

SET-222

SECTION - I

1. Let the four-digit number be

$$1000a + 100a + 10b + b = 1100a + 11b$$

This number will be a perfect square if

$$1100a + 11b = k^2; \text{ where } k \text{ is an integer.}$$

$$\Rightarrow 11(100a + b) = k^2$$

$$\Rightarrow 100a + b = \frac{k^2}{11}$$

\therefore k should be a multiple of 11 such that $100a + b$ is a 3-digit number $k = 44, 55, 66, \dots, 99$

Corresponding values of $100a + b$ will be 176, 275, 396, 539, 704, 891.

Now, since a and b are digits of a number.

\therefore a, b < 9 only '704' satisfies this.

$$\therefore 1100a + 11b = 7700 + 44 = 7744 = (88)^2$$

Hence, [4].

Answers to questions 2 and 3:

Let the speed of the plane be x km/hr

Then its speed from B to A = $(x + 50)$ km/hr

and its speed from A to B = $(x - 50)$ km/hr

The flight starts from city B(8.00 a.m.) and arrives at city B (8.00 a.m.) after halting for 1 hour in city A

\therefore Total time taken = 11 hours

$$\text{i.e., } \frac{3000}{x+50} + \frac{3000}{x-50} = 11$$

$$\Rightarrow \frac{2x}{x^2 - 2500} = \frac{11}{3000}$$

$$\Rightarrow 11x^2 - 6000x - 27500 = 0$$

Solving the above we get, $x = 550$

$$\therefore \text{ Time taken from B to A} = \frac{3000}{500} = 6$$

Flight reaches A when local time in B is 2.00 p.m. which is same as local time 3.00 p.m. in A

\therefore Required time difference = 1 hour

$$2-[3]$$

$$3-[1]$$

4. Total number of teams = n

Number of players in each team = k

Number of players common to two teams = Number of teams = n

∴ Total number of players participating in the tournament

$$= nk - n = n(k - 1)$$

Hence, [5].

5. A member (a, b) will have an enemy of the form (c, d) where c, d, a, b are all distinct.

∴ c and d can be chosen in ${}^{n-2}C_2$ ways.

$$\text{So, number of enemies} = \frac{(n-2)(n-3)}{2} = \frac{1}{2}(n^2 - 5n + 6)$$

Hence, [3].

6. Consider friends (a, b) and (a, c).

Their common friend can be either (b, c) or a member of the form (a, d) or (d, a) where d is different from a, b, c.

Now, d can be chosen in $(n - 3)$ ways.

∴ Number of common friends = $(n - 3) + 1 = n - 2$.

Hence, [3].

7. $S = \{2, 3, 4, \dots, 2n + 1\}$

Total number of elements in $S = 2n$

$$X = \frac{3+5+\dots+(2n+1)}{n}$$

$$Y = \frac{2+4+6+\dots+2n}{n}$$

$$\therefore X - Y = \frac{(3-2)+(5-4)+\dots+(2n+1-2n)}{n}$$

$$= \frac{1+1+\dots+1(n \text{ times})}{n} = \frac{n}{n} = 1$$

Hence, [1].

8. Ten years ago, total age of 8 members = 231

Three years later, sum of the ages = $231 + 8 \times 3 - 60 = 195$

Three more years later, sum of the ages = $195 + 8 \times 3 - 60$

$$= 159$$

Now, sum of current ages = $159 + 8 \times 4 = 191$

$$\therefore \text{Required average} = \frac{191}{8} \approx 24 \text{ years.}$$

Hence, [4].

$$9. \quad f(n) = \frac{f(1) + f(2) + \dots + f(n-1)}{n^2 - 1}$$

$$f(1) = 3600$$

$$f(2) = \frac{f(1)}{3} = \frac{3600}{3} = 1200$$

$$f(3) = \frac{f(1) + f(2)}{8} = \frac{4800}{8} = 600$$

$$f(4) = \frac{f(1) + f(2) + f(3)}{15} = \frac{5400}{15} = 360$$

$$f(5) = \frac{f(1) + \dots + f(4)}{24} = \frac{5760}{24} = 240$$

$$f(6) = \frac{f(1) + \dots + f(5)}{35} = \frac{6000}{35} = \frac{1200}{7}$$

$$f(7) = \frac{f(1) + \dots + f(6)}{48}$$

$$= \frac{6000}{48} + \frac{1200}{7 \times 48}$$

$$= 125 + \frac{25}{7}$$

$$f(8) = \frac{f(1) + \dots + f(7)}{63} = \frac{6125}{63} + \frac{1225}{7 \times 63} = 100$$

$$f(9) = \frac{f(1) + \dots + f(8)}{80} = \frac{6125 + 175 + 100}{80} = 80$$

Hence, [5].

