip to Solve: In voting puzzles, check the worst case for the unknown vote: here candidate 4's vote cannot stop candidate 1 from winning, thanks to the tie-break on score.

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23. In a class of 30 students, Rashmi secured the third rank among the girls, while her brother Kumar studying in the same class secured the sixth rank in the whole class. Between the two, who had a better overall rank?

A. Kumar was among the top 25% of the boys merit list in the class in which 60% were boys.

B. There were three boys among the top five rank holders, and three girls among the top ten rank holders. [1 mark]

(A) The question can be answered by using one of the statements alone but not by using the other statement alone.

(B) The question can be answered by using either of the statements alone.

(C) The question can be answered by using both statements together but not by either statement alone.

(D) The question cannot be answered on the basis of the two statements.

Correct Answer: (A) The question can be answered by using one of the statements alone but not by using the other statement alone.

Solution:

Concept:

- Kumar's overall rank is 6. Rashmi is the 3rd among the girls, so her overall rank is $3+$(number of boys above her), at least 3. We need to know whether Rashmi is above or below rank 6.
- Test each statement alone, then together, and match the result with the four standard options.

Step 1: Test statement A alone With 60% boys, there are 18 boys and 12 girls. The top 25% of 18 is 4.5, so Kumar is among the top 4 boys. If Kumar is the k-th boy ($k \leq 4$), then $6-k$ girls are above him, so there are 2 to 5 girls above him. If $k=4$, exactly 2 girls are above him, so Rashmi (the 3rd girl) is below him. If $k=3$, 3 girls are above him, so Rashmi is above him. Both cases are possible, so A alone is not sufficient.

Step 2: Test statement B alone The top five contain 3 boys, hence exactly 2 girls. Rashmi, the 3rd girl, is therefore not in the top five, and rank 6 is Kumar's. So Rashmi's overall rank is 7 or worse, and Kumar has the better rank. So B alone is sufficient.

Step 3: Match the option B alone answers the question but A alone does not, which is the first option.

Step 4: Conclusion Statement B alone is sufficient, statement A alone is not. Hence, the correct option is (A).

Quick Tip to Solve: Count how many girls (or boys) can lie above rank 6. B fixes that count at 2, so the 3rd girl cannot beat Kumar.

24. Tarak is standing 2 steps to the left of a red mark and 3 steps to the right of a blue mark. He tosses a coin. If it comes up heads, he moves one step to the right; otherwise he moves one step to the left. He keeps doing this until he reaches one of the two marks, and then he stops.

At which mark does he stop?

A. He stops after 21 coin tosses.

B. He obtains three more tails than heads. [1 mark]

(A) The question can be answered by using one of the statements alone but not by using the other statement alone.

(B) The question can be answered by using either of the statements alone.

(C) The question can be answered by using both statements together but not by either statement alone.

(D) The question cannot be answered on the basis of the two statements.

Correct Answer: (B) The question can be answered by using either of the statements alone.

Solution:

Concept:

- Take Tarak's starting point as 0, with the red mark at $+2$ (2 steps to the right) and the blue mark at -3 (3 steps to the left). Heads moves him $+1$, tails -1; he stops on first reaching $+2$ or -3.
- After n tosses with H heads and T tails, the position is $H - T$ and $n = H + T$, so the position and n have the same parity.

Step 1: Test statement A alone He stops after 21 tosses, an odd number. The red mark is at $+2$, an even position, which can only be reached after an even number of tosses. The blue mark -3 is odd, reached after an odd number of tosses. So he stops at the blue mark. (Such a walk exists, for example 9 heads and 12 tails arranged so as not to touch $+2$ earlier.) So A alone is sufficient.

Step 2: Test statement B alone Three more tails than heads means $H - T = -3$. He stops at the position -3, the blue mark. (Position $+2$ would need $H - T = +2$.) So B alone is also sufficient.

Step 3: Match the option Each statement alone answers the question, which is the second option.

Step 4: Conclusion The question can be answered by using either statement alone. Hence, the correct option is (B).

Quick Tip to Solve: Use parity: red is an even distance away, blue an odd one, so the parity of the number of tosses tells which mark he stopped at.

25. Ravi spent less than Rs. 75 to buy one kilogram each of potato, onion, and gourd. Which one of the three vegetables bought was the costliest?

A. 2 kg potato and 1 kg gourd cost less than 1 kg potato and 2 kg gourd.

B. 1 kg potato and 2 kg onion together cost the same as 1 kg onion and 2 kg gourd. [1 mark]

(A) The question can be answered by using one of the statements alone but not by using the other statement alone.

(B) The question can be answered by using either of the statements alone.

(C) The question can be answered by using both statements together but not by either statement alone.

(D) The question cannot be answered on the basis of the two statements.

Correct Answer: (C) The question can be answered by using both statements together but not by either statement alone.

Solution:

Concept:

- Data sufficiency: a statement is sufficient only if it gives one definite answer for every set of values consistent with it; test each statement alone, then both together.
- Let the prices per kg of potato, onion and gourd be p, o and g rupees. The condition that the total is below Rs. 75 only says the prices are positive and small; it does not help to rank them.

Step 1: Translate the statements Statement A: $2p + g < p + 2g \Rightarrow p < g$. So gourd is dearer than potato, but nothing is said about onion. Statement B: $p + 2o = o + 2g \Rightarrow p + o = 2g$, i.e. $g = \frac{p+o}{2}$: gourd is the average of potato and onion.

Step 2: Test each statement alone Using A alone: take $p = 10,\ g = 20$. With $o = 5$, gourd is costliest; with $o = 30$, onion is costliest. Not sufficient. Using B alone: if $p = 10,\ o = 30$ then $g = 20$ and onion is costliest; if $p = 30,\ o = 10$ then $g = 20$ and potato is costliest. Not sufficient.

Step 3: Combine the statements Since gourd is the average of potato and onion, one of p, o is above g and the other below it (unless all are equal). By A, $p < g$, so $p < g < o$. Hence onion is the costliest, a definite answer. Thus neither statement alone is enough, but together they are.

Step 4: Conclusion Onion is the costliest, but this follows only from both statements together. Hence, the correct option is (C).

Quick Tip to Solve: In a sufficiency question first find an example where each statement alone gives two different answers; here the equal-average relation in B plus the inequality in A fixes the order.

26. Nandini paid for an article using currency notes of denominations Re. 1, Rs. 2, Rs. 5, and Rs. 10 using at least one note of each denomination. The total number of five and ten rupee notes used was one more than the total number of one and two rupee notes used. What was the price of the article?

A. Nandini used a total of 13 currency notes.

B. The price of the article was a multiple of Rs. 10. [1 mark]

(A) The question can be answered by using one of the statements alone but not by using the other statement alone.

(B) The question can be answered by using either of the statements alone.

(C) The question can be answered by using both statements together but not by either statement alone.

(D) The question cannot be answered on the basis of the two statements.

Correct Answer: (D) The question cannot be answered on the basis of the two statements.

Solution:

Concept:

- Let the numbers of Re. 1, Rs. 2, Rs. 5 and Rs. 10 notes be a, b, c, d, each at least 1. The given condition is $c + d = a + b + 1$, and the price is $P = a + 2b + 5c + 10d$.
- A statement is sufficient only if the price is one definite number for every case consistent with it.

Step 1: Use statement A alone Total notes $= 13$: $(a + b) + (c + d) = 13$ and $c + d = a + b + 1$, so $a + b = 6$ and $c + d = 7$. Many prices are possible: $(a, b, c, d) = (1, 5, 1, 6)$ gives $1 + 10 + 5 + 60 = 76$, while $(5, 1, 6, 1)$ gives $5 + 2 + 30 + 10 = 47$. Not sufficient.

Step 2: Use statement B alone Only $P \equiv 0 \pmod{10}$ is known, along with $c + d = a + b + 1$. Two valid cases: $(a, b, c, d) = (2, 4, 6, 1)$: $c + d = 7 = a + b + 1$ and $P = 2 + 8 + 30 + 10 = 50$; $(a, b, c, d) = (2, 4, 4, 3)$: $c + d = 7 = a + b + 1$ and $P = 2 + 8 + 20 + 30 = 60$. Both prices are multiples of 10 but they differ. Not sufficient.

Step 3: Use both statements together With $a + b = 6$ $(1 \le b \le 5)$ and $c + d = 7$ $(1 \le d \le 6)$:

$$P = a + 2b + 5c + 10d = (6 + b) + (35 + 5d) = 41 + b + 5d.$$

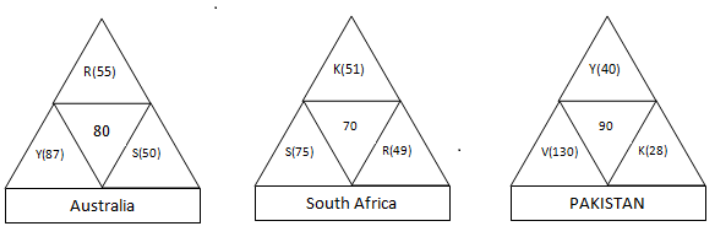
P is a multiple of 10 only if $b + 5d + 1 \equiv 0 \pmod{10}$. If d is even, this needs $b = 9$, impossible. If d is odd, $b = 4$, and then $d = 1, 3, 5$ give $P = 50,\ 60,\ 70$. So even both statements together leave three possible prices (for example $(a, b, c, d) = (2, 4, 6, 1)$ gives 50 and $(2, 4, 4, 3)$ gives 60).

Step 4: Conclusion The price cannot be determined even from both statements together. Hence, the correct option is (D).

Quick Tip to Solve: Reduce the data to equations: $a + b = 6,\ c + d = 7$ and $P = 41 + b + 5d$; the multiple-of-10 condition still leaves three prices, so the data are insufficient.

Questions 27–30. Directions for the following four questions: Answer the questions on the basis of the information given below.

Coach John sat with the score cards of Indian players from the 3 games in a one-day cricket tournament where the same set of players played for India and all the major batsmen got out. John summarized the batting performance through three diagrams, one for each games. In each diagram, the three outer triangles communicate the number of runs scored by the three top scores from India, where K, R, S, V, and Y represent Kaif, Rahul, Saurav, Virender, and Yuvraj respectively. The middle triangle in each diagram denotes the percentage of total score that was scored by the top three Indian scorers in that game. No two players score the same number of runs in the same game. John also calculated two batting indices for each player based on his scores in the tournaments; the R-index of a batsman is the difference between his highest and lowest scores in the 3 games while the M-index is the middle number, if his scores are arranged in a non-increasing order.



27. For how many Indian players is it possible to calculate the exact M-index? [2 marks]

(A) 0

(B) 1

(C) 2

(D) More than 2

Correct Answer: (C) 2

Solution:

Concept:

- The middle triangle gives the top three scorers' total as a percentage of the team total, so team total $= \dfrac{\text{sum of the three scores}}{\text{percentage}} \times 100$.
- The remaining batsmen in a game together scored (team total $-$ top-three sum), and each of them scored less than the third-highest score of that game. The M-index (median of three scores) is exact only when the ordering of the player's three scores is certain.

Step 1: Find what is known about players outside the top three Australia: $55 + 87 + 50 = 192 = 80\%$, total 240; all others together scored 48, so each scored at most 48. South Africa: $51 + 75 + 49 = 175 = 70\%$, total 250; every other batsman scored less than 49. Pakistan: $40 + 130 + 28 = 198 = 90\%$, total 220; all others together scored 22, so each scored at most 22.

Step 2: Examine each player's three scores Kaif: Australia $x \leq 48$ (unknown), South Africa 51, Pakistan 28. The median is 28 if $x < 28$ but x if $28 \leq x \leq 48$: not exact. Rahul: Australia 55, South Africa 49, Pakistan ≤ 22. The order is $55 > 49 >$ Pakistan score, so the median is exactly 49. Saurav: Australia 50, South Africa 75, Pakistan ≤ 22. The order is $75 > 50 >$ Pakistan score, so the median

is exactly 50. Virender: Pakistan 130, while his Australian and South African scores (both ≤ 48) are unknown; the median is the larger of those two: not exact. Yuvraj: Australia 87, Pakistan 40, South Africa unknown ≤ 48. The median is 40 if the South African score is at most 40, else that score: not exact.

Step 3: Conclusion The exact M-index can be calculated only for Rahul (49) and Saurav (50), that is for 2 players. Hence, the correct option is (C).

Quick Tip to Solve: A median is exact only when the unknown (not-in-top-three) score is certain to be the smallest of the three; this holds for Rahul and Saurav, whose unknown Pakistan score is at most 22.

28. Among the players mentioned, who can have the lowest R-index from the tournament? [2 marks]

(A) Only Kaif, Rahul or Yuvraj

(B) Only Kaif or Rahul

(C) Only Kaif or Yuvraj

(D) Only Kaif

Correct Answer: (A) Only Kaif, Rahul or Yuvraj

Solution:

Concept:

- R-index = (highest score) − (lowest score) of a batsman over the 3 games. Scores of players outside the top three of a game are unknown but bounded: at most 48 in Australia, below 49 in South Africa and at most 22 in Pakistan (team totals 240, 250, 220).

Step 1: Bounds on each player's R-index Kaif: scores x (≤ 48), 51, 28. If $28 \leq x \leq 48$ the R-index is $51 - 28 = 23$; if $x < 28$ it is $51 - x \leq 51$. So it lies between 23 and 51. Rahul: 55 and 49 with Pakistan score $r \leq 22$: R-index $= 55 - r$, between 33 and 55. Saurav: 75 and 50 with Pakistan score $s \leq 22$: R-index $= 75 - s \geq 53$. Virender: 130− (smaller of two scores ≤ 48) ≥ 82. Yuvraj: 87, 40 and a South African score $y \leq 48$: R-index $= 87 - \min(40, y) \geq 47$.

Step 2: Who can be the lowest Saurav (at least 53) and Virender (at least 82) always exceed Kaif's maximum of 51, so they can never have the lowest R-index. Kaif can be lowest: take $x = 40$, giving 23, below every other minimum. Rahul can be lowest: take $x = 0$ (Kaif 51), $r = 22$ (Rahul 33), and Yuvraj ≥ 47. Yuvraj can be lowest: take Kaif $x = 0$ (51), Rahul $r = 0$ (55) and Yuvraj's South African score $y = 45$ (R-index 47).

Step 3: Conclusion Only Kaif, Rahul or Yuvraj can have the lowest R-index. Hence, the correct option is (A).

Quick Tip to Solve: Compare minimum possible R-indices against the maximum possible for Kaif (51): anyone whose minimum exceeds 51 (Saurav, Virender) is eliminated, and the rest are each shown possible by an example.

29. How many players among those listed definitely scored less than Yuvraj in the tournament?

[2 marks]

(A) 0

(B) 1

(C) 2

(D) More than 2

Correct Answer: (B) 1

Solution:

Concept:

- A player definitely scored less than Yuvraj if his maximum possible tournament total is below Yuvraj's minimum possible total. Unknown scores of players outside the top three are bounded by the team totals: at most 48 (Australia), below 49 (South Africa), at most 22 (Pakistan).

Step 1: Yuvraj's total Yuvraj scored 87 (Australia) and 40 (Pakistan); his South African score y is unknown ($0 \le y \le 48$). So his total is at least $87 + 40 + 0 = 127$ and at most 175.

Step 2: Maximum possible totals of the others Rahul: $55 + 49 + r \le 55 + 49 + 22 = 126 < 127$. Always less than Yuvraj. Kaif: $51 + 28 + x \le 79 + 48 = 127$, which can equal Yuvraj's 127 (when $x = 48,\ y = 0$), so he is not definitely less. Saurav: $50 + 75 + s$ can reach 147, above Yuvraj's minimum, so not definitely less. Virender: at least 130 from Pakistan alone, and can exceed Yuvraj's total; not definitely less.

Step 3: Conclusion Only Rahul definitely scored less than Yuvraj, i.e. 1 player. Hence, the correct option is (B).

Quick Tip to Solve: Take Yuvraj's smallest possible total (127) and compare with each rival's largest possible total; only Rahul (at most 126) stays strictly below.

30. Which of the players had the best M-index from the tournament?

[2 marks]

(A) Rahul

(B) Saurav

(C) Virender

(D) Yuvraj

Correct Answer: (B) Saurav

Solution:

Concept:

- M-index = middle of a player's three scores. Scores of players outside a game's top three are unknown but bounded: at most 48 in Australia, below 49 in South Africa, at most 22 in Pakistan.

Step 1: Evaluate or bound each M-index Rahul: scores $55,\ 49,\ r \le 22$, so the middle score is exactly 49. Saurav: scores $50,\ 75,\ s \le 22$, so the middle score is exactly 50. Virender: 130 in Pakistan; his other two scores are at most 48, so the middle is the larger of these, at most 48. Yuvraj: scores $87,\ 40$

and a South African score $y \leq 48$; the middle is $\max(40, y) \leq 48$.

Step 2: Compare Saurav's 50 exceeds Rahul's 49 and the upper bound 48 for both Virender and Yuvraj. So Saurav's M-index is certainly the best, Rahul's is next, and those of Virender and Yuvraj can be at most 48.

Step 3: Conclusion Saurav has the best M-index (50). Hence, the correct option is (B).

Quick Tip to Solve: Compute the exactly known medians first (Rahul 49, Saurav 50) and then show the rest are capped at 48 by the totals of the other batsmen.

Questions 31–34. Directions for the following four questions: Answer the questions on the basis of the information given below.

Twenty one participants from four continents (Africa, Americas, Australasia, and Europe) attended a United Nations conference. Each participant was an expert in one of four fields, labour, health, population studies, and refugee relocation. The following five facts about the participants are given.

(a) The number of labour experts in the camp was exactly half the number of experts in each of the three other categories.

(b) Africa did not send any labour expert. Otherwise, every continent, including Africa, sent at least one expert for each category.

(c) None of the continents sent more than three experts in any category.

(d) If there had been one less Australasian expert, then the Americas would have had twice as many experts as each of the other continents.

(e) Mike and Alfanso are leading experts of population studies who attended the conference. They are from Australasia.

31. Which of the following combinations is NOT possible? [2 marks]

(A) 2 experts in population studies from the Americas and 2 health experts from Africa attended the conference.

(B) 2 experts in population studies from the Americas and 1 health expert from Africa attended the conference.

(C) 3 experts in refugee relocation from the Americas and 1 health expert from Africa attended the conference.

(D) Africa and America each had 1 expert in population studies attending the conference.

Correct Answer: (D) Africa and America each had 1 expert in population studies attending the conference.

Solution:

Concept:

- Translate the conditions into counts: with L labour experts, each of health (H), population studies (P) and refugee relocation (R) has $2L$ experts, so $7L = 21$ and $L = 3$; each of H, P, R has 6 experts. Then use the continent-wise conditions to fix every cell of the continent-by-field table.

Step 1: Totals per continent from condition (d) After removing one Australasian expert there are 20 experts, with Americas $= 2a$ and the other three continents a each: $5a = 20 \Rightarrow a = 4$. So Africa $= 4$,

Europe $= 4$, Australasia $= 5$, Americas $= 8$.

Step 2: Distribute among fields Labour: Africa 0; the other three continents have 1 each (3 in all, each at least 1). Europe: 4 experts, so 1 in each of H, P, R. Australasia: 5, so 1 labour and 4 in H, P, R with each at least 1; condition (e) puts two in P: $(H, P, R) = (1, 2, 1)$. Each of H, P, R has 6 experts, so Africa and Americas together have $H = 4,\ P = 3,\ R = 4$. Africa has 4 experts with at least one in each of H, P, R, so exactly one field has 2, giving three cases (listed as (H, P, R)):

Case	Africa	Americas
1	(2,1,1)	(2,2,3)
2	(1,2,1)	(3,1,3)
3	(1,1,2)	(3,2,2)

Step 3: Test the options (A) Americas P $= 2$, Africa H $= 2$: Case 1, possible. (B) Americas P $= 2$, Africa H $= 1$: Case 3, possible. (C) Americas R $= 3$, Africa H $= 1$: Case 2, possible. (D) Africa P $= 1$ and Americas P $= 1$: Americas P $= 1$ occurs only in Case 2, where Africa P $= 2$. Not possible.

Step 4: Conclusion The combination in (D) cannot occur. Hence, the correct option is (D).

Quick Tip to Solve: Get the 4-4-5-8 continent totals from condition (d) first; the population-studies column (Africa + Americas = 3) then makes (1,1) impossible.

32. If Ramos is the lone American expert in population studies, which of the following is NOT true about the numbers of experts in the conference from the four continents? [2 marks]

(A) There is one expert in health from Africa.

(B) There is one expert in refugee relocation from Africa.

(C) There are two experts in health from the Americas.

(D) There are three experts in refugee relocation from the Americas.

Correct Answer: (C) There are two experts in health from the Americas.

Solution:

Concept:

- From the conditions, $L = 3$ and each of health (H), population studies (P) and refugee relocation (R) has 6 experts; condition (d) fixes continent totals Africa 4, Europe 4, Australasia 5, Americas 8.

Step 1: Basic table Labour: Africa 0, others 1 each. Europe: $(H, P, R) = (1, 1, 1)$. Australasia: $(1, 2, 1)$, because Mike and Alfanso are both from Australasia in population studies. So Africa and Americas together have $H = 4,\ P = 3,\ R = 4$, with Africa having 4 experts (one field with 2, the others 1).

Step 2: Impose the given condition Ramos is the lone American expert in P, so Americas $P = 1$; then Africa $P = 2$, and since Africa has only four experts, Africa $(H, P, R) = (1, 2, 1)$. Americas then have $H = 4 - 1 = 3$ and $R = 4 - 1 = 3$: $(3, 1, 3)$, which totals 7 plus 1 labour $= 8$ as required.

Step 3: Test the options (A) Africa H $= 1$: true. (B) Africa R $= 1$: true. (C) Americas H $= 2$: false, it is 3. (D) Americas R $= 3$: true.

Step 4: Conclusion Statement (C) is not true, since the Americas have three (not two) health experts. Hence, the correct option is (C).

Quick Tip to Solve: Once Americas P is 1, Africa P must be 2 and the rest follow from column totals (Africa + Americas: H 4, R 4).

33. Alex, an American expert in refugee relocation, was the first keynote speaker in the conference. What can be inferred about the number of American experts in refugee relocation in the conference, excluding Alex?

i. At least one

ii. At most two [2 marks]

(A) Only i and not ii

(B) Only ii and not I

(C) Both i and ii

(D) Neither i nor ii

Correct Answer: (C) Both i and ii

Solution:

Concept:

- Translate each condition into equations on the numbers of experts, then use the bounds (each continent sends at least 1 and at most 3 experts in a category) to list every possible distribution.
- Let L be the number of labour experts; by (a) each of the other three fields has $2L$ experts.

Step 1: Numbers of experts in each field Total $= L + 3(2L) = 7L = 21$, so $L = 3$. Hence labour $= 3$ and each of health, population studies and refugee relocation $= 6$. By (b) Africa has no labour expert and every other continent has at least one, so Americas, Australasia and Europe have exactly one labour expert each.

Step 2: Numbers of experts on each continent By (d), after removing one Australasian expert, Americas has twice as many experts as each of the other three continents. So let Africa $= x$, Europe $= x$, Australasia $= x + 1$ and Americas $= 2x$. Then

$$x + x + (x + 1) + 2x = 21 \;\Rightarrow\; x = 4.$$

Africa $= 4$, Europe $= 4$, Australasia $= 5$, Americas $= 8$.

Step 3: Distribution by field Write each distribution as (health, population, refugee). Europe: labour 1, the remaining 3 experts are one in each field, so $(1, 1, 1)$. Australasia: labour 1; the other 4 experts are at least 1 in each field, and population studies has at least 2 (Mike and Alfanso), so $(1, 2, 1)$. Africa and Americas must then supply $6 - 2 = 4$ health, $6 - 3 = 3$ population and $6 - 2 = 4$ refugee experts. Africa has 4 experts in three fields with at least 1 each, i.e. a permutation of $(2, 1, 1)$; Americas has 8 experts, 1 of them labour, so 7 in the other fields with each at most 3. Checking the three possibilities:

$$\text{Africa } (1, 2, 1),\ \text{Americas } (3, 1, 3);$$
$$\text{Africa } (2, 1, 1),\ \text{Americas } (2, 2, 3);$$
$$\text{Africa } (1, 1, 2),\ \text{Americas } (3, 2, 2).$$

Step 4: American refugee-relocation experts, excluding Alex In the three cases, Americas has $3,\ 3,\ 2$ refugee-relocation experts. Excluding Alex this is $2,\ 2,\ 1$. (i) At least one: true in every case. (ii) At most two: true in every case. So both statements can be inferred.

Step 5: Conclusion Both i and ii follow in every possible arrangement. Hence, the correct option is (C).

Quick Tip to Solve: First fix the totals: 7L = 21 gives 6 per field, and (d) gives continent totals 4, 8, 5, 4; then enumerate the few distributions that fit the 1-to-3 limits.

34. Which of the following numbers cannot be determined from the information given? [2 marks]

(A) Number of labour experts from the Americas.

(B) Number of health experts from Europe.

(C) Number of health experts from Australasia.

(D) Number of experts in refugee relocation from Africa.

Correct Answer: (D) Number of experts in refugee relocation from Africa.

Solution:

Concept:

- From the conditions, the numbers per field and per continent are fixed; only some cells of the continent-by-field table are determined uniquely.
- A number cannot be determined if it takes different values in different arrangements that satisfy all the facts.

Step 1: Recall the fixed totals From (a), labour $= 3$ and each other field $= 6$. From (b) and (d), the continents have Africa 4, Europe 4, Australasia 5, Americas 8 experts. Each of Americas, Australasia and Europe has exactly one labour expert; Europe is $(1, 1, 1)$ and Australasia is $(1, 2, 1)$ in (health, population, refugee).

Step 2: The remaining arrangements The only possibilities for Africa and Americas in (health, population, refugee) are:

$$\text{Africa } (1, 2, 1),\ \text{Americas } (3, 1, 3);$$
$$\text{Africa } (2, 1, 1),\ \text{Americas } (2, 2, 3);$$
$$\text{Africa } (1, 1, 2),\ \text{Americas } (3, 2, 2).$$

Step 3: Test each option (A) Labour experts from the Americas: exactly 1 in every case, so determined. (B) Health experts from Europe: 1, determined. (C) Health experts from Australasia: 1, determined. (D) Refugee-relocation experts from Africa: 1, 1 or 2 in the three cases, so it cannot be determined.

Step 4: Conclusion Only the number of refugee-relocation experts from Africa varies between valid arrangements. Hence, the correct option is (D).

Quick Tip to Solve: Africa has 4 non-labour experts split as (2,1,1); where the 2 sits is not fixed by any fact, so any Africa cell other than labour is the one that cannot be determined.

