The explanatory answers are based on the question and option order in Set 333. Please refer to the table for tracking the questions in other sets.

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

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

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, [3].

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

From the given condition

$3(100x + y) = 100y + x - 50$

$\Rightarrow 300x + 3y = 100y + x - 50$

$\Rightarrow 299x = 97y - 50$

$\Rightarrow y=\frac{299x+50}{97}$

3. Possible combinations

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

$2 \times 50 + 1 \times 10 + 7 \times 1$ ... 1 way

Case 2 : Bill is paid with only one 50 miso

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

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

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

. . .

. . .

. . .

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

} i.e., 6 ways

Case 3 : Bill is paid with no 50 misos

$10 \times 10 + 7 \times 1$
$9 \times 10 + 17 \times 1$
. .
. . } i.e., 10 ways
. .
$1 \times 10 + 97 \times 1$

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

1×107 ... 1 way

$\therefore$ Total number of ways = 1 + 6 + 10 + 1 = 18 ways.

Hence, [1].

4.

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,

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

Also $240 + 60b + 3600c = \frac{3}{2}(240 + 40b + 1600c)$

$= \frac{5}{2}(240 + 20b + 400c)$ ... (ii)

From (i) $2800c + 20b - 480 = 0$ ... (iii)

$5200c + 20b - 720 = 0$ ... (iv)

$2400c = 240$

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

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

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

f(x) is maximum at x if f′(x) = 0

i.e., – $\frac{2x}{10}$ + 20 = 0

2x = 200

x = 100

Hence, [4].

5. Maximum daily profit = f(100)

= –1000 + 2000 – 240

= Rs.760

Hence, [2].

Answers to 6 and 7:

$a_1 = p, b_1 = q$

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

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

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

$n = 5 : a_5 = pa_4 = p^3q^2; b_5 = qa_5 = p^2q^3$

$n = 6 : a_6 = pb_5 = p^3q^3; b_6 = qb_2 = p^2q^4$

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

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

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

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

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

7. $p = \frac{1}{3}, q = \frac{2}{3} \Rightarrow p + q = 1$ 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 = $p = \frac{1}{3}, q = \frac{2}{3}$

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

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, [2].

8. 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, [4].

9. Let the four-digit number be

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

This number will be a perfect square if

1100a + 11b = k^2; where k is an integer.

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

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

∴ k should be a multiple of 11 such that 100a + b is a 3-digit number k = 44, 55, 66, ..., 99

Corresponding values of 100a + b will be 176, 275, 396, 539, 704, 891. Now, since a and b are digits of a number.

∴ a, b < 9 only '704' satisfies this.

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

Hence, [3].

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

∴ Depending on whether there is a rise or fall in the stack market,

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

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

The maximum guaranteed return will be earned when $\frac{5-5k}{2}$ = 2k – 3.

i.e., 9k = 16,

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

$\therefore$ 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.11)

Since option A gives a return of 0.1% which is lesser than this, no amount should be invested in option A.

$\therefore$ Maximum guaranteed return = 0.20% Hence, [1].

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

We calculate her guaranteed return in case of each of the given options: Option [4] : 0.1% of 100 = 0.1

Option [5] : 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

$= \frac{1+128}{100} = 0.2$

$\therefore$ Guaranteed return = 0.2

Option [1] : Rise in market gives earning

= 5% if 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 [2] and [3] is also negative.

$\therefore$ Option [5] offers the highest guaranteed

return. Hence, [5].

12. 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 ways.

So, number of enemies = $\frac{(n-2)(n-3)}{2} = \frac{1}{2}\left(n^2 - 5n + 6\right)$ Hence, [2].

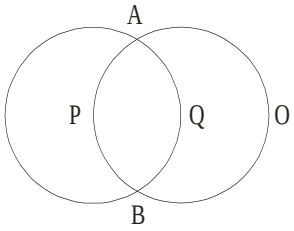
13. Consider friends (a, b) and (a, c).

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, [2].

14. 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 Δ APQ will be an equilateral triangle.

∴ m ∠ AQP = 60°

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

Hence, [1].

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

Price of Darjeeling tea on 100^{th} day and onwards

= 100 + 0.10 (100)

= Rs.110

Now, price of Ooty tea will be Rs.110

when 89 + 0.15n = 110

$\Rightarrow$ 0.15n = 21

$\Rightarrow$ n = 140

$\therefore$ Prices will be equal on 140^{th} day i.e., May 20.
Hence, [1].

16. Let $f(x) = ax^2 + bx + c$
f attains a maximum at x = 1
$f'(x) = 0$
$\Rightarrow 2ax + b = 0$

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

$\Rightarrow -b = 2a$

$\Rightarrow$ –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, [5].

Answers to questions 17 and 18:

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

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

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

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

Solving the above we get, x = 550

$\therefore$ 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

17-[2] 18-[4].

19.

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

$$f(1)=3600$$

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

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

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

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

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

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

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

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

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

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

Hence, [4].

20. S = {2, 3, 4, ... 2n + 1}

Total number of elements in S = 2n

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

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

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

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

Hence, [5].

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

Three years later, sum of the ages = 231 + 8 × 3 – 60 = 195
Three more years later, sum of the ages = 195 + 8 × 3 – 60
= 159
Now, sum of current ages = 159 + 8 × 4 = 191

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

22 Using Statement A:
For minimum diameter i.e., 8m,

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

= 268.19kl

< 400kl
For diameter greater than 8m, say 9.9m,

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

= 508.25 kl

> 400kl
Hence, statement A alone cannot be used to answer the question. Using statement B:

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

$\therefore$ Outer volume – Inner volume = V

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

23. Using statement A:
$x + y + z = 89$
For $x^2 + y^2 + z^2$ to be minumum, each of x, y, z must take integral value nearest to $\frac{89}{3}$
Let $x = 30, y = 30, z = 29$
$\therefore$ 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].

24. $W_I \equiv$ Average weight of Section I $W_{II} \equiv$ Average weight of section II $W_I + W_{II} = 90$ where $W_I < W_{II}$

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

$$\frac{50 \times W_I + D -}{P} \qquad \frac{50 \times W_{II} - D +}{P} = W_I$$

$\Longrightarrow$ $50(W_{II} - W_I) = D - P$ Using Statement A alone:

$50 \times 1 = D - P$ .... (i)

Thus D and P can take various values

So, Statement A alone is not sufficient. Using Statement B alone:

$$\frac{50 \times W_I +}{D} \qquad \frac{50 \times W_{II} - D}{49} \qquad \text{(ii)}$$

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].

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

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

$\therefore (\text{OM}) \leq \sqrt{2} \times (\text{LK})$ ....(i)

and $(\text{OL}) \geq (\text{LK})$ ....(ii)

From (i) and (ii) we can conclude that such a point can not be drawn. Hence, [1].