10. Using statement A:

$$x + y + z = 89$$

For $x^2 + y^2 + z^2$ to be minimum, each of x, y, z must take integral value nearest to $\frac{89}{3}$

Let $x = 30, y = 30, z = 29$

$$\therefore \text{Minimum value of } x^2 + y^2 + z^2 = (30)^2 + (30)^2 + (29)^2 = 2641$$

Thus statement A alone is sufficient to answer the question. Hence, [1].

11. The farthest point from point M which is on the square is the diagonally opposite point.

$$\therefore \ell(\text{OM}) \leq \sqrt{2} \times \text{side of the square.}$$

$$\therefore \ell(\text{OM}) \leq \sqrt{2} \times \ell(\text{LK}) \quad \dots \text{ (i)}$$

$$\text{and } \ell(\text{OL}) \geq \ell(\text{LK}) \quad \dots \text{ (ii)}$$

From (i) and (ii) we can conclude that such a point can not be drawn.

Hence, [1].

12. $W_I \equiv$ Average weight of Section I

$W_{II} \equiv$ Average weight of section II

$$W_I + W_{II} = 90 \text{ where } W_I < W_{II}$$

Let weight of Deepak and Ponam be D and P kgs respectively

$$\text{Then } \frac{50 \times W_I + D - P}{50} = W_{II} \text{ and } \frac{50 \times W_{II} - D + P}{50} = W_I$$

$$\Rightarrow 50(W_{II} - W_I) = D - P$$

Using Statement A alone:

$$50 \times 1 = D - P \quad \dots \text{ (i)}$$

Thus D and P can take various values

So, Statement A alone is not sufficient.

Using Statement B alone:

$$\frac{50 \times W_I + D}{51} = \frac{50W_{II} - D}{49} \quad \dots \text{ (ii)}$$

Since values of W_I and W_{II} are not known

We cannot find the value of D

Combining both the statements,

values of W_I and W_{II} can be found and hence value of D and P can be found, using (i) and (ii).

Hence, [3].

13. Using Statement A:

For minimum diameter i.e., 8m,

$$\text{the capacity of the tank} = \frac{4}{3} \times \frac{22}{7} \times 4^3 \text{ m}^3$$

$$= 268.19\text{kl}$$

$$< 400\text{kl}$$

For diameter greater than 8m, say 9.9m,

$$\text{the capacity of the tank} = \frac{4}{3} \times \frac{22}{7} \times (4.95)^3 \text{ m}^3$$

$$= 508.25 \text{ kl}$$

$$> 400\text{kl}$$

Hence, statement A alone cannot be used to answer the question.

Using statement B:

$$\text{Volume of material used} = \frac{\text{Mass}}{\text{Density}} = V \text{ (say), which is given}$$

$$\therefore \text{Outer volume} - \text{Inner volume} = V$$

\therefore We can find the inner volume of the answer the question. Hence, [2].

Answers to 14 and 15:

$$a_1 = p, b_1 = q$$

$$n = 2 : a_2 = pb_1 = pq ; b_2 = qb_1 = q^2$$

$$n = 3 : a_3 = pq_2 = p^2q ; b_3 = qa_2 = pq^2$$

$$n = 4 : a_4 = pb_3 = p^2q^2 ; b_4 = qb_3 = pq^3$$

$$n = 5 : a_5 = pa_4 = p^3q^2 ; b_5 = qa_4 = p^2q^3$$

$$n = 6 : a_6 = pb_5 = p^3q^3 ; b_6 = qb_5 = p^2q^4$$

$$n = 7 : a_7 = pa_6 = p^4q^3 ; b_7 = qa_6 = p^3q^4$$

$$14. a_2 + b_2 = pq + q^2 = q(p + q)$$

$$a_4 + b_4 = p^2q^2 + pq^3 = pq^2(p + q) = q(pq)(p + q)$$

$$a_6 + b_6 = p^3q^3 + p^2q^4 = p^2q^3(p + q) = q(pq)^2(p + q)$$

$$\therefore \text{In general, } a_n + b_n = q(pq)^{\frac{1}{2}n-1} (p + q)$$

Hence, [5].

15. $p = \frac{1}{3}, q = \frac{2}{3} \Rightarrow p + q = 1$ and $pq = \frac{2}{9}$

i.e., $a_1 + b_1 = 1$

Now, $a_3 + b_3 = pq(p + q) = pq$

$a_5 + b_5 = (pq)^2 (p + q) = (pq)^2$

$a_7 + b_7 = (pq)^3 (p + q) = (pq)^3$

In general, for odd 'n' and $p = \frac{1}{3}, q = \frac{2}{3}$

$$a_n + b_n = (pq)^{\frac{(n-1)}{2}} = \left(\frac{2}{9}\right)^{\frac{(n-1)}{2}}$$

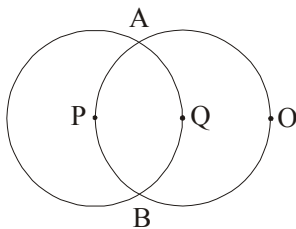
Starting from the smallest option

$$a_7 + b_7 = \left(\frac{2}{9}\right)^3 = 0.01$$

$$a_9 + b_9 = \left(\frac{2}{9}\right)^4 = 0.002 < 0.01$$

Hence, [3].