Questions 35–38. Directions for the following four questions: Answer the questions on the basis of the information given below.

The year was 2006. All six teams in Pool A of World Cup hockey, play each other exactly once.

Each win earns a team three points, a draw earns one point and a loss earns zero points. The two teams with the highest points qualify for the semifinals. In case of a tie, the team with the highest goal difference (Goal For . Goals Against) qualifies.

In the opening match, Spain lost to Germany.

After the second round (after each team played two matches), the pool table looked as shown below.

In the third round, Spain played Pakistan, Argentina played Germany, and New Zealand played South Africa. All the third round matches were drawn. The following are some results from the fourth and fifth round matches

(a) Spain won both the fourth and fifth round matches.

(b) Both Argentina and Germany won their fifth round matches by 3 goals to 0.

(c) Pakistan won both the fourth and fifth round matches by 1 goal to 0.

Teams	Games Played	Won	Drawn	Lost	Goals For	Goals Against	Points
Germany	2	2	0	0	3	1	6
Argentina	2	2	0	0	2	0	6
Spain	2	1	0	1	5	2	3
Pakistan	2	1	0	1	2	1	3
New Zealand	2	0	0	2	1	6	0
South Africa	2	0	0	2	1	4	0

35. Which one of the following statements is true about matches played in the first two rounds?

[2 marks]

(A) Germany beat New Zealand by 1 goal to 0.

(B) Spain beat New Zealand by 4 goals to 0.

(C) Spain beat South Africa by 2 goals to 0.

(D) Germany beat South Africa by 2 goals to 1.

Correct Answer: (D) Germany beat South Africa by 2 goals to 1.

Solution:

Concept:

- Use the pool table after two rounds (wins, losses, goals for and against) to reconstruct every score of the first six matches.
- A win means more goals scored than conceded; a team with 0 goals against that won both matches won each by a margin equal to its goals scored.
- The round 3 fixtures (Spain–Pakistan, Argentina–Germany, New Zealand–South Africa) cannot also be fixtures of the first two rounds.

Step 1: Scores of Argentina, Germany and Pakistan Argentina: two wins, GF 2, GA 0, so both were 1–0. Germany: two wins, GF 3, GA 1, so the scores were 1–0 and 2–1; one of them was against Spain (the opening match). Pakistan: one win, one loss, GF 2, GA 1, so it lost 0–1 and won 2–0. Spain's only loss was to Germany, so Argentina's two victims and Pakistan's victim come from Pakistan, New

Zealand and South Africa, and Pakistan's victim is New Zealand or South Africa (Spain–Pakistan is a round 3 match).

Step 2: Use the goals against New Zealand and South Africa New Zealand and South Africa lost four matches in all, conceding $6 + 4 = 10$ goals. If Pakistan had lost to Germany, Germany's other win would be 2–1 over Spain, so Spain's win was 4–0 and Argentina's two wins were over New Zealand and South Africa. The goals conceded would be $1 + 1 + 4 + 2 = 8 \neq 10$, which is impossible. So Pakistan lost 0–1 to Argentina. The four defeats of New Zealand and South Africa are then: Argentina 1–0 (1 against), Pakistan 2–0 (2 against), Germany (g against) and Spain (s against). From $1 + 2 + g + s = 10$ we get $g + s = 7$, so $g = 2$, $s = 5$: Germany won 2–1 there, hence beat Spain 1–0, and Spain's win was 5–1. Spain's and Germany's victims each scored one goal, matching GF $= 1$ for each of the two teams, so they are different teams. New Zealand (6 against) is Spain's victim ($5 + 1$ with Argentina) and South Africa (4 against) is Germany's victim ($2 + 2$ with Pakistan). Results: Germany 1–0 Spain; Germany 2–1 South Africa; Argentina 1–0 Pakistan; Argentina 1–0 New Zealand; Spain 5–1 New Zealand; Pakistan 2–0 South Africa.

Step 3: Test the options (A) Germany beat New Zealand 1–0: Germany played Spain and South Africa, so false. (B) Spain beat New Zealand 4–0: the score was 5–1, so false. (C) Spain beat South Africa 2–0: Spain's victim was New Zealand, so false. (D) Germany beat South Africa 2–1: true.

Step 4: Conclusion The only true statement is that Germany beat South Africa 2–1. Hence, the correct option is (D).

Quick Tip to Solve: Zero goals against for Argentina forces two 1-0 wins and Germany's 3-1 total forces 1-0 and 2-1. Then the goals conceded by NZ and SA (6 + 4 = 10) fix the rest.

36. Which one of the following statements is true about matches played in the first two rounds?

[2 marks]

(A) Pakistan beat South Africa by 2 goals to 1.

(B) Argentina beat Pakistan by 1 goal to 0.

(C) Germany beat Pakistan by 2 goals to 1.

(D) Germany beat Spain by 2 goals to 1.

Correct Answer: (B) Argentina beat Pakistan by 1 goal to 0.

Solution:

Concept:

- The pool table after two rounds fixes all six scores: Argentina won 1–0 twice, Germany won 1–0 and 2–1, Pakistan lost 0–1 and won 2–0.
- Then compare each option with the reconstructed results.

Step 1: Reconstruct the first two rounds Argentina (GF 2, GA 0) won both matches 1–0; Germany (GF 3, GA 1) won 1–0 and 2–1; Pakistan (GF 2, GA 1, one win and one loss) lost 0–1 and won 2–0. New Zealand and South Africa conceded 6 and 4 goals in their four defeats. Testing the possibilities against these totals (Pakistan's loss to Germany makes the goals conceded by the two weakest teams

only $1+1+4+2=8$, not 10), the only consistent results are: Germany 1–0 Spain; Germany 2–1 South Africa; Argentina 1–0 Pakistan; Argentina 1–0 New Zealand; Spain 5–1 New Zealand; Pakistan 2–0 South Africa.

Step 2: Test the options (A) Pakistan beat South Africa 2–1: the score was 2–0, so false. (B) Argentina beat Pakistan 1–0: true. (C) Germany beat Pakistan 2–1: Germany did not meet Pakistan in the first two rounds (their only match is in a later round), so false. (D) Germany beat Spain 2–1: the opening match was 1–0, so false.

Step 3: Conclusion Argentina beat Pakistan 1–0 in the first two rounds. Hence, the correct option is (B).

Quick Tip to Solve: Argentina's table line (GF 2, GA 0 after two wins) means two 1-0 wins, and its only possible victims include Pakistan, whose loss is 0-1.

37. If Pakistan qualified as one of the two teams from Pool A, which was the other team that qualified?

[2 marks]

(A) Argentina

(B) Germany

(C) Spain

(D) Cannot be determined

Correct Answer: (D) Cannot be determined

Solution:

Concept:

- In a round of a six-team round robin there are exactly three matches. If no match is drawn, a round has at most three winners.
- If the facts given are mutually inconsistent, no final standing can be deduced from them.

Step 1: Check the facts about the fifth round From (a) Spain won its fifth-round match, from (b) Argentina and Germany won their fifth-round matches by 3–0, and from (c) Pakistan won its fifth-round match 1–0. None of these was drawn, so each is a win for a different team. That makes four different winners (Spain, Argentina, Germany, Pakistan) in the fifth round. But a round has only $6/2=3$ matches, so at most three teams can win in it. The facts contradict each other.

Step 2: Further check on the schedule After rounds 1 to 3, the matches left are Germany–Pakistan, Germany–New Zealand and Pakistan–New Zealand (among others). These three matches involve the same three teams pairwise, so they cannot all be played in just two rounds (4 and 5). This confirms that the given results cannot all hold together.

Step 3: Consequence for the options Since the facts cannot hold at the same time, the final points table and goal differences cannot be fixed from them, and one cannot say which team would be the second qualifier along with Pakistan. Naming Argentina, Germany or Spain would rest on ignoring part of the given data.

Step 4: Conclusion The data are inconsistent, so the other qualifying team cannot be determined.

Hence, the correct option is (D).

Quick Tip to Solve: Count the winners of one round: four teams are said to win in round 5 but only three matches are played, so the question is unanswerable.

38. Which team finished at the top of the pool after five rounds of matches? [2 marks]

(A) Argentina

(B) Germany

(C) Spain

(D) Cannot be determined

Correct Answer: (D) Cannot be determined

Solution:

Concept:

- A round of a six-team pool has exactly three matches, hence at most three winners when there are no draws.
- Standings can be worked out only from facts that can all be true together.

Step 1: Count the fifth-round winners Spain won both its fourth- and fifth-round matches (a). Argentina and Germany each won their fifth-round matches 3–0 (b). Pakistan won both its fourth- and fifth-round matches 1–0 (c). So Spain, Argentina, Germany and Pakistan all won a fifth-round match. Those are four winners from only three matches, which is impossible.

Step 2: Why a ranking cannot be forced One could ignore the schedule and add the points: after round 3 Germany and Argentina have 7 each and Spain and Pakistan 4 each; adding the stated wins gives each of the four teams 10 points, and the goal differences would then separate them. But that uses results (such as Pakistan beating New Zealand and Germany, and Germany beating New Zealand, all within two rounds) that cannot be scheduled, so the standings are not reliable. Since the given facts contradict each other, no team can be named as the top of the pool.

Step 3: Conclusion The information is inconsistent, so the team at the top cannot be determined. Hence, the correct option is (D).

Quick Tip to Solve: Before computing points, check consistency: four winners in round 5 from only three matches shows that the question cannot be settled.

39. Two boats, traveling at 5 and 10 kms per hour, head directly towards each other. They begin at a distance of 20 kms from each other. How far apart are they (in kms) one minute before they collide. [1 mark]

(A) 1/12

(B) 1/6

(C) 1/4

(D) 1/3

Correct Answer: (C) 1/4

Solution:

Concept:

- For two bodies moving towards each other, the relative speed is the sum of the speeds, and distance = relative speed $\times$ time.

Step 1: Relative speed The boats head directly towards each other, so they close the gap at $5 + 10 = 15$ km/h. The initial 20 km is irrelevant because the question asks about the gap exactly one minute before the collision.

Step 2: Distance covered in one minute One minute $= \dfrac{1}{60}$ hour, so the gap one minute before they collide is

$$15 \times \frac{1}{60} = \frac{1}{4} \text{ km.}$$

Check against the options: $1/12$ km would be the gap after 20 seconds, $1/6$ km after 40 seconds and $1/3$ km after 80 seconds, so only $1/4$ km corresponds to one minute.

Step 3: Conclusion The boats are $\frac{1}{4}$ km apart one minute before the collision. Hence, the correct option is (C).

Quick Tip to Solve: The gap just before a collision is only relative speed times time: 15 km/h is 0.25 km per minute, whatever the starting distance.

40. A rectangular sheet of paper, when halved by folding it at the mid point of its longer side, results in a rectangle, whose longer and shorter sides are in the same proportion as the longer and shorter sides of the original rectangle. If the shorter side of the original rectangle is 2, what is the area of the smaller rectangle? [1 mark]

(A) $4\sqrt{2}$

(B) $2\sqrt{2}$

(C) $\sqrt{2}$

(D) None of the above

Correct Answer: (B) $2\sqrt{2}$

Solution:

Concept:

- Two rectangles are similar when the ratio of their longer side to shorter side is the same.
- Area of a rectangle = length $\times$ breadth; folding at the midpoint of a side halves that side and leaves the other unchanged.

Step 1: Set up the sides Let the original rectangle have shorter side 2 and longer side L ($L > 2$). Folding at the midpoint of the longer side gives a rectangle with sides $\frac{L}{2}$ and 2.

Step 2: Use similarity The new rectangle's longer side is 2 and its shorter side is $\frac{L}{2}$ (this needs $L < 4$), so

$$\frac{2}{L/2} = \frac{L}{2} \Rightarrow L^2 = 8 \Rightarrow L = 2\sqrt{2},$$

which satisfies $2 < L < 4$. (If instead $L/2$ were the longer side, we would need $\frac{L/2}{2} = \frac{L}{2}$, which is impossible for $L > 0$.)

Step 3: Area of the smaller rectangle Its sides are $\frac{L}{2} = \sqrt{2}$ and 2, so the area is $2\sqrt{2}$. Option (A) $4\sqrt{2}$ is the area of the original rectangle ($2 \times 2\sqrt{2}$), and (C) $\sqrt{2}$ is one side only. Since $2\sqrt{2}$ is listed as (B), (D) "None of the above" is also wrong.

Step 4: Conclusion The area of the smaller rectangle is $2\sqrt{2}$. Hence, the correct option is (B).

Quick Tip to Solve: A sheet that keeps its shape on halving has sides in the ratio $\sqrt{2} : 1$ (the A-series paper ratio). So the long side is $2\sqrt{2}$, and the half sheet has area $\frac{1}{2} \times 2 \times 2\sqrt{2}$.

41. If the sum of the first 11 terms of an arithmetic progression equals that of the first 19 terms, then what is the sum of the first 30 terms? [1 mark]

(A) 0

(B) -1

(C) 1

(D) Not unique

Correct Answer: (A) 0

Solution:

Concept:

- Sum of the first n terms of an AP with first term a and common difference d: $S_n = \frac{n}{2}[2a+(n-1)d]$.
- If $S_m = S_n$ for $m \neq n$, the terms from $m+1$ to n add up to zero, which forces $2a+(m+n-1)d = 0$.

Step 1: Use $S_{11} = S_{19}$

$$\frac{11}{2}(2a+10d) = \frac{19}{2}(2a+18d) \;\Rightarrow\; 22a+110d = 38a+342d \;\Rightarrow\; 16a+232d = 0.$$

Dividing by 8 gives $2a+29d = 0$.

Step 2: Find S_{30}

$$S_{30} = \frac{30}{2}[2a+29d] = 15 \times 0 = 0.$$

This holds for every progression satisfying the given condition, whatever a and d are, so the sum is the same number in every case.

Step 3: Check the other options The value is exactly 0, so -1 in (B) and 1 in (C) are wrong. Option (D) says the sum is not unique, but the working shows it is fixed at 0 for all such progressions, so (D) is also wrong.

Step 4: Conclusion The sum of the first 30 terms is 0. Hence, the correct option is (A).

Quick Tip to Solve: If $S_m = S_n$ then $S_{m+n} = 0$; here $11+19 = 30$, so the answer is 0 without any algebra.

42. If a man cycles at 10 km/hr, then he arrives at a certain place at 1 p.m. If he cycles at 15 km/hr, he will arrive at the same place at 11 a.m. At what sped must he cycle to get there at noon? [1 mark]

(A) 11 km/hr

(B) 12 km/hr

(C) 13 km/hr

(D) 14 km/hr

Correct Answer: (B) 12 km/hr

Solution:

Concept:

- Distance $=$ speed $\times$ time, so for a fixed distance d: time $= \dfrac{d}{v}$.
- The starting time is the same in every case, so only the travelling times differ; the difference of arrival times fixes d.

Step 1: Find the distance At 10 km/hr he arrives at 1 p.m. and at 15 km/hr at 11 a.m., so the two journeys differ by 2 hours:

$$\frac{d}{10} - \frac{d}{15} = 2 \;\Rightarrow\; \frac{3d - 2d}{30} = 2 \;\Rightarrow\; d = 60 \text{ km}.$$

Step 2: Find the starting time and the required time At 10 km/hr the journey takes $60/10 = 6$ hours, and he arrives at 1 p.m., so he starts at 7 a.m. (check: at 15 km/hr, $60/15 = 4$ hours gives 11 a.m.). To arrive at noon he must travel $12 - 7 = 5$ hours.

Step 3: Find the speed

$$v = \frac{60}{5} = 12 \text{ km/hr}.$$

The other options give times $60/11 \approx 5.45$ h, $60/13 \approx 4.6$ h and $60/14 \approx 4.3$ h, none equal to 5 h, so they do not give arrival at noon.

Step 4: Conclusion He must cycle at 12 km/hr. Hence, the correct option is (B).

Quick Tip to Solve: The speeds 10 and 15 and the 2-hour gap give d = 60 at once (LCM 30 times 2); then noon is exactly midway between 11 a.m. and 1 p.m., so 5 h and 12 km/hr.

43. On January 1, 2004 two new societies S1 and S2 are formed, each n numbers. On the first day of each subsequent month, S1 adds b members while S2 multiples its current numbers by a constant factor r. Both the societies have the same number of members on July 2, 2004. If b = 10.5n, what is the value of r? [1 mark]

(A) 2.0

(B) 1.9

(C) 1.8

(D) 1.7

Correct Answer: (A) 2.0

Solution:

Concept:

- S1 grows by a fixed amount each month (an arithmetic progression): after k additions it has $n + kb$ members.
- S2 is multiplied by a fixed factor each month (a geometric progression): after k months it has $n\,r^k$ members.

Step 1: Count the monthly changes The changes occur on the first day of each month after January 1, namely on Feb 1, Mar 1, Apr 1, May 1, Jun 1 and Jul 1. By July 2, 2004 there have been exactly 6 changes in each society.

Step 2: Form the two membership counts

$$S_1 = n + 6b = n + 6(10.5\,n) = n + 63n = 64n, \qquad S_2 = n\,r^6.$$

Step 3: Equate and solve The societies are equal on July 2, so

$$n\,r^6 = 64\,n \;\Rightarrow\; r^6 = 64 = 2^6 \;\Rightarrow\; r = 2.$$

Check of the other options: $1.9^6 \approx 47.0$, $1.8^6 \approx 34.0$ and $1.7^6 \approx 24.1$, none equal to 64.

Step 4: Conclusion The factor is $r = 2.0$. Hence, the correct option is (A).

Quick Tip to Solve: Count the number of monthly changes first (6, Feb 1 to Jul 1); then $r^6 = 1 + 6 \times 10.5 = 64$ gives $r = 2$ directly.

44. If $f(x) = x^3 - 4x + p$, and f(0) and f(1) are of opposite signs, then which of the following is necessarily true [1 mark]

(A) -1 < p < 2

(B) 0 < p < 3

(C) -2 < p < 1

(D) -3 < p < 0

Correct Answer: (B) 0 < p < 3

Solution:

Concept:

- Values of the polynomial: $f(0)$ and $f(1)$ are found by substitution.
- Two numbers have opposite signs exactly when their product is negative: $f(0)\,f(1) < 0$.

Step 1: Evaluate the function For $f(x) = x^3 - 4x + p$:

$$f(0) = p, \qquad f(1) = 1 - 4 + p = p - 3.$$

Step 2: Use the opposite-sign condition

$$f(0)\,f(1) < 0 \;\Rightarrow\; p\,(p-3) < 0 \;\Rightarrow\; 0 < p < 3.$$

This is exactly the interval of option (B), so it is necessarily true.

Step 3: Why the interval is exactly $0 < p < 3$ The product $p(p-3)$ is a parabola in p opening upward with roots at $p = 0$ and $p = 3$; it is negative only between the roots. At $p = 0$ or $p = 3$ one of $f(0), f(1)$ is zero, which is neither positive nor negative, so the end points are excluded. Equivalently, by the intermediate value theorem the cubic then has a root in $(0, 1)$.

Step 4: Test the other options Take $p = 2.5$: $f(0) = 2.5 > 0$ and $f(1) = -0.5 < 0$, so the condition holds; but $p = 2.5$ is outside $-1 < p < 2$ (option A), outside $-2 < p < 1$ (option C) and outside $-3 < p < 0$ (option D). Hence A, C and D are not necessarily true.

Step 5: Conclusion The condition forces $0 < p < 3$. Hence, the correct option is (B).

Quick Tip to Solve: f(0) = p and f(1) = p - 3; opposite signs means p(p - 3) < 0, so p lies between the roots 0 and 3.

45. Suppose n is an integer such that the sum of digits on n is 2, and $10^{10} < n < 10^{11}$. The number of different values of n is [1 mark]

(A) 11

(B) 10

(C) 9

(D) 8

Correct Answer: (A) 11

Solution:

Concept:

- $10^{10} < n < 10^{11}$ means n is an 11-digit number (10^{10} itself has 11 digits but is excluded).
- Digit sum 2 with a non-zero leading digit: either the digits are $\{2, 0, \ldots, 0\}$ or $\{1, 1, 0, \ldots, 0\}$, with the leading digit at least 1.

Step 1: Case 1: a digit 2 and ten zeros The only possibility is 20000000000 (the digit 2 must lead, otherwise the leading digit would be 0). This gives 1 number.

Step 2: Case 2: two digits equal to 1 The leading digit must be 1 and the second 1 can be in any of the remaining 10 places, giving 10 numbers: $10000000001,\ 10000000010, \ldots,\ 11000000000$. All of them exceed 10^{10} and are below 10^{11}.

Step 3: Total

$$1 + 10 = 11.$$

The value 10 (option B) forgets the number 20000000000, while 9 and 8 are too small.

Step 4: Conclusion There are 11 such integers. Hence, the correct option is (A).

Quick Tip to Solve: List by digit pattern: 2 followed by zeros (1 way) and 1 at the front with another 1 in one of 10 places (10 ways); do not forget the 2 case.

46. A milkman mixes 20 litres of water with 80 litres of milk. After selling one-fourth of this mixture, he adds water to replenish the quantity that he had sold. What is the current proportion of water to milk? [1 mark]

(A) 2 : 3

(B) 1 : 2

(C) 1 : 3

(D) 3 : 4

Correct Answer: (A) 2 : 3

Solution:

Concept:

- When a part of a uniform mixture is removed, water and milk are removed in the same ratio as in the mixture.

- Replacing the removed quantity with pure water raises only the water.

Step 1: Initial mixture Water $= 20$ L, milk $= 80$ L, total $= 100$ L, water : milk $= 1 : 4$.

Step 2: Remove one-fourth One-fourth of the mixture is 25 L, containing $\frac{1}{4} \times 20 = 5$ L of water and $\frac{1}{4} \times 80 = 20$ L of milk. What is left is

$$\text{water} = 20 - 5 = 15 \text{ L}, \qquad \text{milk} = 80 - 20 = 60 \text{ L}.$$

Step 3: Add water to restore 100 L The 25 L sold is replaced by pure water, so water becomes $15 + 25 = 40$ L and milk stays 60 L:

$$\text{water} : \text{milk} = 40 : 60 = 2 : 3.$$

With milk fixed at 60 L, the ratios $1 : 2$, $1 : 3$ and $3 : 4$ of options (B), (C) and (D) would need 30 L, 20 L and 45 L of water, but the water is 40 L, so they are ruled out.

Step 4: Conclusion The new ratio of water to milk is $2 : 3$. Hence, the correct option is (A).

Quick Tip to Solve: Milk left is 3/4 of 80 = 60 and the total is back to 100, so water is 40; the ratio $40 : 60 = 2 : 3$ follows immediately.

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47. If $\frac{a}{b+c} = \frac{b}{a+c} = \frac{c}{b+a} = r$, then r cannot take any value except [1 mark]

(A) 1/2

(B) -1

(C) 1/2 or -1

(D) -1/2 or -1

Correct Answer: (C) 1/2 or -1

Solution:

Concept:

- If $\frac{x_1}{y_1} = \frac{x_2}{y_2} = \frac{x_3}{y_3} = r$, then $r = \frac{x_1 + x_2 + x_3}{y_1 + y_2 + y_3}$ whenever the sum of the denominators is non-zero (equal ratios).
- The case $a + b + c = 0$ must be treated separately.

Step 1: Case 1: $a + b + c \neq 0$ Adding numerators and denominators,

$$r = \frac{a + b + c}{(b + c) + (a + c) + (b + a)} = \frac{a + b + c}{2(a + b + c)} = \frac{1}{2}.$$

(Example: $a = b = c = 1$ gives each ratio $= \frac{1}{2}$.)

Step 2: Case 2: $a + b + c = 0$ Then $b + c = -a$, so $\frac{a}{b + c} = \frac{a}{-a} = -1$; similarly the other ratios equal -1, so $r = -1$. (Example: $a = 1,\ b = 2,\ c = -3$: $\frac{1}{-1} = -1,\ \frac{2}{-2} = -1,\ \frac{-3}{3} = -1$.)

Step 3: Combine Both values actually occur, so r can be $\frac{1}{2}$ or -1, and no other value. Option (A)

misses the case $a+b+c=0$; option (B) misses $a=b=c$; option (D) has $-\frac{1}{2}$, which never occurs.

Step 4: Conclusion $r=\frac{1}{2}$ or $r=-1$. Hence, the correct option is (C).

Quick Tip to Solve: Add the three fractions' numerators and denominators to get r = 1/2, and remember the special case a + b + c = 0, which gives r = -1.

48. Let $y=\cfrac{1}{2+\cfrac{1}{3+\cfrac{1}{2+\cfrac{1}{3+\cdots}}}}$. Then y equals? [1 mark]

(A) $\frac{\sqrt{11}+3}{2}$

(B) $\frac{\sqrt{11}-3}{2}$

(C) $\frac{\sqrt{15}+3}{2}$

(D) $\frac{\sqrt{15}-3}{2}$

Correct Answer: (D) $\frac{\sqrt{15}-3}{2}$

Solution:

Concept:

- The continued fraction repeats the block $2+\cfrac{1}{3+\cdots}$, so the tail after the first "2 +" is $3+y$.
- Form a quadratic in y, solve with the formula, and keep the positive root since $y>0$.

Step 1: Form the equation The tail $3+\cfrac{1}{2+\cfrac{1}{3+\cdots}}$ is $3+y$. Hence

$$y=\frac{1}{2+\cfrac{1}{3+y}}=\frac{3+y}{2(3+y)+1}=\frac{3+y}{7+2y}.$$

Step 2: Solve the quadratic

$$y(7+2y)=3+y \;\Rightarrow\; 2y^2+6y-3=0 \;\Rightarrow\; y=\frac{-6\pm\sqrt{36+24}}{4}=\frac{-3\pm\sqrt{15}}{2}.$$

Since $y>0$, $y=\frac{\sqrt{15}-3}{2}\approx 0.436$.

Step 3: Check Numerically $\cfrac{1}{2+\frac{1}{3.436}}=\frac{1}{2.291}\approx 0.436$, which agrees. Option (B), $\frac{\sqrt{11}-3}{2}\approx 0.158$, does not match, and the options with $+3$ have values above 2, but $y<\frac{1}{2}$ since the denominator exceeds 2.

Step 4: Conclusion $y=\frac{\sqrt{15}-3}{2}$. Hence, the correct option is (D).

Quick Tip to Solve: Spot the repeating block, write y = (3 + y)/(7 + 2y), and remember y < 1/2, which kills every option with +3.

