# Delhi Public School, Howrah.

## Class - XI

## Applied Mathematics

## PT - II Examination

## Answer Key

### Section - A

1) (b) $\frac{1}{8}$

2) (b) $\bar{2}.5127$

3) (a) $75^\circ$

4) (b) 120 cm

5) (b) $\frac{5}{\sqrt{13}}$

6) (a) $-\frac{3}{4}$

7) (d) $x+y=5$

8) (d) $\frac{19}{5}$

9) (d) SVZX

10) (a) Cousin

11) (b) 3546

12) (c) All fruits are healthy

13) (a) $A=B$

14) (c) 4

15) (b) 12

16) (c) 16

17) (a) 12

18) (b) 5

19) (a) (i)

20) (d) (iv)

### Section - B

21) The data :- 3, 3, 5, 13, 15, 17, 18, 20, 20

$n = 9$

$Q_1 = \left(\frac{9+1}{4}\right)^{th}$ observation $= 2.5^{th}$ obs. $= \frac{(2^{nd} + 3^{rd}) \text{ obs.}}{2}$

$\Rightarrow Q_1 = \frac{3+5}{2} = 4.$ $\longrightarrow [\frac{1}{2} M]$

$Q_3 = \frac{3(n+1)}{4}^{th}$ observation $= \frac{3(9+1)}{4}^{th} = 7.5^{th}$ observation

$= \frac{7^{th} + 8^{th}}{2} = \frac{20+18}{2} = 19$ $\longrightarrow [\frac{1}{2} M]$

$\therefore$ Q.D. $= \dfrac{Q_3 - Q_1}{2}$

$= \dfrac{19-4}{2} = \boxed{7.5} \longrightarrow$ [1M]

Ans

22.) (a) $n(A) = 400$

$n(B) = 200$

$n(A \cap B) = 50$

$n(A \cup B) = n(A) + n(B) - n(A \cap B) \longrightarrow$ [1M]

$= 400 + 200 - 50$

$= 600 - 50 \longrightarrow [\frac{1}{2} M]$

$\Rightarrow n(A \cup B) = 550 \neq 500$. Hence the data is incorrect $\rightarrow [\frac{1}{2} M]$

OR

(b) $R = \{(x, y) : x, y \in W,\ x^2 + y^2 = 100\}$

$= \{(6,8), (8,6), (0,10), (10,0)\} \longrightarrow$ [1M]

$\therefore$ Domain of $R = \{0, 6, 8, 10\} \longrightarrow [\frac{1}{2} M]$

Range of $R = \{0, 6, 8, 10\} \longrightarrow [\frac{1}{2} M]$

23.) Here $n = 10$; For score 88, $L = 7$; $E = 2 \longrightarrow [\frac{1}{2} m]$

$\therefore P_R = \dfrac{L + 0.5 \times E}{n} \times 100 = \dfrac{7 + 0.5 \times 2}{10} \times 100 = 80 \rightarrow$ [1m]

$\therefore \boxed{P_R = 80}$ Ans $\longrightarrow [\frac{1}{2} m]$

24.) (a) Part of the field reaped in 1 day $= \dfrac{1}{30}$

Part of the field reaped in 25 days $= \dfrac{\cancel{25}^{5}}{\cancel{30}_{6}} = \boxed{\dfrac{5}{6}}$

OR

(b) $\dfrac{x_1 + x_2 + \dots + x_{15}}{15} = 45$ ; $\dfrac{x_1 + x_2 + \dots + x_8}{8} = 48$ ;

$\dfrac{x_8 + x_9 + \dots + x_{15}}{8} = 42$

$\therefore \quad x_1 + x_2 + \cdots + x_{15} = 45 \times (8+7) = 360 + 315 = 675$