16. P and Q do not lie within intersection of the circles. The extreme case can be that they lie on the circumference of the other circle as shown in the figure.



In this case ΔAPQ will be an equilateral triangle.

$$\therefore m\angle AQP = 60^\circ$$

If $m\angle AQP$ is more than 60° , then P and Q will lie within the intersection of the circles

Hence, [2].

17. From $100 + 0.10n = 89 + 0.15n$, n will be definitely greater than 100

Price of Darjeeling tea on 100th day and onwards

$$= 100 + 0.10 (100) = \text{Rs.}110$$

Now, price of Ooty tea will be Rs.110

$$\text{when } 89 + 0.15n = 110$$

$$\Rightarrow 0.15n = 21$$

$$\Rightarrow n = 140$$

\therefore Prices will be equal on 140th day i.e., May 20.

Hence, [2].

18. Let $f(x) = ax^2 + bx + c$

f attains a maximum at $x = 1$

$$f'(x) = 0$$

$$\Rightarrow 2ax + b = 0$$

$$\Rightarrow x = \frac{-b}{2a} = 1$$

$$\Rightarrow -b = 2a$$

Also $\max f(x) = 3$

$$\Rightarrow a + b + c = 3$$

$$\Rightarrow a - 2a + c = 3$$

$$\Rightarrow c - a = 3$$

$$f(0) = 1$$

$$\Rightarrow c = 1$$

$$\Rightarrow a = -2$$

$$\therefore f(x) = -2x^2 + 4x + 1$$

$$f(10) = -2(100) + 4(10) + 1$$

$$= -200 + 41 = -159$$

Hence, [1].

19. Let the amount invested in options B and C be in the ratio 1 : K

\therefore Depending on whether there is a rise or fall in the stock market,

the amount earned will be $5 - \frac{5k}{2}$ or $2k - 3$.

$$\therefore \text{Guaranteed return} = \min \left\{ \frac{5-5k}{2}, 2k-3 \right\}$$

\therefore The maximum guaranteed return will be earned when $\frac{5-5k}{2} = 2k - 3$. i.e., $9k = 16$,

$$\text{i.e., } k = \frac{16}{9}.$$

∴ The maximum guaranteed return is when, the amounts invested are in the ratio 9 : 16 i.e., 36% and 64% respectively. Now, the guaranteed return for this distribution is 0.2% (see expans of Q.20) Since option A gives a return of 0.1% which is lesser than this, no amount should be invested in option A.

∴ Maximum guaranteed return = 0.20%
Hence, [2].

20. Let us assume that Shabnam has Rs.100.

We calculate her guaranteed return in case of each of the given options:

Option [5] : 0.1% of 100 = 0.1

Option [1] : If there is a rise in the stock market, earning = 5% of 36 – 2.5% of 64

$$= \frac{180-160}{100} = 0.4$$

If there is a fall in the stock market, earning = –3% of 36 + 2% of 64

$$= \frac{-108+128}{100} = 0.2$$

∴ Guaranteed return = 0.2

Option [2] : Rise in market gives earning

= 5% of 64 + 2.5% of 36 = 2.4

Fall in market gives earning = –3% of 64 + 2% of 36 = –1.2 which is negative.

Similarly, the guaranteed return for options [3] and [4] is also negative.

∴ Option [1] offers the highest guaranteed return.

Hence, [1].

21.

Quantity produced	CP	SP	Profit
x	$240 + bx + cx^2$	30x	$30x - 240 - bx - cx^2$
20	$240 + 20b + 400c$	600	$600 - 240 - 20b - 400c$
40	$240 + 40b + 1600c$	1200	$1200 - 240 - 40b - 1600c$
60	$240 + 60b + 3600c$	1800	$1800 - 240 - 60b + 3600c$

From the given conditions,

$$(240 + 40b + 1600c) = \frac{5}{3} (240 + 20b + 400c) \quad \dots (i)$$

$$\begin{aligned} \text{Also } 240 + 60b + 3600c &= \frac{3}{2}(240 + 40b + 1600c) \\ &= \frac{5}{2}(240 + 20b + 400c) \quad \dots \text{ (ii)} \end{aligned}$$

$$\text{From (i) } 2800c + 20b - 480 = 0 \quad \dots \text{ (iii)}$$

$$5200c + 20b - 720 = 0 \quad \dots \text{ (iv)}$$

$$2400c = 240$$

$$c = \frac{1}{10} \Rightarrow b = 10$$

$$\text{Profit on } x \text{ units} = f(x) = 30x - 240 - 10x - \frac{x^2}{10}$$

$$\text{i.e., } f(x) = -\frac{x^2}{10} + 20x - 240$$

$f(x)$ is maximum at x if $f'(x) = 0$

$$\text{i.e., } -\frac{2x}{10} + 20 = 0$$

$$2x = 200$$

$$x = 100$$

Hence, [1].

