ANSWER KEY

1.	(C)	13.	(0)	25.	(12)	37.	(C)	49.	(B)	61.	(A)
2.	(B)	14.	(-4/3)	26.	(B)	38.	(B)	50.	(C)	62.	(B)
3.	(B)	15.	(C)	27.	(0.84)	39.	(C)	51.	(C)	63.	(D)
4.	(D)	16.	(A)	28.	(B)	40.	(B)	52.	(C)	64.	(C)
5.	(B)	17.	(C)	29.	(C)	41.	(C)	53.	(A)	65.	(B)
6.	(B)	18.	(A)	30.	(C)	42.	(B)	54.	(D)		
7.	(C)	19.	(A)	31.	(B)	43.	(C)	55.	(D)		
8.	(B)	20.	(C)	32.	(B)	44.	(C)	56.	(C)		
9.	(B)	21.	(D)	33.	(B)	45.	(B)	57.	(A)		
10.	(A)	22.	(50%)	34.	(A)	46.	(C)	58.	(C)		
11.	(A)	23.	(B)	35.	(D)	47.	(B)	59.	(B)		
12.	(B)	24.	(B)	36.	(C)	48.	(A)	60.	(D)		

SOLUTIONS

1. (C)

A square matrix A is an orthogonal matrix if its transpose is equal to its inverse. An orthogonal matrix A is necessarily invertible and unitary.

Conditions for an orthogonal matrix:

$A^T = A^{-1}$ and

$A\ A^T = A^T\ A = I,$

where I is an Identity matrix.

2. (B)

A is skew symmetric of order $n X n$, order of $X = n \times 1$ and order of $X' = 1 \times n$, then order of

$X'AX = ((1 \times n)(n \times n))(n \times 1)$

$= (1 \times n)(n \times 1) = 1$

Let $X'AX = Y$

$(X'AX)' = Y'$

$X'A'X'' = Y'$ (since $(AB)' = B'A'$)

As A is a skew-symmetric matrix, $A' = -A$

$X'(-A)X'' = Y'$

$-(X'AX) = Y$

$-Y = Y$

$Y = 0$

3. (B)

Let $A = \begin{bmatrix} a_1 \\ b_1 \\ c_1 \end{bmatrix}$; $B = [a_2 \quad b_2 \quad c_2]$;

$$\therefore \quad C = \begin{bmatrix} a_1a_2 & a_1b_2 & a_1c_2 \\ b_1a_2 & b_1b_2 & b_1c_2 \\ c_1a_1 & c_1b_2 & c_1c_2 \end{bmatrix}$$

4. (D)

Determinant $A = 1(\cos\Theta + \sin 2\Theta)$ Hence A is non-singular and A^{-1} exists

5. (B)

$f(x) = \alpha \log|x| + \beta x^2 + x$

for extreme points $f'(x) = 0$

$f'(x) = \alpha / x + 2\beta x + 1 = 0$

for $x = -1 : -\alpha - 2\beta = -1$

for $x = 2 : x = 2 : \alpha / 2 + 4\beta = -1$

from here we can get the value of $\alpha = 2$ and $\beta = -1/2$

6. (B)

$$\lim_{x \to 0} \frac{1 - \cos x}{x^2}$$

Using L'Hospital's Rule:

$$\lim_{x \to 0} \frac{\frac{d}{dx}(1 - \cos x)}{\frac{d}{dx}(x^2)}$$

$$\lim_{x \to 0} \frac{(0 - (-\sin x))}{2x}$$

Again, using L'Hospital's Rule:

$$\lim_{x \to 0} \frac{\cos x}{2}$$

Put $x = 0$

$\dfrac{\cos 0}{2}$

$= \dfrac{1}{2}$

7. (C)

$f(x) = \dfrac{x}{x^2 - 4}$

$= \dfrac{x}{(x-2)(x+2)}$

According to function graph, there are two points on which this function is discontinuous.