$x_1 + x_2 + \cdots + x_8 = 48 \times 8 = 384$

$x_8 + \cdots + x_{15} = 42 \times 8 = 336$

$(+) \qquad\qquad (+)$

$x_1 + x_2 + \cdots + x_8 + x_8 + \cdots + x_{15} = 384 + 336$

$= 720$

$\Rightarrow (x_1 + x_2 + \cdots + x_8 + \ldots x_{15}) + x_8$

$\Rightarrow \quad 675 + x_8 = 720$

$\Rightarrow \quad x_8 = 720 - 675$

$\Rightarrow \quad x_8 = \boxed{45}$ Ans

25) $\frac{4^x + 4^{1-x}}{2} \geq \sqrt{4^x \times 4^{1-x}}$ $[\because A.M. \geq G.M.]$

$\Rightarrow 4^x + 4^{1-x} \geq 2 \times \sqrt{4^{x+1-x}}$

$\Rightarrow 4^x + 4^{1-x} \geq 2 \times 2 = 4$

$\Rightarrow \boxed{4^x + 4^{1-x} \geq 4}$ $\therefore$ The Minimum Value is $\boxed{4}$ Ans

$\boxed{\text{Section - C}}$

26) (a) $x^4 y^2 z^3 = 49392$

| | |
|---|---|
| $\therefore$ 2 | 49392 |
| 2 | 24696 |
| 2 | 12348 |
| 2 | 6174 |
| 3 | 3087 |
| 3 | 1029 |
| 7 | 343 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

$\therefore 49392 = 2^4 \times 3^2 \times 7^3 = x^4 y^2 z^3$

$\therefore \boxed{\begin{array}{l} x = 2 \\ y = 3 \\ z = 7 \end{array}}$ Ans

OR

(b) $\log_3 x + \log_9 x + \log_{81} x = \frac{7}{4}$

$\Rightarrow \frac{1}{\log_x 3} + \frac{1}{\log_x 9} + \frac{1}{\log_x 81} = \frac{7}{4}$

$\Rightarrow \frac{1}{\log_x 3} + \frac{1}{2\log_x 3} + \frac{1}{4\log_x 3} = \frac{7}{4}$

$\Rightarrow \frac{1}{\log_x 3}\left(\frac{1}{1} + \frac{1}{2} + \frac{1}{4}\right) = \frac{7}{4}$

$\Rightarrow \frac{1}{\log_x 3} \times \left(\frac{4+2+1}{4}\right) = \frac{7}{4}$

$\Rightarrow \frac{1}{\log_x 3} = 1 \quad \Rightarrow \log_x 3 = 1 \quad \Rightarrow \boxed{x^1 = 3}$ Ans

(27) (a)

| | | |
|---|---|---|
| 2 | 450 | |
| 2 | 225 | 0 |
| 2 | 112 | 1 |
| 2 | 56 | 0 |
| 2 | 28 | 0 |
| 2 | 14 | 0 |
| 2 | 7 | 0 |
| 2 | 3 | 1 |
| | 1 | 1 |

$\therefore (450)_{10} = (111000010)_2$ Ans

(b) Length of the longest rod $= \sqrt{10^2 + 12^2 + 15^2}$

$= \sqrt{100 + 144 + 225}$

$= \sqrt{469}$

$= \boxed{21.65 \text{ m}}$ Ans

(28) Let the equation of the line be $\frac{x}{a} + \frac{y}{b} = 1$

Where $a + b = 2$; & $\frac{2}{a} + \frac{2}{b} = 1 \Rightarrow 2(a+b) = ab$

$\Rightarrow ab = 2 \times 2 = 4$

$\therefore \quad a+b = 2$

$ab = 4$

$\Rightarrow b = \left(\frac{4}{a}\right)$

$\therefore \quad a + \frac{4}{a} = 2$

$\Rightarrow a^2 + 4 = 2a$

$\Rightarrow a^2 - 2a + 4 = 0$

$\Rightarrow (a-2)^2 = 0$

$\Rightarrow \boxed{a = 2}$

$\therefore \quad b = \frac{4}{2} = 2 \Rightarrow \boxed{b = 2}$

$\therefore$ Reqd. Equation is $\frac{x}{2} + \frac{y}{2} = 1 \Rightarrow \boxed{x + y = 2}$ Ans.