22. Maximum daily profit = $f(100)$
 $= -1000 + 2000 - 240 = \text{Rs.}760$

Hence, [3].

23. Possible combinations

Case 1 : Bill is paid with only two 50's misos

$$2 \times 50 + 1 \times 10 + 7 \times 1 \quad \dots \quad 1 \text{ way}$$

Case 2 : Bill is paid with only one 50 miso

$$1 \times 50 + 5 \times 10 + 7 \times 1$$

$$1 \times 50 + 4 \times 10 + 17 \times 1$$

$$1 \times 50 + 3 \times 10 + 27 \times 1$$

$$\cdot \quad \cdot \quad \cdot$$

$$\cdot \quad \cdot \quad \cdot$$

$$\cdot \quad \cdot \quad \cdot$$

$$1 \times 50 + 0 \times 10 + 57 \times 1$$

i.e., 6 ways

Case 3 : Bill is paid with no 50 misos

$$\begin{array}{l}
 10 \times 10 + 7 \times 1 \\
 9 \times 10 + 17 \times 1 \\
 \cdot \qquad \qquad \cdot \\
 \cdot \qquad \qquad \cdot \\
 \cdot \qquad \qquad \cdot \\
 1 \times 10 + 97 \times 1
 \end{array}
 \left. \vphantom{\begin{array}{l} 10 \times 10 + 7 \times 1 \\ 9 \times 10 + 17 \times 1 \\ \cdot \qquad \qquad \cdot \\ \cdot \qquad \qquad \cdot \\ \cdot \qquad \qquad \cdot \\ 1 \times 10 + 97 \times 1 \end{array}} \right\} \text{ i.e., 10 ways}$$

Case 4 : Bill is paid with no 10 misos and 50 misos

$$1 \times 107 \qquad \dots \qquad 1 \text{ way}$$

∴ Total number of ways = 1 + 6 + 10 + 1 = 18 ways.

Hence, [2].

24. Let the original amount be Rs.x and y paise. Then interchanged amount = Rs.y and x paise

From the given condition

$$\begin{aligned}
 3(100x + y) &= 100y + x - 50 \\
 \Rightarrow 300x + 3y &= 100y + x - 50 \\
 \Rightarrow 299x &= 97y - 50 \\
 \Rightarrow y &= \frac{299x + 50}{97}
 \end{aligned}$$

Considering the options, only for x = 18, we get an integral value for y i.e., y = 56.

Hence, [3].

25. $\frac{1}{m} = \frac{1}{12} - \frac{4}{n}$

$$\Rightarrow m = \frac{12n}{n - 48}$$

Since m is positive, n must be greater than 48. Possible odd values of n such that 48 < n < 60 are 49, 51, 53, 55, 57 and 59 of which only 49, 51 and 57 give integral values of m.

Hence, [4].

SECTION - II

Answers to questions 26 to 29:

Costs for Material, Labour and Operating cost of machines are variable while for other parameters are more or less fixed. In 2002, variable component accounted for Rs.1,00,000 and production is 1000 units. In 2006, production is 1200 units and variable three factor amounted to Rs.1,20,000. Other factors in 2006 have constant value Rs.9600.

∴ Cost defining equation can be $100 \times (\text{no. of units}) + 9600$

26. Cost price for 1400 units (approximately)
 $= (1400 \times 100) + 9600 = \text{Rs.}149600$

$$\therefore \text{Cost per unit} = \frac{149600}{1400} \approx \text{Rs.}107.$$

Hence, [2].

27. Let 'x' be the minimum number of units required. Selling price for 2007 will be Rs.125. This information along with approximate formula for cost determination in 2007 is extracted from the sentence in the data of question which say 'information provided for 2006 is the basis for projecting the figures of the 2007.'

$$\therefore 100x + 9600 = 125x$$

$$\therefore x = \frac{9600}{25} = 384.$$

Hence, [3].

28. Production cost for 1400 units is approximately Rs.149600.

$$\text{Profit for 1400 units} = (140 \times 125) - 149600 \\ = 17500 - 149600 = \text{Rs.}25,400.$$

$$\text{For } x \text{ units more than 1400, profit equation is } 120(1400 + x) - 100(1400 + x) - 9600 \\ = 20x + 18400.$$

This is maximum when x take maximum possible value i.e., 300 i.e., total 1700 units.

$$\text{Profit for 1700 units} = (20 \times 300) + 18400 = \text{Rs.}24,400.$$

∴ Profit is maximum when 1400 units are produced.