8. (B)

A function which is continuous at a point is also differentiable at that point

9. (B)

$f(x) = e^{2x} + e^{-x} + \log x$

$\dfrac{d}{dx} f(x) = e^{2x} \times 2 + e^{-x}(-1) + \dfrac{1}{x}$

$= 2e^{2x} - e^{-x} + \dfrac{1}{x}$

10. (A)

$\dfrac{d}{dx}\left(x^2y + x^3y^2 + xy^3\right) = 0$

$x^2\dfrac{dy}{dx} + y \cdot 2 \cdot x + 2x^3y\dfrac{d}{dy}(y) + y^2 3 \cdot x^2$

$+x \cdot 3y^2\dfrac{dy}{dx} + y^3 = 0$

$\dfrac{dy}{dx}\left[x^2 + 2x^3y + 3xy^2\right] + 2xy + 3x^2y + y^3 = 0$

$\dfrac{dy}{dx}\left[x^2 + 3xy^2 + 2x^3y\right] = -2xy - 3x^2y^2 - y^3$

$\dfrac{dy}{dx} = -\dfrac{2xy + y^3 + 3x^2y^2}{x^2 + 3xy^2 + 2x^3y}$

11. (A)

12. (B)

$L\left(\cos^2 t\right) = \dfrac{1}{2}L(1 + \cos 2t) = \dfrac{1}{2}\left\{\dfrac{1}{s} + \dfrac{s}{s^2 + 4}\right\}$

$\therefore$ By shifting property

$L\left(e^{2t}\cos^2 t\right) = \dfrac{1}{2}\left\{\dfrac{1}{s-2} + \dfrac{s-2}{(S-2)^2 + 4}\right\}$

13. (0)

Sum of Eigen Values of a matrix = trace of the matrix

As trace of the given matrix is = 4 + 1 – 5 =0.

Hence sum of the Eigen Values = 0.

14. (-4/3)

$f(z) = \dfrac{1 - e^{2z}}{z^4}$

$f(z)$ has a pole at $z = 0$ of order 4.

Residue of $f(z)$ at $z = 0$

$= \dfrac{1}{(m-1)!}\lim_{z\to 0}\dfrac{d^{m-1}}{dz^{m-1}}(z - z_0)^m f(z)$

$= \dfrac{1}{(4-1)!}\lim_{z\to 0}\dfrac{d^3}{dz^3}\left[z^4 \cdot \left(\dfrac{1 - e^{2z}}{z^4}\right)\right]$

$= \dfrac{1}{3!}\lim_{z\to 0}\dfrac{d^3}{dz^3}\left(1 - e^{2z}\right) = \dfrac{-1}{3!}\lim_{z\to 0} 8e^{2z}$

$= -\dfrac{4}{3}$

15. (C)

E_1 = Ball is red

E_2 = Ball is blue

A = Ball is broken

Given $P(E_1) = \dfrac{70}{100} = 0.7$, $P(E_2) = \dfrac{30}{100} = 0.3$,

By Baye's theorem

$P(E_2 / A) = \dfrac{P(E_2)\cdot P\left(\dfrac{A}{E_2}\right)}{P(E_1)\cdot P\left(\dfrac{A}{E_1}\right) + P(E_2)\cdot P\left(\dfrac{A}{E_2}\right)}$

$= \dfrac{(0.3)(0.03)}{(0.7)(0.02) + (0.3)(0.03)} = 0.39 \cong 0.4$

16. (A)

Number of ways 5 people can sit around round table = (5–1)! = 4!

Now 5 spots are created for other 5 people wearing black white shirt.

$\therefore$ Total ways = 4! × 5!

Now for each arrangement 10 spots are created for the person wearing Red shirt.

$\therefore$ Total ways = 4!5!10 = 28800

17. (C)

Given,

$\dfrac{dp}{dx} = \left(100 - 12\sqrt{x}\right)$

$\Rightarrow dp = \left(100 - 12\sqrt{x}\right)dx$

$\Rightarrow P = 100x - 8x^{\frac{3}{2}} + C$

When $x = 0$, then $P = 2000$

$\Rightarrow C = 2000$

When $x = 25$

$P = 100 \times 25 - 8 \times (25)^{\frac{3}{2}} + 2000$

$= 2500 - 8 \times 125 + 200$

$= 4500 - 1000 = 3500$

18. (A)

Given

$$\frac{dp(t)}{dt} = \frac{1}{2}p(t) - 200$$

$$\Rightarrow \frac{dp(t)}{dt} - \frac{1}{2}p(t) = -200$$

This is a linear differential equation.

$$IF = e^{\int -\left(\frac{1}{2}\right)dx} = e^{-\frac{t}{2}}$$

The solution of this differential equation is given by

$$p(t) \cdot e^{-\frac{t}{2}} = \int -200 \cdot e^{\frac{-t}{2}} dt$$

$$p(t) \cdot e^{-\frac{t}{2}} = 400e^{-\frac{t}{2}} + K$$

$$\Rightarrow p(t) = 400 + ke^{\frac{t}{2}}$$

If $p(0) = 100$, then $k = -300$

$$\Rightarrow p(t) = 400 - 300e^{\frac{t}{2}}$$

19. (A)

Because identify matrix is identity & as they define abc ! = 0, then it is non-singular so inverse is also defined.