49. Karan and Arjun run a 100-meter race, where Karan beats Arjun 10 metres. To do a favour to Arjun, Karan starts 10 metres behind the starting line in a second 100 metre race. They both run at their earlier speeds. Which of the following is true in connection with the second race? [1 mark]

(A) Karan and Arjun reach the finishing line simultaneously.

(B) Arjun beats Karan by 1 metre

(C) Arjun beats Karan by 11 metres.

(D) Karan beats Arjun by 1 metre.

Correct Answer: (D) Karan beats Arjun by 1 metre.

Solution:

Concept:

- In the same time, the distances run are in the ratio of the speeds.
- Compare the distances covered in the time the faster runner takes to finish.

Step 1: Speeds from the first race When Karan has run 100 m, Arjun has run $100 - 10 = 90$ m in the same time, so

$$v_K : v_A = 100 : 90 = 10 : 9.$$

Step 2: Second race Karan now has to run 110 m while Arjun runs 100 m. Let $v_K = 10u$, $v_A = 9u$. Karan takes $\frac{110}{10u} = \frac{11}{u}$ and Arjun takes $\frac{100}{9u} = \frac{11.11}{u}$, so Karan reaches the line first.

Step 3: Gap when Karan finishes In time $\frac{11}{u}$ Arjun covers $9u \times \frac{11}{u} = 99$ m, so he is $100 - 99 = 1$ m short of the line. Hence Karan beats Arjun by 1 m. Option (A) is false since the times differ, and options (B) and (C) have Arjun winning, which is false.

Step 4: Conclusion Karan beats Arjun by 1 metre. Hence, the correct option is (D).

Quick Tip to Solve: Speeds are 10 : 9, so in the time Karan covers 110 m, Arjun covers 99 m; the 1 m gap is in Karan's favour.

50. N persons stand on the circumference of a circle at distinct points. Each possible pair of persons, not standing next to each other, sings a two-minute song one pair after the other. If the total time taken for singing is 28 minutes, what is N? [1 mark]

(A) 5

(B) 7

(C) 9

(D) None of the above

Correct Answer: (B) 7

Solution:

Concept:

- Pairs from N persons: $\binom{N}{2}$. Of these, N pairs are neighbours on the circle.

- So pairs not standing next to each other $= \binom{N}{2} - N = \dfrac{N(N-3)}{2}$, the number of diagonals of an N-gon.

Step 1: Number of songs Each song lasts 2 minutes and the total time is 28 minutes, so the number of songs is $28/2 = 14$.

Step 2: Form the equation

$$\frac{N(N-3)}{2} = 14 \;\Rightarrow\; N^2 - 3N - 28 = 0 \;\Rightarrow\; (N-7)(N+4) = 0.$$

Since $N > 0$, $N = 7$.

Step 3: Verify For $N = 7$: $\binom{7}{2} - 7 = 21 - 7 = 14$ pairs, i.e. $14 \times 2 = 28$ minutes, as required. For $N = 5$ the number of non-adjacent pairs is $\dfrac{5 \times 2}{2} = 5$ (10 minutes) and for $N = 9$ it is $\dfrac{9 \times 6}{2} = 27$ (54 minutes), so options (A) and (C) fail. Because $N = 7$ is itself one of the printed options, "None of the above" (D) cannot be correct. The quadratic has only one admissible root, so there is no second possible value of N.

Step 4: Conclusion $N = 7$. Hence, the correct option is (B).

Quick Tip to Solve: Non-adjacent pairs on a circle number N(N - 3)/2; set it equal to 14 songs and solve the quadratic.

51. In NutsAndBolts factory, one machine produces only nuts at the rate of 100 nuts per minute and needs to be cleaned for 5 minutes after production of every 1000 nuts.

Another machine produces only bolts at the rate of 75 bolts per minute and needs to be cleaned for 10 minutes after production of every 1500 bolts. If both the machines start production at the same time, what is the minimum duration required for producing 9000 pairs of nuts and bolts? [1 mark]

(A) 130 minutes

(B) 135 minutes

(C) 170 minutes

(D) 180 minutes

Correct Answer: (C) 170 minutes

Solution:

Concept:

- Total time of a machine = production time + cleaning time, and cleaning is needed only between batches (none is needed after the last item is made).
- Both machines run in parallel, so the required duration is the larger of the two times.

Step 1: Machine making nuts Production: $9000/100 = 90$ minutes. Cleaning is needed after every 1000 nuts, i.e. after 1000, 2000, ..., 8000 (8 times; none after the final 9000th nut). Cleaning time $= 8 \times 5 = 40$ minutes. Total $= 90 + 40 = 130$ minutes.

Step 2: Machine making bolts Production: $9000/75 = 120$ minutes. Cleaning is needed after 1500,

3000, 4500, 6000, 7500 bolts (5 times; none after the last batch at 9000). Cleaning time $= 5 \times 10 = 50$ minutes. Total $= 120 + 50 = 170$ minutes.

Step 3: Minimum duration for 9000 pairs A pair needs one nut and one bolt, so production ends when the slower machine finishes: $\max(130, 170) = 170$ minutes. Options (A) and (B) (130 or 135) would leave the bolts unfinished, and 180 minutes (D) wrongly counts a cleaning after the last batch of bolts.

Step 4: Conclusion The minimum duration is 170 minutes. Hence, the correct option is (C).

Quick Tip to Solve: Count cleanings as batches minus one (8 for nuts, 5 for bolts); the bolt machine takes 120 + 50 = 170 minutes and decides the answer.

52. A father and his son are waiting at a bus stop in the evening. There is a lamp post behind them. The lamp post, the father and his son stand on the same straight line. The father observes that the shadows of his head and his son's head are incident at the same point on the ground. If the heights of the lamp post, the father and his son are 6 metres, 1.8 metres and 0.9 metres respectively, and the father is standing 2.1 metres away from the post then how far (in metres) is son standing form his father? [1 mark]

(A) 0.9

(B) 0.75

(C) 0.6

(D) 0.45

Correct Answer: (D) 0.45

Solution:

Concept:

- The lamp post, father and son are all vertical, so the triangles formed with their shadows are similar right triangles (AA).
- The shadows of both heads end at the same point on the ground, so both shadow tips coincide.

Step 1: Find where the shadow tip lies Let the father's shadow length be s. Similar triangles (lamp post 6 m, father 1.8 m):

$$\frac{6}{2.1 + s} = \frac{1.8}{s} \Rightarrow 6s = 3.78 + 1.8s \Rightarrow s = 0.9 \text{ m}.$$

So the tip is $2.1 + 0.9 = 3.0$ m from the post.

Step 2: Position of the son Let the son stand d m from the post, with shadow $3 - d$. Similar triangles with the son's height 0.9 m:

$$\frac{6}{3} = \frac{0.9}{3 - d} \Rightarrow 3 - d = 0.45 \Rightarrow d = 2.55 \text{ m}.$$

Step 3: Distance between son and father

$$2.55 - 2.1 = 0.45 \text{ m}.$$

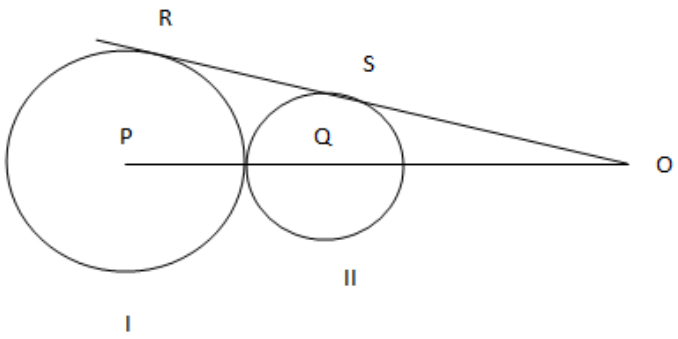
Check: the son's shadow is 0.45 m, and the father's is 0.9 m; the son stands exactly 0.45 m behind his father, which matches option (D). Options (A), (B) and (C) do not satisfy the similar-triangle equations.

Step 4: Conclusion The son stands 0.45 m from his father. Hence, the correct option is (D).

Quick Tip to Solve: The son's shadow is 0.45 m (from 6/3 = 0.9/shadow), and the tip is 3.0 m from the post, so he is at 2.55 m, 0.45 m past the father.

Questions 53–55. Directions for the following three questions: Answer the questions on the basis of the information given below

In the adjoining figure I and II are circles with centres P and Q respectively, The two circles touch each other and have common tangent that touches them at points R and S respectively. This common tangent meets the line joining P and Q at O. The diameters of I and II are in the ratio 4: 3. It is also known that the length of PO is 28 cm.



53. What is the ratio of the length of PQ to that of QO? [1 mark]

(A) 1 : 4

(B) 1 : 3

(C) 3 : 8

(D) 3 : 4

Correct Answer: (B) 1 : 3

Solution:

Concept:

- Tangent is perpendicular to the radius at the point of contact, so $PR \perp RO$ and $QS \perp SO$; hence $\triangle PRO \sim \triangle QSO$.
- Two circles touching externally have $PQ = r_1 + r_2$, where r_1, r_2 are the radii, and P, Q, O are collinear.

Step 1: Set up the radii and lengths The diameters are in the ratio $4:3$, so the radii are $PR = 4k$ and $QS = 3k$. The circles touch externally, so

$$PQ = 4k + 3k = 7k, \qquad QO = PO - PQ = 28 - 7k.$$

Step 2: Use similar triangles $PR \perp RO$ and $QS \perp SO$, so $PR \parallel QS$ and $\triangle PRO \sim \triangle QSO$. Therefore

$$\frac{PR}{QS} = \frac{PO}{QO} \Rightarrow \frac{4k}{3k} = \frac{28}{28 - 7k} \Rightarrow 4(28 - 7k) = 84 \Rightarrow 112 - 28k = 84 \Rightarrow k = 1.$$

Step 3: Find the required ratio With $k = 1$: $PQ = 7$ cm and $QO = 28 - 7 = 21$ cm. Hence

$$PQ : QO = 7 : 21 = 1 : 3.$$

Check of the other options: $1:4$ is the ratio $PQ : PO = 7 : 28$ and $3:4$ is the ratio $QO : PO = 21 : 28$, neither of which is the ratio asked for; $3:8$ does not match $7:21$.

Step 4: Conclusion $PQ : QO = 1 : 3$. Hence, the correct option is (B).

Quick Tip to Solve: Write the radii as 4k and 3k, equate the ratio PO/QO to 4/3 (similar right triangles) and solve for k; the rest follows quickly.

54. What is the radius of the circle II? [1 mark]

(A) 2 cm

(B) 3 cm

(C) 4 cm

(D) 5 cm

Correct Answer: (B) 3 cm

Solution:

Concept:

- Radii PR and QS are perpendicular to the common tangent, so $PR \parallel QS$ and $\triangle OQS \sim \triangle OPR$.
- For circles touching externally, $PQ = r_1 + r_2$, and P, Q, O lie on one line.

Step 1: Express the radii in terms of one unknown The diameters are in the ratio $4:3$, so the radii are $PR = 4k$ cm and $QS = 3k$ cm. Then $PQ = 7k$ cm and $QO = PO - PQ = (28 - 7k)$ cm.

Step 2: Apply similarity of triangles PRO and QSO

$$\frac{PR}{QS} = \frac{PO}{QO} \Rightarrow \frac{4k}{3k} = \frac{28}{28 - 7k}.$$

Cross-multiplying, $4(28 - 7k) = 3 \times 28$, i.e. $112 - 28k = 84$, so $28k = 28$ and $k = 1$.

Step 3: Read off the radius of circle II Radius of circle II $= QS = 3k = 3$ cm and radius of circle I $= 4$ cm. Check: $PQ = 7$, $QO = 21$, and $PO = 7 + 21 = 28$ cm, as given. The value 4 cm is the radius of circle I, not of circle II. Also, similarity gives $PO = 4\,PQ = 28k$, so the options 2, 4 and 5 cm, which

mean $k = \frac{2}{3}, \frac{4}{3}, \frac{5}{3}$, do not satisfy $PO = 28$.

Step 4: Conclusion The radius of circle II is 3 cm. Hence, the correct option is (B).

Quick Tip to Solve: Take radii $4k$ and $3k$; $PO/QO = 4/3$ gives $QO = 21$, so $PQ = 7 = 7k$ and $k = 1$; radius of II $= 3$ cm.

55. The length of SO is [1 mark]

(A) $8\sqrt{3}$ cm

(B) $10\sqrt{3}$ cm

(C) $12\sqrt{3}$ cm

(D) $14\sqrt{3}$ cm

Correct Answer: (C) $12\sqrt{3}$ cm

Solution:

Concept:

- A tangent is perpendicular to the radius at the point of contact, so $\triangle QSO$ is right-angled at S.
- Pythagoras theorem: $SO^2 = QO^2 - QS^2$.

Step 1: Find the radii and QO Let the radii be $PR = 4k$ and $QS = 3k$. Then $PQ = 7k$ and $QO = 28 - 7k$. Since $PR \parallel QS$, $\triangle PRO \sim \triangle QSO$, so

$$\frac{4k}{3k} = \frac{28}{28 - 7k} \Rightarrow k = 1.$$

Hence $QS = 3$ cm, $PQ = 7$ cm and $QO = 28 - 7 = 21$ cm.

Step 2: Apply Pythagoras theorem in $\triangle QSO$ As $QS \perp SO$,

$$SO = \sqrt{QO^2 - QS^2} = \sqrt{21^2 - 3^2} = \sqrt{441 - 9} = \sqrt{432} = \sqrt{144 \times 3} = 12\sqrt{3} \text{ cm}.$$

Step 3: Check against the options Cross-check with the larger triangle: $RO = \sqrt{28^2 - 4^2} = \sqrt{768} = 16\sqrt{3}$, so $RS = RO - SO = 16\sqrt{3} - 12\sqrt{3} = 4\sqrt{3}$. This agrees with the length of the direct common tangent of two externally touching circles, $2\sqrt{r_1 r_2} = 2\sqrt{4 \times 3} = 4\sqrt{3}$. Options $8\sqrt{3}, 10\sqrt{3}, 14\sqrt{3}$ do not satisfy $SO^2 = 432$ (they give 192, 300 and 588).

Step 4: Conclusion $SO = 12\sqrt{3}$ cm. Hence, the correct option is (C).

Quick Tip to Solve: After finding QO = 21 and QS = 3, use $SO = \sqrt{21^2 - 3^2} = \sqrt{432}$; since $432 = 144 \times 3$, $SO = 12\sqrt{3}$.

56. Let $f(x) = ax^2 - b|x|$, where a and b are constants. Then at x = 0, f(x) is [1 mark]

(A) maximized whenever a > 0, b > 0

(B) maximized whenever a > 0, b < 0

(C) minimized whenever a > 0, b > 0

(D) minimized whenever a > 0, b< 0

Correct Answer: (D) minimized whenever a > 0, b< 0

Solution:

Concept:

- For $f(x) = ax^2 - b|x|$ we have $f(0) = 0$, and $f(x) = |x|\,(a|x| - b)$ because $x^2 = |x|^2$.
- To decide whether $x = 0$ gives a minimum or a maximum, compare $f(x)$ with $f(0) = 0$ for all x.

Step 1: Write $f(x)$ in terms of $|x|$

$$f(x) = a|x|^2 - b|x| = |x|\,\big(a|x| - b\big), \qquad f(0) = 0.$$

The sign of $f(x)$ compared with $f(0) = 0$ decides whether $x = 0$ is a minimum or a maximum.

Step 2: Case $a > 0,\ b < 0$ Put $b = -c$ with $c > 0$. Then $f(x) = ax^2 + c|x| \geq 0$ for every real x, and it equals 0 only at $x = 0$. So f has its least value at $x = 0$: f is *minimized* at $x = 0$. This is option (D).

Step 3: Case $a > 0,\ b > 0$ Here $f(x) = |x|(a|x| - b) < 0$ for $0 < |x| < b/a$, so $f(0) = 0$ is larger than the nearby values and 0 is not a minimum. Yet $f(x) \to +\infty$ as $|x| \to \infty$ because $a > 0$, so 0 is only a local peak and f is not maximized at $x = 0$. This rules out (A) and (C).

Step 4: Remaining option Option (B) (maximized for $a > 0,\ b < 0$) fails, since then $f(x) = ax^2 + c|x| \geq 0$ is never below $f(0)$ and grows without bound. Only (D) holds.

Step 5: Conclusion At $x = 0$, $f(x)$ is minimized whenever $a > 0$ and $b < 0$. Hence, the correct option is (D).

Quick Tip to Solve: Test the sign: with a>0 and b<0 both terms ax^2 and $-b|x|$ are non-negative, so f(0)$=0$ is the smallest value.

57. Each family in a locality has at most two adults, and no family has fewer than 3 children. Considering all the families together, there are more adults than boys, more boys than girls, and more girls than families.

Then the minimum possible number of families in the locality is [1 mark]

(A) 4

(B) 5

(C) 2

(D) 3

Correct Answer: (D) 3

Solution:

Concept:

- Let F be the number of families, A adults, B boys and G girls; translate each condition into an inequality in integers.
- For integers, a strict inequality $x > y$ means $x \geq y + 1$.

Step 1: Translate the conditions At most two adults per family: $A \leq 2F$. At least three children per family: $B + G \geq 3F$. Also $A > B > G > F$.

Step 2: Chain the integer inequalities Since all quantities are integers, $G \geq F + 1$, $B \geq G + 1 \geq F + 2$, and $A \geq B + 1 \geq F + 3$. Combining with $A \leq 2F$: $F + 3 \leq 2F$, so $F \geq 3$.

Step 3: Check that $F = 3$ is possible Take $F = 3$: $A \leq 6$, $G \geq 4$, $B \geq 5$, $A \geq 6$. So $A = 6$, $B = 5$, $G = 4$ satisfies $6 > 5 > 4 > 3$. Children number $B + G = 9 = 3F$, which meets "at least three children per family". For example, two families have 2 boys and 1 girl, and the third has 1 boy and 2 girls (total 5 boys, 4 girls).

Step 4: Eliminate the other options $F = 2$ in (C) is impossible because $F \geq 3$ is forced, and 4 or 5 in (A), (B) are not the minimum since 3 already works.

Step 5: Conclusion The minimum possible number of families is 3. Hence, the correct option is (D).

Quick Tip to Solve: Strict inequalities on counts add 1 at each step: $F + 3 \leq A \leq 2F$ gives $F \geq 3$ at once.

58. The total number of integers pairs (x, y) satisfying the equation x + y = xy is [1 mark]

(A) 0

(B) 1

(C) 2

(D) None of the above

Correct Answer: (C) 2

Solution:

Concept:

- Rewrite $x + y = xy$ as $(x - 1)(y - 1) = 1$; a product of two integers equals 1 only when both are 1 or both are -1.

Step 1: Factorise the equation

$$xy - x - y = 0 \;\Rightarrow\; xy - x - y + 1 = 1 \;\Rightarrow\; (x - 1)(y - 1) = 1.$$

Step 2: List integer solutions Since $x - 1$ and $y - 1$ are integers with product 1, either both equal 1 or both equal -1. $x - 1 = y - 1 = 1$ gives $(x, y) = (2, 2)$; $x - 1 = y - 1 = -1$ gives $(x, y) = (0, 0)$.

Step 3: Why no other integer pair exists If $|x - 1| \geq 2$, then $|y - 1| = 1/|x - 1| \leq \frac{1}{2}$ cannot be a non-zero integer, and $x - 1 = 0$ would make the product $0 \neq 1$. So $x - 1$ must be ± 1, and $y - 1$ has the same sign and size.

Step 4: Verify and count Check: $2 + 2 = 4 = 2 \times 2$ and $0 + 0 = 0 = 0 \times 0$. No other integer pair works, because 1 has only the factorisations $1 \cdot 1$ and $(-1)(-1)$. So there are exactly two pairs, which eliminates (A) 0, (B) 1 and (D) "none of the above".

Step 5: Conclusion There are exactly 2 integer pairs, namely $(2, 2)$ and $(0, 0)$. Hence, the correct option is (C).

Quick Tip to Solve: Whenever you see $x + y = xy$, add 1 to both sides to get $(x - 1)(y - 1) = 1$ and list the factor pairs of 1.

59. Let C be a circle with centre P_0 and AB be a diameter of C. Suppose P_1 is the mid point of the line segment P_0B,P_2 is the mid point of the line segment P_1B and so on. Let $C_1, C_2, C_3, \ldots$ be circles with diameters $P_0P_1, P_1P_2, P_2P_3 \ldots$ respectively. Suppose the circles $C_1, C_2, C_3, \ldots$ are all shaded. The ratio of the area of the unshaded portion of C to that of the original circle is [2 marks]

(A) 8 : 9

(B) 9 : 10

(C) 10 : 11

(D) 11 : 12

Correct Answer: (D) 11 : 12

Solution:

Concept:

- Area of a circle of radius r is πr^2; the radii of $C_1, C_2, \ldots$ form a geometric progression.
- Sum of an infinite GP: $S_\infty = \dfrac{a}{1-r}$ for $|r| < 1$.

Step 1: Find the radii of the shaded circles Let the radius of C be R, so $P_0B = R$. Then $P_0P_1 = \dfrac{R}{2}$, $P_1P_2 = \dfrac{R}{4}$, $P_2P_3 = \dfrac{R}{8}, \ldots$ because each P_n is the midpoint of $P_{n-1}B$. These are the diameters of $C_1, C_2, C_3, \ldots$, so their radii are $\dfrac{R}{4}$, $\dfrac{R}{8}$, $\dfrac{R}{16}, \ldots$

Step 2: Add the shaded areas

$$\text{Shaded} = \pi\left(\frac{R^2}{16} + \frac{R^2}{64} + \frac{R^2}{256} + \cdots\right) = \pi R^2 \cdot \frac{1/16}{1 - 1/4} = \frac{\pi R^2}{12}.$$

The circles lie along the diameter without overlapping, since each touches the next at a single point.

Step 3: Ratio of the unshaded area to the whole circle

$$\frac{\text{Unshaded}}{\text{Area of } C} = \frac{\pi R^2 - \pi R^2/12}{\pi R^2} = \frac{11}{12}.$$

So the ratio is $11 : 12$. The other options $8 : 9$, $9 : 10$, $10 : 11$ would need shaded fractions $1/9$, $1/10$, $1/11$, none of which equals $1/12$.

Step 4: Conclusion The unshaded area is to the area of the original circle as $11 : 12$. Hence, the correct option is (D).

Quick Tip to Solve: The shaded areas form a GP with first term $\pi R^2/16$ and ratio $1/4$; the sum is $\frac{1/16}{3/4} = \frac{1}{12}$ of the big circle.

60. Consider the sequence of numbers a_1, a_2, a_3..... to infinity where $a_1 = 81.33$ and $a_2 = -19$ and $a_j = a_{j-1} - a_{j-2}$ for $j \geq 3$. What is the sum of the first 6002 terms of this sequence? [2 marks]

(A) -100.33

(B) -30.00

(C) 62.33

(D) 119.33

Correct Answer: (C) 62.33

Solution:

Concept:

- For a recurrence $a_j = a_{j-1} - a_{j-2}$ the sequence repeats after a few terms; find the period and the sum over one period.

Step 1: Generate the first few terms With $a_1 = 81.33$ and $a_2 = -19$:

$$a_3 = a_2 - a_1 = -100.33, \quad a_4 = a_3 - a_2 = -81.33, \quad a_5 = a_4 - a_3 = 19, \quad a_6 = a_5 - a_4 = 100.33.$$

Then $a_7 = a_6 - a_5 = 81.33 = a_1$ and $a_8 = a_7 - a_6 = -19 = a_2$, so the sequence repeats with period 6.

Step 2: Sum over one period

$$a_1 + \cdots + a_6 = 81.33 - 19 - 100.33 - 81.33 + 19 + 100.33 = 0.$$

Each block of six consecutive terms therefore adds up to zero.

Step 3: Sum of the first 6002 terms $6002 = 6 \times 1000 + 2$. The first 6000 terms form 1000 complete periods with total 0. The remaining terms are $a_{6001} = a_1$ and $a_{6002} = a_2$:

$$S_{6002} = a_1 + a_2 = 81.33 - 19 = 62.33.$$

The values in (A), (B) and (D) do not arise: -100.33 is only the single term a_3, and no partial sum of the cycle equals -30.00 or 119.33.

Step 4: Conclusion The sum of the first 6002 terms is 62.33. Hence, the correct option is (C).

Quick Tip to Solve: For $a_j = a_{j-1} - a_{j-2}$ the period is always 6 and a full period sums to 0, so only the $6002 \bmod 6 = 2$ leftover terms matter.

61. A sprinter starts running on a circular path of radius r metres. Her average speed (in metres/minute) is π r during the first 30 seconds, π r/2 during next one minute, π r/4 during next 2 minutes, π r/8 during next 4 minutes, and so on. What is the ratio of the time taken for the nth round to that for the previous round? [2 marks]

(A) 4

(B) 8

(C) 16

(D) 32

Correct Answer: (C) 16

Solution:

Concept:

- Distance = speed $\times$ time; the circumference of the path is $2\pi r$, and one round means covering $2\pi r$.

Step 1: Distance covered in each stage Stage 1: speed πr m/min for 0.5 min gives $\frac{\pi r}{2}$. Stage 2: speed $\frac{\pi r}{2}$ for 1 min gives $\frac{\pi r}{2}$. Stage 3: speed $\frac{\pi r}{4}$ for 2 min gives $\frac{\pi r}{2}$. Stage 4: speed $\frac{\pi r}{8}$ for 4 min gives $\frac{\pi r}{2}$, and so on. Every stage covers $\frac{\pi r}{2}$, which is one quarter of the circumference $2\pi r$.

Step 2: Time per round One round needs 4 stages. The stage durations (in minutes) are $\frac{1}{2}, 1, 2, 4, 8, \ldots$, a GP with ratio 2. Round 1 takes stages 1 to 4: $\frac{1}{2}(1+2+4+8) = \frac{15}{2}$ min. Round 2 takes stages 5 to 8, each stage being $2^4 = 16$ times the corresponding stage of round 1.

Step 3: Ratio of successive rounds The time for round n is $\frac{1}{2}(2^{4n-4})(1+2+4+8)$, and for round $n-1$ it is $\frac{1}{2}(2^{4n-8})(1+2+4+8)$. Hence

$$\frac{T_n}{T_{n-1}} = 2^4 = 16.$$

A ratio of 4 or 8 would arise only if one round took 2 or 3 stages, but a round is exactly 4 stages; and 32 would need 5 stages.

Step 4: Conclusion The time for each round is 16 times that of the previous round. Hence, the correct option is (C).

Quick Tip to Solve: Find the distance per stage first: it is constant at $\pi r/2$, a quarter of the track, so a round is 4 stages and the time ratio is $2^4 = 16$.