(29) (i) A M I T A B H → 3-15-11-22-3-4-10

1 13 9 20 1 2 8

+2 +2 +2 +2 +2 +2 +2

$\therefore$ D H E R M E N D R A

4 8 5 18 13 5 14 4 18 1

$\therefore$ Ans:→ 6 - 10 - 7 - 20 - 15 - 7 - 16 - 6 - 20 - 3

(ii) C I R C L E : H N W H Q J

$C \xrightarrow{+5} H$

$I \xrightarrow{+5} N$

$R \xrightarrow{+5} W$

$C \xrightarrow{+5} H$

$L \xrightarrow{+5} Q$

$E \xrightarrow{+5} J$

$\therefore$

$P \xrightarrow{+5} U$

$A \longrightarrow F$

$R \longrightarrow W$

$A \longrightarrow F$

$B \longrightarrow G$

$O \longrightarrow T$

$L \longrightarrow Q$

$A \longrightarrow F$

Ans :- $\boxed{\text{UFWFGTQF}}$

(5)

(iii)

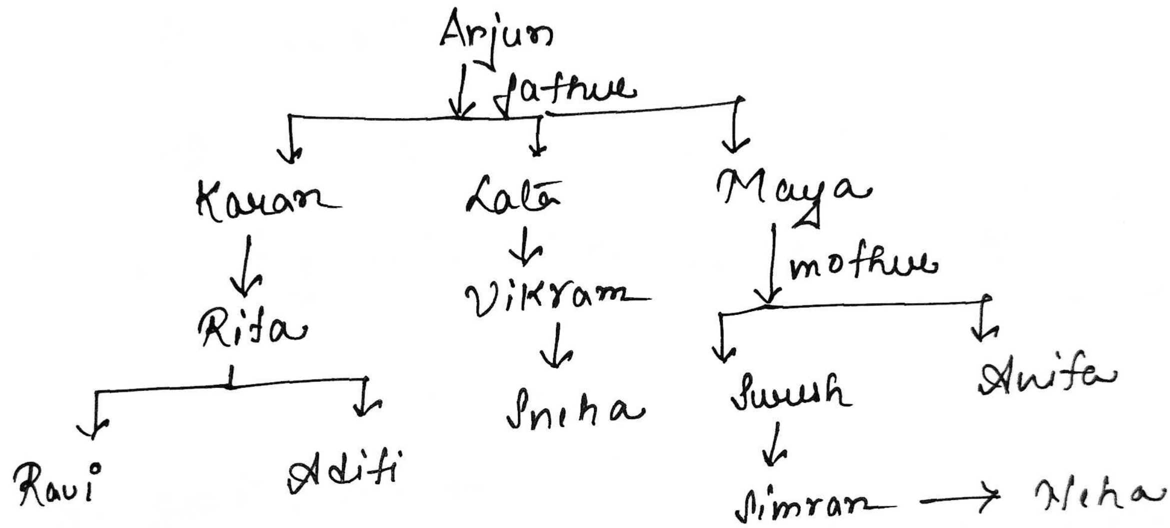
$$\begin{array}{r} Q\ P \\ \times\ Q\ 5 \\ \hline 1\ 8\ 0\ P \\ \hline \end{array}$$

Here $P = 0$; $Q = 4$ → [1M].

$\because$
$$\begin{array}{r} 40 \\ \times 45 \\ \hline 1800 \\ \hline \end{array}$$

OR

(b)




i) Neha is Sneha's Cousin → [1M]
ii) Simran is Karan's Sister-in-law. → [1M]
iii) Aditi is Suresh's Niece → [1M]

(30) Here; $S_{K_B} = 0.5$; $Q_1 + Q_3 = 100$; $Q_2 = 40$.