The set of matrices is the set of Upper triangular matrices (H) of size 3*3 with non-zero determinant. Along with the multiplication operator the set forms as Algebraic Structure since if follows the Closure Property. This is because the product of Two Upper Triangular Matrices is also a Upper Triangular Matrix.

The Algebraic Structure also follows the Associative Property since, multiplication of matrices in general follows the Associative Property. Therefore it is a Semi Group.

The Algebraic Structure is also is Monoid, since it has an identity element, which is the Identity Matrix -I3.

The Algebraic Structure is a Group since every matrix in H is non-singular (given in question).

The Algebraic Structure is not an Abelian Group since it does not follow the Commutative Property.

Therefore Option A is correct.

20. (C)

$$\lim_{x\to 0} \frac{x^2 + \tan^{-1} x}{x + \sin^{-1} x + \sin^2 x}$$

Using L'Hospital's Rule

$$\lim_{x\to 0} \frac{2x + \frac{1}{1+x^2}}{1 + \frac{1}{\sqrt{1-x^2}} + \sin^2 x}$$

$$= \frac{2\times 0 + \frac{1}{1+0}}{1 + \frac{1}{\sqrt{1}} + 0}$$

$$= \frac{1}{1+1}$$

$$= \frac{1}{2}$$

21. (D)

Condition for orthogonal:

$A \cdot A^T = A^T A = I$

Conditions for orthonormal:

1. $A \cdot A^T = A^T A = I$
2. $A \cdot A^* = A^* A$

Where A^T is transpose of A

So, for the real matrices both orthogonal and orthonormal are same.

Hence A and C are orthonormal as well as orthonormal.

Note:

An orthonormal matrix is a square matrix whose **column and rows are orthogonal unit vectors.**

Unit vector of any column/row of Matrix A:

$$u_A = \frac{1}{3}\left(\sqrt{2^2 + 2^2 + 1^2}\right) = 1$$

Unit Vector of any column/row of Matrix B:

$$u_B = \left(\sqrt{\left(\frac{1}{\sqrt{3}}\right)^2 + \left(\frac{1}{\sqrt{3}}\right)^2}\right) \neq 1$$

Unit Vector of any column/row of Matrix C:

$$u_C = \left(\sqrt{\left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2}\right) = 1$$

22. **(50%)**

Scheduled time $(T_S) = 20$ days

Expected time $(T_E) = 20$ days

Standard deviation $(\sigma) = 4$ days

Probability of meeting the scheduled date

$$Z = \frac{T_S - T_E}{\sigma} = \frac{20-20}{4} = 0$$

$\therefore$ Probability = 50%

Note: Probability of project completion in critical time is always 50%.

23. **(B)**

By Green's theorem

$$\int_C (Mdx + Ndy) = \iint_E \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right) dxdy$$

Here $M = y - \sin x$

$N = \cos x$

$$\iint_E \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right) dxdy$$

$$= \int_{x=0}^{x=\frac{\pi}{2}} \int_{y=0}^{y=\frac{2x}{\pi}} (-\sin x - 1)\, dy\, dx$$

$$= -\int_0^{\frac{\pi}{2}} (\sin x + 1) |y|_0^{\frac{2x}{\pi}}\, dx$$

$$= \frac{-2}{\pi} \int_0^{\pi/2} x(\sin x + 1)\, dx$$

$$= \frac{-2}{x}\left\{ |x(-\cos x + x)|_0^{\frac{\pi}{2}} - \int_0^{\frac{\pi}{2}} 1.(-\cos x + x)\, dx \right\}$$

$$= \frac{-2}{\pi}\left\{ \frac{\pi^2}{4} - \left| -\sin x + \frac{x^2}{x} \right|_0^{\frac{\pi}{2}} \right\}$$

$$= \frac{-\pi}{2} + \frac{2}{\pi}\left(-1 + \frac{\pi^2}{8}\right) = -\left(\frac{\pi}{4} + \frac{2}{\pi}\right)$$