Hence, [1].

29. Cost price per unit = Rs.125

$$\text{Reduced cost price per unit} = \frac{95}{100} \times 125 = \text{Rs.}118.75$$

$$\therefore \text{Profit} = 118.75x - (100x + 9600) \\ = 18.75x - 9600$$

This is maximum when x takes the maximum possible value.

$$\Rightarrow x = 2000 \text{ units}$$

Hence, [5].

Answer to questions 30 to 33:

The total number of male students $0.475 \times 800 = 380$ and vegetarian students in the school is $0.53 \times 800 = 424$.

The number of students in secondary section is 640 of which $0.55 \times 440 = 352$ are vegetarian. Similarly, we can calculate,

	Male (M)	Veg (V)
Class 12 (80)	48	32
Class 11 (80)	44	40
Secondary Section (640)	288	352
Total	380	424

30. Percentage of vegetarian students in class 12 = $\frac{32}{80} \times 100 \approx 40\%$. Hence, [1].

31. The number of vegetarian males in class 12 = $0.25 \times 32 = 8$
 \Rightarrow The number of non-vegetarian males is 40. Number of vegetarian female is 24.
 \therefore Required difference = 16. Hence, [5].

32. Percentage of male students in secondary section = $\frac{288}{640} \times 100 \approx 45\%$. Hence, [2].

33. **Note:** The data given in the question is not consistent with the common data given. However, if the question is interpreted as, ‘ In the Secondary Section, 50% of the vegetarian students are males’, then we can arrive at the following.

Vegetarian students = 352

\therefore vegetarian males = 176 and vegetarian females = 176

Total males = 288

Vegetarian males = 176

\therefore non-vegetarian males = 112.

Thus, except non-vegetarian males all other groups are equal.

Hence, option [2] can be marked as correct answer.

34. Total cost of angioplasty, hip replacement and a knee replacement, including cost of poor quality in the four countries in US dollars:

India - $28500 + 21000 = 49500$ US dollars

Thailand - $35000 + 16000 = 51000$ US dollars

Singapore - $38000 + 13000 = 51000$ US dollars

Malaysia - $29000 + 18000 = 47000$ US dollars

\therefore Cheapest is in Malaysia.

Hence, [3].

35. Total cost of hysterectomy including poor quality in India
= $5500 + 5 \times 1000 = 8000$ US dollars.
Total cost in Thailand for the same = 10500 US dollars
Difference = 2500 US dollars
= 2500×32.89
= 82225 Bahts.

Travelling to India and coming back costs 15000 Bahts.

\therefore Total difference = $82225 - 15000 = 67225 \approx 67500$

Hence, [4].

36. Cost of knee replacement including poor quality in the four countries in US dollars:

India - 17500 US dollars

Malaysia - 12000 US dollars

Thailand - 16000 US dollars

Singapore - 17000 US dollars

It is most expensive in India.

Hence, [1].

37. It is not mentioned in the question that the cost of poor quality is to be considered. Hence, difference is calculated only on the cost of surgery.

Spinal fusion in India costs $\frac{5500 \times 40.928}{35} = 6431.54 \approx 6432$ US dollars.

Spinal fusion cost 9000 US dollars in Singapore.

\therefore Difference is $9000 - 6432$

= 2568 US dollars ≈ 2500 US dollars.

Hence, [2].

Answers to questions 38 to 41:

From the given data, we get the following different routes, their distances and prices from city A to city J.

Route	Distance (km)	Price (Rs)
ABJ	2860	2945
ABHJ	2710	2995
ABIJ	3120	3660
ACDJ	2900	4250
ACFJ	2170	2930
ACGJ	2530	3340
ADJ	2500	3700
ADFJ	2445	3100
ADGJ	2320	3290
ADHJ	2200	2925
AEFJ	3465	4450
AEGJ	3045	3640
AEHJ	2495	2900
AFJ	2315	2850
AFGJ	3075	3640
AFIJ	2680	3190
AGJ	2180	3340
AGIJ	2320	3540
AHJ	2350	2275
AHIJ	3200	3360

38. The shortest route form A to J is ACFJ, where the distance is 2170 km and the price to travel is Rs.2930. Hence, [4].

39. The lowest price for A to J is Rs.2275.
 \therefore The company should charge $0.95 \times 2275 = \text{Rs.}2161$ for the direct flight. Hence, [2].

40. If airports C, D and H are closed, the minimum price paid by passenger will be along the route AFJ i.e., Rs.2850. Hence, [3].