$\therefore S_{K_B} = \dfrac{Q_3 + Q_1 - 2Q_2}{Q_3 - Q_1} = 0.5$ → [1M]

$\Rightarrow \dfrac{100 - 2\times40}{Q_3 - Q_1} = 0.5$

$\Rightarrow Q_3 - Q_1 = 40.$ → [$\frac{1}{2}$M]

$$\left.\begin{array}{l} \therefore \cancel{Q_1} + Q_3 = 100 \\ (+)\ -\cancel{Q_1} + Q_3 = 40 \end{array}\right\}$$ → [$\frac{1}{2}$M]

$\Rightarrow Q_3 = 70$ → [$\frac{1}{2}$M]

$\therefore Q_1 = 100 - 70 = 30$ → [$\frac{1}{2}$M]

(31) Let the equation of the line perpendicular to $3x + 2y = 8$ is
$2x - 3y + c = 0$.

Now; the mid pt. of $(5,-2)$ and $(2,2)$ is
$\left(\frac{5+2}{2}, \frac{-2+2}{2}\right)$ i.e. $(3.5, 0)$

$\therefore$ $(3.5, 0)$ passes through $2x - 3y + c = 0$

$\Rightarrow \quad 2 \times 3.5 - 3 \times 0 + c = 0$

$\Rightarrow \quad c = (-7)$.

$\therefore$ Equation of the line :- $\boxed{2x - 3y - 7 = 0}$

## Section - D

(32) (a) Seating Arrangement :-
Bina, Esha, Charan, Jiwi, Aman, Farhan, Divya, Gita → [1M]
(b) Extreme left: Bina, Extreme Right :- Gita → [1M]
(c) If Esha is seated in the 3rd position, then Charan must be seated in the 4th position. → [1M]
(d) Charan and Aman → [1M]
(e) Divya would have to sit in the 6th position. → [1M]

OR

(b) In 1600 yrs; 0 odd days. → [½M]
300 yrs; 1 odd day. → [½M]
1900 yrs; 0+1 = (1) odd day. → [½M]
Now; from 1901 to 1968; there are 17 leap years and 51 non-leap years. $\therefore$ No. of odd days $= 17 \times 2 + 51 \times 1$
$= 34 + 51 = 85$ odd days.
$= 7 \times 12 + 1 = 1$ odd day.
→ [1M]

Now in 1969;

Jan + Feb + March + Apr. + May + Jun + July + Aug. + Sep. +
31 28 31 30 31 30 31 31 30

Oct. + Nov. + Dec $\longrightarrow$ [1M]
31 30 4

$\therefore$ 338 days = 7 × 48 + 2 $\longrightarrow$ [$\frac{1}{2}$M]

So; Total No. of odd days = 1+1+2 = 4 odd days. $\longrightarrow$ [$\frac{1}{2}$m]

$\therefore$ The day on 4th December' 1969 is
Thursday Ans $\longrightarrow$ [$\frac{1}{2}$m]

33.)

| Class | Frequency($f_i$) | $x_i$ | $f_ix_i$ | $x_i^2$ | $f_ix_i^2$ |
|---|---|---|---|---|---|
| 30-40 | 3 | 35 | 105 | 1225 | 3675 |
| 40-50 | 7 | 45 | 315 | 2025 | 14175 |
| 50-60 | 12 | 55 | 660 | 3025 | 36300 |
| 60-70 | 15 | 65 | 975 | 4225 | 63375 |
| 70-80 | 8 | 75 | 600 | 5625 | 45000 |
| 80-90 | 3 | 85 | 255 | 7225 | 21675 |
| 90-100 | 2 | 95 | 190 | 9025 | 18050 |
| | $\Sigma f_i = 50$ | | $\Sigma f_ix_i = 2910$ | | $\Sigma f_ix_i^2 = 202250$ |

[$\frac{1}{2}$M] [1m]

$\therefore$ Mean $= \frac{\Sigma f_ix_i}{\Sigma f_i} = \frac{2910}{50} = 58.2 = \bar{x}$ $\longrightarrow$ [1m]

Now; Variance $= \frac{\Sigma f_i x_i^2}{\Sigma f_i} - (\bar{x})^2 = \frac{202250}{50} - (58.2)^2$ $\longrightarrow$ [1m]

$= 4045 - 3387.24$

$\Rightarrow$ Variance $= 657.76$. $\longrightarrow$ [$\frac{1}{2}$m]

$\therefore$ standard deviation $= \sqrt{\text{Variance}}$ $\longrightarrow$ [$\frac{1}{2}$m]

$= \sqrt{657.76}$

$= 25.65$ $\longrightarrow$ [$\frac{1}{2}$m]

Ans: $\rightarrow$ Mean = 58.2
Variance = 657.76
Standard deviation = 25.65

(34) (a) Let the two numbers be $a$ and $b$.