24. **(B)**

$$\nabla F = \left(i\frac{\partial}{\partial x} + j\frac{\partial}{\partial y} + k\frac{\partial}{\partial z}\right)\left(x^2 - 2y^2 + 4z^2\right)$$

$$\nabla F = 2xi - 4yj + 8zk$$

∇F at $P(1,1,-1)$ is

$$\nabla F = 2i - 4j - 8k$$

in the direction of $\vec{a}$,

$$\frac{\nabla F.\vec{a}}{|\vec{a}|} = \frac{(2i - 4j - 8k)\cdot(2i + j - k)}{\sqrt{4+1+1}} = \frac{8}{\sqrt{6}} = 3.266$$

25. **(12)**

$D = -3, -2$

$(D+3)(D+2)y = 0$

characteristic equation : $\left(D^2 + 5D + 6\right)y = 0$

when $D = \frac{dy}{dx}$

$$\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6 = 0$$

$A = 1,\ B = 5$ and $C = 6$.

So, $A + B + C = 12$

26. **(B)**

$$\begin{vmatrix} 3-x & 2 & 2 \\ 2 & 4-x & 1 \\ -2 & -4 & -1-x \end{vmatrix} = 0$$

$$(3-x)\left[(4-x)(-1-x)+4\right] + 2\left[-2-2(-1-x)\right]$$
$$+2\left[-8+2(4-x)\right] = 0$$

$$-x^3 + 6x^2 - 5x - 12 + 12 - 4x - 4 + 4 + 4x$$
$$-16 + 16 - 4x = 0$$

$$-x^3 + 6x^2 - 9x = 0$$

$$-x\left(x^2 - 6x + 9\right) = 0$$

$x = 0, 3, 3 \Rightarrow$ 2 different values

27. **(0.84)**

Required probability= $\dfrac{\text{Favorable outcomes}}{\text{Total possible outcomes}}$

Favorable outcomes = A false coin is chosen and flipped every time

Probability of selecting a false coin $\frac{1}{4}$

Probability of getting a tail on every flip of false coin = 1.

$\therefore$ Favorable outcomes $= \frac{1}{4} \times 1 = \frac{1}{4}$

Total possible outcomes $= \frac{3}{4}$

Unfavorable outcomes = A fair coin is chosen and flipped everytime to get tail

Probability of selecting a fair coin $= \frac{3}{4}$

Probability of flipping a fail coin 4 time and getting

tails every time $= \left(\frac{1}{2}\right)^4 = \frac{1}{16}$

$\therefore$ Unfavorable outcomes $= \frac{3}{4} \times \frac{1}{16} = \frac{3}{64}$

Total possible outcomes $= \frac{1}{4} + \frac{3}{64} = \frac{19}{64}$

$\therefore$ Required probability $= \frac{\frac{1}{4}}{\frac{19}{64}} = \frac{16}{19} \approx 0.84$

28. (B)

$f(x) = \sin x + \cos 2x$ in $[0, 2\pi]$

$f'(x) = \cos x - 2\sin 2x = \cos x[1 - 4\sin x] = 0$

$\Rightarrow \cos x = 0;\ 1 - 4\sin x = 0$

$\Rightarrow x = \frac{\pi}{2}, \frac{3\pi}{2}$ in $[0, 2\pi]$

$\sin x = \frac{1}{4}$, Also $f'(x)$ exists for all x in $[0, 2\pi]$

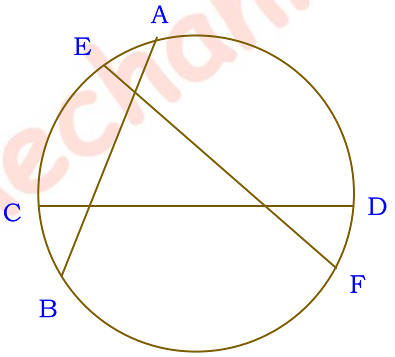
Now $f(0) = 1;\ f(2\pi) = 1;\ f\left(\frac{\pi}{2}\right) = 0;\ f\left(\frac{3\pi}{2}\right) = -2$

Therefore the maximum and minimum values of $f(x)$ are $\frac{9}{8}$ and -2 occured at

$\sin x = \frac{1}{4}$ and $x = \frac{3\pi}{2}$

29. (C)

In the adjoining figure, seven pieces have been formed with the 3 cuts AB, CD and EF. This is the maximum number of pieces.



30. (C)

The meaning to 'to contend with' is to struggle to deal with, and a 'contention;' is a heated argument. 'Content' can have two meanings: happy or satisfied, and the material dealt with in speech or a text. In the given sentence, only C fills all the blanks with the correct words.