62. Let $u = (\log_2 x)^2 - 6\log_2 x + 12$ where x is a real number. Then the equation $x^u = 256$, has [2 marks]

(A) no solution for x

(B) exactly one solution for x

(C) exactly two distinct solutions for x

(D) exactly three distinct solutions for x

Correct Answer: (B) exactly one solution for x

Solution:

Concept:

- Take $\log_2$ of both sides of $x^u = 256$ and use $\log_2 x^u = u \log_2 x$ with $256 = 2^8$.
- Substituting $t = \log_2 x$ turns the problem into a polynomial equation in t; each real t gives exactly one positive $x = 2^t$.

Step 1: Put $t = \log_2 x$ Then $u = t^2 - 6t + 12$, and taking $\log_2$ of $x^u = 256$ gives $u\,t = 8$:

$$t\,(t^2 - 6t + 12) = 8 \;\Rightarrow\; t^3 - 6t^2 + 12t - 8 = 0.$$

Step 2: Factorise the cubic The left side is a perfect cube: $t^3 - 6t^2 + 12t - 8 = (t-2)^3$. So $(t-2)^3 = 0$ and $t = 2$ is the only real root (repeated three times).

Step 3: Count distinct solutions for x $t = 2$ gives $x = 2^2 = 4$. Check: $u = 4 - 12 + 12 = 4$ and $4^4 = 256$. There is only one distinct value of x, although the root repeats thrice, so "three distinct solutions" in (D) is wrong; (C) is wrong since no second root exists, and (A) is wrong since $x = 4$ works.

Step 4: Conclusion The equation has exactly one solution, $x = 4$. Hence, the correct option is (B).

Quick Tip to Solve: Spot the pattern $t(t^2 - 6t + 12) = 8 \Rightarrow (t-2)^3 = 0$: a repeated root means one distinct solution, not three.

Questions 63–64. Directions for the following two questions:

Answer the questions on the basis of the information given below.

$f_1(x) = x$ **if** $0 \le x \le 1$

$f_1(x) = 1$ **if x >= 1**

$f_1(x) = 0$ **otherwise**

$f_2(x) = f_1(-x)$ **for all x**

$f_3(x) = -f_2(x)$ **for all x**

$f_4(x) = f_3(-x)$ **for all x**

63. How many of the following products are necessarily zero for every x:

$$f_1(x)f_2(x), f_2(x)f_3(x), f_2(x)f_4(x)$$

[2 marks]

(A) 0

(B) 1

(C) 2

(D) 3

Correct Answer: (C) 2

Solution:

Concept:

- A product $g(x)h(x)$ is zero for every x only if at each x at least one of $g(x), h(x)$ is zero, i.e. the sets where the two functions are non-zero do not overlap.
- Replacing x by $-x$ reflects a graph in the y-axis; multiplying a function by -1 reflects it in the x-axis.

Step 1: Write out f_1 and the derived functions $f_1(x) = x$ for $0 \le x \le 1$, $f_1(x) = 1$ for $x \ge 1$ and $f_1(x) = 0$ for $x < 0$. So f_1 is non-zero only for $x > 0$.

$f_2(x) = f_1(-x)$: this equals $-x$ for $-1 \le x \le 0$, equals 1 for $x \le -1$, and is 0 for $x > 0$. So f_2 is non-zero only for $x < 0$.

$f_3(x) = -f_2(x)$: this equals x for $-1 \le x \le 0$, equals -1 for $x \le -1$, and is 0 for $x > 0$. So f_3 is non-zero only for $x < 0$.

$f_4(x) = f_3(-x)$: this equals $-x$ for $0 \le x \le 1$, equals -1 for $x \ge 1$, and is 0 for $x < 0$. Thus $f_4(x) = -f_1(x)$, non-zero only for $x > 0$.

Step 2: Test each product $f_1(x)f_2(x)$: f_1 is non-zero only for $x > 0$ and f_2 only for $x < 0$. They never are non-zero together (at $x = 0$ both vanish), so the product is 0 for every x.

$f_2(x)f_3(x) = -[f_2(x)]^2$. At $x = -1$, $f_2 = 1$ and $f_3 = -1$, so the product is $-1 \neq 0$. It is not zero for every x.

$f_2(x)f_4(x)$: f_2 is non-zero only for $x < 0$ and f_4 only for $x > 0$, so again the product is 0 for every x.

Step 3: Count Two of the three products (the first and the third) are necessarily zero for every x.

Step 4: Conclusion Exactly 2 of the products are zero for all x, so the correct option is (C).

Quick Tip to Solve: Sketch the supports: f_1, f_4 live on $x > 0$ and f_2, f_3 on $x < 0$; a product of one function from each side is always zero, while a product within the same side is not.

64. Which of the following is necessarily true? [2 marks]

(A) $f_4(x) = f_1(x)$ for all x

(B) $f_1(x) = -f_3(-x)$ for all x

(C) $f_2(-x) = f_4(x)$ for all x

(D) $f_1(x) + f_3(x) = 0$ for all x

Correct Answer: (B) $f_1(x) = -f_3(-x)$ for all x

Solution:

Concept:

- From the definitions: $f_2(x) = f_1(-x)$, $f_3(x) = -f_2(x) = -f_1(-x)$ and $f_4(x) = f_3(-x) = -f_2(-x) = -f_1(x)$.
- A statement is "necessarily true" only if it holds for every x, so one counter-example rejects an option.

Step 1: Express every function through f_1 $f_2(x) = f_1(-x)$.

$f_3(x) = -f_2(x) = -f_1(-x)$.

$f_4(x) = f_3(-x) = -f_1(-(-x)) = -f_1(x)$.

Step 2: Test options (A) and (C) (A) $f_4(x) = -f_1(x)$, so $f_4 = f_1$ only where $f_1 = 0$. At $x = 1$, $f_4(1) = -1 \neq f_1(1) = 1$. False.

(C) $f_2(-x) = f_1(x)$, whereas $f_4(x) = -f_1(x)$. At $x = 1$ these are 1 and -1. False.

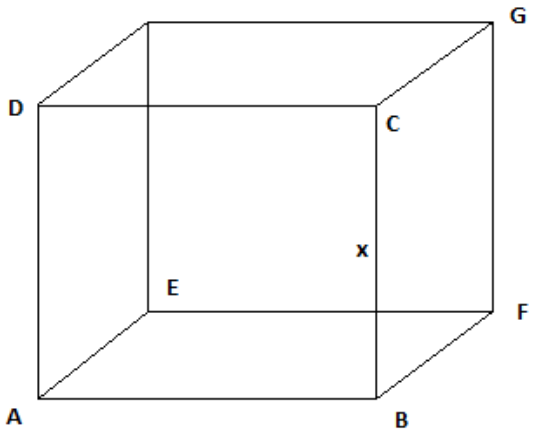
Step 3: Test options (B) and (D) (B) $f_3(-x) = -f_1(-(-x)) = -f_1(x)$, hence $-f_3(-x) = f_1(x)$ for all x. True.

(D) $f_1(x) + f_3(x) = 0$ would need $f_3 = -f_1$. At $x = 1$, $f_1(1) = 1$ but $f_3(1) = -f_2(1) = -f_1(-1) = 0$, so the sum is $1 \neq 0$. False.

Step 4: Conclusion Only the statement $f_1(x) = -f_3(-x)$ holds for all x. Hence, the correct option is (B).

Quick Tip to Solve: First reduce every f_i to $\pm f_1(\pm x)$ (here $f_4 = -f_1$); then each option can be checked by a single value such as $x = 1$.

65. If the lengths of diagonals DF, AG and CE of the cube shown in the adjoining figure are equal to the three sides of a triangle, then the radius of the circle circumscribing that triangle will be? [2 marks]



(A) equal to the side of the cube

(B) $\sqrt{3}$ times the side of the cube

(C) $1/\sqrt{3}$ times the side of the cube

(D) impossible to find from the given information

Correct Answer: (A) equal to the side of the cube

Solution:

Concept:

- A cube of side a has four equal space diagonals, each of length $a\sqrt{3}$.
- A triangle with all sides equal is equilateral, and its circumradius is $R = \dfrac{\text{side}}{\sqrt{3}}$ (from $R = \dfrac{abc}{4\Delta}$).

Step 1: Identify the three segments In the figure, D (top front left) and F (bottom back right) are opposite vertices of the cube. So are A (bottom front left) and G (top back right), and so are C (top front right) and E (bottom back left). So DF, AG and CE are three of the four space diagonals. Each has length $\sqrt{a^2 + a^2 + a^2} = a\sqrt{3}$, where a is the side of the cube.

Step 2: Triangle formed by them The triangle has sides $a\sqrt{3},\ a\sqrt{3},\ a\sqrt{3}$, so it is equilateral with side $s = a\sqrt{3}$.

Step 3: Circumradius For an equilateral triangle, area $\Delta = \dfrac{\sqrt{3}}{4}s^2$, hence

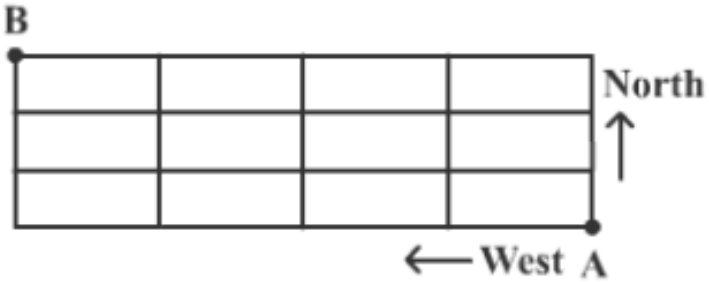
$$R = \frac{s \cdot s \cdot s}{4\Delta} = \frac{s^3}{\sqrt{3}\,s^2} = \frac{s}{\sqrt{3}} = \frac{a\sqrt{3}}{\sqrt{3}} = a.$$

The information is sufficient, so (D) is wrong; (B) $a\sqrt{3}$ is merely the side of the triangle and (C) $a/\sqrt{3}$ is not the circumradius.

Step 4: Conclusion The circumradius equals the side of the cube. Hence, the correct option is (A).

Quick Tip to Solve: All space diagonals of a cube are equal, so the triangle is equilateral; circumradius is side divided by $\sqrt{3}$, and $a\sqrt{3}/\sqrt{3} = a$.

66. In the adjoining figure, the lines represent one-way roads allowing travel only northwards or only westwards. Along how many distinct routes can a car reach point B from point A? [2 marks]



(A) 15

(B) 35

(C) 120

(D) 336

Correct Answer: (B) 35

Solution:

Concept:

- In a grid where only two kinds of moves are allowed, every route is an arrangement of those moves: with m moves of one kind and n of the other, the number of routes is $\dfrac{(m+n)!}{m!\,n!} = {}^{m+n}C_n$.

Step 1: Read the grid The figure is a grid of 4 cells along the west direction and 3 cells along the north direction (5 vertical and 4 horizontal lines). A is at the bottom right corner and B at the top left corner.

Travel is allowed only north or west. So to go from A to B the car must make exactly 4 moves West (W) and 3 moves North (N), a total of 7 moves.

Step 2: Count the arrangements Every route is a sequence of 7 moves containing 4 W's and 3 N's, and each such sequence gives a distinct route along the roads. Therefore

$$\text{number of routes} = {}^{7}C_3 = \frac{7!}{3!\,4!} = \frac{7\cdot 6\cdot 5}{3\cdot 2\cdot 1} = 35.$$

Option (A) 15 would be ${}^{6}C_2$, the count for a grid with only 6 moves, and (C) 120 and (D) 336 ($= 8\cdot 7\cdot 6$) treat the moves as ordered selections, although the 4 W moves are alike and the 3 N moves are alike.

Step 3: Conclusion There are 35 distinct routes. Hence, the correct option is (B).

Quick Tip to Solve: For a grid with $m \times n$ cells and moves in only two directions, the routes number ${}^{m+n}C_m$; here ${}^{7}C_3 = 35$.

67. On a semicircle with diameter AD, chord BC is parallel to the diameter. Further; AD and BC are separated by 2cm, while AD has length 8. What is the length of BC? [2 marks]

(A) $2\sqrt{3}$

(B) $4\sqrt{3}$

(C) 8.6

(D) None of the above

Correct Answer: (B) $4\sqrt{3}$

Solution:

Concept:

- The perpendicular from the centre of a circle to a chord bisects the chord.
- In a circle of radius r, a chord at perpendicular distance d from the centre has length $2\sqrt{r^2 - d^2}$.

Step 1: Set up the semicircle AD is the diameter of length 8, so the centre O is its midpoint and the radius is $r = 4$ cm. Chord BC is parallel to AD and 2 cm from it, so the distance from O to the chord BC is $d = 2$ cm.

Step 2: Find the half-chord Let M be the foot of the perpendicular from O on BC. Then M is the midpoint of BC and, in right triangle OMB,

$$BM^2 = OB^2 - OM^2 = 4^2 - 2^2 = 12 \;\Rightarrow\; BM = 2\sqrt{3}.$$

Step 3: Length of BC

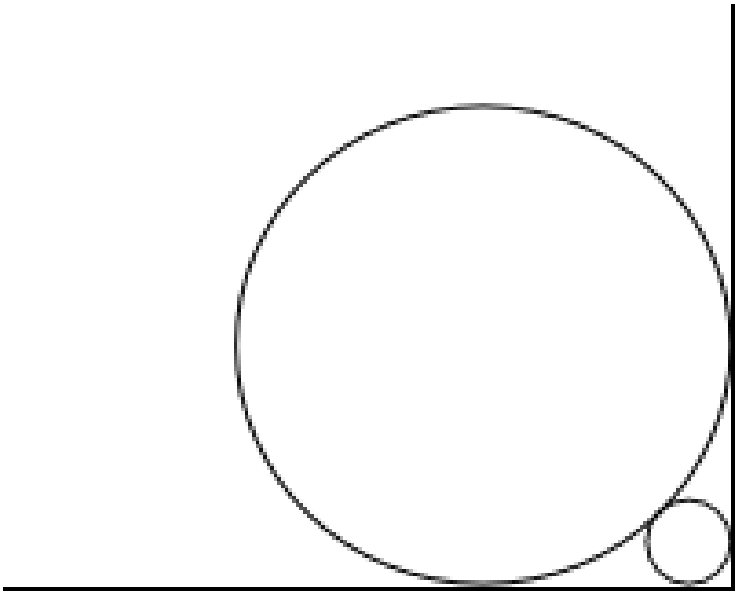
$$BC = 2\,BM = 2 \cdot 2\sqrt{3} = 4\sqrt{3} \text{ cm} \approx 6.93 \text{ cm}.$$

Option (A) $2\sqrt{3}$ is only half the chord, and (C) 8.6 is impossible, because no chord can be longer than the diameter 8. Since (B) is exact, (D) is not needed.

Step 4: Conclusion $BC = 4\sqrt{3}$, hence the correct option is (B).

Quick Tip to Solve: Drop a perpendicular from the centre to the chord and use chord $= 2\sqrt{r^2 - d^2}$; here $2\sqrt{16 - 4} = 4\sqrt{3}$.

68. A circle with radius 2 is placed against a right angle. Another smaller circle is also placed as shown in the adjoining figure. What is the radius of the smaller circle? [2 marks]



(A) $3 - 2\sqrt{2}$
(B) $4 - 2\sqrt{2}$
(C) $7 - 4\sqrt{2}$
(D) $6 - 4\sqrt{2}$

Correct Answer: (D) $6 - 4\sqrt{2}$

Solution:

Concept:

- A circle touching both arms of a right angle has its centre on the bisector of the angle, at distance $\sqrt{2} \times$(radius) from the vertex.
- Two circles touching externally have the distance between their centres equal to the sum of their radii.

Step 1: Place the circles in the corner In the figure the larger circle (radius 2) touches the two perpendicular lines, and the smaller circle (radius r) sits in the same corner touching both lines and the larger circle. Let V be the vertex of the right angle.

Both centres lie on the bisector of the angle at V. The centre of the larger circle is at distance $2\sqrt{2}$ from V and the centre of the smaller one at distance $r\sqrt{2}$.

Step 2: Use tangency of the two circles The distance between the centres is $2\sqrt{2} - r\sqrt{2}$, and it equals the sum of the radii, $2 + r$:

$$\sqrt{2}\,(2 - r) = 2 + r \;\Rightarrow\; 2\sqrt{2} - 2 = r(1 + \sqrt{2}).$$

Step 3: Solve for r

$$r = \frac{2(\sqrt{2}-1)}{\sqrt{2}+1} = 2(\sqrt{2}-1)^2 = 2(3-2\sqrt{2}) = 6-4\sqrt{2}.$$

Numerically $r \approx 0.343$, which matches the small circle in the figure (about one-sixth of the large radius). Options (A) $3-2\sqrt{2} \approx 0.17$, (B) $4-2\sqrt{2} \approx 1.17$ and (C) $7-4\sqrt{2} \approx 1.34$ give wrong values.

Step 4: Conclusion The radius of the smaller circle is $6-4\sqrt{2}$. Hence, the correct option is (D).

Quick Tip to Solve: For two circles in a right-angle corner, $\sqrt{2}(R-r) = R+r$, giving $r = R(\sqrt{2}-1)^2$; with $R=2$ this is $6-4\sqrt{2}$.

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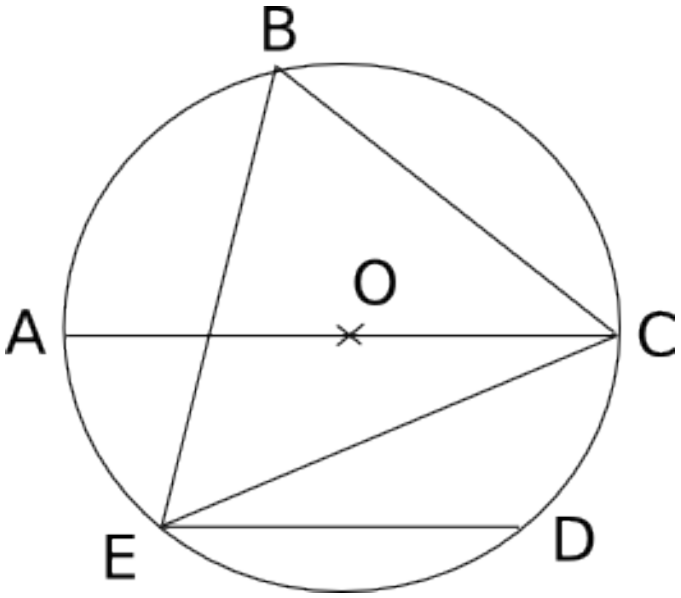
69. In the adjoining figure, chord ED is parallel to the diameter AC of the circle. If angle CBE = 65°, then what is the value of angle DEC? [2 marks]



(A) 35

(B) 55

(C) 45

(D) 25

Correct Answer: (D) 25

Solution:

Concept:

- Angles in the same segment (standing on the same chord) are equal.
- The angle in a semicircle is a right angle; alternate angles made by a transversal across parallel lines are equal.

Step 1: Angle EAC from the angle in the same segment $\angle CBE$ and $\angle CAE$ stand on the same chord

CE, and A and B lie on the same side of CE (both on the upper arc). Hence

$$\angle CAE = \angle CBE = 65^\circ.$$

Step 2: Use the diameter AC is a diameter, so $\angle AEC = 90^\circ$ (angle in a semicircle). In triangle AEC,

$$\angle ECA = 180^\circ - 90^\circ - 65^\circ = 25^\circ.$$

Step 3: Use the parallel chord ED $\parallel$ AC and EC is a transversal, so the alternate angles are equal:

$$\angle DEC = \angle ECA = 25^\circ.$$

Check with arcs: arc CE (not containing B) $= 2 \times 65^\circ = 130^\circ$, so the arc AE on the lower side is $180^\circ - 130^\circ = 50^\circ$. Parallel chords cut off equal arcs between them, so arc CD = arc AE $= 50^\circ$, and $\angle DEC = \frac{1}{2} \times 50^\circ = 25^\circ$. Options 35, 55 and 45 do not agree with this value.

Step 4: Conclusion $\angle DEC = 25^\circ$. Hence, the correct option is (D).

Quick Tip to Solve: Combine three facts in order: equal angles in one segment (65°), right angle in a semicircle, then alternate angles on $ED \parallel AC$; $90^\circ - 65^\circ = 25^\circ$.

Questions 70–71. Directions for the following two questions: Answer the questions on the basis of the information given below.

In an examination, there are 100 questions divided into three groups A, B and C such that each group contains at least one question. Each question in group A carries 1 mark, each question in group B carries 2 marks and each question in group C carries 3 marks. It is known that the questions in group A together carry at least 60% of the total marks.

70. If group B contains 23 questions, then how many questions are there in group C? [2 marks]

(A) 1

(B) 2

(C) 3

(D) Cannot be determined

Correct Answer: (A) 1

Solution:

Concept:

- Let a, b, c be the numbers of questions in groups A, B, C. Then $a + b + c = 100$, and each of a, b, c is a positive integer.
- Total marks $T = a + 2b + 3c$ (each A question is worth 1, each B question 2, each C question 3).
- The condition on group A is $a \geq 0.6\,T$, i.e. $a \geq 0.6\,(a + 2b + 3c)$.

Step 1: Express everything through c Given $b = 23$, so $a + c = 100 - 23 = 77$ and $a = 77 - c$.

The total marks are

$$T = a + 2(23) + 3c = (77 - c) + 46 + 3c = 123 + 2c.$$

Step 2: Apply the condition on group A Group A must carry at least 60% of the total:

$$\begin{aligned} 77 - c &\geq 0.6\,(123 + 2c) \\ 77 - c &\geq 73.8 + 1.2c \\ 3.2 &\geq 2.2c \\ c &\leq \frac{3.2}{2.2} \approx 1.45. \end{aligned}$$

Step 3: Use the "at least one question" condition Each group has at least one question, so $c \geq 1$. Together with $c \leq 1.45$ and c an integer, the only possibility is $c = 1$.

Check: $a = 76$, $b = 23$, $c = 1$; $T = 76 + 46 + 3 = 125$ and $a/T = 76/125 = 60.8\% \geq 60\%$. With $c = 2$, $a = 75$, $T = 127$ and $75/127 \approx 59.1\% < 60\%$, which fails; larger values of c fail by a wider margin. So the value is uniquely fixed, and "cannot be determined" is wrong.

Step 4: Conclusion Group C contains exactly 1 question, so the correct option is (A).

Quick Tip to Solve: Put everything in terms of one unknown (here c), turn the percentage condition into a linear inequality, and combine it with the integer and "at least one" constraints.

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71. If group C contains 8 questions and group B carries at least 20% of the total marks, which of the following best describes the number of questions in group B? [2 marks]

(A) 11 or 12

(B) 12 or 13

(C) 13 or 14

(D) 14 or 15

Correct Answer: (C) 13 or 14

Solution:

Concept:

- Let a, b, c be the numbers of questions in A, B, C, with $a+b+c = 100$ and total marks $T = a+2b+3c$.
- Conditions: $a \geq 0.6\,T$ (group A) and, in this part, $2b \geq 0.2\,T$ (group B), with $c = 8$.

Step 1: Write a and T in terms of b With $c = 8$: $a + b = 92$, so $a = 92 - b$.

Total marks: $T = (92 - b) + 2b + 24 = 116 + b$.

Step 2: Upper bound on b from group A

$$\begin{aligned} 92 - b &\geq 0.6\,(116 + b) = 69.6 + 0.6b \\ 22.4 &\geq 1.6\,b \\ b &\leq 14. \end{aligned}$$

Step 3: Lower bound on b from group B Group B must carry at least 20% of the total:

$$2b \geq 0.2\,(116 + b) = 23.2 + 0.2b$$
$$1.8\,b \geq 23.2$$
$$b \geq 12.89 \;\Rightarrow\; b \geq 13.$$

Step 4: Combine the bounds Since b is an integer, $13 \leq b \leq 14$, so $b = 13$ or $b = 14$.
Check $b = 13$: $a = 79$, $T = 129$, $79/129 \approx 61.2\%$ and $26/129 \approx 20.2\%$, both satisfied. Check $b = 14$: $a = 78$, $T = 130$, $78/130 = 60\%$ and $28/130 \approx 21.5\%$, both satisfied. For $b = 12$: $24/128 = 18.75\% < 20\%$, rejected; for $b = 15$: $77/131 \approx 58.8\% < 60\%$, rejected. Hence the pairs "11 or 12" and "12 or 13" contain values giving group B too small a share, and "14 or 15" contains a value giving group A too small a share.

Step 5: Conclusion The number of questions in group B is 13 or 14, so the correct option is (C).

Quick Tip to Solve: Express the total in the single unknown b, then solve the two percentage conditions separately: one gives an upper bound, the other a lower bound, and integers between them are the answer.

72. The remainder, when $(15^{23} + 23^{23})$ is divided by 19, is [2 marks]

(A) 4
(B) 15
(C) 0
(D) 18

Correct Answer: (C) 0

Solution:

Concept:

- For an odd positive integer n, $x^n + y^n$ is divisible by $x + y$, because $x^n + y^n = (x + y)(x^{n-1} - x^{n-2}y + \cdots + y^{n-1})$.
- Congruence form: $x \equiv -y \pmod{m}$ when $m \mid (x + y)$, so $x^n \equiv (-y)^n$.

Step 1: Look at the sum of the bases The bases are 15 and 23, and $15 + 23 = 38 = 2 \times 19$. So $15 \equiv -23 \pmod{19}$.

Step 2: Use the odd power The exponent 23 is odd, so

$$15^{23} \equiv (-23)^{23} = -23^{23} \pmod{19}.$$

Hence

$$15^{23} + 23^{23} \equiv -23^{23} + 23^{23} = 0 \pmod{19}.$$

Equivalently, $15^{23} + 23^{23}$ is divisible by $15 + 23 = 38$, and therefore by 19.

Step 3: Cross-check with a small case The same idea with exponent 1 gives $15 + 23 = 38 = 2 \times 19$, remainder 0, which agrees. The other options fail because the divisibility argument gives exactly 0,

not 4, 15 or 18.

Step 4: Conclusion The remainder is 0, so the correct option is (C).

Quick Tip to Solve: When the two bases add up to a multiple of the divisor and the power is odd, $x^n + y^n$ is divisible by it, so the remainder is 0.

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73. A new flag is to be designed with six vertical stripes using some or all of the colours yellow, green, blue and red. Then, the number of ways this can be done such that no two adjacent stripes have the same colour is [2 marks]

(A) 12×81

(B) 16×192

(C) 20×125

(D) 24×216

Correct Answer: (A) 12×81

Solution:

Concept:

- Fundamental principle of counting: if a task is done in stages, multiply the number of choices at each stage.
- For a row of n stripes with k colours and no two adjacent equal, there are k choices for the first stripe and $(k-1)$ for each later stripe: $k(k-1)^{n-1}$.