$\therefore \quad a+b = 6 \times \sqrt{ab}$

$$\Rightarrow \frac{a+b}{2\sqrt{ab}} = \frac{3}{1}$$

$$\Rightarrow \frac{a+b+2\sqrt{ab}}{a+b-2\sqrt{ab}} = \frac{3+1}{3-1}$$

$$\Rightarrow \frac{(\sqrt{a}+\sqrt{b})^2}{(\sqrt{a}-\sqrt{b})^2} = \frac{\cancel{4}\,2}{\cancel{2}} = \left(\frac{\sqrt{2}}{1}\right)^2$$

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

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

$$\Rightarrow \frac{(\sqrt{a}+\sqrt{a})}{(\sqrt{b}+\sqrt{b})} = \frac{\sqrt{2}+1}{\sqrt{2}-1}$$

$$\Rightarrow \frac{a}{b} = \frac{2+1+2\sqrt{2}}{2+1-2\sqrt{2}} = \frac{3+2\sqrt{2}}{3-2\sqrt{2}}$$

$\therefore$ The Nos. are in the ratio: $(3+2\sqrt{2}):(3-2\sqrt{2})$

[OR]

(34) (b) $a_0 = 5000$ → [½ m]

C.R. = 2 → [½ m]

doubling period = every 12 days. → [½ m]

target population = 2560000 (i.e. ½ of 5120000) → [½ m]

$\therefore$ $a_n = a_0 r^{n-1}$ → [½ m]

$\Rightarrow \cancel{2560000}^{512} = \cancel{5000} \times 2^{n-1}$

$\Rightarrow 2^{n-1} = 2^9$

$\Rightarrow n - 1 = 9$ → [½ m]

$\Rightarrow n = 10$ → [½ m]

Now; there is one gap of 12 days between 2 terms and 2 gaps of 12 days between 3 terms and so. → [½ m]

$\therefore$ There will be 9 gaps of 12 days between 10 terms → [½ m]

$\therefore$ The Required No. of days = 12×9 = 108. → [½ m]

Ans: In 108 days; 50 % of the population gets infected.

(35)

| $x_i$ | $f_i$ | $f_i x_i$ | $(x_i - \bar{x})$ | $(x_i - \bar{x})^2$ | $(x_i - \bar{x})^4$ | $f_i (x_i - \bar{x})^2$ | $f_i (x_i - \bar{x})^4$ |
|---|---|---|---|---|---|---|---|
| 5 | 8 | 40 | −15 | 225 | 50625 | 1800 | 405000 |
| 10 | 15 | 150 | −10 | 100 | 10000 | 1500 | 150000 |
| 15 | 18 | 270 | −5 | 25 | 625 | 450 | 11250 |
| 20 | 29 | 580 | 0 | 0 | 0 | 0 | 0 |
| 25 | 23 | 575 | 5 | 25 | 625 | 575 | 14375 |
| 30 | 17 | 510 | 10 | 100 | 10000 | 1700 | 170000 |
| 35 | 5 | 175 | 15 | 225 | 50625 | 1125 | 253125 |
| | $\Sigma f_i = 115$ | $\Sigma f_i x_i = 2300$ | | | | $\Sigma = 7150$ | $\Sigma = 1003750$ |
| | | | | | | [½ M] | [1M] |

$\therefore \bar{x} = \frac{2300}{115} = 20$ → [1M]