31. (B)

Let the CP for A = Rs 100

Thus, we form the following table:

	Cost Price (CP)	Profit / Loss	Selling Price (SP)
A	100	30	130
B	130	26	156
C	156	31.2	124.8
D	124.8	12.48	112.32
E	112.32		

112.32 is more than 100 by 12.32%

32. (B)

Since, the number contains exactly 3 zeroes and 3 1's, the maximum and minimum of such numbers is $(111000)_{16}$ and $(100011)_{16}$ = $(16^5+16^4+16^3+16^2+16^1+16^0)$ = $(2^{20} + 2^{16} + 2^{12})$ and $(2^{20}+2^4+2^0)$.

In any case, the number on any base 10 will be the sum of three powers of 2 with the maximum power of 2 being 20. Hence, in base 2 the number will have exactly 21 digits with exactly three 1's and 18 zeros.

33. (B)

Given that, $(2138)_{10} = (4132)_n$

Since 2138 < 4132, n has to be less than 10

Again, since 4 is one of the digits so $n > 4$.

Now to express 2138 in base 5 or base 6 we will need a 5-digit number, So n is 7, 8 or 9.

$9 \times 4 > 2138$, so base cannot be 9.

Checking for 8

$8^3(4) + 8^2(1) + 8(3) + 8^0(2) = 4132$

Thus, $n = 8$ and the decimal equivalent of $(235)_n$

i.e. $(235)_8 = 8^2(2) + 8(3) + 8^0(5) = 157$

34. (A)

$1^{2!} + 2^{3!} + 3^{4!}$ ends with 1+4+1 = 6

Now, from $4^{5!} + \ldots\ldots + 151^{152!} + 152^{153!} + 153^{154!}$ all the indices are multiple of 4. Hence the last digits of all the 10 terms will correspondingly be same as the las digits of every order subsequent set of ten terms. Let the sum of the last digits of the first ten terms be s.

There are a total of 15 such sets of ten terms.

The last digit of these (15×10=) 150 terms will end in 5×s i.e. a zero or a 5 (depending on whether s is even or odd). Hence, 6+5 or 0 will end in either 1 or 6.

Only 1 is present among the choices.

35. (D)

We have to omit 4 digits in such a manner that we get the largest number as the result.

∴ We will omit 2,1,3 and 5 and the result will be 9876.

∴ The largest omitted digit = 5.

36. (C)

A *florist* produces *bouquets*, similarly a *chef* produces *dinner*.

37. (C)

Masochist (n) = a person who is gratified by pain, degradation, etc. that itself imposed or imposed by others.

Misogamist (n) = a person who hates marriage.

Misogynist (n) = A man who hates women.

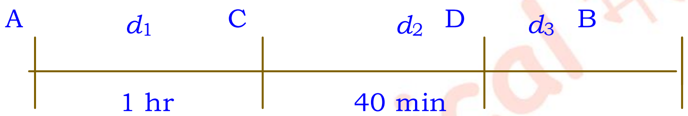
Misanthropist (n) = A person who dislikes and avoids other peoples.

38. (B)

1. 53647 is multiple of 11, because the difference of the sum of the digits in the odd places and the sum of the digits in the even places is divisible by 11, because (5+7+7)–(3+4)=11

Therefore, Total number of five digit multiple of 11 = 3! (Permutation of 5, 6 and 7 in the odd places) × 2!(Permutation of 3 and 4 in the even places). = 6 × 2 = 12.

39. (C)



Time for cyclist to cover $d_1 + 2d_2 + 2d_3 = 1\,\text{hour}$

Time for cyclist to cover $d_2 + 2d_3 = 40\,\text{minutes}$

→ Time for cyclist to cover $d_1 + d_2 = 20\,\text{minutes}$

→ Time for pedestrian to cover $d_1 + d_2 = 100\,\text{min.}$

→ Ratio of their speeds = 5 : 1.

Let $5x$, x be speed of cycle and pedestrian respectively.

Speed of pedestrian $\frac{d_1}{60} = \frac{d_2}{40} \Rightarrow d_1 = \frac{3}{2}d_2$

Time for cyclist to cover $\left(\frac{3}{2}d_2 + d_2\right) = 20\,\text{minutes}$

∴ Time for cyclist to cover $d_2 = 12$ minutes and to cover $d_2 = 8$ minutes.

∴ From (1) time for d_3 (cyclist) =16 minutes. For pedestrian = 80 minutes.