Step 1: Choices for each stripe The first stripe can be coloured in any of the 4 colours (yellow, green, blue, red): 4 ways.

Each next stripe only has to differ from the stripe just before it, so it has $4 - 1 = 3$ choices. There are 5 such stripes.

Step 2: Multiply

$$\text{Number of ways} = 4 \times 3^5 = 4 \times 243 = 972.$$

"Some or all" of the colours is already covered, since the formula allows any colours that keep adjacent stripes different.

Step 3: Match with the options

$$\text{(A) } 12 \times 81 = 972,$$
$$\text{(B) } 16 \times 192 = 3072,$$
$$\text{(C) } 20 \times 125 = 2500,$$
$$\text{(D) } 24 \times 216 = 5184.$$

Only option (A) equals 972.

Step 4: Conclusion The number of flags is $4 \times 3^5 = 972 = 12 \times 81$, so the correct option is (A).

Quick Tip to Solve: For "no two adjacent the same", count k for the first position and $k-1$ for every later one; compute the product and compare with each option.

Questions 74–83. Directions for the following ten questions: Fill up the blanks, numbered [1], [2] up to [10], in the two passages below with most appropriate word from the options given for each blank.

First Passage:

"Between the year 1946 and the year 1955, I did not file any income tax returns." With that [1] statement, Ramesh embarked on an account of his encounter with the income tax department. "I originally owned Rs. 20,000 in unpaid taxes. With [2] and [3], the 20,000 became 60,000. The Income tax Department then went into action, and I learned first hand just how much power the Tax Department wields. Royalties and trust funds can be [4]; automobiles may be [5], and auctioned off. Nothing belongs to the [6] until the case is settled."

Second Passage:

"At that time the white house was as serene as a resort hotel out of season. The corridors were [7]. In the various offices, [8] gray men in waistcoats talked to one another in low-pitched voices. The only color, or choler, curiously enough, was provided by President Eisenhower himself. Apparently, his [9] was easily set off; he scowled when he [10] the corridors.

74. Blank Number [1] [0.5 marks]

(A) devious

(B) blunt

(C) tactful

(D) pretentious

Correct Answer: (B) blunt

Solution:

Concept:

- In sentence completion, use the tone and logic of the sentence and the words around the blank: the missing word must fit the meaning and the collocation.
- Here the speaker opens with a plain admission that he filed no returns for nine years; the blank describes that kind of statement.

Step 1: Read the context of blank [1] The sentence is: "Between the year 1946 and the year 1955, I did not file any income tax returns." With that [1] statement, Ramesh embarked on an account of his encounter with the income tax department.

The quoted line is a direct, frank and unadorned confession of wrongdoing, with no excuse or softening. The blank must describe such a statement.

Step 2: Test each option

- **devious** means indirect, deceitful or sly. A straight confession is not deceitful, so it does not fit.
- **blunt** means direct and plain-spoken, saying a thing without softening. It fits the frank opening line.
- **tactful** means careful not to offend. Announcing in so many words that he never filed returns is the opposite of careful, so it does not fit.
- **pretentious** means showy or self-important. The line is neither, so it does not fit.

Step 3: Conclusion The best word for blank [1] is "blunt", so the correct option is (B).

Quick Tip to Solve: Judge the tone of the quoted line itself: a bare, plain admission is a blunt statement, and the other three words describe sly, polite or showy speech.

75. Blank Number [2] [0.5 marks]

(A) interest

(B) taxes

(C) principal

(D) returns

Correct Answer: (A) interest

Solution:

Concept:

- Use logic and collocation: the blank is one of a pair ("[2] and [3]") that together explain why an unpaid tax of Rs. 20,000 grew to Rs. 60,000.
- Unpaid tax grows through interest charged on the dues and fines imposed for default.

Step 1: Read the context of blank [2] The sentence is: "I originally owned Rs. 20,000 in unpaid taxes. With [2] and [3], the 20,000 became 60,000."

The debt tripled because of two charges that accumulate on unpaid tax. The first charge accrues with time on the amount owed; the second (blank [3]) is a penalty. So blank [2] must be a charge that grows on an unpaid sum.

Step 2: Test each option

- **interest** is the charge that accumulates on money left unpaid, and it pairs naturally with penalties or fines. It fits.
- **taxes** would be circular: the 20,000 is itself unpaid taxes, and extra taxes were not what swelled it.
- **principal** is the original sum, the 20,000 itself, not something that adds to it.
- **returns** are the filed statements the speaker failed to submit; they carry no money charge.

Step 3: Conclusion Blank [2] is best filled by "interest", so the correct option is (A).

Quick Tip to Solve: Ask what makes a debt grow over time: interest (paired with fines or penalties). The principal is the starting amount, never the growth.

76. Blank Number [3] [0.5 marks]

(A) sanctions

(B) refunds

(C) fees

(D) fines

Correct Answer: (D) fines

Solution:

Concept:

- Use logic and collocation: "[2] and [3]" are two additions to an unpaid tax liability, the first being interest.
- The natural companion of interest on a defaulted tax is a monetary penalty for non-payment, that

is, a fine.

Step 1: Read the context of blank [3] The sentence is: "With [2] and [3], the 20,000 became 60,000." Blank [2] is "interest". A tripling of the debt needs a second charge of the kind that the tax authority levies on a defaulter.

Step 2: Test each option

- **sanctions** are approvals or punitive measures taken by states, and the word does not describe a sum added to a tax debt.
- **refunds** are payments made back to the taxpayer, which would reduce, not raise, the amount owed.
- **fees** are charges for a service; a defaulter is not charged "fees" as a penalty in this sense, and the pairing "interest and fees" is weaker.
- **fines** are monetary penalties for breaking a rule, here for failing to file returns and pay on time. "Interest and fines" is a standard pair and explains the jump from 20,000 to 60,000.

Step 3: Conclusion Blank [3] is best filled by "fines", so the correct option is (D).

Quick Tip to Solve: Match pairs by meaning: for a tax defaulter, interest and fines (penalties) are the two charges that inflate the dues.

77. Blank Number [4]

[0.5 marks]

(A) closed

(B) detached

(C) attached

(D) impounded

Correct Answer: (C) attached

Solution:

Concept:

- Collocation and context: the Tax Department's power is shown by what it can do to a defaulter's income and property.
- In tax and legal language, a bank account, salary or royalty is "attached" when the authority legally seizes it to recover dues.

Step 1: Read the context of blank [4] The sentence is: "Royalties and trust funds can be [4]; automobiles may be [5], and auctioned off." The speaker is listing how the department takes control of a defaulter's assets: income streams and funds in one case, physical property that can be sold in the other.

Step 2: Test each option

- **closed** fits an account or a file, not royalties or trust funds, which are not shut down.
- **detached** means separated, which says nothing about legal action by the department.
- **attached** is the legal term for taking a debtor's income or funds under court or tax authority order

to recover a debt. It fits "royalties and trust funds".

- **impounded** is used for physical objects such as vehicles or goods held in custody, so it suits the next blank (automobiles) better than money-like assets; it is also a nearer synonym of "seized" than of the legal freezing of funds.

Step 3: Conclusion Blank [4] is best filled by "attached", so the correct option is (C).

Quick Tip to Solve: Money and rights (royalties, trust funds, wages) are "attached"; vehicles and goods are "seized" or impounded. Use the object to choose the verb.

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78. Blank Number [5] [0.5 marks]

(A) smashed

(B) seized

(C) dismantled

(D) frozen

Correct Answer: (B) seized

Solution:

Concept:

- Context clue: the automobiles are to be "auctioned off", so the blank must name what the authority does to them before the auction.
- Property is auctioned only after it has been legally taken into the authority's possession, that is, seized.

Step 1: Read the context of blank [5] The sentence is: "Royalties and trust funds can be [4]; automobiles may be [5], and auctioned off." The two verbs in the second clause describe successive acts on the same cars: first they are taken from the owner, then sold at auction to recover the dues.

Step 2: Test each option

- **smashed** and **dismantled** describe destruction, which would defeat the purpose of auctioning the vehicles for money.
- **seized** means taken possession of by legal authority, and it leads naturally to "auctioned off". It fits.
- **frozen** is the term for bank accounts and funds, which cannot be auctioned as goods; it does not suit a car.

Step 3: Conclusion Blank [5] is best filled by "seized", so the correct option is (B).

Quick Tip to Solve: Look at the verb that follows: things that are "auctioned off" must first be seized; funds are frozen, and nothing is smashed before a sale.

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79. Blank Number [6] [0.5 marks]

(A) purchaser

(B) victim

(C) investor

(D) offender

Correct Answer: (D) offender

Solution:

Concept:

- Context clue: the sentence says that nothing belongs to a certain person "until the case is settled", that is, the person is the party against whom the tax case is being fought.
- The blank is the role of the person facing the tax department's action, a defaulter.

Step 1: Read the context of blank [6] The sentence is: "Nothing belongs to the [6] until the case is settled." After describing how royalties, funds and cars are attached or seized, the speaker concludes that, while the case is pending, the person under proceedings owns nothing, because everything is under the department's control. The blank must name that person.

Step 2: Test each option

- **purchaser** is a buyer; the speaker is not buying anything.
- **victim** would present him as wronged, but the passage shows the speaker himself failed to file returns for nine years.
- **investor** refers to someone who puts money in ventures, which is irrelevant here.
- **offender** is the person who has broken the law, here by not filing returns and paying taxes. It fits the legal context of a case against him.

Step 3: Conclusion Blank [6] is best filled by "offender", so the correct option is (D).

Quick Tip to Solve: Ask who the tax case is against: the person who broke the rule. Remember the speaker confessed at the start that he did not file returns.

80. Blank Number [7] [0.5 marks]

(A) striking

(B) hollow

(C) empty

(D) white

Correct Answer: (C) empty

Solution:

Concept:

- This cloze item tests choosing the word that fits the meaning, tone and collocation of the sentence in its passage.
- Context clue: the Second Passage opens by calling the White House "as serene as a resort hotel out

of season"; a blank that follows must continue that picture of stillness and absence of people.

Step 1: Read the clue around Blank [7] The sentence is "The corridors were [7]." The sentence before it compares the White House to a resort hotel out of season, that is, a place that is quiet and almost deserted. The sentence after it says that in the offices the men talked "in low-pitched voices". So the corridors must be described as having no people and no noise in them.

Step 2: Test each option

- (A) *striking*: means impressive or eye-catching. It says nothing about quiet or emptiness, and a hotel out of season is not striking.
- (B) *hollow*: describes something with an empty inside, or a sound that echoes. Corridors are not described as hollow; the word is not a natural collocation here.
- (C) *empty*: a corridor with nobody in it, which matches the out-of-season hotel image.
- (D) *white*: it repeats the colour of the building ("white house") and the passage later says the only colour was Eisenhower's temper, so it adds no sense of serenity.

Step 3: Conclusion Only "empty" continues the image of a quiet, deserted resort hotel, so Blank [7] is *empty*. Hence, the correct option is (C).

Quick Tip to Solve: In a cloze test, first read the sentence just before and after the blank for the mood (here: serene, deserted) and then eliminate words that clash with it.

81. Blank Number [8] [0.5 marks]

(A) quiet

(B) faded

(C) loud

(D) stentorian

Correct Answer: (A) quiet

Solution:

Concept:

- This cloze item tests selecting an adjective that agrees with the mood of the passage and with the other details in the same sentence.
- Context clue: the gray men in the offices "talked to one another in low-pitched voices", so the adjective must describe subdued, soft-spoken people.

Step 1: Read the clue around Blank [8] The sentence is "In the various offices, [8] gray men in waistcoats talked to one another in low-pitched voices." The White House has just been described as serene, like a resort hotel out of season. The men in grey waistcoats are shown as part of this hushed atmosphere, so the missing adjective should describe their quiet manner.

Step 2: Test each option

- (A) *quiet*: suits men who speak in low-pitched voices and fits the serene setting.
- (B) *faded*: describes colour or appearance, and "gray" already carries the idea of dullness; it says

nothing about their behaviour or voices.

- (C) *loud*: directly contradicts "low-pitched voices" and the serene mood.
- (D) *stentorian*: means extremely loud and powerful in voice, again the opposite of low-pitched talk.

Step 3: Conclusion "Quiet" agrees with the serene atmosphere and the low-pitched voices, while the other three either contradict it or add nothing. Hence, the correct option is (A).

Quick Tip to Solve: When a sentence already contains a clue such as "low-pitched voices", knock out every option with the opposite sense (loud, stentorian) first.

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82. Blank Number [9] [0.5 marks]

(A) laughter

(B) curiously

(C) humour

(D) temper

Correct Answer: (D) temper

Solution:

Concept:

- This cloze item tests spotting the word-play and the meaning clue in the passage: "choler" means anger, and the blank must name a trait that can be "set off" and shown by scowling.
- Only a noun for a mood or disposition can be "easily set off"; the word must also agree with the grammar of "his [9] was easily set off".

Step 1: Read the clue around Blank [9] The passage says that "the only color, or choler, curiously enough, was provided by President Eisenhower himself." Choler is the old word for anger. The next sentence says "Apparently, his [9] was easily set off; he scowled when he [10] the corridors." So the blank must be a noun meaning quickness to anger, which is what "choler" and "scowled" point to.

Step 2: Test each option

- (A) *laughter*: is a cheerful response and does not fit a scowl or the idea of choler.
- (B) *curiously*: is an adverb, so it cannot be the subject of "was set off"; it merely repeats a word from the earlier sentence.
- (C) *humour*: ordinarily means a sense of fun; the gloomy scowl contradicts it, and it is not "set off".
- (D) *temper*: means a tendency to become angry; a temper is "set off", and it matches "choler" and "scowled".

Step 3: Conclusion "Temper" is the noun that matches choler (anger) and the scowling, and it takes the verb phrase "set off". Hence, the correct option is (D).

Quick Tip to Solve: Look back for synonyms already planted in the passage: here "choler" announces that the blank means anger, so temper is the only fit.

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83. Blank Number [10] [0.5 marks]

(A) paced

(B) strolled

(C) stormed

(D) prowled

Correct Answer: (A) paced

Solution:

Concept:

- This cloze item tests the choice of the verb of movement that matches mood (restless, angry) and the grammar of the sentence (a verb that takes the direct object "the corridors").
- "Pace" is a transitive verb meaning to walk up and down in a measured way, usually because of worry or impatience; it can take the object directly ("paced the corridors").

Step 1: Read the clue around Blank [10] The sentence is "he scowled when he [10] the corridors." It describes the President's bad temper ("his [9] was easily set off"), and the verb has to take "the corridors" as its direct object, with no preposition. A restless, brooding walk up and down the passages fits the scowl.

Step 2: Test each option

- (A) *paced*: walked back and forth restlessly; it takes the corridors directly and agrees with a scowl.
- (B) *strolled*: a relaxed, leisurely walk, which contradicts the angry scowl; it also normally needs "through/along".
- (C) *stormed*: shows anger, but needs a preposition ("stormed through/along the corridors"); "stormed the corridors" would mean attacked them, so it does not fit.
- (D) *prowled*: moving stealthily like a hunter, which does not suit a man openly scowling in a quiet building.

Step 3: Conclusion "Paced" suggests restless irritation and takes "the corridors" as a direct object without any preposition. Hence, the correct option is (A).

Quick Tip to Solve: If two options both fit the mood (paced, stormed), test the grammar: only the one that takes the object with no preposition fits "[10] the corridors".

84. Identify the incorrect sentence or sentences

A. It was a tough situation and Manasi was taking pains to make it better.

B. Slowly her efforts gave fruit and things started improving.

C. Everyone complemented her for her good work.

D. She was very happy and thanked everyone [1 mark]

(A) A

(B) D

(C) B and C

(D) A and C

Correct Answer: (C) B and C

Solution:

Concept:

- This item tests idiomatic usage and commonly confused words: collocations such as "bear fruit" and the pair *complement / compliment*.
- Each sentence is checked on its own; the answer lists every sentence that has an error.

Step 1: Check sentences A and D **A.** "Manasi was taking pains to make it better": "take pains" means to make a careful effort, so the idiom is correct. **D.** "She was very happy and thanked everyone" is correct in grammar and meaning. Both are acceptable.

Step 2: Check sentences B and C **B.** "Her efforts gave fruit" is wrong: the fixed idiom is "her efforts *bore* fruit" (or "yielded results"). **C.** "Everyone complemented her" is wrong: *complement* means to complete or go well with something, whereas to praise someone is to *compliment* her. So B and C are incorrect.

Step 3: Match with the options (A) "A" alone fails, since A is correct. (B) "D" fails, since D is correct. (D) "A and C" includes the correct sentence A. Only "B and C" lists exactly the faulty sentences.

Step 4: Conclusion The incorrect sentences are B ("gave fruit" for "bore fruit") and C ("complemented" for "complimented"). Hence, the correct option is (C).

Quick Tip to Solve: Learn idioms as whole units (bear fruit, take pains) and pairs like complement and compliment; test each sentence separately and then match the set.

85. Identify the incorrect sentence or sentences

A. Harish told Raj to plead guilty.

B. Raj pleaded guilty of stealing money from the shop.

C. The court found Raj guilty of all the crimes he was charged with.

D. He was sentenced for three years in jail [1 mark]

(A) A and C

(B) B and D

(C) A, C, and D

(D) B, C, and D

Correct Answer: (B) B and D

Solution:

Concept:

- This item tests prepositions that go with particular verbs and adjectives in legal usage: *plead guilty to*, *guilty of*, *sentenced to*.
- Each sentence is checked separately and the faulty ones are collected.

Step 1: Check sentences A and C **A.** "Harish told Raj to plead guilty" is correct: "tell someone to do something" is a normal structure and "plead guilty" is a fixed expression. **C.** "The court found Raj guilty of all the crimes he was charged with" is correct: one is "found guilty *of*" an offence, and "charged with" is the right preposition. Both are acceptable.

Step 2: Check sentences B and D **B.** "Raj pleaded guilty *of* stealing" is wrong: the preposition after "plead guilty" is *to* ("pleaded guilty to stealing money"). **D.** "He was sentenced *for* three years in jail" is wrong: a person is sentenced *to* a term ("sentenced to three years in jail"). So B and D are faulty.

Step 3: Match with the options Options (A) and (C) include sentence C, and option (C) also includes A, which are correct. Option (D) includes C as well. Only "B and D" lists exactly the faulty sentences.

Step 4: Conclusion Sentences B ("guilty of" for "guilty to") and D ("sentenced for" for "sentenced to") are incorrect. Hence, the correct option is (B).

Quick Tip to Solve: Remember the legal pairs: plead guilty TO, found guilty OF, sentenced TO, charged WITH; a wrong preposition is the commonest planted error.

86. Identify the incorrect sentence or sentences

A. Last Sunday, Archana had nothing to do.

B. After waking up, she lay on the bed thinking of what to do.

C. At 11 o'clock she took shower and got ready.

E. She spent most of the day shopping [1 mark]

(A) B and C

(B) C

(C) A and B

(D) B, C, and D

Correct Answer: (A) B and C

Solution:

Concept:

- This item tests articles and idiomatic phrasing: a singular countable noun such as *shower* needs an article (*took a shower*), and fixed phrases like *lay in bed*.
- Each lettered sentence is judged separately; note that the fourth sentence is printed with the letter E, not D, in the paper.

Step 1: Check sentences A and E **A.** "Last Sunday, Archana had nothing to do" is correct. **E (the fourth sentence).** "She spent most of the day shopping" is correct, with "spend time doing something" used properly. Neither contains an error.

Step 2: Check sentences B and C **C.** "She took shower" is wrong: the countable noun needs an article, "she took *a* shower". **B.** "she lay on the bed thinking of what to do" is also faulty: the idiom for staying down after waking up is "lay *in* bed", and the usual construction is "thinking *about* what to do". Hence B and C are the incorrect sentences.

Step 3: Match with the options (B) "C" alone leaves out B. (C) "A and B" includes the correct sentence A. (D) "B, C, and D" refers to sentence D, which does not exist in the printed list (the fourth sentence is labelled E), and would also include a sentence that is correct. Only "B and C" agrees with the analysis.

Step 4: Conclusion Sentence C (missing article before "shower") and sentence B ("on the bed" for "in bed", and "thinking of" for "thinking about") are the incorrect sentences, while A and the last sentence are correct. Hence, the correct option is (A).

Quick Tip to Solve: Look first for the missing article with countable nouns (take a shower, have a bath); then check fixed phrases and the preposition after the verb.

87. Fill in the Blanks: Many people suggest _____ and still other would like to convince people not to buy pirated cassettes. [1 mark]

(A) to bring down audiocassette prices to reduce the incidence of music piracy, others advocate strong legal action against the offenders,

(B) bringing down audiocassette prices to reduce the incidents of music piracy, others are advocating strong legal action against offenders,

(C) bringing down audiocassette prices to reduce the incidents of music piracy, others advocate strong legal action against offenders,

(D) audiocassette prices to be brought down to reduce incidents of music piracy, others advocate that strong legal action must be taken against offenders,

Correct Answer: (C) bringing down audiocassette prices to reduce the incidents of music piracy, others advocate strong legal action against offenders,

Solution:

Concept:

- This item tests grammatical parallelism and verb patterns: *suggest* is followed by a gerund (*suggest bringing*), not by the infinitive, and the verbs of the parallel clauses should agree in tense.
- The correct option must also fit with the clause that follows: "and still other would like to convince people not to buy pirated cassettes".

Step 1: Fix the structure the blank must supply The sentence has the form "Many people suggest [X], others [verb] [Y], and still other would like to convince people . . . ". So X is a gerund phrase after *suggest*, and "others [verb]" must use the simple present, like "suggest" and "would like".

Step 2: Test each option

- (A) "suggest to bring down": *suggest* cannot take "to + verb", so the verb pattern is wrong.
- (B) "others are advocating": the present continuous breaks the parallel with the simple present "suggest" and "would like", so the tenses are inconsistent.
- (C) "bringing down audiocassette prices . . . others advocate strong legal action against offenders": gerund after *suggest*, simple present in the parallel clause, and the phrasing is clear.
- (D) "audiocassette prices to be brought down . . . that strong legal action must be taken": mixes an infinitive passive with a that-clause; the verb pattern after *suggest* is wrong and the sentence becomes clumsy.

Step 3: Conclusion Only option (C) uses the correct gerund after *suggest* and keeps the clauses parallel in the simple present. Hence, the correct option is (C).

Quick Tip to Solve: Verbs like suggest, avoid and advocate take the gerund; also keep every parallel clause in the same tense, which often eliminates two options at once.

88. Fill in the Blanks: The ancient Egyptians believed _____ so that when these objects were magically reanimated through the correct rituals, they would be able to functions effectively. [1 mark]

(A) that it was essential that things they portrayed must have every relevant feature shown as clearly as possible,

(B) it was essential for things they portray to have had every relevant feature shown as clearly as possible,

(C) it was essential that the things they portrayed had every relevant feature shown as clearly as possible,

(D) that when they portrayed things, it should have every relevant feature shown as clearly as possible,

Correct Answer: (C) it was essential that the things they portrayed had every relevant feature shown as clearly as possible,

Solution:

Concept:

- This item tests the sequence of tenses: after a past-tense verb of belief (*believed*), the noun clause takes past forms (*was*, *portrayed*, *had*).
- The sentence must also read smoothly with the clause that follows: "so that . . . they would be able to function effectively".

Step 1: Fix the structure the blank must supply The main verb is "believed" (past). What the Egyptians believed is a noun clause, and the clause "when these objects were magically reanimated . . . " refers back to the "things" they portrayed. So the blank needs "it was essential that the things they portrayed had every relevant feature shown", with "that" introducing the clause and the verbs in the past.

Step 2: Test each option

- (A) "believed that it was essential that things they portrayed must have . . . ": "believed" is followed by "that" again after "essential", and the modal "must" clashes with the past tense; the repeated "that" and the missing "the" make it clumsy.
- (B) "believed it was essential for things they portray to have had": "portray" (present) and "to have had" (perfect infinitive) do not agree with the past time of the sentence.
- (C) "believed it was essential that the things they portrayed had every relevant feature shown as clearly as possible": tenses agree, "the things" refers clearly to the objects, and the sentence is idiomatic.
- (D) "believed that when they portrayed things, it should have every relevant feature": "it" has no clear antecedent and "should have" is a wrong tense pattern.

Step 3: Conclusion Option (C) is the only one in which the tenses follow "believed" and the reference of "the things they portrayed" is clear. Hence, the correct option is (C).

Quick Tip to Solve: Once the main verb is in the past, check every verb in the dependent clause for the matching past form, and discard options with a pronoun that has no clear antecedent.

89. Fill in the Blanks: Archaeologists believe that the pieces of red-ware pottery excavated recently near Bhavnagar and _____ shed light on a hitherto dark 600-year period in the Harappan history of Gujarat. [1 mark]

(A) estimated with a reasonable certainty as being about 3400 years old,

(B) are estimated reasonably certain to be about 3400 years old,

(C) estimated at about 3400 years old with reasonable certainty,

(D) estimated with reasonable certainty to be about 3400 years old,

Correct Answer: (D) estimated with reasonable certainty to be about 3400 years old,

Solution:

Concept:

- This item tests parallel structure and subject-verb agreement. The subject is "the pieces of red-ware pottery", which is described by two parallel participial phrases joined by "and", and the only finite verb must be "shed".
- The idiom is "estimated to be about . . . ", and the adverbial phrase "with reasonable certainty" is placed before it.

Step 1: Fix the structure the blank must supply The sentence reads "the pieces of red-ware pottery [excavated recently near Bhavnagar] and [blank] shed light on . . . ". The first modifier is a past participle (*excavated*), so the blank must also begin with a past participle and must not add a second finite verb, because "shed" is already the main verb.

Step 2: Test each option

- (A) "estimated with a reasonable certainty as being about 3400 years old": "estimated as being" is not idiomatic, and "a reasonable certainty" is clumsy.
- (B) "are estimated reasonably certain to be": adds a finite verb "are" which breaks the parallel with "excavated", and "estimated reasonably certain" is ungrammatical.
- (C) "estimated at about 3400 years old with reasonable certainty": "estimated at" goes with a figure, not with "years old"; the word order is also awkward.
- (D) "estimated with reasonable certainty to be about 3400 years old": a past participle parallel to "excavated", with the correct pattern "estimated to be".

Step 3: Conclusion Option (D) keeps the participles parallel and uses the idiomatic "estimated to be about 3400 years old". Hence, the correct option is (D).

Quick Tip to Solve: When the blank follows "and", copy the grammatical form of what stands before "and" (here a past participle) and reject options that add an extra finite verb.