41. The minimum cost that the company incurred is $\frac{2275}{1.1} \approx \text{Rs.}2068$.

\therefore The minimum cost per kilometer is $\frac{2068}{2350} = \text{Rs.}0.88/\text{km}$.

Hence, [2].

42. Cost incurred per km is:

$$\text{Option [1]: } \frac{2930}{1.15 \times 2170} \approx \frac{1.35}{1.15}$$

$$\text{Option [2]: } \frac{3340}{1.15 \times 2180} \approx \frac{1.53}{1.15}$$

$$\text{Option [3]: } \frac{2850}{1.15 \times 2315} \approx \frac{1.23}{1.15}$$

$$\text{Option [4]: } \frac{2275}{1.15 \times 2350} \approx \frac{0.96}{1.15}$$

Hence, [4].

43. The diet must contain:

Fat – 10%

Protein \geq 30%

Option [1]: To get 10% fat, P and Q must be mixed in the ratio 4 : 1, then the mixture will

contain $\frac{110}{500} = 22\% < 30\%$ protein.

Hence, option [1] is eliminated.

Option [2] is eliminated as P and S both do not contain fat.

Option [3]: P and R must be mixed in the ratio 3 : 1, then the mixture will contain

$\frac{110}{400} < 30\%$ protein.

Hence, option [3] is eliminated.

Option [4]: Q and S must be mixed in the ratio 1 : 4, then the mixture will contain

$\frac{230}{500} > 30\%$ protein.

$$\text{The cost per unit} = \frac{200 + 4 \times 100}{500} = \frac{600}{500} = \frac{6}{5}$$

Option [5]: R and S must be mixed in the ratio 1 : 3, then the mixture will contain $\frac{50 + 150}{400}$

$= \frac{200}{400} > 30\%$ protein.

$$\text{The cost per unit} = \frac{800}{400} = 2 > \frac{6}{5}$$

Hence, [4].

44. Since for P, the cost per unit is the least and it contains the highest percentage of carbohydrates, the proportion of P should be the highest.

Thus, options [1] and [3] are eliminated.

$$\text{Option [2]: Carbohydrates} = \frac{4 \times 80 + 10 + 2 \times 45}{700} = \frac{320 + 10 + 90}{700} = \frac{420}{700} = 60\%$$

$$\text{Cost per unit} = \frac{200 + 200 + 200}{7} = \frac{600}{7}$$

$$\text{Option [4]: Carbohydrates} = \frac{3 \times 80 + 10 + 2 \times 45}{600} = \frac{240 + 100}{600} = \frac{340}{600} < 60\%, \text{ which is not possible.}$$

$$\text{Option [5]: Carbohydrates} = \frac{4 \times 80 + 10 + 45}{600} = \frac{320 + 55}{600} = \frac{375}{600} > 60\%$$

$$\text{Cost per unit} = \frac{200 + 200 + 100}{6} = \frac{500}{6}$$

$$\therefore \frac{600}{7} > \frac{500}{6}. \text{ Hence, [5].}$$

45. The diet must contain:

Carbohydrate $\geq 30\%$

Protein $\geq 30\%$

Fat $\leq 25\%$

Minerals $\geq 5\%$

$$\text{Option [1]: Protein} = \frac{30+20}{200} = \frac{50}{200} = 25\% < 30\%, \text{ hence option [1] is eliminated.}$$

$$\text{Option [2]: Carbohydrate} = \frac{50}{200} < 30\%, \text{ hence option [2] is eliminated.}$$

$$\text{Option [3]: Minerals} = \frac{5}{200} < 5\%, \text{ hence option [3] is eliminated.}$$

$$\text{Option [4]: Carbohydrate} = \frac{15}{200} < 30\%, \text{ hence option [4] is eliminated.}$$

Option [5]: everything is satisfied.

Hence, [5].

46. The diet must contain:

Minerals – 10%

Protein $\geq 30\%$

The only combination which gives 10% minerals is ‘O and Q in equal proportion.’ No other combination of two or more ingredients in any proportion contain 10% minerals.

Hence, [1].

47. From the given data, we know $D > E$ and $B > C$ and C has either 4th and 5th rank in descending order.

From statement I:

Atul is ranked 5 but any one of B or D can be the top ranker in the group.

∴ Statement I alone is not sufficient to answer the question.

From statement II:

B's rank is 3rd, 4th or 5th. We cannot arrive at the arrangement.

∴ Statement II alone is not sufficient to answer the question.

Combining both the statements, we get $D > E > B > C > A$.

Hence, [4].

48. Let the number of employees be x .

∴ The number of female employees are $0.7x$ and those with engineering background are $0.07x$.

From statement I:

The number of employees with engineering background is $0.25x$.