∴ Total time for pedestrian

= 1 hr + 40 min + 80 min = 3 hours

40. (B)

Least value is 1. Since 6+1+3+5+n+2 = 18.

Thus n = 1

41. (C)

Using formula $a - b + \left(\frac{ab}{100}\right)$

i.e. $+30 - 30 - \left(30 \times \frac{30}{100}\right)$

or –9%. here minus sign shows decrease.

42. (B)

We have, (A's share at present) $\left(1 + \frac{4}{100}\right)^7$

= (B's share at present) $\left(1 + \frac{4}{100}\right)^9$

∴

$$\frac{A\text{'s share at present}}{B\text{'s share at present}} = \left(1 + \frac{4}{100}\right)^2 = \left(\frac{26}{25}\right)^2 = \frac{676}{625}$$

Dividing Rs. 3903 in the ration 676 : 625.

A's present share = $\frac{676}{676 + 625} \times 3903$ = Rs. 2028.

B's present share = Rs. 3903 – Rs. 2028

= Rs. 1875

43. (C)

We know each suspect tell one true statement and one false statement. Let's check Kartik's statement "It was Ritam." If the statement is true, then the statement "it was not Vivek" was false. This implies Vivek stole the mobile which is a contradiction. Therefore both Ritam and Vivek have not stolen the mobile. Similarly if we check Ritam's statement and compare them with Kartik's statement we see that "it was not Pranav" is a false statement. This means Pranav stole the mobile. Similarly Rajat's statement "it was Ritam" is false. Therefore Rajat's statement "it was Pranav" is true. Similarly when we check each suspect's statement, we can infer that Pranav stole the mobile.

44. (C)

Total number of ways of selecting 3 out of 12 pens = $C(12,3)$

Number of ways of selecting any blue - ink pen $= C(5,3)$

∴ Required probability $= 1 - \frac{{}^5C_3}{{}^{12}C_3} = \frac{21}{22}$

45. (B)

The last digits are either 9, 7, 5, 3 or 7, 5, 3, 1 and the remaining odd digit is either 1 or 9 which can only be the digit in the first part.

The sum of the digits in the first part = 9, hence the odd digit among these cannot be 9 and so must be 1. Thus the sum of the remaining two number (in the first part) = 8. The three digits in the second part can be 864, 642, 420, leaving the pairs 2 and 0, 8 and 0 or 8 and 6 respectively as the two even digits in the first part. Of these the pair 8 and 0 has sum 8, so the first three digits are 8, 1, 0. Hence, the code is:

810-642-9753. And ∴ the required sum is 1+4+7+3 = 15.

46. (C)

The 2-4 link comes out from the reference made in 4 about the 'understanding' that is mentioned in 2 'intuitively understand'. Also, 1 follows from 4, in which articulation is followed by giving voice to employees. Finally, 3 reflects on 1 and completes the thought. This sequence is found only in C.

For Q. 47 & 48

Total number of players = (Players who like) [(Volleyball+ Football + Cricket) – Exactly two – 2 (Exactly three) + none]

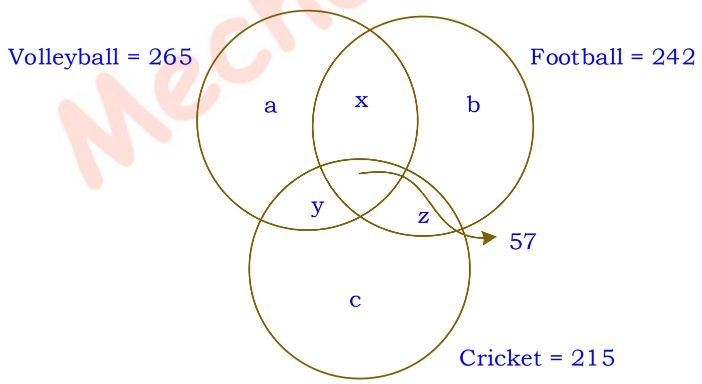
$$500=(265+242+213)-(x+y+z)-2(57)+50$$

$$x+y+z=720-500-114+50$$

Players who like exactly two sports $x+y+z=156$

Because players who like exactly one sports $a+b+c$ = Total – (n + exactly two + exactly three)

500 – (50+156+57) = 237



47. (B)

$$x+y+z=156 \qquad ....(1)$$

$$a+x+y=265-57=208 \qquad ....(2)$$

Subtracting (1) and (2), we get –

$$a-z=52.$$

48. (A)