90. Choose the option in which the usage of BOLT is INCORRECT or INAPPROPRIATE? [1 mark]

(A) The shopkeeper showed us a bolt of fine silk.

(B) As he could not move, he made a bolt for the gate.

(C) Could you please bolt the door?

(D) The thief was arrested before he could bolt from the scene of the crime.

Correct Answer: (B) As he could not move, he made a bolt for the gate.

Solution:

Concept:

- This item tests the different meanings of one word. *Bolt* is a noun meaning a roll of cloth or a sudden dash, and a verb meaning to fasten with a bolt or to run away suddenly.
- The option with a meaning that does not suit its sentence is the answer.

Step 1: Check options A, C and D (A) "a bolt of fine silk": a bolt is a roll of cloth, so the usage is correct. (C) "Could you please bolt the door?": to bolt is to fasten with a bolt, which is correct. (D) "the thief was arrested before he could bolt from the scene": to bolt means to run off suddenly, which is correct.

Step 2: Check option B "As he could not move, he made a bolt for the gate." The phrase "make a bolt for" means to dash quickly towards something, which needs movement. The sentence says he could not move, so the reason and the result contradict each other, and the usage is inappropriate.

Step 3: Conclusion Options A, C and D use *bolt* correctly as a roll of cloth, to fasten, and to run away, while in B the dash for the gate contradicts "he could not move". Hence, the correct option is (B).

Quick Tip to Solve: For a word with many meanings, assign a meaning to each option and check the sentence for logic; one sentence usually contradicts itself.

91. Choose the option in which the usage of FALLOUT is INCORRECT or INAPPROPRIATE? [1 mark]

(A) Nagasaki suffered from the fallout of nuclear radiation.

(B) People believed that the political fallout of the scandal would be insigficant.

(C) Who can predict the environmental fallout of the WTO agreements?

(D) The headmaster could not understand the fallout of several of his good students at the public examination.

Correct Answer: (D) The headmaster could not understand the fallout of several of his good students at the public examination.

Solution:

Concept:

- This item tests the meaning of *fallout*: the radioactive dust that settles after a nuclear explosion, and by extension the (usually unpleasant) after-effects or consequences of an event or decision.
- The word never means a failure or a dropping-out of persons; that sense belongs to words such as *dropout* or *failure rate*.

Step 1: Check options A, B and C (A) "Nagasaki suffered from the fallout of nuclear radiation": literal sense, correct. (B) "the political fallout of the scandal would be insignificant": consequences of an event, so correct (the misspelling "insigficant" in print is a typing slip, not a question of usage). (C) "the environmental fallout of the WTO agreements": after-effects of an agreement, correct.

Step 2: Check option D "The headmaster could not understand the fallout of several of his good students at the public examination." Here the writer means that good students failed or did badly. *Fallout* cannot mean failure of persons, and the phrase "fallout of students" does not describe the after-effects of an event. This is an inappropriate use.

Step 3: Conclusion In A, B and C, *fallout* means radioactive dust or after-effects, but in D it is wrongly used for students failing an examination. Hence, the correct option is (D).

Quick Tip to Solve: Replace the word by its dictionary meaning (here "after-effects of an event") in each sentence; the one that no longer makes sense is the misuse.

92. Choose the option in which the usage of PASSING is INCORRECT or INAPPROPRIATE? [1 mark]

(A) She did not have passing marks in mathematics.

(B) The mad woman was cursing everybody passing her on the road.

(C) At the birthday party all the children enjoyed a game of passing the parcel.

(D) A passing taxi was stopped to rush the accident victims to the hospital.

Correct Answer: (B) The mad woman was cursing everybody passing her on the road.

Solution:

Concept:

- This item tests usage of the word *passing* in four sentences: as an adjective meaning *sufficient to pass*, in the name of a game, and as an adjective meaning *going by*.
- The odd one out is the sentence in which the word is not used in the standard idiom for the sense intended; check each sentence against the natural phrase.

Step 1: Check options A, C and D **(A)** "passing marks in mathematics": *passing marks* is the standard phrase for the marks needed to pass, so the usage is correct. **(C)** "a game of passing the parcel": the children's game consists of passing a parcel from hand to hand, so the word is used in its ordinary verbal sense and is correct. **(D)** "A passing taxi was stopped": *passing* is an adjective meaning *going by at that moment*, placed before the noun as usual, so the usage is correct.

Step 2: Check option B "The mad woman was cursing everybody passing her on the road." Here *passing* is made to take the woman as its object (*passing her*), which is not the natural idiom for people who go by on the road. The natural expression is *passing by* or *passing on the road*, with *passing* describing the passers-by. This is the sentence in which the usage is inappropriate.

Step 3: Conclusion Options A, C and D use *passing* in recognised, idiomatic senses, whereas in B the construction *passing her* is inappropriate (*passing by* is the natural form). Hence, the correct option is (B).

Quick Tip to Solve: Replace *passing* by its dictionary sense in each sentence (adequate to pass, handing on, going by); the sentence that needs an awkward object after it is the misuse.

Questions 93 and 115–117. Throughout human history, the leading causes of death have been infection and trauma. Modern medicine has scored significant victories against both, and the major causes of ill health and death are now the chronic degenerative diseases, such as coronary artery disease, arthritis, osteoporosis, Alzheimer's, macular degeneration, cataract and cancer. These have a long latency period before symptoms appear and a diagnosis is made. It follows that the majority of apparently healthy people are pre-ill.

But are these conditions inevitably degenerative? A truly preventive medicine that focuses on the pre-ill, analyzing the metabolic errors which lead to clinical illness, might be able to correct them before the first symptom. Genetic risk factors are known for all the chronic degenerative diseases, and are important to the individuals who possess them. At the population level, however, migration studies confirm that these illnesses are linked for the most part to lifestyle factors — exercise, smoking and nutrition. Nutrition is the easiest of these to change, and the most versatile tool for affecting the metabolic changes needed to tilt the balance away from disease.

Many national surveys reveal that malnutrition is common in developed countries. This is not the calorie and/or micronutrient deficiency associated with developing nations (type A malnutrition); but multiple micronutrient depletion, usually combined with calorific balance or excess (Type B malnutrition). The incidence and severity of Type B malnutrition will be shown to be worse if newer micronutrient groups such as the essential fatty acids, xanthophylls and flavonoids are included in the surveys. Commonly ingested levels of these micronutrients seem to be far too low in many developed countries.

There is now considerable evidence that Type B malnutrition is a major cause of chronic degenerative diseases. If this is the case, then it is logical to treat such diseases not with drugs but with multiple micronutrient repletion, or 'pharmaco-nutrition'. This can take the form of pills and capsules — 'nutraceuticals', or food formats known as 'functional foods'. This approach has been neglected hitherto because it is relatively unprofitable for drug companies — the products are hard to patent — and it is a strategy which does not sit easily with modem medical interventionism. Over the last 100 years, the drug industry has invested huge sums in developing a range of subtle and powerful drugs to treat the many diseases we are subject to. Medical training is couched in pharmaceutical terms and this approach has provided us with an exceptional range of therapeutic tools in the treatment of disease and in acute medical emergencies. However, the pharmaceutical model has also created an unhealthy dependency culture, in which relatively few of us accept responsibility for maintaining our own health. Instead, we have handed over this responsibility to health professionals who know very little about health maintenance, or disease prevention.

One problem for supporters of this argument is the lack of the right kind of hard evidence. We have a wealth of epidemiological data linking dietary factors to health profiles/disease risks, and a great deal of information on mechanism: how food factors interact with our biochemistry. But almost all intervention studies with micronutrients, with the notable exception of the omega 3 fatty acids, have so far produced conflicting or negative results. In other words, our science appears to have no predictive value. Does this invalidate the science? Or are we simply asking the wrong questions?

Based on pharmaceutical thinking, most intervention studies have attempted to measure the impact of a single micronutrient on the incidence of disease. The classical approach says that if you give a compound formula to test subjects and obtain positive results, you cannot know which ingredient is exerting the benefit, so you must test each ingredient individually. But in the field of nutrition, this does not work. Each intervention on its own will hardly make enough difference to be measured. The best therapeutic response must therefore combine micronutrients to normalise our internal physiology. So do we need to analyse each individual's nutritional status and then tailor a formula specifically for him or her? While we do not have the resources to analyze millions of individual

cases, there is no need to do so. The vast majority of people are consuming suboptimal amounts of most micronutrients, and most of the micronutrients concerned are very safe. Accordingly, a comprehensive and universal program of micronutrient support is probably the most cost-effective and safest way of improving the general health of the nation.

93. Why are a large number of apparently healthy people deemed pre-ill? [1 mark]

(A) They may have chronic degenerative diseases.

(B) They do not know their own genetic risk factors which predispose them to diseases.

(C) They suffer from Type-B malnutrition.

(D) There is a lengthy latency period associated with chronically degenerative diseases.

Correct Answer: (A) They may have chronic degenerative diseases.

Solution:

Concept:

- Inference-based reading comprehension: the answer must follow from what the passage says, and where two options look close, choose the one that states the actual meaning of the term asked about.
- "Pre-ill" is explained in the first paragraph: chronic degenerative diseases have a long latency period, so most apparently healthy people are already on the way to illness.

Step 1: Locate the statement about the pre-ill The first paragraph says that chronic degenerative diseases "have a long latency period before symptoms appear and a diagnosis is made. It follows that the majority of apparently healthy people are pre-ill." So a person who looks healthy may already carry such a disease that has not yet produced symptoms; this is what *pre-ill* means.

Step 2: Test each option **(A)** Apparently healthy people may already have a chronic degenerative disease that is still silent, so they are deemed pre-ill. This states the meaning directly. **(B)** Genetic risk factors are mentioned only as important to the individuals who possess them; they are not the reason the majority is called pre-ill. **(C)** Type B malnutrition is discussed later as a cause of the diseases, not as the reason for the pre-ill label. **(D)** This is the closest rival, because the long latency period explains why such a disease is not yet visible. But a latency period is a feature of the diseases; by itself it does not say that these healthy-looking people have anything. They are *pre-ill* because a disease may already be developing silently in them, and only option (A) says this about the people.

Step 3: Conclusion Apparently healthy people are deemed pre-ill because they may already have a chronic degenerative disease that has not yet shown symptoms. Hence, the correct option is (A).

Quick Tip to Solve: When two options overlap (here A and D), pick the one that answers "why are they called pre-ill" directly (they may have the disease), not the one that only explains why symptoms are absent.

94. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph?

A. The two neighbours never fought each other.

B. Fights involving three male fiddler crabs have been recorded, but the status of the participants was unknown

C. They pushed or grappled only with the intruder.

D. We recorded 17 cases in which a resident that was fighting an intruder was joined by an immediate neighbour, an ally.

E. We therefore tracked 268 intruder males until be saw them fighting a resident male. [1 mark]

(A) BEDAC

(B) DEBAC

(C) BDCAE

(D) BCEDA

Correct Answer: (A) BEDAC

Solution:

Concept:

- Para jumbles: find the opening sentence that introduces the subject, then link the sentences by connectives (*therefore*), pronouns (*they*) and logical sequence.

Step 1: Find the opening and the links Sentence B introduces the topic: fights involving three male fiddler crabs have been recorded, but the status of the participants was unknown. Sentence E begins "We therefore tracked 268 intruder males. . . ", so it follows B as the response to that gap. Sentence D then reports what was found: 17 cases in which a resident fighting an intruder was joined by a neighbour, an ally.

Step 2: Complete the chain and test the options Sentence A ("The two neighbours never fought each other") refers to the resident and the ally of D, and C ("They pushed or grappled only with the intruder") refers to the two neighbours of A, so the order is B-E-D-A-C. Option (B) DEBAC begins with D, which speaks of an ally before the situation is set up. Option (C) BDCAE puts C ("They") before the neighbours appear in A, and ends with E, which must come earlier because of "therefore". Option (D) BCEDA has C ("They") with no antecedent.

Step 3: Conclusion The coherent order is BEDAC. Hence, the correct option is (A).

Quick Tip to Solve: Fix the opening sentence first, then use "therefore" and pronouns like "They" to place the others; here B-E-D comes first and A-C is the closing pair.

95. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph?

A. He felt justified in bypassing Congress altogether on a variety of moves.

B. At times he was fighting the entire Congress.

C. Bush felt he had a mission to restore power to the presidency.

D. Bush was not fighting just the democrats.

E. Representatives democracy is a messy business, and a CEO of the white House does not like a legislature of second guessers and time wasters. [1 mark]

(A) CAEDB

(B) DBAEC

(C) CEADB

(D) ECDBA

Correct Answer: (D) ECDBA

Solution:

Concept:

- Para jumbles: the opening sentence sets the general theme, and pairs such as "not just X" followed by "at times he was..." form mandatory sequences.

Step 1: Identify the opening and the mandatory pairs Sentence E states a general idea (representative democracy is messy and a CEO of the White House dislikes second guessers). Sentence C then brings in Bush, who felt he had a mission to restore power to the presidency, so E-C is the start. Sentence D ("Bush was not fighting just the democrats") leads directly into B ("At times he was fighting the entire Congress"), so D-B is a fixed pair.

Step 2: Place the last sentence and test the options Sentence A ("He felt justified in bypassing Congress altogether") is the conclusion that follows from the fight with the whole Congress. The sequence is E-C-D-B-A. Options (A) CAEDB and (C) CEADB place A before D and B, which breaks the D-B sequence and leaves the reason for bypassing Congress unexplained. Option (B) DBAEC starts with D, which needs Bush to be introduced first.

Step 3: Conclusion The coherent order is ECDBA. Hence, the correct option is (D).

Quick Tip to Solve: Look for mandatory pairs first (D then B here), then start with the general sentence (E) that introduces the theme before the named person.

96. Choose the option which summarizes the passage the best.

The human race is spread all over world, from the polar regions to the tropics. The people of whom it is made up eat different kinds of food, partly according to the climate in which they live, and partly according to the kind of food which their country produces.

In hot climates; meat and fat are not much needed; but in the Arctic regions they seem to be very necessary for keeping up the heat of the body. Thus, in India, People live chiefly on different kinds of grains, eggs, milk, or sometimes fish and meat. In Europe people eat more meat and less gain. In the Arctic regions, where no grains and fruits are produced, the Eskimo and others races live almost entirely on meat and fish. [1 mark]

(A) Food eaten by people in different regions of the world depends on the climate and produce of the region, and varies from meat and fish in the Arctic to predominantly grains in the tropics.

(B) Hot climates require people to eat grains while cold regions require people to eat meat and fish.

(C) In hot countries people eat mainly grains while in the Arctic, they eat meat and fish because they cannot grow grains.

(D) While people in Arctic regions like meat and fish and those in hot regions like India prefer mainly grains, they have to change what they eat depending on the local climate and the local produce.

Correct Answer: (A) Food eaten by people in different regions of the world depends on the climate and produce of the region, and varies from meat and fish in the Arctic to predominantly grains in the tropics.

Solution:

Concept:

- A good summary captures every main idea of the passage, adds nothing that is not stated and does not change the emphasis.
- Here the main ideas are: food differs from region to region, and the two causes are climate and local produce, with examples from the tropics, Europe and the Arctic.

Step 1: Identify the central ideas The passage says people eat different foods "partly according to the climate... and partly according to the kind of food which their country produces". Hot climates need less meat and fat; the Arctic needs them for body heat and produces no grains; India eats mainly grains, Europe more meat, and the Eskimo meat and fish.

Step 2: Test each option **(A)** Covers both causes (climate and produce) and the range from meat and fish in the Arctic to grains in the tropics. It is faithful and complete. **(B)** Mentions only the climate and omits the local produce. **(C)** Gives only the lack of grains as the reason in the Arctic and drops climate as a general factor. **(D)** Introduces what people "like" or "prefer", which the passage never says; it is about need and availability.

Step 3: Conclusion Only option (A) states both causes and the contrast accurately. Hence, the correct option is (A).

Quick Tip to Solve: Eliminate summaries that leave out one of the two causes the passage gives, or that add an idea of the writer's own (such as people's liking).

97. Choose the option which summarizes the passage the best.

You seemed at first to take no notice of your school-fellows, or rather to set yourself against them because they were strangers to you. They knew as little of you as you did of them; this would have been the reason for their keeping aloof from you as well, which you would have felt as a hardship. Learn never to conceive a prejudice against others because you know nothing of them. It is bad reasoning, and makes enemies of half the world. Do not think ill of them till they behave ill to you; and then strive to avoid the faults, which you see in them. This will disarm their hostility sooner than pique or resentment or complaint. [1 mark]

(A) The discomfort you felt with your school fellows was because both sides knew little of each other. You should not complain unless you find others prejudiced against you and have attempted to carefully analyze the faults you have observed in them.

(B) The discomfort you felt with your school fellows was because both sides knew little of each other. Avoid prejudice and negative thoughts till you encounter bad behavior from others, and then win them over by shunning the faults you have observed.

(C) You encountered hardship amongst your school fellows because you did not know then well. You should learn not to make enemies because of your prejudices irrespective of their behaviour towards you.

(D) You encountered hardship amongst your school fellows because you did not know them well. You should learn to not make enemies because of your prejudices unless they behave badly with you.

Correct Answer: (B) The discomfort you felt with your school fellows was because both sides knew little of each other. Avoid prejudice and negative thoughts till you encounter bad behavior from others, and then win them over by shunning the faults you have observed.

Solution:

Concept:

- A summary must preserve the cause of the problem described, the writer's advice and its condition, without distorting the meaning.

Step 1: Break the passage into its ideas (1) The discomfort with the school fellows arose because both sides knew little of each other. (2) Learn not to form a prejudice against others simply because you do not know them. (3) Do not think ill of them until they behave ill to you. (4) Then strive to avoid the faults you see in them, which will disarm their hostility sooner than resentment or complaint.

Step 2: Test each option **(A)** Says "do not complain unless you find others prejudiced against you" and asks you to analyse their faults, which distorts the advice. **(B)** Gives the cause (both knew little of each other), the advice (avoid prejudice until bad behaviour is met) and the remedy (win them over by shunning the faults observed). It is complete and accurate. **(C)** Says only that you did not know them well, ignoring that they knew little of you, and advises against enemies "irrespective of their behaviour", which is not what the passage says; the remedy is missing. **(D)** Also omits the mutual ignorance and the advice to avoid their faults and disarm their hostility.

Step 3: Conclusion Option (B) preserves the cause, the advice and the remedy. Hence, the correct option is (B).

Quick Tip to Solve: Match each option with the passage's four steps (cause, no prejudice, wait for bad behaviour, avoid their faults); the option that keeps all four is the answer.

Questions 98–102. The painter is now free to paint anything he chooses. There are scarcely any forbidden subjects, and today everybody is prepared to admit that a painting of some fruit can be as important as a painting of a hero dying. The Impressionists did as much as anybody to win this previously unheard-of freedom for the artist. Yet, by the next generation, painters began to abandon the subject altogether, and began to paint abstract pictures. Today the majority of pictures painted are abstract.

Is there a connection between these two developments? Has art gone abstract because the artist is embarrassed by his freedom? Is it that, because he is free to paint anything, he doesn't know what to paint? Apologists for abstract art often talk of it as the art of maximum freedom. But could this be the freedom of the desert island? It would take too long to answer these questions properly. I believe there is a connection. Many things have encouraged the development of abstract art. Among them has been the artists' wish to avoid the difficulties of finding subjects when all subjects are equally possible.

I raise the matter now because I want to draw attention to the fact that the painter's choice of a subject is a far more complicated question than it would at first seem. A subject does not start with what is put in front of the easel or with something which the painter happens to remember. A subject starts with the painter deciding he would like to paint such-and-such because for some reason or other he finds it meaningful. A subject begins when the artist selects something for special mention. (What makes it special or meaningful may seem to the artist to be purely visual - its colours or its form.) When the subject has been selected, the function of the painting itself is to communicate and justify the significance of that selection.

It is often said today that subject matter is unimportant. But this is only a reaction against the excessively literary and moralistic interpretation of subject matter in the nineteenth century. In truth, the subject is literally the beginning and end of a painting. The painting begins with a selection (I will paint this and not everything else in the world); it is finished when that selection is justified (now you can see all that I saw and felt in this and how it is more than merely itself).

Thus, for a painting to succeed it is essential that the painter and his public agree about what is significant. The subject may have a personal meaning for the painter or individual spectator; but there must also be the possibility of their agreement on its general meaning. It is at this point that the culture of the society and period in question precedes the artist and his art. Renaissance art would have meant nothing to the Aztecs -and vice versa. If, to some extent, a few intellectuals can appreciate them both today it is because their culture is an historical one; its inspiration is history and therefore it can include within itself, in principle if not in every particular, all known developments to date.

When a culture is secure and certain of its values, it presents its artists with subjects. The general agreement about what is significant is so well established that the significance of a particular subject accrues and becomes traditional. This is true, for instance, of reeds and water in China, of the nude body in Renaissance, of the animal in Africa. Furthermore, in such cultures the artist is unlikely to be a free agent: he will be employed for the sake of particular subjects, and the problem, as we have just described it, will not occur to him.

When a culture is in a state of disintegration or transition, the freedom of the artist increases - but the question of subject matter becomes problematic for him: he, himself, has to choose for society. This was at the basis of all the increasing, crises in European art during the nineteenth century. It is too often forgotten how many of the art scandals of that time were provoked by the choice of subject (Gericault, Courbet, Daumier, Degas, Lautrec, Van Gogh, etc.).

By the end of the nineteenth century there were, roughly speaking, two ways in which the painter could meet this challenge of deciding what to paint and so choosing for society. Either he identified himself with the people and so allowed their lives to dictate his subjects to him, or he had to find

his subjects within himself as a painter. By people, I mean everybody except the bourgeoisie. Many painters did of course work for the bourgeoisie according to their copy-book of approved subjects, but all of them, filling the Salon and the Royal Academy year after year, are now forgotten, buried under the hypocrisy of those they served so sincerely.

98. When a culture is insecure, the painter chooses his subject on the basis of: [1 mark]

(A) The prevalent style in the society of his time.

(B) Its meaningfulness to the painter.

(C) What is put in front of the easel.

(D) Past experience and memory of the painter

Correct Answer: (B) Its meaningfulness to the painter.

Solution:

Concept:

- Fact-based reading comprehension tests whether you can locate what the passage says about a stated condition and match it to an option, without importing outside ideas.
- Here the condition is an insecure culture, which the passage describes as one in a state of disintegration or transition (the seventh paragraph), and the matter asked is how the painter then chooses a subject.

Step 1: Identify what the passage says about an insecure culture The seventh paragraph begins: "When a culture is in a state of disintegration or transition, the freedom of the artist increases — but the question of subject matter becomes problematic for him: he, himself, has to choose for society." So, in an insecure culture, tradition no longer hands the artist his subject. The choice passes to the artist.

Step 2: Find the basis of the artist's choice The third paragraph explains how any subject comes about: "A subject starts with the painter deciding he would like to paint such-and-such because for some reason or other he finds it meaningful. A subject begins when the artist selects something for special mention." Hence, when the artist must choose for himself, the ground of his choice is the meaning the subject holds for him.

Step 3: Test every option **(A)** The prevalent style of the society: this fits a secure culture, where "the general agreement about what is significant is so well established" that subjects are presented to the artist. It is wrong here.

(B) Its meaningfulness to the painter: supported directly by the third paragraph. Correct.

(C) What is put in front of the easel: the passage says a subject "does not start with what is put in front of the easel". Wrong.

(D) Past experience and memory: the same sentence says a subject does not start "with something which the painter happens to remember". Wrong.

Step 4: Conclusion In an insecure culture the painter has to choose his subject himself, and he chooses it because he finds it meaningful. Hence, the correct option is (B).

Quick Tip to Solve: Eliminate options the passage explicitly denies: the line "does not start with what is put in front of the easel or with something which the painter happens to remember" removes both (C) and (D) at once.

99. In the sentence, "I believe there is a connection" (second paragraph), what two developments is the author referring to? [1 mark]

(A) Painters using a dying hero and using a fruit as a subject of painting.

(B) Growing success of painters and an increase in abstract forms.

(C) Artists gaining freedom to choose subjects and abandoning subjects altogether.

(D) Rise of Impressionists and an increase in abstract forms.

Correct Answer: (C) Artists gaining freedom to choose subjects and abandoning subjects altogether.

Solution:

Concept:

- When a sentence says "these two developments" or "this connection", the referents are found in the sentences just before it. Read back to the two developments the author has set side by side.

Step 1: Read the lines before the sentence The second paragraph opens: "Is there a connection between these two developments?" It then asks whether art has gone abstract because the artist is embarrassed by his freedom, and later says "I believe there is a connection." The two developments are therefore the ones set out at the close of the first paragraph.

Step 2: Identify the two developments The first paragraph says: "The painter is now free to paint anything he chooses" and that the Impressionists won this "previously unheard-of freedom for the artist". It then adds: "Yet, by the next generation, painters began to abandon the subject altogether, and began to paint abstract pictures." So the two developments are (1) the artist's freedom to choose any subject, and (2) the abandonment of subjects, that is, abstract art.

Step 3: Test every option **(A)** A dying hero and a fruit are only examples of subjects now accepted as equally important. They are not the developments. Wrong.

(B) "Growing success of painters" is never mentioned as a development. Wrong.

(C) Freedom to choose subjects and abandoning subjects altogether: matches exactly. Correct.

(D) The rise of the Impressionists is the cause of the new freedom, not a separate development, and "an increase in abstract forms" alone is only one of the two. Wrong.

Step 4: Conclusion The author links the artist's new freedom to choose any subject with the later abandonment of subjects in abstract art. Hence, the correct option is (C).

Quick Tip to Solve: For "these two developments", look at the sentences immediately before it: the "Yet, by the next generation" contrast marks the second development.

100. Which of the following is NOT necessarily among the attributes needed for a painter to succeed:

[1 mark]

(A) The painter and his public agree on what is significant.

(B) The painting is able to communicate and justify the significance of its subject selection.

(C) The subject has a personal meaning for the painter.

(D) The painting of subjects is inspired by historical developments.

Correct Answer: (C) The subject has a personal meaning for the painter.

Solution:

Concept:

- In a "NOT necessarily" question, the options that the passage states as requirements are wrong answers. The right answer is the one the passage treats only as a possibility ("may") and not as a requirement.

Step 1: Find what the passage requires for success The fifth paragraph begins: "Thus, for a painting to succeed it is essential that the painter and his public agree about what is significant." The third paragraph says that after the subject is selected, "the function of the painting itself is to communicate and justify the significance of that selection." So agreement on significance and the justification of the selection are named as needed for success.