The percentage of male employees with engineering background out of the males can be calculated

$$\text{as } \frac{0.25x - 0.07x}{0.3x} \times 100 .$$

Also, the percentage of male employees out of total employees can be calculated as $\frac{0.25x - 0.07x}{x} \times 100$

∴ Statement I is sufficient to answer the question.

From statement II:

The number of male employees having engineering background is $1.2 \times 0.07x$.

∴ The percentage of male employees with engineering background out of males can be calculated

$$\text{as } \frac{1.2 \times 0.07x}{0.3x} \times 100 \text{ and out of total can be calculated as } \frac{1.2 \times 0.07x}{x} \times 100$$

∴ Statement II alone is sufficient to answer the question.

Hence, [3].

49. Since we do not know the number of goals scored by the opponent team, statement I alone is not sufficient to answer the question.

Since we do not know the total number of goals scored by Mahindra and Mahindra club in the match, statement II alone is not sufficient to answer the question.

Combining the statements I and II also, as we do not know goals scored by Mahindra and Mahindra club in first time it is not possible to find the number of goals scored by both the teams.

As possibilities can be: In the first half, Mahindra and Mahindra club can trail by 3-0 and final score can be 4-4 or the club can trail by 4-1 and the final score can be 4-5. Hence, [5].

50. From statement I:

40% of top academic performers were athletes which is equal to 10 students.

$$\therefore \text{The total number of top academic performers were } \frac{10}{0.4} = 25.$$

∴ Statement I alone is sufficient to answer the question.

Statement II does not give any significant information about academic performers.

Hence, [1].

SECTION - III

51. Refer to the third paragraph where the author mentions that isolated islands can furnish many ‘natural experiments’ for students of history. From the word ‘experiment’ we can infer that the author intends the students to observe the societies of these islands and how they evolve, which will provide data for understanding how human history can be different in different circumstances. This is what is encapsulated in [1]. Options [2] and [5] are too general and vague. [4] can be negated because the author implies that the islands have to be compared to each other and not to the continents. [3], though close, can be negated because it is too specific - it restricts itself to only two parameters.
Hence, [1].
52. Refer to the first paragraph. The author mentions why historical sciences, including human history, face difficulties because of a number of factors, like a large number of variables, inability to conduct controlled experiments, etc. Options [1], [3] and [5] mention only specific limiting factors. [4] cannot be inferred at all. Only [2] covers the full range.
Hence, [2].
53. Refer to the third paragraph, the second sentence. The author states ‘large islands that have developed complex societies’ are particularly useful as natural experiments for students of history. This is what is mentioned in [3]. Options [1] and [2] can be negated as they have a critical tone that is not found in the passage. [4] is untrue as this problem is not unique to historians but is found among all historical sciences. [5] has no basis in the passage.
Hence, [3].
54. E follows A because it draws a parallel between economic approaches to explaining the evolution of family structures [mentioned in A] and patterns of crime. C extends the parallel by declaring that the claims of the economic basis of criminal activity and family structures are both inconclusive. B elaborates on the ways in which the two claims are inconclusive. Finally, D notes the prevalence of numerous studies that contradict one another. Hence, ECBD.
Hence, [4].
55. E is in continuation with A as it introduces the third discourse about good mothers in addition to the two presented in A. D discusses the factor common to all three discourses [frameworks]. D ends by stating that a woman is predisposed to care for a child. B should follow D because it mentions another requirement (medical expert guidance) in the process of motherhood. B ends with how ‘good mothering’ has been conceived differently. C sums up how historical work has also indicated this. Hence, EDBC.
Hence, [1].
56. B lists the shifts in formal governance arrangements mentioned in A. C mentions the shifts in the non-formal arrangements in the media, NGOs, etc. that have also taken place. D notes that some donors and analysts have viewed all these changes optimistically, while E points out that other analysts consider these only cosmetic changes. Hence, BCDE.
Hence, [5].
57. C identifies the squatters mentioned in A. B goes on to describe the squatters’ settlement and their staple crops. E continues the description of the main crops started in B. D concludes by mentioning the secondary crops grown by the squatters. Hence, CBED.
Hence, [2].