$\therefore \mu_2 = \frac{\Sigma f_i (x_i - \bar{x})^2}{n} = \frac{7150}{115} = 62.17$ → [½M]

$$\mu_4 = \frac{\Sigma f_i (x_i - \bar{x})^4}{\Sigma f_i} = \frac{1003750}{115} = 8728.26 \longrightarrow [\tfrac{1}{2} m]$$

$$\therefore \beta_2 = \frac{\mu_4}{\mu_2^2} = \frac{8728.26}{(62.17)^2} = \frac{8728.26}{3865.11} \longrightarrow [\tfrac{1}{2} m]$$

$$= 2.26 < 3 \longrightarrow [\tfrac{1}{2} m]$$

Hence the curve is platykurtic. Ans $\longrightarrow [\tfrac{1}{2} m]$

## Section - E

(36) Case Study - 1 :-

(i) Road A: $\frac{y-3}{x-2} = \frac{7-3}{8-2} \longrightarrow [\tfrac{1}{2} m]$

$\Rightarrow \frac{y-3}{x-2} = \frac{\cancel{4}\,2}{\cancel{6}\,3}$

$\Rightarrow 3y - 9 = 2x - 4$

$\Rightarrow \boxed{3y = 2x + 5} \longrightarrow [\tfrac{1}{2} M]$

(ii) slope of Road A $= \frac{2}{3} \longrightarrow [\tfrac{1}{2} M]$

$\therefore$ slope of Road B $= -\frac{3}{2} \longrightarrow [\tfrac{1}{2} m]$

(iii) Road B: $y - (-2) = -\frac{3}{2}(x-5) \longrightarrow [1M]$

$\Rightarrow 2y + 4 = -3x + 15$

$\Rightarrow \boxed{2y + 3x = 11} \longrightarrow [1m]$

OR

(iv) $3(3y - 2x = 5)$
$2(3x + 2y = 11)$

$\Rightarrow$
$\cancel{-6x} + 9y = 15$
$\cancel{6x} + 4y = 22$
(+)
$\longrightarrow [\tfrac{1}{2} M]$

$13y = 37$

$y = \left(\frac{37}{13}\right) \longrightarrow [\tfrac{1}{2} m]$

$\therefore 2x = 3y - 5$

$= 3 \times \frac{37}{13} - 5 \Rightarrow 2x = \frac{111 - 65}{13} = \frac{46}{13} \therefore x = \frac{+23}{13} \longrightarrow [\tfrac{1}{2} M]$

Ans: $\left(\frac{+23}{13}, \frac{37}{13}\right) \longrightarrow [\tfrac{1}{2} m]$

(37) Case Study - 2 :-

(i) $a_1 = 10$

$d = 5$ → [1M]

$n = 10$

$\therefore S_{10} = \frac{\cancel{10}^{5}}{\cancel{2}}\left[2\times 10 + 9\times 5\right]$ → [½M]

$= 5\times(45+20)$

$= 5\times 65$ → [½M]

$\boxed{S_{10} = 325₹}$

(ii) Total Amount = ₹(1500 × 325)

$= \boxed{₹\ 487500}$ → [1M]

(iii) $a_1 = 10$ ; $d = 5$ ; $n = 15$

$S_{15} = \frac{15}{2}\left[2\times 10 + (15-1)5\right]$ → [½M]

$= \frac{15}{2}\times 90$

$= 675$

$\therefore \boxed{S_{15} = ₹\ 675}$ → [½M]

[OR]

(iv) Remaining Amt. = ₹ 2451 2500.

~~Let the~~ additional no. of days be K ; therefore, the first term for the new AP = $10 + 9\times 5 = 55$.

$\therefore S_K = \frac{K}{2}\left[2\times 55 + (K-1)5\right] = \frac{K}{2}(5K+105)$ → [½M]

$\therefore$ Total Contribution = $1500\, S_K$.

$\therefore$ ~~Extra~~ Additional Days ≃ 10.83 i.e. 11 days.

$\therefore$ Total No. of days = (10 + 11) days = $\boxed{21 \text{ days}}$ → [½M]

(38) <u>Case Study - 3 :</u>

(a) D must be the female politician. ⟶ [1m]

(b) I is the male lawyer. ⟶ [1m]

(c) C is a home maker. ⟶ [1m]

(d) A is the grand father of H. ⟶ [1m]

— x —