Step 2: Check the personal meaning of the subject The fifth paragraph continues: "The subject *may* have a personal meaning for the painter or individual spectator; but there must also be the possibility of their agreement on its general meaning." The word "may" shows that personal meaning is allowed but not required. What is required is the possibility of agreement on general meaning.

Step 3: Test every option **(A)** Stated as "essential". It is necessary.

(B) Stated as the function of the painting once the subject is chosen. It is necessary.

(C) A personal meaning is only something the subject "may" have. It is not necessarily needed. This is the answer.

(D) The passage says the culture of the society, with its history, precedes the artist and makes agreement on general meaning possible. This is tied to the requirement of shared significance, so it is treated as a condition of success, not as an optional extra.

Step 4: Conclusion Only the personal meaning for the painter is stated as a possibility and not as a requirement, so it is the attribute that is NOT necessarily needed. Hence, the correct option is (C).

Quick Tip to Solve: In "NOT necessarily" questions, watch for hedge words such as "may" in the passage. They mark the option that is allowed but not required.

101. In the context of the passage, which of the following statements would NOT be true? [1 mark]

(A) Painters decided subjects based on what they remembered from their own lives.

(B) Painters of reeds and water in China faced no serious problem of choosing a subject.

(C) The choice of subject was a source of scandals in nineteenth century European art.

(D) Agreement on the general meaning of a painting is influenced by culture and historical context.

Correct Answer: (A) Painters decided subjects based on what they remembered from their own lives.

Solution:

Concept:

- In a "would NOT be true" question, three options restate the passage and one contradicts it. Verify each option against a specific sentence.

Step 1: Check option (A) against the passage The third paragraph says: "A subject does not start with what is put in front of the easel or with something which the painter happens to remember." A subject starts when the painter finds something meaningful and selects it. So the claim that painters decided subjects based on what they remembered from their own lives contradicts the passage. It is NOT true.

Step 2: Verify the other options **(B)** The sixth paragraph says that in a secure culture, with traditional subjects such as "reeds and water in China", the artist is employed for particular subjects and "the problem . . . will not occur to him". True.

(C) The seventh paragraph says "many of the art scandals of that time were provoked by the choice of subject" in nineteenth-century Europe. True.

(D) The fifth paragraph says "the culture of the society and period in question precedes the artist and his art", and that agreement on general meaning is possible through culture, which is historical. True.

Step 3: Conclusion Of the four statements, only the one about subjects chosen from the painter's own memories contradicts the line that a subject does not start with something the painter happens to remember. Hence, the correct option is (A).

Quick Tip to Solve: For "NOT true" questions, match each option to a sentence in the passage. The option that cannot be matched, or is directly denied, is the answer.

102. Which of the following views is taken by the author? [1 mark]

(A) The more insecure a culture, the greater the freedom of the artist.

(B) The more secure a culture, the greater the freedom of the artist.

(C) The more secure a culture, more difficult the choice of subject.

(D) The more insecure a culture, the less significant the choice of the subject.

Correct Answer: (A) The more insecure a culture, the greater the freedom of the artist.

Solution:

Concept:

- The author's view is the relationship the passage draws between the security of a culture and the freedom of the artist. Find the two paragraphs that state it, one for a secure culture and one for an insecure culture.

Step 1: Secure culture The sixth paragraph says: "When a culture is secure and certain of its values, it presents its artists with subjects . . . in such cultures the artist is unlikely to be a free agent." So the more secure the culture, the less free the artist.

Step 2: Insecure culture The seventh paragraph says: "When a culture is in a state of disintegration or transition, the freedom of the artist increases — but the question of subject matter becomes problematic for him." So the more insecure the culture, the greater the freedom of the artist, and the harder the choice of subject.

Step 3: Test every option **(A)** The more insecure a culture, the greater the freedom of the artist: stated directly. Correct.

(B) The more secure a culture, the greater the freedom: the reverse of the passage. Wrong.

(C) The more secure a culture, the more difficult the choice of subject: in a secure culture subjects are presented to the artist, so the choice is easy. Wrong.

(D) The more insecure a culture, the less significant the choice of subject: the passage calls the subject "the beginning and end of a painting", and the choice becomes more problematic in an insecure culture. Wrong.

Step 4: Conclusion The author holds that the less secure a culture is, the greater is the artist's freedom. Hence, the correct option is (A).

Quick Tip to Solve: Put the two cases side by side: secure culture gives subjects and less freedom, insecure culture gives more freedom and a harder choice. Options reversing this are wrong.

Questions 103–106. Recently I spent several hours sitting under a tree in my garden with the social anthropologist William Ury, a Harvard University professor who specializes in the art of negotiation and wrote the bestselling book, Getting to Yes. He captivated me with his theory that tribalism protects people from their fear of rapid change. He explained that the pillars of tribalism that humans rely on for security would always counter any significant cultural or social change. In this way, he said, change is never allowed to happen too fast. Technology, for example, is a pillar of society. Ury believes that every time technology moves in a new or radical direction, another pillar such as religion or nationalism will grow stronger in effect, the traditional and familiar will assume greater importance to compensate for the new and untested. In this manner, human tribes avoid rapid change that leaves people insecure and frightened.

But we have all heard that nothing is as permanent as change. Nothing is guaranteed. Pithy expressions, to be sure, but no more than cliches. As Ury says, people don't live that way from day-to-day. On the contrary, they actively seek certainty and stability. They want to know they will be safe.

Even so, we scare ourselves constantly with the idea of change. An IBM CEO once said: 'We only re-structure for a good reason, and if we haven't re-structured in a while, that's a good reason.' We are scared that competitors, technology and the consumer will put us Out of business — so we have to change all the time just to stay alive. But if we asked our fathers and grandfathers, would they have said that they lived in a period of little change? Structure may not have changed much. It may just be the speed with which we do things.

Change is over-rated, anyway, consider the automobile. It's an especially valuable example, because the auto industry has spent tens of billions of dollars on research and product development in the last 100 years. Henry Ford's first car had a metal chassis with an internal combustion, gasoline-powered engine, four wheels with rubber types, a foot operated clutch assembly and brake system, a steering wheel, and four seats, and it could safely do 18 miles per hour. A hundred years and tens of thousands of research hours later, we drive cars with a metal chassis with an internal combustion, gasoline-powered engine, four wheels with rubber tyres a foot operated clutch assembly and brake system, a steering wheel, four seats - and the average speed in London in 2001 was 17.5 miles per hour!

That's not a hell of a lot of return for the money. Ford evidently doesn't have much to teach us about change. The fact that they're still manufacturing cars is not proof that Ford Motor Co. is a sound organization, just proof that it takes very large companies to make cars in great quantities — making for an almost impregnable entry barrier.

Fifty years after the development of the jet engine, planes are also little changed. They've grown bigger, wider and can carry more people. But those are incremental, largely cosmetic changes.

Taken together, this lack of real change has come to man that in travel — whether driving or flying — time and technology have not combined to make things much better. The safety and design have of course accompanied the times and the new volume of cars and flights, but nothing of any significance has changed in the basic assumptions of the final product.

At the same time, moving around in cars or aero-planes becomes less and less efficient all the time. Not only has there been no great change, but also both forms of transport have deteriorated as more people clamour to use them. The same is true for telephones, which took over hundred years to become mobile or photographic film, which also required an entire century to change.

The only explanation for this is anthropological. Once established in calcified organizations, humans do two things: sabotage changes that might render people dispensable, and ensure industry-wide emulation. In the 1960s, German auto companies developed plans to scrap the entire combustion engine for an electrical design. (The same existed in the 1970s in Japan, and in the 1980s in France.)

So for 40 years we might have been free of the wasteful and ludicrous dependence on fossil fuels. Why didn't it go anywhere? Because auto executives understood pistons and carburettors, and would be loath to cannibalize their expertise, along with most of their factories

103. According to the above passage, which of the following statements is true? [1 mark]

(A) Executives of automobile companies are inefficient and ludicrous.

(B) The speed at which an automobile is driven in a city has not changed much in a century.

(C) Anthropological factors have fostered innovation in automobiles by promoting use of new technologies.

(D) Further innovation in jet engines has been more than incremental.

Correct Answer: (B) The speed at which an automobile is driven in a city has not changed much in a century.

Solution:

Concept:

- In a fact-based ('which statement is true') question the answer must be supported by something the passage states explicitly; an option that goes beyond, reverses or exaggerates the text is wrong.
- Method: locate the lines of the passage that deal with each option, and accept only the option that the text confirms.

Step 1: Find the evidence the passage gives about cars The fourth paragraph compares Henry Ford's first car, which 'could safely do 18 miles per hour', with today's cars, and then says: 'the average speed in London in 2001 was 17.5 miles per hour!'. The author uses this to show that, after a hundred years and billions of dollars of research, the speed at which a car actually moves in a city has hardly changed.

Step 2: Test option (A) The author says that executives were 'loath to cannibalize their expertise', i.e. they resisted change. The words 'wasteful and ludicrous' describe the dependence on fossil fuels, not the executives. So (A) distorts the text.

Step 3: Test options (C) and (D) (C) is the opposite of what the passage says: the anthropological explanation is that organisations 'sabotage changes', so they obstruct, not foster, innovation. (D) is also contradicted: after the jet engine the changes are called 'incremental, largely cosmetic'.

Step 4: Test option (B) The speed of 18 miles per hour then against 17.5 miles per hour in London in 2001 is practically the same, so (B) is directly supported by the passage.

Step 5: Conclusion Only option (B) is confirmed by the passage: the city speed of an automobile has remained almost the same over a century. Hence, the correct option is (B).

Quick Tip to Solve: In fact-based questions, hunt for the number or phrase in the passage (here 18 mph against 17.5 mph) and reject options that contain reversed words such as 'fostered' or 'more than incremental'.

104. Which of the following views does the author fully support in the passage? [1 mark]

(A) Nothing is as permanent as change.

(B) Change is always rapid.

(C) More money spent on innovation leads to more rapid change.

(D) Over decades, structural change has been incremental.

Correct Answer: (D) Over decades, structural change has been incremental.

Solution:

Concept:

- In 'which view does the author fully support' questions, separate the author's own position from ideas the author quotes only to criticise them.
- The correct option must match the author's argument without exaggeration, so words like 'always' deserve suspicion.

Step 1: Identify what the author is arguing The passage argues that change is over-rated. People actually seek certainty and stability, and in cars and aircraft the basic product has hardly changed in a century or half a century.

Step 2: Eliminate (A) and (B) (A) 'Nothing is as permanent as change' is one of the 'pithy expressions' that the author dismisses as 'no more than cliches'. (B) 'Change is always rapid' is contradicted by Ury's theory that tribalism ensures 'change is never allowed to happen too fast'.

Step 3: Eliminate (C) The auto industry spent 'tens of billions of dollars' on research, yet the car stayed essentially the same, and the author calls it 'not a hell of a lot of return for the money'. So more money does not lead to more rapid change.

Step 4: Confirm (D) The author says 'Structure may not have changed much', that planes show only 'incremental, largely cosmetic changes', and that cars keep the same basic design. So over decades structural change has been incremental, and the author fully supports this.

Step 5: Conclusion The only view the author fully endorses is that over decades structural change has been only incremental. Hence, the correct option is (D).

Quick Tip to Solve: Statements the author calls 'cliches' or 'myths' are never the author's view; look for the claim the author repeats with evidence, here slow incremental change.

105. Which of the following best describes one of the main ideas discussed in the passage? [1 mark]

(A) Rapid change is usually welcomed in society.

(B) Industry is not as innovative as it is made out to be.

(C) We should have less change than what we have now.

(D) Competition spurs companies into radical innovation.

Correct Answer: (B) Industry is not as innovative as it is made out to be.

Solution:

Concept:

- A main-idea question asks for the thesis that the whole passage develops, not a detail from one paragraph.
- Check each option against the opening, the examples and the closing explanation of the passage.

Step 1: State the thesis of the passage The author says 'Change is over-rated'. The examples of the automobile, the jet engine, the telephone and photographic film show that industries, despite huge research spending, have changed their basic products very little. The closing paragraph explains this anthropologically: organisations sabotage changes that threaten them. So industry is not as innovative as it is made out to be.

Step 2: Reject (A) and (D) (A) is false: Ury's theory says people fear rapid change, so tribal pillars slow it down. (D) says competition spurs radical innovation, but the author says established organisations obstruct radical change and imitate each other ('industry-wide emulation').

Step 3: Reject (C) The author does not prescribe less change; he only observes that real change is smaller than people believe. Nothing is said about what society should want, so (C) is an unsupported recommendation.

Step 4: Accept (B) Option (B) summarises the central argument that industry's record of innovation is weak compared with its image.

Step 5: Conclusion The main idea is that industry is less innovative than is generally believed. Hence, the correct option is (B).

Quick Tip to Solve: The title of this passage could be 'The myth of rapid change'; test each option against that one-line summary and drop options that are prescriptions or details.

106. According to the passage, the reason why we continue to be dependent on fossil fuels is that:

[1 mark]

(A) Auto executives did not wish to change.

(B) No alternative fuels were discovered.

(C) Change in technology was not easily possible

(D) German, Japanese and French companies could not come up with new technologies.

Correct Answer: (A) Auto executives did not wish to change.

Solution:

Concept:

- For a 'according to the passage, the reason is' question, take the reason that the passage itself states, not one that is merely plausible.

Step 1: Find the sentence that explains the dependence on fossil fuels In the last paragraph the author asks why plans to replace the combustion engine with an electrical design 'didn't go anywhere'. The answer given is: 'Because auto executives understood pistons and carburettors, and would be loath to cannibalize their expertise, along with most of their factories'. The executives were unwilling to change.

Step 2: Test (B) and (C) (B) is wrong because the passage does not say that alternatives were undiscovered; an electrical design had actually been planned. (C) is wrong because the obstacle was not technological impossibility: the plans existed, but were sabotaged.

Step 3: Test (D) (D) is wrong because German, Japanese and French companies did come up with such plans in the 1960s, 1970s and 1980s respectively.

Step 4: Confirm (A) The cause named in the passage is the reluctance of auto executives to give up their expertise and factories, which is exactly option (A).

Step 5: Conclusion The continued dependence on fossil fuels is attributed to the unwillingness of auto executives to change. Hence, the correct option is (A).

Quick Tip to Solve: The words 'Why didn't it go anywhere? Because ...' signal the answer; options that say 'no alternative existed' contradict the plans mentioned just before.

Questions 107–110. The viability of the multinational corporate system depends upon the degree to which people will tolerate the unevenness it creates. It is well to remember that the 'New Imperialism' which began after 1870 in a spirit of Capitalism Triumphant, soon became seriously troubled and after 1914 was characterized by war, depression, breakdown of the international economic system and war again, rather than Free Trade, Pax Britannica and Material Improvement. A major reason was Britain's inability to cope with the byproducts of its own rapid accumulation of capital; i.e., a class-conscious labour force at home; a middle class in the hinterland; and rival centres of capital on the Continent and in America. Britain's policy tended to be atavistic and defensive rather than progressive — more concerned with warding off new threats than creating new areas of expansion. Ironically, Edwardian England revived the paraphernalia of the landed aristocracy it had just destroyed. Instead of embarking on a 'big push' to develop the vast hinterland of the Empire, colonial administrators often adopted policies to arrest the development of either a native capitalist class or a native proletariat which could overthrow them.

As time went on, the centre had to devote an increasing share of government activity to military and other unproductive expenditures; they had to rely on alliances with an inefficient class of landlords,

officials and soldiers in the hinterland to maintain stability at the cost of development. A great part of the surplus extracted from the population was thus wasted locally.

The New Mercantilism (as the Multinational Corporate System of special alliances and privileges, aid and tariff concessions is sometimes called) faces similar problems of internal and external division. The centre is troubled: excluded groups revolt and even some of the affluent are dissatisfied with the roles. Nationalistic rivalry between major capitalist countries remains an important divisive factor. Finally, there is the threat presented by the middle classes and the excluded groups of the underdeveloped countries. The national middle classes in the underdeveloped countries came to power when the centre weakened but could not, through their policy of import substitution manufacturing, establish a viable basis for sustained growth. They now face a foreign exchange crisis and an unemployment (or population) crisis—the first indicating their inability to function in the international economy and the second indicating their alienation from the people they are supposed to lead. In the immediate future, these national middle classes will gain a new lease of life as they take advantage of the spaces created by the rivalry between American and non-American oligopolists striving to establish global market positions.

The native capitalists will again become the champions of national independence as they bargain with multinational corporations. But the conflict at this level is more apparent than real, for in the end the fervent nationalism of the middle class asks only for promotion within the corporate structure and not for a break with that structure. In the last analysis their power derives from the metropolis and they cannot easily afford to challenge the international system. They do not command the loyalty of their own population and cannot really compete with the large, powerful, aggregate capitals from the centre. They are prisoners of the taste patterns and consumption standards' set at the centre.

The main threat comes from the excluded groups. It is not unusual in underdeveloped countries for the top 5 per cent to obtain between 30 and 40 per cent of the total national income, and for the top one-third to obtain anywhere from 60 to 70 per cent. At most, one-third of the population can be said to benefit in some sense from the dualistic growth that characterizes development in the hinterland. The remaining two-thirds, who together get only one-third of the income, are outsiders, not because they do not contribute to the economy, but because they do not share in the benefits. They provide a source of cheap labour which helps keep exports to the developed world at a low price and which has financed the urban-biased growth of recent years. In fact, it is difficult to see how the system in most underdeveloped countries could survive without cheap labour since removing it (e.g. diverting it to public works projects as is done in socialist countries) would raise consumption costs to capitalists and professional elites.

107. According to the author, the British policy during the "New Imperialism" period tended to be defensive because [1 mark]

(A) it was unable to deal with the fallouts of a sharp increase in capital.

(B) its cumulative capital had undesirable side-effects.

(C) its policies favoured developing the vast hinterland.

(D) it prevented the growth of a set-up which could have been capitalistic in nature.

Correct Answer: (A) it was unable to deal with the fallouts of a sharp increase in capital.

Solution:

Concept:

- Find the exact sentence in which the author explains why British policy was defensive, and match it with the option that paraphrases it most closely.

Step 1: Locate the explanation in the first paragraph The author writes: 'A major reason was Britain's inability to cope with the byproducts of its own rapid accumulation of capital; i.e., a class-conscious labour force at home; a middle class in the hinterland; and rival centres of capital'. Then he says: 'Britain's policy tended to be atavistic and defensive'. So the defensiveness arose from the inability to handle the fallouts of rapid capital growth.

Step 2: Match with option (A) (A) says the policy was defensive because Britain was unable to deal with the fallouts of a sharp increase in capital. This is a close paraphrase of the passage.

Step 3: Test (B), (C) and (D) (B) names the side-effects but not Britain's inability to cope with them, and it does not explain the defensive policy. (C) is the opposite: policy was defensive rather than progressive, and Britain did not embark on a 'big push' to develop the hinterland. (D) describes a tactic of colonial administrators (arresting a native capitalist class), which is an instance of the defensive policy and not the reason for it.

Step 4: Conclusion The passage explains British defensiveness by its inability to cope with the byproducts of rapid capital accumulation. Hence, the correct option is (A).

Quick Tip to Solve: Separate a cause from its consequence: option (D) is something the defensive policy did, whereas option (A) is why that policy existed.

108. Under New Mercantilism, the fervent nationalism of the native middle classes does not create conflict with the multinational corporations because they (the middle classes) [1 mark]

(A) negotiate with the multinational corporations

(B) are dependent on the international system for their continued prosperity.

(C) are not in a position to challenge the status quo.

(D) do not enjoy popular support.

Correct Answer: (C) are not in a position to challenge the status quo.

Solution:

Concept:

- An inference question needs the option that follows most directly from the author's own explanation, in the author's words.

Step 1: Read the explanation of the middle-class nationalism The fourth paragraph says that the conflict is 'more apparent than real', since the nationalism of the middle class 'asks only for promotion within the corporate structure and not for a break with that structure'. The reason is given in the next sentence: 'they cannot easily afford to challenge the international system'.

Step 2: Match with option (C) Being unable to afford a challenge to the international system means

that they are not in a position to challenge the status quo. This is option (C).

Step 3: Test (A), (B) and (D) (A) Bargaining with the multinationals is what the native capitalists do, and it is the conflict that is called apparent; it is not the reason why no conflict arises. (B) is only partly suggested by 'their power derives from the metropolis'; the passage never speaks of their 'prosperity', and the reason it gives for avoiding conflict is that they cannot afford a challenge, which is (C). (D) is stated in the passage, but as a separate point: lack of popular loyalty makes them weak in competition, and it is not given as the reason for avoiding conflict.

Step 4: Conclusion The middle classes avoid real conflict with the multinational corporations because they cannot afford to challenge the existing international order. Hence, the correct option is (C).

Quick Tip to Solve: When two options both look true, choose the one that repeats the author's own reason ('cannot easily afford to challenge'), not one that merely describes the background.

109. In the sentence, "They are prisoners of the taste patterns and consumption standards set at the center." (fourth paragraph), what is the meaning of "centre"? [1 mark]

(A) National government

(B) Native capitalists.

(C) New capitalists.

(D) None of the above.

Correct Answer: (D) None of the above.

Solution:

Concept:

- The meaning of a word in context depends on how the author uses it across the passage. Here 'centre' is contrasted with 'hinterland', the periphery.

Step 1: Trace how 'centre' is used In the first paragraph the author speaks of the 'hinterland of the Empire', and in the second paragraph of the 'centre' that had to spend on military and unproductive items and rely on landlords and officials in the hinterland. In the third paragraph the national middle classes in the underdeveloped countries came to power 'when the centre weakened'. In the fourth paragraph the native capitalists are 'prisoners of the taste patterns and consumption standards set at the centre', and their power derives from the 'metropolis'. So the centre is the metropolis, the developed capitalist countries (and the multinational corporations based there), against the underdeveloped hinterland.

Step 2: Test the options (A) A national government is not the centre; the centre is outside the underdeveloped countries. (B) The native capitalists are the ones who are prisoners of the centre, so they cannot be the centre. (C) 'New capitalists' is not a group the passage speaks of at all.

Step 3: Conclude None of the first three options gives the meaning of 'centre' as the developed, metropolitan capitalist countries.

Step 4: Conclusion 'Centre' means the metropolitan, developed capitalist countries, and none of the first three options says this. Hence, the correct option is (D).

Quick Tip to Solve: Look for the opposite word: 'centre' pairs with 'hinterland' and 'metropolis', and this contrast shows it is the developed core, not any local group.

110. The author is in a position to draw parallels between New Imperialism and New Mercantilism because [1 mark]

(A) both originated in the developed Western capitalist countries.

(B) New Mercantilism was a logical sequel to New Imperialism

(C) they create the same set of outputs: a labour force, middle classes and rival centers of capital.

(D) both have comparable uneven and divisive effects.

Correct Answer: (D) both have comparable uneven and divisive effects.

Solution:

Concept:

- A parallel drawn by an author rests on the common feature the passage itself stresses, not on every similarity that can be imagined.

Step 1: Find the common theme The first sentence says that the viability of the multinational corporate system depends on how far people tolerate 'the unevenness it creates'. The third paragraph says that the New Mercantilism 'faces similar problems of internal and external division'. So the author compares the two systems on the basis of their uneven and divisive effects, which led New Imperialism to trouble and now threaten the multinational system.

Step 2: Test (A) and (B) (A) Origin in Western capitalist countries is not the basis the author gives for the comparison. (B) The passage never says that New Mercantilism is a logical sequel to New Imperialism; it only says that it has similar problems.

Step 3: Test (C) (C) The labour force, middle classes and rival centres of capital are the byproducts of Britain's capital accumulation, a feature of New Imperialism; the author does not say that New Mercantilism creates the same outputs.

Step 4: Accept (D) Both systems create uneven development and divisions (excluded groups, rival nationalisms, middle-class tension), which makes them comparable. This is option (D).

Step 5: Conclusion The parallel is drawn because both systems have comparable uneven and divisive effects. Hence, the correct option is (D).

Quick Tip to Solve: Match the option with the passage's opening and 'similar problems of internal and external division'; sequels, origins and outputs are not claimed.

Questions 111–114. Fifty feet away three male lions lay by the road. They didn't appear to have a hair on their heads. Noting the color of their noses (leonine noses darken as they age, from pink to black), Craig estimated that they were six years old — young adults. "This is wonderful!" he said, after staring at them for several moments. "This is what we came to see. They really are maneless." Craig, a professor at the University of Minnesota, is arguably the leading expert on the majestic Serengeti lion, whose head is mantled in long, thick hair. He and Peyton West, a doctoral student who has been working with him in Tanzania, had never seen the Tsavo lions that live some 200 miles east of the Serengeti. The scientists had partly suspected that the maneless males were adolescents mistaken for adults by amateur observers. Now they knew better.

The Tsavo research expedition was mostly Peyton's show. She had spent several years in Tanzania, compiling the data she needed to answer a question that ought to have been answered long ago: Why do lions have manes? It's the only cat, wild or domestic, that displays such ornamentation. In Tsavo she was attacking the riddle from the opposite angle. Why do its lions not have manes? (Some "maneless" lions in Tsavo East do have partial manes, but they rarely attain the regal glory of the Serengeti lions.) Does environmental adaptation account for the trait? Are the lions of Tsavo, as some people believe, a distinct subspecies of their Serengeti cousins?

The Serengeti lions have been under continuous observation for more than 35 years, beginning with George Schaller's pioneering work in the 1960s. But the lions in Tsavo, Kenya's oldest and largest protected ecosystem, have hardly been studied. Consequently, legends have grown up around them. Not only do they look different, according to the myths, they behave differently, displaying greater cunning and aggressiveness. "Remember too," Kenya: The Rough Guide warns, "Tsavo's lions have a reputation of ferocity." Their fearsome image became well-known in 1898, when two males stalled construction of what is now Kenya Railways by allegedly killing and eating 135 Indian and African laborers. A British Army officer in charge of building a railroad bridge over the Tsavo River, Lt. Col. J. H. Patterson, spent nine months pursuing the pair before he brought them to bay and killed them. Stuffed and mounted, they now glare at visitors to the Field Museum in Chicago. Patterson's account of the leonine reign of terror, The Man-Eaters of Tsavo, was an international best seller when published in 1907. Still in print, the book has made Tsavo's lions notorious. That annoys some scientists. "People don't want to give up on mythology," Dennis King told me one day. The zoologist has been working in Tsavo off and on for four years. "I am so sick of this maneater business. Patterson made a helluva lot of money off that story, but Tsavo's lions are no more likely to turn man-eater than lions from elsewhere."