58. The author begins the passage by stating that he intends to discover the relation between rules, paradigms and normal science. He continues on this theme throughout the passage and in the last few sentences arrives at a suitable conclusion. Thus only [1] is correct. [2], [3] and [5] are only parts of the process, while [4] is too general.
Hence, [1].
59. Refer to the first paragraph where the author uses the phrase ‘loci of commitment’. He goes on to explain that in the second sentence as ‘close historical investigation ... and instrumental applications’. The phrase ‘given specialty at a given time’ gives us the clue that the author implies adherence to a particular paradigm of scientific enquiry. So only [3] is correct.
Hence, [3].
60. Refer to paragraphs 1 and 3 where the author muses on the nature of paradigms. Unlike rules, they need not be very rigid or even defined clearly. They are the general guidelines followed by those who work in a scientific tradition. This is what is mentioned in [5]. The rest of the options either cannot be inferred from the passage or contradict it altogether.
Hence, [5].
61. The phrase ‘returned to’ in part A is incorrect - the preposition ‘to’ is redundant here. The correct expression in B should have been ‘get my hands on’. In D, a lack of a comma after the word ‘*Shaliach*’ renders the sentence incorrect. In C a comma is required after ‘That same year’. So only E is correct.
Hence, [3].
62. ‘Out of slump’ in C is incorrect because it is missing an article. In D, ‘a temporary stimuli’ is wrong as ‘stimuli’ is a plural word. The correct word in E should have been ‘effect’ and not ‘affect’. A is structurally incorrect. Thus we are left with only B as the correct part.
Hence, [5].
63. In A the correct verb should have been ‘said’ and not ‘told’. The idiomatic expression in C should have been ‘handed down to us’. In E, the sentence is meaningless, because the word ‘hence’ has been substituted for ‘but’. Only B and D are correct.
Hence, [3].
64. The expression “like a Madonna from a Madonna” in the passage states that, new works of arts do not differ entirely from the old in terms of content, but only in the ways in which they are represented. This meaning is best expressed in Option [2].
Hence, [2].
65. The sea and ‘other creation’ leads Rilke ‘to define the place of the poet in his culture’, because the story that Rilke narrates from T.S. Elliot's poem is a metaphor for the place of the poet in society.
Hence, [1].
66. From paragraph 2, lines 3-5, it is clear that “Adventurers of experience” refers to poets and artists of the Renaissance.
Hence, [3].

67. The passage ends with a discussion on how whole organizations are personified as actors in the macro-level. Therefore, we have to look for an option where both the issues, personification of organization, as well as their relevance at the macro-level are discussed. 'Identities and relationships of the characters' is not the focus of the passage. Only option [5] fulfils this requirement.
Hence, [5].
68. The passage starts by saying how photographs 'still' enchant people. It goes on to describe how the change from the earliest daguerreotypes to modern digital photographs has not changed this fact. Therefore, only option [1] completes the theme of this passage by re-emphasizing this continuity and specifying why it is so.
Hence, [1].
69. The passage starts by listing Mma Ramotswa's assets in her detective agency. The style is that of an inventory - i.e., a list which specifies each and every item in store. The passage ends by stating that the only real necessity for a detective agency were intuition and intelligence. So [3] finishes this theme by stating that such intangibles would not appear on an inventory list.
Hence, [3].
70. Specific role expectations differ from culture to culture, but behaviour, in general, is coordinated by the reciprocal nature of roles across all cultures. This is the idea prevalent throughout the passage.
Hence, [5].
71. If only biological linkages structured human society, we would have no specific role expectations of people and, therefore, a father playing his role 'tongue in cheek' would not offend us.
Hence, [2].
72. "Some roles are more absorbing than others" refers to some specific role expectations that restrain people from expressing their true selves, as explained in the last paragraph.
Hence, [1].
73. 'Cricket council' is a collective noun and, hence, takes the singular form of the verb [was/is]. The critics cannot 'censor' or 'edit' a work of art, but can 'censure' or 'criticize' it.
Only people can be 'credulous' or 'gullible', whereas an explanation can only be 'credible' or 'believable'.
One can cough 'discreetly' or 'inconspicuously' but not 'discretely' or 'separately'. Hence, AABBA.
Hence, [1].
74. The intensification of an activity can be described as going 'further', whereas 'farther' denotes a progression across physical space.
An event can be 'historic'[memorable] or 'historical' [past]. This sentence requires the first term.
To be 'distrustful' is to be 'suspicious of something'. To be 'mistrustful' is to 'not trust anything'. Only the former would be a healthy attitude.
'Real' is an attribute of inanimate physical objects, whereas 'true' would describe concepts and narratives.
Only a 'compliment' or a 'favourable remark' can be backhanded, not a 'complement' or 'an addition to something that completes it'. Hence, ABABA.. Hence, [5].

75. To decline an invitation can be 'regrettable' or 'unfortunate', but not 'regretful' or 'remorseful'. A painting can be 'sensuous' or 'appealing to the senses' but not 'sensual' or 'physically passionate'. 'To be **beside** oneself with rage' is correct idiomatic usage. A truck can be 'stationary' or 'immobile', whereas 'stationery' refers to 'office supplies'. 'Over' is a preposition that denotes 'physical location', whereas 'above' is a preposition that denotes 'higher gradation'. **This calls for the sequence ABBAB; however, the only option beginning with A [2] is an incorrect one and the closest is option BBBAB.** Hence, BBBAB. Hence, [3].
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