The number of players who like exactly two games $x+y+z=156$ ....(1)

$$\therefore\ c+y+z=156 \qquad ....(2)$$

From (1) and (2)

$$c=x$$

∴ The number of players, who like only cricket, is same as those who like only Football and Volleyball

49. (B)

Let b and g be the number of boys and girls in the class respectively. Number of games in which both the players were boys $= {}^{b}C_2 = 300$

$$\frac{1}{2}b\times(b-1)=300$$

$$\therefore\ b=25.$$

Similarly,

Number of games in which both the players were girls ${}^{g}C_2=120$

$$\frac{1}{2}g\times(g-1)=120$$

$$\therefore\ g=16.$$

Now, the number of matches between a boy and a girl $= {}^{25}C_1\times{}^{16}C_1=400$

∴ Total number of matches played

= 400+120+300 = 820.

50. (C)

Each of the 8 new students are contributing an excess of 9 marks over the class average of 64 marks.

∴ total excess is 9×8 = 72.

This should be distributed over $(n+8)$ students to get the increase in average (x).

$$(x)=\frac{(9)(8)}{(n+8)}$$

For x to be a whole number, 72 [(9)(8)] must be divisible by $(n+8)$. By observing the answer choices, only 36 and 72 divide 72. As the initial number of students lies between 25 and 60; 72 can't be our answer, hence answer is 36.

51. (C)

Let 9am supporters be x.

Then, 7am supporters will be $\frac{3x}{2}$.

Given that,

$\left(x+6\right)-\left(3x\sqrt{2}-6\right)=3$

$\therefore$ Number of 7am supporters are $\frac{3}{2}\times 18=27$

$\therefore$ Total number of employees are 18+27 = 45.

52. **(C)**

$4\log_2\left[\left(\log_2\left(x^2+24x\right)\right)\right]-17\log_2\left(x^2+24x\right)$
$+72=0$

$\left(2^2\right)\log_2\left[\left(\log_2\left(x^2+24x\right)\right)\right]-17\log_2\left(x^2+24x\right)$
$+72=0$

Taking $\log_2\left[\left(\log_2\left(x^2+24x\right)\right)\right]=a,$

we get $a^2-17a+72=0$

$\therefore$ a = 8 or 9.

If $a=8,\ x^2+24x=2^8$

$x=-32$ or 8.

Both –32 and 8 satisfies the original equation.

If $a=9,\ x^2+24x=2^9$

The discriminant of the above equation is irrational.

$\therefore$ x is not an integer.

$\therefore$ The given equation has only two integral solutions for x.

53. **(A)**

$\left[X\right]$ denotes the greatest integer less than or equal to X .

$\therefore$ $\left[\frac{1}{3}\right]=0,\ \left[\frac{1}{3}+\frac{1}{99}\right]=0,\quad \left[\frac{1}{3}+\frac{2}{99}\right]=0,\quad ....,$
$\left[\frac{1}{3}+\frac{65}{99}\right]=0,$

$(\because$ for $\left[X\right]$ to be 1, X must be $\geq 1)$

$\left[\frac{1}{3}+\frac{66}{99}\right]=1,\left[\frac{1}{3}+\frac{67}{99}\right]=1,\ \ldots,\ \left[\frac{1}{3}+\frac{98}{99}\right]=1$

$\left[\frac{1}{3}\right]+\left[\frac{1}{3}+\frac{1}{99}\right]+\left[\frac{1}{3}+\frac{2}{99}\right]+\ldots+\left[\frac{1}{3}+\frac{98}{99}\right]$

$=0+0+\ldots[66\,\text{terms}]+1+1+\ldots[33\text{ terms}]=33$

Hence Ans. (A).

54. **(D)**

	System	Operations	HR
Boys	a	c	
Girls	b	20 – b	
Students	d	22	25

From the given data, we have,

$20-b+a=37$ ...(1)

$c+d=37$ ...(2)

$a+b=d$ ...(3)

$c-b=2$ ...(4)

On solving these equations, we get, $a=23, b=6, c=8$ and $d=29$

$\therefore$ Total number of students in second year =29+25+ 22=76

Hence, Option (D)

55. **(D)**

	System	Operations	HR
Boys	23	8	x
Girls	6	14	y
Students	29	22	25

Now, y = 20% of total number of girls.

$\therefore$ 16 + 4 = 20 = 80% of total number of girsl.