But tales of their savagery and wiliness don't all come from sensationalist authors looking to make a buck. Tsavo lions are generally larger than lions elsewhere, enabling them to take down the predominant prey animal in Tsavo, the Cape buffalo, one of the strongest, most aggressive animals of Earth. The buffalo don't give up easily: They often kill or severely injure an attacking lion, and a wounded lion might be more likely to turn to cattle and humans for food.

And other prey is less abundant in Tsavo than in other traditional lion haunts. A hungry lion is more likely to attack humans. Safari guides and Kenya Wildlife Service rangers tell of lions attacking Land Rovers, raiding camps, stalking tourists. Tsavo is a tough neighborhood, they say, and it breeds tougher lions.

But are they really tougher? And if so, is there any connection between their manelessness and their ferocity? An intriguing hypothesis was advanced two years ago by Gnoske and Peterhans: Tsavo lions may be similar to the unmaned cave lions of the Pleistocene. The Serengeti variety is among the most evolved of the species — the latest model, so to speak — while certain morphological differences in Tsavo lions (bigger bodies, smaller skulls, and maybe even lack of a mane) suggest that they are closer to the primitive ancestor of all lions. Craig and Peyton had serious doubts about this idea, but

admitted that Tsavo lions pose a mystery to science.

111. The book Man-Eaters of Tsavo annoys some scientists because [1 mark]

(A) it revealed that Tsavo lions are ferocious.

(B) Patterson made a helluva lot of money from the book by sensationalism.

(C) it perpetuated the bad name Tsavo lions had.

(D) it narrated how two male Tsavo lions were killed.

Correct Answer: (C) it perpetuated the bad name Tsavo lions had.

Solution:

Concept:

- In a 'because' question, use the sentence in which the passage itself gives the reason; do not choose an option that only mentions a related fact.

Step 1: Locate the sentence The third paragraph says that Patterson's book 'The Man-Eaters of Tsavo' was an international best seller, and 'Still in print, the book has made Tsavo's lions notorious. That annoys some scientists.' Dennis King adds: 'People don't want to give up on mythology ... Tsavo's lions are no more likely to turn man-eater than lions from elsewhere.' So the scientists are annoyed because the book keeps alive the bad reputation of Tsavo lions.

Step 2: Test (A) The scientists do not say that the book revealed ferocity; they say that the idea is a myth. So (A) is wrong.

Step 3: Test (B) and (D) (B) King does remark on Patterson's earnings, but the annoyance is stated to arise from the book making the lions notorious, not from the money. (D) The killing of two lions is told in the book, but it is not what troubles the scientists.

Step 4: Accept (C) The book perpetuated the lions' bad name, which fits 'has made Tsavo's lions notorious'.

Step 5: Conclusion Scientists are annoyed because the book perpetuated the bad name of the Tsavo lions. Hence, the correct option is (C).

Quick Tip to Solve: The sentence just before 'That annoys some scientists' always holds the cause; here it is 'the book has made Tsavo's lions notorious'.

112. The sentence which concludes the first paragraph, "Now they knew better", implies that: [1 mark]

(A) The two scientists were struck by wonder on seeing maneless lions for the first time.

(B) Though Craig was an expert on the Serengeti lion, now he also knew about the Tsavo lions.

(C) Earlier, Craig and West thought that amateur observers had been mistaken.

(D) Craig was now able to confirm that darkening of the noses as lions aged applied toTsavo lions as well.

Correct Answer: (C) Earlier, Craig and West thought that amateur observers had been mistaken.

Solution:

Concept:

- To interpret a sentence such as 'Now they knew better', read the sentence just before it, which states what the characters believed earlier.

Step 1: Read the sentence before the line The previous sentence says: 'The scientists had partly suspected that the maneless males were adolescents mistaken for adults by amateur observers.' Then comes 'Now they knew better.' So seeing the six-year-old maneless lions showed them that the earlier suspicion was wrong; the males really were adults, and Tsavo lions are really maneless.

Step 2: Test (A) Craig says 'This is wonderful!', so he is pleased, but 'knew better' tells us about correcting a belief, not about wonder.

Step 3: Test (B) and (D) (B) Learning about Tsavo lions is true, but the sentence is about correcting a specific earlier belief. (D) Nose colour was used to estimate the age, but nothing says that this was newly confirmed.

Step 4: Test (C) Craig and West had suspected the amateur observers were mistaken (they thought the maneless males were adolescents). They now saw this was wrong. This is implied by the sentence, and option (C) states the earlier thinking.

Step 5: Conclusion The sentence implies that earlier Craig and West thought the amateur observers had been mistaken, which they now found was not so. Hence, the correct option is (C).

Quick Tip to Solve: For 'knew better' or 'realised' sentences, find the earlier belief in the preceding line; the correct option names that belief.

113. According to the passage, which of the following has NOT contributed to the popular image of Tsavo lions as savage creatures? [1 mark]

(A) Tsavo lions have been observed to bring down one of the strongest and most aggressive animals . the Cape buffalo.

(B) In contrast to the situation in traditional lion haunts, scarcity of non-buffalo prey in the Tsavo makes the Tsavo lions more aggressive.

(C) The Tsavo lion is considered to be less evolved than the Serengeti variety.

(D) Tsavo lions have been observed to attack vehicles as well as humans.

Correct Answer: (C) The Tsavo lion is considered to be less evolved than the Serengeti variety.

Solution:

Concept:

- In a NOT question, three options are stated in the passage as causes of the popular image, and the remaining one is not. Check each option against the passage and select the exception.

Step 1: Check (A) The fourth paragraph says Tsavo lions take down the Cape buffalo, 'one of the strongest, most aggressive animals of Earth'. This is given among the 'tales of their savagery'. So (A) contributes to the image.

Step 2: Check (B) and (D) The next paragraph says 'other prey is less abundant in Tsavo than in other traditional lion haunts. A hungry lion is more likely to attack humans.' This supports (B). It continues: 'Safari guides and Kenya Wildlife Service rangers tell of lions attacking Land Rovers, raiding camps, stalking tourists', which supports (D).

Step 3: Check (C) That Tsavo lions are less evolved and closer to the primitive ancestor is the scientific hypothesis of Gnoske and Peterhans. It is a hypothesis advanced two years ago, and Craig and Peyton doubted it. It is not part of the legends, guides' stories or reputation that formed the popular image of savagery.

Step 4: Conclusion The idea that the Tsavo lion is less evolved than the Serengeti lion is a scientific hypothesis, not a source of the popular image of savagery. Hence, the correct option is (C).

Quick Tip to Solve: In NOT questions, tick the three options you can underline in the passage; the one left over, here a scientific hypothesis and not popular lore, is the answer.

114. Which of the following, if true, would weaken the hypothesis advanced by Gnoske and Peterhans most? [1 mark]

(A) Craig and Peyton develop even more serious doubts about the idea that Tsavo lions are primitive.

(B) The maneless Tsavo East lions are shown to be closer to the cave lions.

(C) Pleistocene cave lions are shown to be far less violent than believed.

(D) The morphological variations in body and skull size between the cave and Tsavo lions are found to be insignificant.

Correct Answer: (C) Pleistocene cave lions are shown to be far less violent than believed.

Solution:

Concept:

- To weaken a hypothesis, find the option that attacks the link between its premise and its conclusion; an option that strengthens it or is irrelevant to it does not weaken it.

Step 1: State the hypothesis and the link it is meant to explain The paragraph asks whether there is a connection between the manelessness and the ferocity of Tsavo lions. Gnoske and Peterhans suggest that Tsavo lions are like the unmaned cave lions of the Pleistocene, which were closer to the primitive ancestor. The idea is therefore that Tsavo lions are ferocious and maneless because they resemble the cave lions.

Step 2: Test (A), (B) and (D) (A) The doubts of Craig and Peyton are opinions, not new facts, so they do not weaken it. (B) Showing that the Tsavo East lions are closer to the cave lions supports the hypothesis. (D) If the differences in body and skull size are insignificant, then the Tsavo and cave lions are more alike, which again supports it.

Step 3: Test (C) If the cave lions were far less violent than believed, then resemblance to them cannot account for the ferocity of the Tsavo lions. This breaks the link between manelessness and ferocity that the hypothesis was meant to explain, so (C) weakens it most.

Step 4: Conclusion Showing that Pleistocene cave lions were far less violent than believed undermines the connection with Tsavo ferocity, and so weakens the hypothesis the most. Hence, the correct option is (C).

Quick Tip to Solve: A 'weaken' option must hit the link in the argument; evidence that makes the two groups more alike, or merely adds doubt, never weakens it.

115. The author recommends micronutrient-repletion for large-scale treatment of chronic degenerative diseases because

[1 mark]

(A) it is relatively easy to manage.

(B) micronutrient deficiency is the cause of these diseases.

(C) it can overcome genetic risk factors.

(D) it can compensate for other lifestyle factors.

Correct Answer: (B) micronutrient deficiency is the cause of these diseases.

Solution:

Concept:

- Fact-based reading comprehension: the answer must be the reason the author actually gives, found in the passage, not a plausible outside idea.
- Look for the author's causal chain: cause (Type B malnutrition) $\rightarrow$ disease (chronic degenerative diseases) $\rightarrow$ remedy (micronutrient repletion).

Step 1: Locate the author's recommendation in the passage In the fourth paragraph the author writes: "There is now considerable evidence that Type B malnutrition is a major cause of chronic degenerative diseases. If this is the case, then it is logical to treat such diseases not with drugs but with multiple micronutrient repletion." The word "if" and the phrase "it is logical" show that the recommendation rests on the causal claim that multiple micronutrient depletion (Type B malnutrition) produces the diseases.

Step 2: Test each option against the passage **(A)** The passage never says repletion is easy to manage; it only says the approach has been neglected because it is unprofitable for drug companies and clashes with medical interventionism. **(B)** Micronutrient depletion is named as a major cause of the diseases, so replacing the missing micronutrients is the logical large-scale treatment. This is the stated reason. **(C)** Genetic risk factors are said to matter to individuals, but nothing says repletion overcomes them; at population level lifestyle dominates. **(D)** Nutrition is called one of the lifestyle factors; repletion is not said to compensate for exercise or smoking.

Step 3: Conclusion The author recommends micronutrient repletion because deficiency (Type B malnutrition) is the cause of these diseases. Hence, the correct option is (B).

Quick Tip to Solve: Hunt for "if this is the case, then it is logical" type signals; the sentence before them gives the premise the author is actually using.

116. Tailoring micronutrient-based treatment plans to suit individual deficiency profiles is not necessary because [1 mark]

(A) it very likely to give inconsistent or negative results.

(B) it is a classic pharmaceutical approach not suited to micronutrients.

(C) most people are consuming suboptimal amounts of safe-to-consume micronutrients.

(D) it is not cost effective to do so.

Correct Answer: (C) most people are consuming suboptimal amounts of safe-to-consume micronutrients.

Solution:

Concept:

- Fact-based reading comprehension: pick the reason the passage itself gives for a stated conclusion, and reject options that are true elsewhere in the passage but answer a different point.

Step 1: Find where the author dismisses individual tailoring The last paragraph asks: "So do we need to analyse each individual's nutritional status and then tailor a formula specifically for him or her?" It answers: "While we do not have the resources to analyze millions of individual cases, there is no need to do so. The vast majority of people are consuming suboptimal amounts of most micronutrients, and most of the micronutrients concerned are very safe." So tailoring is unnecessary because nearly everyone is short of the same micronutrients and the supplements are safe.

Step 2: Test each option against the passage **(A)** Inconsistent or negative results are attributed to testing single micronutrients, not to tailoring plans. **(B)** The classical pharmaceutical approach is the testing of ingredients one by one; it is not the same as tailoring a formula to a person. **(C)** This is the author's own reason: most people consume suboptimal amounts of micronutrients that are safe, so one universal programme will do. **(D)** This is tempting, since the author concedes that "we do not have the resources to analyze millions of individual cases". But that clause begins with "While": it is a concession, and the author's point is that there is "no need" to analyse them because of what follows. Cost-effectiveness is named only as a merit of the universal programme.

Step 3: Conclusion Tailoring is unnecessary because most people consume suboptimal amounts of safe-to-consume micronutrients. Hence, the correct option is (C).

Quick Tip to Solve: Match the option's words to the sentence that begins "there is no need to do so"; the reason follows immediately after it.

117. Type-B malnutrition is a serious concern in developed countries because [1 mark]

(A) developing countries mainly suffer from Type-A malnutrition.

(B) it is a major contributor to illness and death.

(C) pharmaceutical companies are not producing drugs to treat this condition.

(D) national surveys on malnutrition do not include newer micronutrient groups.

Correct Answer: (B) it is a major contributor to illness and death.

Solution:

Concept:

- Fact-based reading comprehension: separate the reason Type B malnutrition is dangerous (its consequence) from facts that merely describe it or its context.

Step 1: Find why Type B malnutrition matters The first paragraph says the major causes of ill health and death are now the chronic degenerative diseases. The fourth paragraph states: "There is now considerable evidence that Type B malnutrition is a major cause of chronic degenerative diseases." Hence Type B malnutrition, which is common in developed countries, is serious because it contributes greatly to illness and death.

Step 2: Test each option against the passage **(A)** True (developing nations suffer Type A), but it describes where the other type occurs and gives no reason for concern about Type B. **(B)** This is the consequence the author stresses: Type B malnutrition leads to the diseases that cause most ill health and death. **(C)** Drug companies are said to neglect the nutritional approach because it is unprofitable; this does not make the malnutrition serious. **(D)** The passage says the incidence would look worse if newer micronutrients were included, which concerns measurement, not the seriousness of the condition.

Step 3: Conclusion Type B malnutrition is a serious concern because it is a major contributor to illness and death. Hence, the correct option is (B).

Quick Tip to Solve: When asked why something is a "concern", choose the harm it causes, not a fact about its definition, location or measurement.

118. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph?

A. In the west, Allied Forces had fought their way through southern Italy as far as Rome.

B. In June 1944 Germany's military position in World War two appeared hopeless

C. In Britain, the task of amassing the men and materials for the liberation of northern Europe had been completed.

D. Red Army was poised to drive the Nazis back through Poland.

E. The situation on the eastern front was catastrophic. [1 mark]

(A) EDACB

(B) BEDAC

(C) BDECA

(D) CEDAB

Correct Answer: (B) BEDAC

Solution:

Concept:

- Para jumble: find the opening sentence that sets the general scene, then link sentences through pronouns, contrasts ("In the west") and the flow from the general to the specific.

Step 1: Find the opening and the eastern-front chain Sentence B ("In June 1944 Germany's military position in World War two appeared hopeless") gives the time and the general situation, so it opens the paragraph. E ("The situation on the eastern front was catastrophic") explains the hopeless position, and D ("Red Army was poised to drive the Nazis back through Poland") gives the detail of that eastern front. So the start is B–E–D.

Step 2: Link the western-front sentences A begins "In the west", a deliberate contrast with the east just described, and C ("In Britain, the task of amassing the men and materials for the liberation of northern Europe had been completed") adds the further western preparation. The order is B E D A C.

Step 3: Eliminate the other options (A) EDACB opens with E, which has no time or context given. (C) BDECA places D before E, but D is a detail that illustrates E. (D) CEDAB opens with Britain's preparation, which would have no setting and ends with the general statement B, which should be first.

Step 4: Conclusion The coherent order is BEDAC. Hence, the correct option is (B).

Quick Tip to Solve: Put the sentence with the date and general claim first, and keep contrast markers like "In the west" right after the sentences about the east.

119. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph?

A. But this does not mean that death was the Egyptians only preoccupation.

B. Even papyri come mainly from pyramid temples.

C. Most of our traditional sources of information about the Old Kingdom are monuments of the rich like pyramids and tombs.

D. Houses in which ordinary Egyptian lived have not been preserved, and when most people died they were buried in simple graves.

E. We know infinitely more about the wealthy people of Egypt than we do about the ordinary people, as most monuments were made for the rich. [2 marks]

(A) CDBEA

(B) ECDAB

(C) EDCBA

(D) DECAB

Correct Answer: (C) EDCBA

Solution:

Concept:

- Para jumble: start with the general claim, follow with the supporting details in logical order, and place the sentence beginning with "But" last when it qualifies everything before it.

Step 1: Identify the opening sentence Sentence E ("We know infinitely more about the wealthy people of Egypt than we do about the ordinary people, as most monuments were made for the rich") is the general thesis. It needs no earlier context and states the idea that the other sentences develop. So the paragraph begins with E.

Step 2: Build the supporting chain D follows naturally: houses of ordinary people have not survived and they were buried in simple graves, which explains why we know little about them. C then names what does survive, the monuments of the rich such as pyramids and tombs. B continues the same point with "Even papyri come mainly from pyramid temples", an extra example of sources tied to royal monuments. A, beginning "But this does not mean that death was the Egyptians' only preoccupation", qualifies the whole description of tombs and temples, so it closes the paragraph. The order is E D C B A.

Step 3: Eliminate the other options (A) CDBEA states the thesis E late and ends the chain of sources before it. (B) ECDAB puts A before B, so "Even papyri" hangs after the concluding qualification. (D) DECAB starts with the detail D, whose reference to ordinary people has not been introduced.

Step 4: Conclusion The most coherent order is EDCBA. Hence, the correct option is (C).

Quick Tip to Solve: The sentence starting with "But this does not mean..." qualifies a statement already made, so it usually belongs at the end of the paragraph.

120. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph?

A. Experts such as Larry Burns, head of research at GM, reckon that only such a full hearted leap will allow the world to cope with the mass motorization that will one day come to China or India.

B. But once hydrogen is being produced from biomass or extracted from underground coal or made from water, using nuclear or renewable electricity, the way will be open for a huge reduction in carbon emissions from the whole system.

C. In theory, once all the bugs have been sorted out, fuel cells should deliver better total fuel economy than any existing engines.

D. That is twice as good as the internal combustion engine, but only five percentage points better than a diesel hybrid.

E. Allowing for the resources needed to extract hydrogen from hydrocarbon, oil coal or gas, the fuel cell has an efficiency of 30%. [2 marks]

(A) CEDBA

(B) CEBDA

(C) AEDBC

(D) ACEBD

Correct Answer: (A) CEDBA

Solution:

Concept:

- Para jumble: track pronoun and demonstrative references ("That", "such") and keep "But" sentences after the point they qualify.

Step 1: Build the opening C ("In theory, once all the bugs have been sorted out, fuel cells should deliver better total fuel economy") introduces the topic. E then gives the figure for the fuel cell: "the fuel cell has an efficiency of 30%". D ("That is twice as good as the internal combustion engine, but only five percentage points better than a diesel hybrid") depends on E, because "That" refers to the 30% efficiency. So C E D stand together.

Step 2: Build the close B begins "But once hydrogen is being produced from biomass ..." and contrasts the modest efficiency gain with the large carbon-emission reduction possible later. A ("Experts ... reckon that only such a full hearted leap") refers back to this change and closes the paragraph. The order is C E D B A.

Step 3: Eliminate the other options (B) CEBDA separates D from E, so "That" loses its referent. (C) AEDBC opens with "such a full hearted leap", which has no antecedent. (D) ACEBD again puts A first and ends with D, which must follow E directly.

Step 4: Conclusion The correct sequence is CEDBA. Hence, the correct option is (A).

Quick Tip to Solve: Pair sentences joined by a pointer word: "That is twice as good" must directly follow the sentence that gives the number it refers to.

121. Choose the option that best captures the essence of the text.

Local communities have often come in conflict with agents trying to exploit resources, at a faster pace, for an expanding commercial-industrial economy. More often than not, such agents of resource-intensification are given preferential treatment by the state, through the grant of generous long leases over mineral or fish stocks, for example, or the provision of raw material at an enormously subsidized price. With the injustice so compounded, local communities at the receiving end of this process have no recourse except direct action, resisting both the state and outside exploiters through a variety of protest techniques. These struggles might perhaps be seen as a manifestation of a new kind of class conflict. [2 marks]

(A) A new kind of class conflict arises from preferential treatments given to agents of resource-intensification by the state, which the local community sees as unfair.

(B) The grant of long leases to agents of resource-intensification for an expanding commercial-industrial economy leads to direct protests from the local community, which sees it as unfair.

(C) Preferential treatment given by the state to agents of resource-intensification for an expanding commercial-industrial economy exacerbates injustice to local communities and leads to direct protests from them, resulting in a new type of class conflict.

(D) Local communities have no option but to protest against agents of resource intensification and create a new type of class conflict when they are given raw material at subsidized prices for an expanding commercial-industrial economy.

Correct Answer: (C) Preferential treatment given by the state to agents of resource-intensification for an expanding commercial-industrial economy exacerbates injustice to local communities and leads to direct protests from them, resulting in a new type of class conflict.

Solution:

Concept:

- Para summary: the best option captures the whole chain of ideas (cause, effect, conclusion) in the text without adding or distorting anything.

Step 1: Trace the argument of the text The text moves in four links. (1) Agents exploiting resources faster for the commercial-industrial economy clash with local communities. (2) The state favours these agents through long leases and subsidised raw material, which compounds the injustice. (3) Local communities have no recourse except direct protest. (4) These struggles may be seen as a new kind of class conflict.

Step 2: Compare the options with this chain **(A)** It links the class conflict only to preferential treatment and omits the injustice felt and the direct protest that lie in between. **(B)** It mentions only the long leases and protests, leaving out the state's preferential treatment as a whole and the class-conflict idea. **(C)** It covers the preferential treatment by the state, the injustice to local communities, their direct protest and the resulting new class conflict, so it follows every link. **(D)** It says the communities are the ones given subsidised raw material, when the text says the agents are, and it asserts the conflict outright instead of suggesting it "perhaps".

Step 3: Conclusion Option (C) is the only one that carries the full sequence of the text accurately. Hence, the correct option is (C).

Quick Tip to Solve: Number the ideas of the paragraph first, then reject options that drop a link or swap who receives the benefit.

122. Choose the option that best captures the essence of the text.

Although almost all climate scientists agree that the Earth is gradually warming, they have long been of two minds about the process of rapid climate shifts within larger periods of change. Some have speculated that the process works like a giant oven or freezer, warming or cooling the whole planet at the same time. Others think that shifts occur on opposing schedules in the Northern and Southern Hemisphere, like exaggerated seasons. Recent research in Germany examining climate patterns in the Southern Hemisphere at the end of the last Ice Age strengthens the idea that warming and cooling occurs at alternate times in the two hemispheres. A more definitive answer to this debate will allow scientists to better predict when and how quickly the next climate shift will happen. [2 marks]

(A) Scientists have been unsure whether rapid shifts in the Earth's climate happen all at once or on opposing schedules in different hemispheres; research will help find a definitive answer and better predict climate shifts in future.

(B) Scientists have been unsure whether rapid shifts in the Earth's climate happen all at once or on opposing schedules in different hemispheres; finding a definitive answer will help them better predict climate shifts in future.

(C) Research in Germany will help scientists find a definitive answer about warming and cooling of the Earth and predict climate shifts in the future in a better manner.

(D) More research rather than debates on warming or cooling of the Earth and exaggerated seasons in its hemisphere will help scientists in Germany predict changes better in future.

Correct Answer: (B) Scientists have been unsure whether rapid shifts in the Earth's climate happen all at once or on opposing schedules in different hemispheres; finding a definitive answer will help them better predict climate shifts in future.

Solution:

Concept:

- Para summary: capture the central issue and its significance, and prefer the option that keeps the cause-and-effect the author states instead of changing it.

Step 1: Find the central idea of the text Scientists agree the Earth is warming but disagree about rapid shifts: some think the whole planet warms or cools together, others that the two hemispheres shift on opposite schedules. German research supports the second view. The text ends by saying a more definitive answer to this debate will let scientists better predict when and how quickly the next shift will occur.

Step 2: Compare the options with this idea **(A)** It is close, but it says research will help find the answer, a change from the text, where finding the answer is what improves prediction; **(B)** it states the debate (all at once or opposite schedules) and says that finding a definitive answer will help them predict future shifts, which matches the last sentence exactly. **(C)** It reduces the text to Germany's research, which is only a supporting detail. **(D)** It sets research against debate, says scientists in Germany will predict changes and calls the seasons "exaggerated" hemispheres, all of which distort the text.

Step 3: Conclusion Option (B) states both the uncertainty and the benefit of resolving it, just as the text does. Hence, the correct option is (B).

Quick Tip to Solve: When two options look alike, check the last clause: it must show the same cause and effect as the author's closing sentence.

123. Choose the option that best captures the essence of the text.

Modern bourgeois society, said Nietzsche, was decadent and enfeebled - a victim of the excessive development of the rational faculties at the expense of will and instinct. Against the liberal-rationalist stress on the intellect, Nietzsche urged recognition of the dark mysterious world of instinctual desires - the true forces of life. Smother the will excessive intellectualizing and you destroy the spontaneity that sparks cultural creativity and ignites a zest for living. The critical and theoretical outlook destroyed the creative instincts. For man's manifold potential to be realized, he must forego relying on the intellect and nurture again the instinctual roots of human existence. [2 marks]

(A) Nietzsche urges the decadent and enfeebled modern society to forego intellect and give importance to creative instincts.

(B) Nietzsche urges the decadent and enfeebled modern society to smother the will with excessive intellectualizing and ignite a zest for living.

(C) Nietzsche criticizes the intellectuals for enfeebling the modern bourgeois society by not nurturing man's creative instincts.

(D) Nietzsche blames excessive intellectualization for the decline of modern society and suggests nurturing creative instincts instead.

Correct Answer: (D) Nietzsche blames excessive intellectualization for the decline of modern society and suggests nurturing creative instincts instead.

Solution:

Concept:

- Para summary: identify who is saying what (Nietzsche's diagnosis and his remedy) and reject options that reverse roles or distort the claims.

Step 1: Find the central idea of the text Nietzsche says modern bourgeois society was decadent because of the excessive development of reason at the cost of will and instinct. He argues that over-intellectualising kills the spontaneity behind creativity, and that people should stop relying on intellect and nurture the instinctual roots of life again. The text thus has a diagnosis (excess of intellect causes decline) and a remedy (nurture creative instincts).

Step 2: Compare the options with this idea **(A)** It gives the remedy but skips the diagnosis (excessive intellectualization) and says society must "forego intellect" wholesale. **(B)** It asks society to "smother the will with excessive intellectualizing", the exact opposite of the text, which says doing so destroys spontaneity. **(C)** It blames "the intellectuals" for not nurturing instincts; Nietzsche blames the over-development of reason in society, not a group of people. **(D)** It states that excessive intellectualization caused the decline and suggests nurturing creative instincts instead, which covers both diagnosis and remedy.

Step 3: Conclusion Option (D) alone captures both Nietzsche's criticism and his proposed remedy. Hence, the correct option is (D).

Quick Tip to Solve: Check each option for a reversed cause; B and C swap what Nietzsche blames and what he recommends, so they fail at once.