$\therefore$ Total number of girls = 25

As total number of students = 76 and total number of girls = 25

$\therefore$ Total number of boys = 76 – 25 = 51

Hence, Option (D)

56. **(C)**

There are codes 10 to 99 which are 90 in number. The numbers 1,8,6,9 which have diagonal symmetry can lead to confusion. So the likely codes which may cause confusion are (16,91), (18,81), (19,61), (68,89), (66,99) – i.e., 10 in number. So the number of codes that may not cause any confusion is 90–10 = 80.

57. **(A)**

$\sqrt{1+\frac{1}{1^2}+\frac{1}{2^2}}+\sqrt{1+\frac{1}{2^2}+\frac{1}{3^2}}+\ldots$
$+\sqrt{1+\frac{1}{2007^2}+\frac{1}{2008^2}}$

$=\sqrt{\frac{1^2\cdot 2^2+2^2+1^2}{1^2\cdot 2^2}}+\sqrt{\frac{2^2\cdot 3^2+3^2+2^2}{2^2\cdot 3^2}}+\ldots$
$+\sqrt{\frac{\left(2007^2\cdot 2008^2\right)+2008^2+2007^2}{2007^2\cdot 2008^2}}$

$=\sqrt{\frac{\left(1\cdot 2+1\right)^2}{1^2\cdot 2^2}}+\sqrt{\frac{\left(2\cdot 3+1\right)^2}{2^2\cdot 3^2}}+\ldots$
$+\sqrt{\frac{\left(2007\times 2008+1\right)^2}{2007^2\times 2008^2}}$

$$=\frac{1\times2+1}{1\times2}+\frac{2\times3+1}{2\times3}+\ldots+\frac{2007\times2008+1}{2007\times2008}$$

$$=\left(1\frac{1}{1\times2}\right)+\left(1+\frac{1}{2\times3}\right)+\ldots+\left(1+\frac{1}{2007\times2008}\right)$$

$$=2007+\left[\left(\frac{1}{1}-\frac{1}{2}\right)+\left(\frac{1}{2}-\frac{1}{3}\right)+\ldots+\left(\frac{1}{2007}-\frac{1}{2008}\right)\right]$$

$$=2007+\left(1-\frac{1}{2008}\right)=\left(2008-\frac{1}{2008}\right)$$

58. (C)

It is clear from the passage that the mother and son didn't see eyetoeye on a few occasions. ye no further deductions can be made. It is not clear whether McQueen felt deep lover for his mother or just a pang of mercy by the quote "Dying before you". Thre is no mention of a cause of death in the passage. This negates option (2). Author is certainly not sarcastic about the relationship. (S)he may be casual about it, but not sarcastic.

59. (B)

All other options are mentioned in the passage. We cannot deduce option (2) as we only know that McQueen was aged 40 when he died in 2010. Hence, he should have been 25 in 1995. But he joined in 1996 as is stated in the paragraph that the second designer joined in 1995 and served an year. Thus, McQueen could only have joined when he was 26 or more. Which is shown in the passage as to be 27.

60. (D)

Let the number of boys and girls in the classroom is x each. From the question,

$$2(x-8)=x$$

$\therefore$ Number of boys and girls = 16 + 16 =32.

61. (A)

Area of path = 2 × width of path × [length + breadth of the part – 2×(width of path)]

→ 570 = 2 × x × [37+30–2x]

→ 570 = 134x – 4x^2 – 134x + 570 = 0

On solving this equation we get, x = 5m.

62. (B)

Let the annual payment be P rupees.

The amount of Rs. P in 4 years at 5%

$$=P+\frac{P\times4\times5}{100}=\frac{120P}{100}$$

The amount of Rs. P in 3 yrs. at 5% $=\frac{115P}{100}$

The amount of Rs. P in 2 yrs. at 5% $=\frac{105}{100}$

The amount of Rs. P in 1 yrs. at 5% $=\frac{115P}{100}$.

These four amounts together with the last annual payment of Rs. P will discharge the debt of Rs. 770.

$$\therefore\ \frac{550}{100}=770.$$

$$\therefore\ P=\frac{770\times100}{550}=140$$

Hence annual payment = Rs. 140

63. (D)

Clearly, for 1994 it is minimum i.e. $\frac{5}{35}=\frac{1}{7}$.

64. (C)

Total profit = 5 + 10 + 10 + 10 = 35 crore.

65. (B)

It is $\frac{100}{130}\times100=74\%$ (approx.)